Fagatele Bay National Marine Sanctuary
Climate Change Site Scenario
Reviewer Comment Table

Six reviewers submitted comments on the Climate Change Site Scenario during the Spring 2011. The comments were compiled and discussed by Editors Brien Cheng and Emily Gaskin. The following is a summary of the major reviewer comments and the editor's responses.

Section	***Page Number***	***Comment***	***Response***
-	2	What is the preferred citation for this document? This could go at the bottom of Page 2.	Accepted, new text added.
-	3	Suggest moving the authors to the table of contents on the next page to save space.	Authors for specific sections was moved to behind the table of contents.
1	5	First paragraph of the introduction suggests that the title of the document should be "Climate Change Story"? or is that a separate document?	Accepted, all text changed to "Climate Change Site Scenario"
1	5	In the "Problem of Climate Change" section it may be good to have something about the "natural" variation in climate to place the current trends into greater context.	Accepted. New text added.
1	5	The phrase "climate change impact drivers" is used in many places but is quite awkward and should be clarified.	Accepted, all new phrases similar to this have been rewritten as "climate change drivers".
1	7	The marine and terrestrial habitats have been impacted by the changes in the climate. The climate is changing due to the drivers. But the habitats are not being impacted directly by the drivers.	Acknowledged, but as currently stated this sentence is correct.
1	8	Popular these days to use a long word when a short word will do.	Accepted.
1	9	If the data don't "reflect lagoon or open water habitats", what do they represent? Pirhalla et al offer some more insight into the ENSO link and the regional scales of variability that may be useful. Also of note, there is some discussion of the latitudinal variance in SST that may exacerbate the effects of climate change at the latitude of American Samoa (see end of Pirhalla et al ref).	Accepted. New text added.

1	9	I would think a review of the status of the sanctuary resources would include a review of the status of the coral reef there. There is lots of info on that.	Review includes a paragraph on coral reefs at top of page.
1	10	Regarding rainfall impacts, the results of the studies are essentially inconclusive, trends among studies may point in opposite directions, and Samoa is at the intersection of regions with opposite predictions. In other words, anything could happen here but the discussion seems to focus on the greater threat of sedimentation when its not so clear there is one. Forgive some of my ignorance here, but some text explaining the following physical aspects of FBNMS would be helpful. Are there any streams? How much land in the watershed is developed? My admittedly limited understanding is that these issues aren't a really big concern for such a well vegetated and relatively pristine watershed. On another note, I've seen mention over the concerns about polluted groundwater seepage into FBNMS from the landfill in an adjacent watershed. Lots of rain may turn up the flow but this is admittedly speculative. Maybe an information need to highlight someplace though.	This section has been moved.
1	11	Section 2.1, I've been told to be careful of using the term "weather" when discussing "climate". The variables discussed are not really "weather" anyway in this section so perhaps a better section header could be devised.	Agreed, this should really be called climate. Section 2.1: Variation in Climate (not weather)
2	11	Review includes a paragraph on coral reefs at top of page.	Sentence rephrased.
2	11	Is there a citation that could go with this statement?	Citation added.
2	11	Over what period of time? Time is critical.	Year added.
2	12	Its not clear if the authors are going as far as to say that the intensity or frequency of storms will increase for Samoa given the conflicting predictions noted in the preceding paragraph.	Previous paragraph has been rephrased for clarity.
2	12	Eric Mielbrecht produced a graph that shows the actual recorded SST's in our area and how they have risen and the correlation of years with higher peaks with local bleaching events. Would be good to include that. I have an electronic copy, comes from the EPA report on global warming and bleaching that he wrote.	Figure is below. We should absolutely add this figure in and supportive text.
2	12	Figure 2.1 isn't listed in text. Also is this "global" temperature?	This figure has been deleted in favor

		Citation?	of the Figure below (US EPA 2007).
2	14	See general comments about the organization of the document. This does not really fit here.	Agreed that this paragraph is probably out of place.
2	15	The dramatic "dips" in sea level in these figures are correlated with the severity of ENSO and could be discussed here since they are mentioned later in the "responses" section of the document (see Pirhalla et al. ref).	Rejected. This link is already made in this chapter.
2	15	Consider a little explanation of high points. Are topo high points the highest elevations? If so it seems a bit counter intuitive that the sed rates would be the lowest. Just explain a bit better.	Accepted. New text added.
2	15	None of the text actually refers to the figure that I could tell so I was not sure what Nino3 and Nino4 were.	None of the text actually refers to the figure that I could tell so I was not sure what Nino3 and Nino4 were.
2	15	Figure 2.4 not listed in text.	Elected to delete El Nino Figure from Lee and McPhaden 2010.
2	15	What is the “cube” of windspeed?	Sentence rewritten.
2	16	Hurricanes have been naturally present here for the entire life of the island, which is 1.5 million years old. If hurricanes hit about once in 5 years on the average, there would have been 300,000 hurricanes in the life of the island. Coral reefs recover from hurricanes in natural circumstances, but if human impacts have decreased their resilience, or their magnitude increases, they may not.	True but this discussion should really take place in the next chapter. Explanation of biological impacts should be brief.
2	16	I think I saw that there is a new study saying global winds have increased with climate change.	Citation added.
2	17	Suggest deletion. Disagree with this comment. Intertidal organisms may be unable to migrate upland if habitat is unsuitable.	Disagree with this comment. Intertidal organisms may be unable to migrate upland if habitat is unsuitable.
2	17	If you wanted to cite a study that discusses this see OGSTON, A.S. and FIELD, M.E., 2010. Predictions of turbidity due to enhanced sediment resuspension resulting from sea-level rise on a fringing coral reef: evidence from Molokai, Hawaii. Journal of Coastal Research, 26(6), 1027–1037. West Palm Beach (Florida), ISSN 0749-0208.	Citation added.
2	17	Suggest delection. But again the changes are likely to improve water quality and habitat for corals and other marine organisms..	Again, there is no evidence to support this statement.

2	21	Section 2.3 Ocean Circulation. This is the subject of a chapter in an upcoming report (chapter after Pirhalla et al in the Biogeographic Assessment of the Samoa Archipelago, Kendall and Poti (eds) 2011). We actually know a great deal about ocean circulation around American Samoa at present (alterations due to climate change are another matter). It may be too late to incorporate much of this new information into the climate report but the info is available if needed and will be provided to the authors of this report.	Accepted. Pirhalla et al. citation is widely used in paragraph on local current conditions.
3	26	The "Calcification and Ocean Acidification" subheader seems an odd fit with the others in section 3.1	Accepted. This sub-section has been rephrased simply as “Calcification”.
3	28	May want to bring in the concept of winners and losers here, some species will benefit other will be detrimentally impacted.	Text added.
3	28	While most generally agree with this, as written it may be a bit of an overstatement following the example of Astudy of a single threatened species in a different ocean. Some coral species (and genotypes) may be better adapted to warmer conditions.	Accepted. New sentence added at end of paragraph to reflect uncertainty regarding coral responses.
3	29	The section on Coral Calcification seems like it could be better organized with the previous calcification section.	Accepted, this section has been deleted.
3	29	Staying away from the Degree Heating Weeks approach eh?	No action needed.
3	29	Where a total of about 700 introduced species have been documented, including a few invasive and damaging species such as the soft coral Carijoa reesii and a sponge.	My read on Coles et al. reports 98 introduced species not 700.
3	30	Although CLOD is not rare in Fagatele Bay, coralline algae is abundant and can completely cover large areas of newly exposed surfaces within about six months, as happened after the 2009 tsunami.	No changes are really suggested with this comment.
3	30	The low sea level events could be better set up in the "drivers" section as previously noted. Also, these events affect more than just the corals on the reef flat, its the whole reef flat so maybe this fits better in the "ecological" effects subheader? In case its needed to better establish the scope of the issue, a recent mapping project shows that ~10% of all reefs on American Samoa are on "reef flats" and that ~11% of FBNMS lies in potentially affected reef zones. You can cite Kendall at Poti (eds) 2011 if this info is useful.	Rejected. Much of this physical discussion is written from the perspective of the biological impacts. Thus, it should remain in Chapter 3.

3	31	There is a report by Ali Green that documents some corals spawning around this time.	Unable to locate this reference.
3	31	But there is nothing of commercial importance in Fagatele, and little of cultural importance below the water level.	Rejected, culturally important artifacts are known below the water level.
3	32	Phytoplankton section could point out that Samoa lies in a very oligotrophic part of the ocean that is believed to be expanding.Polovina, JJ, E Howell, and M Abecassis. 2008. Ocean's least productive waters are expanding. Geophysical Research Letters. 35:L03618, doi:10.1029/2007GL031745, 2008.	Accepted. New text added.
3	32	So what were they attributed to?	Text added.
3	32	There is a study of organisms around CO2 volcanic vents in Italy, where CO2 bubbles up out of the sea floor and drives the water acidic. Calcium depositing organisms disappear close to the bubbling areas.	Yes this is Hall-Spencer et al 2008. We don't need to add this example here though.
3	34	Could add a blurb on the potential impacts of climate change on fish larvae and potential impacts to connectivity (see Kendall and Poti (eds) chap 3 and other recent journal articles).	Accepted. New text added.
3	34	Could also talk about the balance on a healthy reef of erosion and accretion and how OA might disrupt this balance.	Rejected, this section is already too lengthy.
3	34	Reports of them consuming the zoox are pretty rare. Also, it is not entirely obvious whether the coral actively eject the zoox cells or they actively leave, though it is often stated that they are ejected.	Accepted. Changed text to reflect uncertainty in mechanism for loss of zooxanthellae.
3	34	The effects on growth and reproduction are likely minor compared to the effects on coral mortality. That is the single largest effect of climate change on coral reefs, and will severely degrade reefs in the future, changing them in to algae beds. This needs a whole paragraph if not a whole section.	Agreed but this text states the effects of bleaching on reproduction, even if they are minor.
3	34	Sometimes mild, sometimes close to death	Accepted, text removed.
3	34	Probably not, the Acropora there usually don't bleach. However, the high temperatures in these pools are very brief, with top temps of only a half hour or so duration. It is quite a different thing when the high temp is continuous.	Accepted, sentenced rephrased.
3	34	The question of whether corals can adapt is a controversial topic, with many people assuming they can't, others saying they can, and various	Agreed, since no consensus exists, we

		lines of evidence. Corals may have some ability to adapt, but in areas where extreme temperatures are reached, such as the Arabian Gulf, only a few species survive, in spite of the long period of time there to adapt. Corals have limited abilities to adapt, for instance there are no corals that live in brackish water, let alone fresh water, in spite of hundreds of millions of years in which to adapt to those conditions.	will leave the sentence as is.
3	35	There is a paper that shows that most of the corals that die, die very quickly.	No action needed.
3	36	Corals can grow far faster than sea level rise. Max coral growth rates are on the order of 20 cm a year. The reef itself as a whole grows much slower, typical rates are around 3 mm a year, though can be larger up closer to 10 mm.	Rejected, under ideal conditions corals may grow at this rate but this paragraph discusses the impacts of sea level rise in conjunction with ocean acidification.
3	36	Maybe a better way of stating it is that if temperatures are more than about 2 C above the average summer maximum, there will be significant coral mortality. Corals that don't die regain their zooxanthellae.	Rejected, the suggested phrasing does not have citations to support this.
3	36	Do sea turtles nest at FBNMS? Actually, a related and more important question not specific to turtles- how much of a rise in sea level would it take for the entire beach at FBNMS to "go away".My guess is not much since its right up against a cliff in most places?	Sea turtles do not nest at FBNMS. Disregard.
3	37	Most coral skeletons will be overgrown by filamentous algae within days, and then that may be replaced by coralline algae starting within about 6 mo or so. Branching colonies will crumble to rubble before they can be colonized by corals. Agreed. – KLA	Accepted.
3	39	Coral reefs are adapted to live in very oligotrophic marine environments, as well as those that are less so. Although there are major trophic inputs of plankton on reefs, with planktivorous fish forming "walls of mouths" that consume much of the plankton in water flowing over reefs, reefs also survive in areas with low plankton levels. Our reefs have low levels of plankton feeders such as clams and feather duster worms, and may have low levels of planktivorous fish. Thus,	Rejected. The current paragraph does not contradict this comment.

		the reefs may already have a low dependence on plankton, and a reduction in plankton may have little effect on the reef.	
3	41	Maybe consider rewording because climate effects can occur in both polar areas and AS since diseases can be contracted there.	Current sentence appears to be appropriate.
4	41	Some of the discussion in section 4 is reaching a bit perhaps. Parts of the discussion could be refocused to address how particular stressors may aggravate impacts or work in concert with climate change. How could these things (fishing, COTS, agriculture) be affected by climate change? Would like to see more reference to climate in this section.	Accept recommendation.
4	41	Change heading *Parallel Ecosystem Stressors* to *Non-Climate Ecosystem Stressors*	Reject insertion because headings were developed by ONMS for all Sanctuary Climate Change Site Scenarios.
4	41	Change *combined impacts* to *cumulative impacts*	Accept change.
4	41	Is this Land-Based Sources of Pollution of which Ag is one component? But just listing Agriculture are you missing other contributors?	Headings and content in *Parallel Ecosystem Stressors* section match Stressors on the Sanctuary section in the *Fagatele Bay National Marine Sanctuary Condition Report.*
4	41	For each of the sections below can a brief explanation be added on how negative effects from climate change coupled with this stressor may cause even more harm? Or how the two may interact?	Accept recommendation.
4	41	Such as Bumphead Parrotfish, Bolbometopon muricatum, which has been petitioned for Endangered Species status in the U.S.	Accept recommendation
4	41	Williams et al (2011) published data showing that fish populations are lower near people in the territory than farther away from people, with the effect largest for large fish and least for small fish. This can only be explained by fishing, no other threat can produce this pattern. The same pattern was found in the Hawaiian chain and the Marianas. The effect of fishing to remove the largest fish is well documented in many fisheries. The CRED team has also found that the effect extends far from population centers, which also can only be explained by fishing. CRED has shown we have low overall biomass, and other published	Accept recommendation – some text added.

		studies have shown that about half the total fish biomass is in the large apex predators. Apex predators have major effects on ecosystems, and their loss has potentially great effects on reef resilience, it is certainly an unnatural system. The removal of half the biomass in the large fish is probably the single largest effect of humans on the coral reefs here. Published data (Dalzell, based on data from Wass) show that fishing intensity in Tutuila was the highest known on any coral reef in the world around in the late 1970's. Large fish with late maturity are slow to recover, particularly for sharks which only have 2-4 pups per year. Fishing pressure is relatively low now, but the effects of past heavy fishing pressure continue, and light fishing may stop the large fish from recovering.	
4	41	How about using Leslie Whalen's picture of the big one hanging from a tree next to the proud fisherman? I think Kevin has a copy, if not I do.	Accept recommendation.
4	41	Essentially the only important protection afforded by the sanctuary, as in most MPA's, is limited protection against fishing. Yet the cow's already out of the barn, half the fish biomass is gone. Further, the size of the sanctuary is too small to provide any protection for the sharks, certainly, which range around widely for miles, which are the largest part of the missing apex predators. It is probably too small to protect bumphead parrots that range around in schools and are now very rare. So the sanctuary is unfortunately very ineffective at protecting the reef there against the greatest damaging effect of humans. Only tiny amounts of fishing are sufficient to remove fish like sharks, and the sanctuary has not provided sufficient protection. (this is not someone's fault, this was not known until recently, I'm not blaming anyone, but we need to realize it is not effective. The solution must be over a much wider area to have a chance to be effective.)	Comment noted.
4	42	Unfortunately, it is certainly much less than this. The estimated age of the 7 m tall giant in Ta'u is only about 350 years, using the best available scientific information, a formula for growth rate as a function of temperature, from an article by J. Lough.	Accept change. Text deleted.
4	42	Change *spate* to *round.*	Accept change.

		A lot is actually known, there is tons of information, and the theory best supported by the evidence is by none other than our own Chuck Birkeland. His theory is that a period of no rain followed by heavy rains washes out more built up nutrients than normal, which fuels a plankton bloom. If COTS spawn then, a larger portion of the larvae survive due to more food. They settle and go into holes in the reef and eat coralline algae, only emerging in daytime after about 3 years, suddenly appearing out of nowhere. A recent review found good evidence to support all but one link in the causal chain, and that link there was no evidence on. There is a possible role of human produced nutrients, of course, adding to plankton blooms.	Accept recommendation. Text added from Birkeland (1982) and Brodie (2004).
4	42	Change *will replace* to *may replace*	Accept change.
4	42	Change *reefs of American Samoa* to *reefs of Fagatele Bay*	Accept change.
4	42	Add: *Following the September 29, 2009 tsunami, large areas of pre-existing rubble moved by the tsunami had no coralline algae cover, yet there was 100% cover within less than six months later. Growth of coral on those rubble fields may take decades.*	Accept addition.
4	43	Again is Land-based Sources of Pollution more accurate or is it really just agriculture?	Headings and content in *Parallel Ecosystem Stressors* section match Stressors on the Sanctuary section in the *Fagatele Bay National Marine Sanctuary Condition Report.*
4	43	How big of an area could be affected by agricultural development in FBNMS watershed? A map would be good to show the scope of the potential problem.	Comment Noted. Image added.
4	43	Add: *taro, bananas, breadfruit*	Accept addition.
4	43	I'd think not. More likely people will occupy more and more land, taken from agriculture, as the US subsidizes the economy more and more. On the other hand, I agree that more of the last scraps of unfarmed or unoccupied land are likely to be turned into farm land. But there is little of that land left that is not on a very steep slope. I agree that farming is likely to increase around Fagatele. And it is likely	Deleted per recommendation.

		to be on steeper and steeper slopes, increasing erosion.	
4	43	Change heading *visitation* to *tourism visitation.*	Reject insertion because not all visitation is by tourists (school groups, business travel, etc.)
4	44	From this description it sounds like there really is no threat to the resource posed by visitation. On the flip side, I have heard of treats to potential visitors by those guarding access to the trail!	Comment noted.
4	44	The Fagatele Sanctuary does not control land around it, making it difficult to influence land uses there.	Comment noted. Text deleted.
5	46	Chapter 5. This chapter in particular is more about American Samoa as a whole rather than FBNMS. Also, its unclear how climate change may affect these issues and it reads more like a summary of economic sectors rather than anything related to climate change per se. In the Hertitage subsection climate issues are linked more effectively into the discussion	Comment accepted. Changes made.
5	49	Add: *Most of the business of the last surviving dive shop was to fill tanks for scuba spearfishing, but that collapsed with the ban on scuba spearfishing.*	Accept addition.
		Add: *American Samoa has little flat land, all of which is coastal and near sea level, making land erosion a significant threat. Some of the land in villages was actually built by dredging material from reef flats, such as in Alofau, Faga'alu, Aua and Gataivai, and the airport runway was built on reef flats (killing it) and built up by dredging reef flat on both sides of the runway. In addition, some reefs in the harbor were filled in and built on, for instance the Rainmaker Hotel was build on reef flat next to tiny "Goat Island." Therefore there seems little alternative but to install shoreline protection schemes where key assets are at risk (Spurgeon et al. 2004). Rising sea levels would allow more wave energy to reach shore if the reef did not grow upward at the same rate that sea level rose. That is because the ability of the reef to attenuate wave power depends on the water depth on the reef flat, the deeper it is, the less energy the reef can absorb. The greatest damage to shorelines will occur with the largest waves, which will be in*	Accept addition.

		hurricanes. For the near future, the reef can keep up with sea level rise, but in future decades when higher water temperatures cause mass coral bleaching and mass coral deaths, the reef will likely not be able to keep up, and eventually shoreline erosion will increase due to this. The power of the waves to erode the shoreline can easily be seen east of Pago Pago harbor where many black basalt rocks torn out of the shoreline litter the reef flat (D. Fenner, personal comm.).	
6	56	Change *Climate Change Story* to *Climate Change Site Scenario.*	Accept change.
6	56	Are there existing plans or policies (e.g., community development plans, natural hazards mitigation plans) that could be "climatized" to help integrate climate mitigation or adaptation planning?	Already addressed in conclusion.
6	56	Are there legal barriers or opportunities that need to be addressed?	Not relevant to document.
6	56	What interdisciplinary teams can be created to develop the plan? For instance, Pidgeon and Fischhoff (*Nature Climate Change*, March, 2011) suggested including a range of technical experts (climate scientists, biologists, etc), decision scientists, programme development specialists, communications experts, etc. I would add to that list professional evaluators (so that you know what factors affected plan implementation and effectiveness) and community leaders (elected officials, business leaders, cultural elders, and faith-based organizations).	Already addressed in conclusion.
6	56	What participatory processes will be used to develop the plan so that there is community buy-in and an opportunity to iteratively evaluate and revise the plan?	Already addressed in introduction & conclusion.