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An Economic Appraisal of a SMART Hospital Initiative: Pogson Medical Centre – St. Kitts Nevis

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Introduction

This document presents an economic assessment for the restoration of the Pogson Medical Centre in St Kitts and Nevis. The project is being funded by the United Kingdom's Department for International Development (UK-DFID) under the SMART Hospital Initiative. The objective of this project is to rehabilitate the Pogson Medical Centre to make it more climate resilient that will allow it to withstand the expected greater intensity in hurricanes.[1] The project is expected to, *inter alia*, retrofit the roof that will allow it to withstand hurricanes with a Category 4 intensity, while simultaneously improving security, safety and health standards. Further, the retrofitted roof has been designed to comply with ASCE 7-05 (as adjusted by the Caribbean Application Document prepared for PAHO by Tony Gibbs) using the wind speed developed as part of the Pan America Health Organization –United States Agency for International Development (PAHO-USAID) study conducted by Peter Vickery of ARA in 2008. The retrofitted roof, therefore, is expected to comply with the strictest design standards against variable weather impacts, resisting strong winds of up to 150mph and reducing the possibility of forced entry. The retrofitted medical centre is also expected to improve water and energy usage efficiency and provide the hospital with equipment for reliable and alternative energy sources.

Currently, the hospital is in a state of disrepair which affects the quality of health services provided. The current roofing structure is weak and the exterior termite damaged doors leaves the building susceptible to storm and hurricane force winds. Of equal importance are the defects observed in wall finishes, a leaky plumbing system and windows that are not properly insulated thus raising appreciable health concerns. The hospital's electrical battery supply is faulty and alternative energy source nonexistent. Although these issues are known priorities for the Pogson Medical Centre, with a debt to gross domestic product (GDP) ration of above 80% in 2013[2], the Government of St. Kitts and Nevis lacks the resources and fiscal space to pursue the rehabilitative works necessary to enhance the quality of health services provided at the Medical Centre.

The SMART Hospital Restoration Project proposed for St. Kitts and Nevis is part of the Regional initiatives carried out by PAHO/WHO promoting Safe Hospitals in the Caribbean, a programme that started in 2009. The project aims to reduce the vulnerability of the health sector to natural disasters and climate variability. The retrofitting seeks to address the priority issues of the medical centre outlined above and entails: (i) strengthening the infrastructure such as roofing and ceiling, walls, windows, doors, plumbing, electrical and disposal and sanitations systems; (ii) installing an emergency power and renewable energy systems; and (iii) ensure compliance with safety standards aimed at risk reduction and enhance staff awareness and development. One of the major outputs of this project is to create a model climate smart health care facility at the Pogson Medical Centre that will serve as an example for other facilities on the Island and in the wider Caribbean.

Intervention

The aim of this particular intervention is to retrofit the Pogson Medical Centre such that it improves the conditions under which health care is provided and reduce the cost of operation and maintenance of the medical centre whist simultaneously mitigating the severe negative impacts associated with extreme weather events, especially tropical storms and hurricanes.

[1] This projection is based on the climate models that emerged out of the Inter-Governmental Panel on Climate Change Fourth Assessment Report (2007).
[2] International Monetary Fund (2013)

The project is expected to meet the following objectives:

- Improve the ventilation, security, safety, hygiene, accessibility, disposal, lighting, heating and cooling, health, sanitation, aesthetics and morale at the medical facility;
- Improve efficiency in water and energy consumption, which will save the Hospital monies that could be use to provide better health care services to the community;
- A retrofitted roofing infrastructure, which complies with the strictest security standards, and standards against storms and hurricanes impact;
- Install a complete emergency energy supply system (generator and Solar PV)
- Demonstrate how safe (Disaster Risk Reduction, [DRR]) and green (environmentally friendly) components can be combined to create a SMART healthcare facility;
- Serve as an example for public buildings such as schools, health centers, government offices and private buildings such as residence and hotels.

The Cost Benefit Analysis Framework

There are a number of decision support tools available to help decision makers to assess the worth of a particular intervention, in order to evaluate the alternative scenarios, and select between alternative investments, projects, or policies. The choice of which decision support tool to use will largely be determined by the type of decision problem and the availability and nature of information related to each potential option.

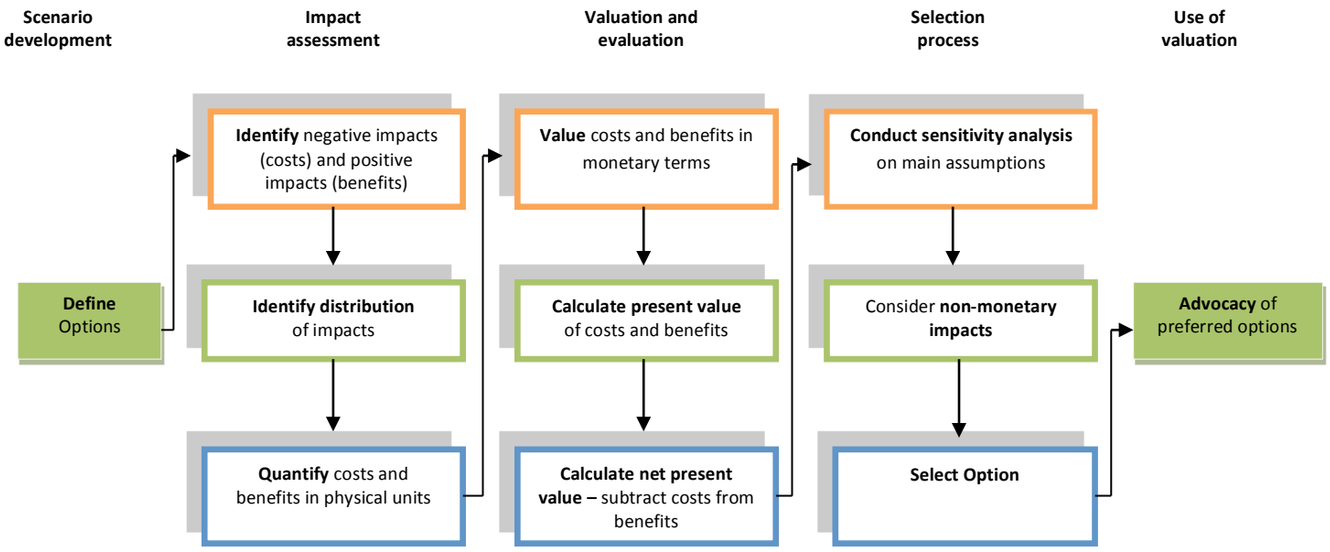
When all the impacts of alternative options can be quantified in monetary terms, the most common tool for appraisal is *cost-benefit analysis (CBA).* This decision support tool involves summing up the value of the costs and benefits of each option and comparing options in terms of their net benefits (i.e. the extent to which benefits exceed costs).

Cost-benefit analysis (CBA) is the most commonly used decision support tool for assessing and comparing economic and financial trade-offs, and that is what was applied for the SMART Hospital intervention in St. Vincent and the Grenadines as well. It is the standard tool for appraising and evaluating investments, projects and policies within many government departments and donor organizations. CBA is a decision support method in which the costs and benefits of alternative options are expressed and compared in monetary terms and it provides a framework into which monetised environmental values can easily be integrated. CBA provides an indication of how much a prospective project or investment contributes to social welfare by calculating the extent to which the benefits of the project exceed the costs – essentially society's "profit" from a project or investment. It is important to recognise the difference between a CBA that is carried out from the perspective of society as a whole (societal or economic analysis or extended CBA) and CBA that is from the perspective of an individual, group, or firm (financial analysis).

The main steps in performing a CBA are presented in Figure 1, showing how these steps fit with the overall framework of analysis advocated in the toolkit. These steps are described in detail below:

1. **Define options**. The first step in the CBA was to identify the alternative options to be considered. The options under consideration were specific to the particular problem and context, but under other circumstances may have included investments, projects, policies, and development plans. It was important to have a clear and detailed description of what each option was as detailed in the following section.

Figure 1: Methodological Steps Followed in the Cost Benefit Analysis for the SMART Health Care Facility



2. **Identify costs and benefits**. We then identified all negative impacts (costs) and positive impacts (benefits) related to each option under consideration. This included costs and benefits accruing to affected groups and individuals (not just those involved in the project development) and projected costs and benefits that will be incurred in the future. If known, it is useful to describe the geographical and temporal boundaries of the analysis, i.e. the area and number of years over which costs and benefits are expected to accrue. In our analysis, the entire Island was seen as being the beneficiary and the project was projected to have a life of 20 years.

3. **Identify the distribution of impacts**. Costs and benefits of alternative options will not be distributed evenly over the various individuals and groups that are impacted by the project. Although the overall impact of the project may be positive, some groups may lose out while others gain. The distribution of costs and benefits (and the potential need for compensation) therefore becomes an important determinant of whether the project was acceptable and desirable. The gainers and losers from each option was identified using categories that are relevant to the context in question. Relevant groups were defined by income class and asset base mainly, though in other studies they may be defined by ethnic group, profession, location etc.

4. **Quantify costs and benefits in physical units**. Each cost and benefit was then quantified in relevant physical units for each year in which those benefits and costs occur. It is often useful to use spreadsheet software such as Excel to create a table with each cost and benefit item represented by a column and each year included as a row. We utilized the excel spreadsheet for our analysis.

5. **Value costs and benefits in monetary units**. Each cost and benefit was then quantified in monetary units for each year in which it occurs. In cases where costs and benefits were not directly observable in monetary terms in well-functioning markets (as is the case for many environmental impacts), estimates were made using non-market valuation methods such as contingent valuation through the application of a questionnaire survey.

6. **Calculate present values**. Calculating present value (PV) involved discounting values that occur in future years. Present value costs and benefits were then summed across years to obtain the total present value costs and benefits.

7. **Calculate the net present value (NPV)**. The net present value (NPV) of each option was then calculated by simply subtracting the present value costs from present value benefits. A positive NPV indicates that implementing the project will improve social welfare. The NPVs of alternative investments should be compared in order to identify the most beneficial project.

8. **Calculate the benefit cost ratio (BCR) and internal rate of return (IRR).** The results of a CBA can also be represented by two other indicators of a project's worth (in addition to NPV). These are the benefit cost ratio (BCR) and the internal rate of return (IRR). BCR is the ratio between discounted total benefits and costs, and shows the extent to which project benefits exceed costs. A BCR greater than 1 indicates that the benefits of a project exceed the costs. The IRR is the discount rate at which a project's NPV becomes zero. If the IRR exceeds the discount rate, the project generates returns in excess of other investments in the economy, and can be considered worthwhile.

9. **Conduct sensitivity analysis**. Information on the monetary values of costs and benefits of alternative options will often not be known with absolute certainty. Uncertainty over the values or assumptions included in the analysis leads to the results also being uncertain. Different values may have resulted in a different ordering of options in terms of NPV. It is therefore necessary to recognise areas of uncertainty and test how sensitive the results are to changes in values or assumptions. One such area is the discount factor applied. We therefore varied this, among other things, to test the sensitivity of our analysis.

10. **Select option**. Based on the information generated on the NPV of each option, the sensitivity of the results, the distribution of impacts, and additional non-monetary information, a decision maker can select the most preferred option.

11. **Use the results.** The results of the CBA can then be used in various ways to influence a decision over a policy or project.

Incremental Costs and Benefits

This section presents the total incremental costs and benefits of retrofitting the Pogson Medical Centre. Table 1 shows a summary comparison between two options; the 'do nothing' option and retrofitting the Hospital (see Annex 2 for more details).

Table 1: Costs and Benefits of the SMART Hospital

Costs/Issues	Benefits
• The continued disrepair of the medical facility, which hinders its efficient operations. • The roof is prone to leaks under high wind conditions and there is a risk of the roof cracking, main entry roof vulnerable to wind uplift and hurricane events. • Some windows require winder mechanism replacement or repair, the X-ray room window requires proper lining to prevent radiation exposure. • The Emergency exits require improved security features and emergency panic bar mechanisms, the X-ray room door us not adequately lead lined to minimize radiation exposure. • Selected bathroom fixtures require replacement while others have minor damages in need of repairs. • Light fixtures (receptacles, switches, lights) need replacement, ballast units need to be replaced with 60 hz units, breakers trip when multiple appliances and equipment are in use at the sametime, battery supply is faulty, diesel storage tank not properly anchored to foundation, electrical meter should be relocated, properly sheltered and mounted outside the generator housing, no existing alternate power supply. • Lack of ventilation, cooling units not working or susceptible to flood damages. • Inadequate water storage capacity and nonexistent water treatment systems. • Shelving units that store medical supplies and files are not properly secured. • Fading, peeling and moss/mold growth on the exterior walls and ceiling tiles. • Inadequate emergency exits signage, emergency fire equipment are faulty and/or damaged, nonexistent emergency lights, illegible fire extinguisher instructions. • Staircases and handicap ramps are	

	exposed to the elements, surface are slippery when wet. • Drains require demarcation to differentiate between storm vs. sewer manholes, pipes need to be flushed, landscaping to prevent water runoff. • Incomplete wastewater treatment system. • A substandard building code	
	▪ Capital cost of designing and retrofitting the medical facility. ▪ Incremental maintenance cost.	▪ Revised hospital design that can endure greater hurricane intensities. Minimized vulnerability to wind uplift of the roof and improved structural integrity of the hospital. ▪ Improved health facilities and services, mortality and other social spill-off benefits. ▪ Resolved roof leaking issues. ▪ Improved Hospital ventilation, security, safety, hygiene, accessibility, wastage, lighting, healthier, sanitary, aesthetics, and staff morale. ▪ Reduce energy demand and improve efficiency / conservation use and provide reliable production of electricity. ▪ Enhanced hospital conformity to safety and risk reduction and staff awareness and development. ▪ Improve the drainage of the landscape around the facility and eliminate any potential flooding of the facility. ▪ Properly treat and reuse all the sewerage water from the facilities and circulate the treated water through a drip irrigation system into surrounding environs. ▪ Minimize the overflow and pumping of sewerage and eliminate the exposure of sewerage water flowing through open drains. ▪ The project serves as a baseline from which replication and policy recommendations can be drawn for incorporation into the building codes of St. Kitts and Nevis and in the wider Caribbean.

The health facility requires several components as outlined in Table 2 to be mended in order to achieve the objective of the Smart Hospital Initiative. The cost associated with each area of work is also presented in the table below. These costs represent the initial costs of retrofitting the hospital; however, to sustain the characteristic of the Smart Hospital Initiative into the future incremental maintenance and operational costs will be incurred.

Table 2: Shows the estimated cost of Retrofitting the Hospital

Items	Description	Cost (US$)
1	Preliminaries	26473.06
2	Roof Renovations	18531.14
3	Windows	3088.52
4	Doors	33799.28
5	Plumbing and Sanitary Fixtures	14339.58
6	Electrical Works (Light and Power)	40283.18
7	Electrical Works (Emergency Power Supply)	7280.09
8	Mechanical works	36091.61
9	Interior Furnishings	1103.04
10	Wall Finishes	3750.35
11	Ceiling Finishes	4480.37
12	Code Compliance	9526.29
13	External Works	409.13
Total		**188155.65**

Future incremental maintenance and operational cost to be incurred includes (see Annex 1 for estimates associated with these activities):

- Building inspections
- Roof checks and maintenance
- Sanitation and safety checks
- Painting of the facility
- Administrative monitoring
- Insurance for the facility
- Labour costs associated with operating the facility
- Contingency for unforeseen or unplanned expenses

Cost-benefit Analysis: Findings

This section presents the findings of the Cost-benefit Analysis of the project based on a financial and an economic, social and environmental perspective.

Do Nothing

If nothing is done to rehabilitate and retrofit the health facility, the medical centre will continue to deteriorate. The estimated cost of doing nothing is based on the expected continued deterioration of the medical centre, which hinders its efficient operations, over the next 20 years.

It is assumed that the cost of deterioration to the medical facility is 5% per year of all tangible and non-tangible assets of the hospital. This 5% deterioration per year is related to

Table 3: Risk to Hospital Tangible and Non-Tangible Assets

Risk of deteriorate and increase vulnerable to climate variability and climate change	Do Nothing		
	Short-term	Medium-term	Long-term
Low			
Medium	X		
High		X	X

the aesthetics, security and safety, inadequate user take up and fees and inefficient water and light consumption. Additionally, the facility, as it is, is vulnerable to climate variability and climate change as it is not equipped to deal with the potential impact of climate change and extreme weather events such as hurricanes.

Retrofitting

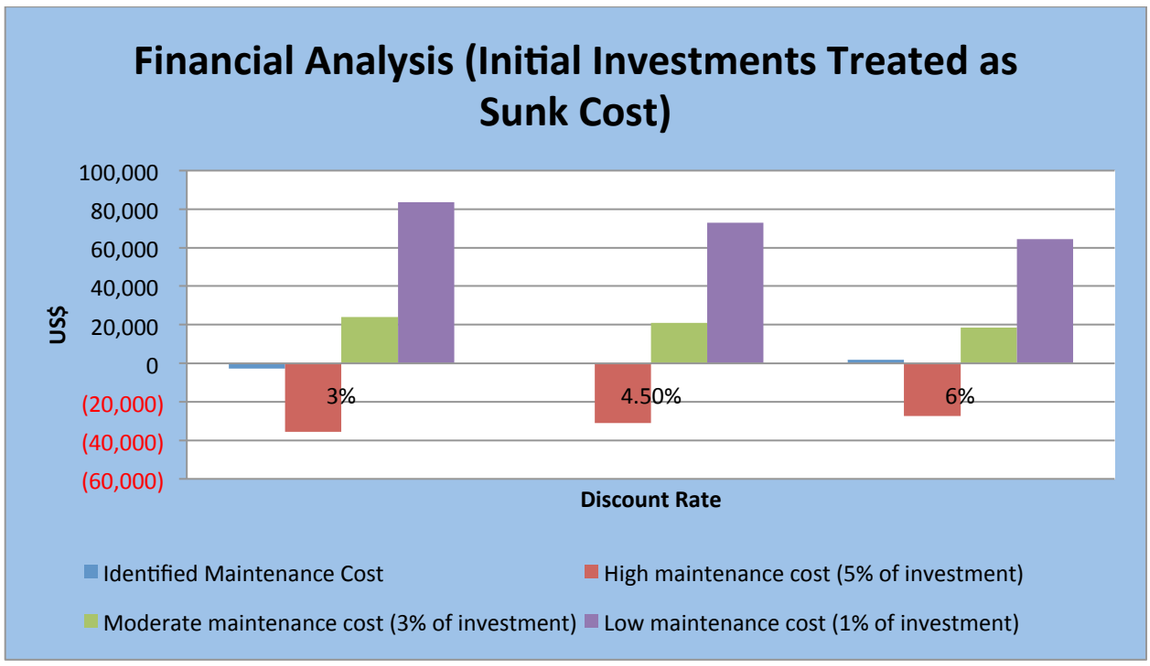
Financial Analysis

The financial analysis consists of recognizable monetary costs and benefits associated with the project implementation as well as its future sustainability. Two potential revenues sources, in the form of savings, were identified namely: (i) savings from the efficient utilization of water, and (ii) the efficiency in energy usage. This analysis assumes that the proposed renovations for the facility could lead to 20% and 10% more efficient in water and energy consumption respectively. No assumption was deduced with regards to the potential increase in the number of patients and revenue that could be generated since data concerning user fees and the number of patients who would visit due to the new aesthetics is unavailable.

Given the above identified revenue streams, from a financial point of view the project on average could see net losses of up to US$1,776 (at current prices) per year for 20 years (see Figure 1). The extent of the losses will be dependent on the activities used to operate and maintain the facilities implemented under this project, as well as the harnessing of further revenue streams. To financially sustain this project, ways must be found to minimize cost and generate funds. These could include:

- Revenue
    - User fees
    - Indirect taxes
    - Grant funding /donors
    - Fund raising ventures
    - Increased efficiency in water and energy consumption
- Cost
    - Hire person on a need basis
    - Maximize the require length for checks and maintenance without compromising the utility afforded under this project.
    - Utilize resources such as labour/skills efficiently

Figure 1: Financial Analysis: Cumulative Net Present Value (NPV) of the project for 20 years



Economic, Social and Environmental Analysis

In conducting the broader economic analysis some economic, social and environmental costs and benefits are identified and included. These are:

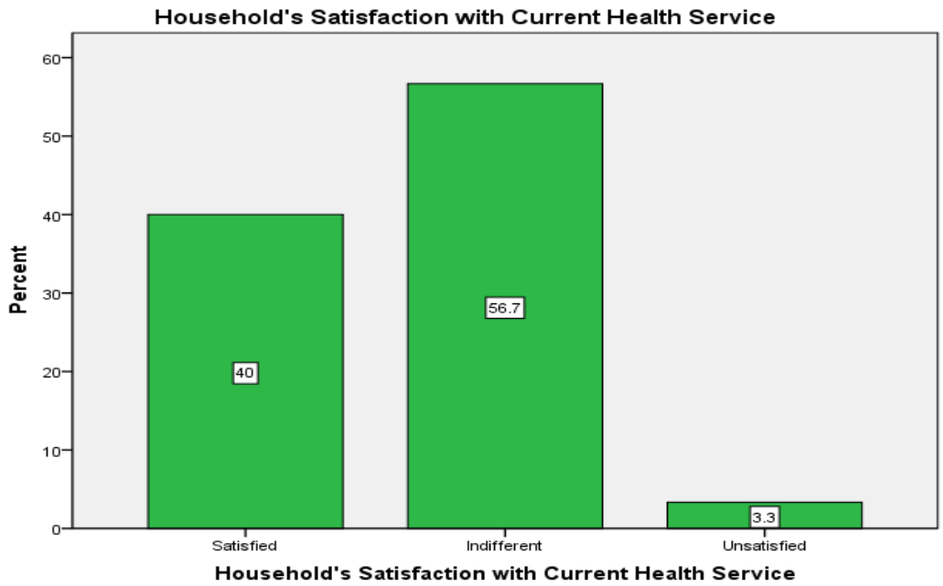
- The utility derived from the improved ventilation, security, safety, hygiene, accessibility, conservation, lighting, health, sanitation, aesthetics and morale;
- Treatment and reuse of sewerage water for landscaping purposes;
- Lesson learnt from implementing such an initiative and the possibility of replication this project for public buildings, hotels and schools; and
- Other benefits, not yet valued and included into the analysis, are net emissions, increased storage capacity, flood and earthquake mitigation.

Another significant output of the project was the involvement of the community. There was significant support from the community which allowed for greater buy-in with regards to the project. The project, through the willingness and ability to pay surveys, also allowed for close interaction with the community, which helped to educate and raise awareness in the community on the project as well as climate change concepts and issues. The traditional media and social media played a great role in raising the awareness of the population. The Government involvement was also vital in this process.

Major Findings of the Willingness and Ability to Pay Survey

A willingness and ability to pay survey[3] was used to estimate the utility derived from retrofitting the health facility. The findings of the survey suggested that 40% of respondents were satisfied with the current health service, 56.7% were indifferent and 3.3% dissatisfied.

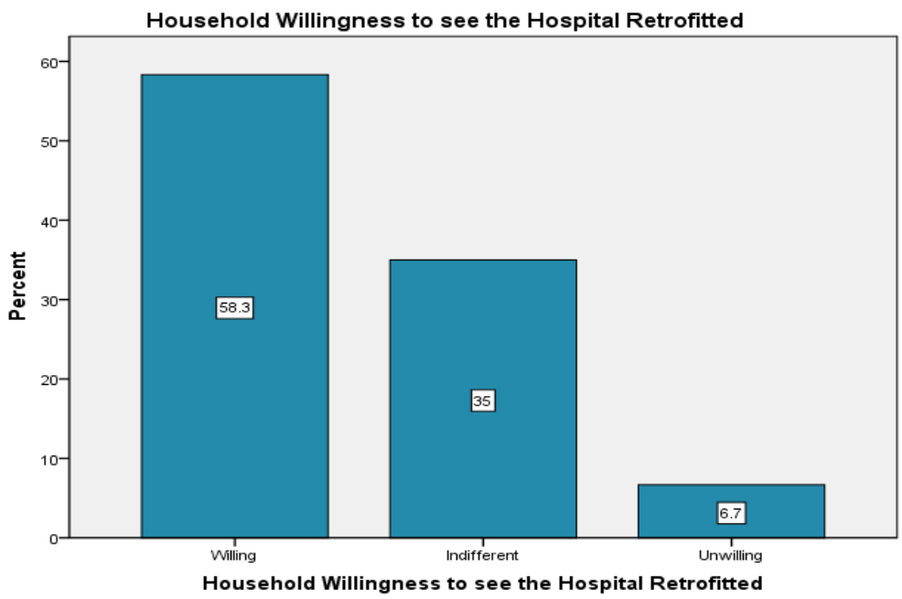
[3] See Annex 2 for results of the Willingness and Ability to pay survey.



Despite majority of the respondents suggesting that they are satisfied with the current health service, when asked about their major concerns about the current health care provided, the following suite of responses followed:

- Deteriorating structure, hospital facilities needs upgrading;
- There are inadequate medical supplies at the facility;
- There is a lack of specialist care and the facility is in need of more trained and qualified health professionals;
- There is a lack of privacy with medical records;
- Need for trained staff;
- The Pogson Medical Centre should be improved to provide hospital care long term admissions/treatments;
- Persons from the Sandy Point Area are transported to JNF Hospital in the Capital if they require long periods of monitoring;
- Better distribution of medical staff is needed to ensure the availability of doctors at rural hospitals ;
- Cost of healthcare and medication is high;
- Waiting time to receive service is too long.

See Annex 2 for a more detailed summary of respondents main concerns about the hospital and quality of service offered at the hospital.



The survey further revealed that 58.3% of respondents want to see the facility retrofitted, 35% are indifferent and 6.7% unwilling to see the retrofit. It was also found that the average willingness to pay for health services was US$19.67 and the average ability to pay was US$20.01[4].

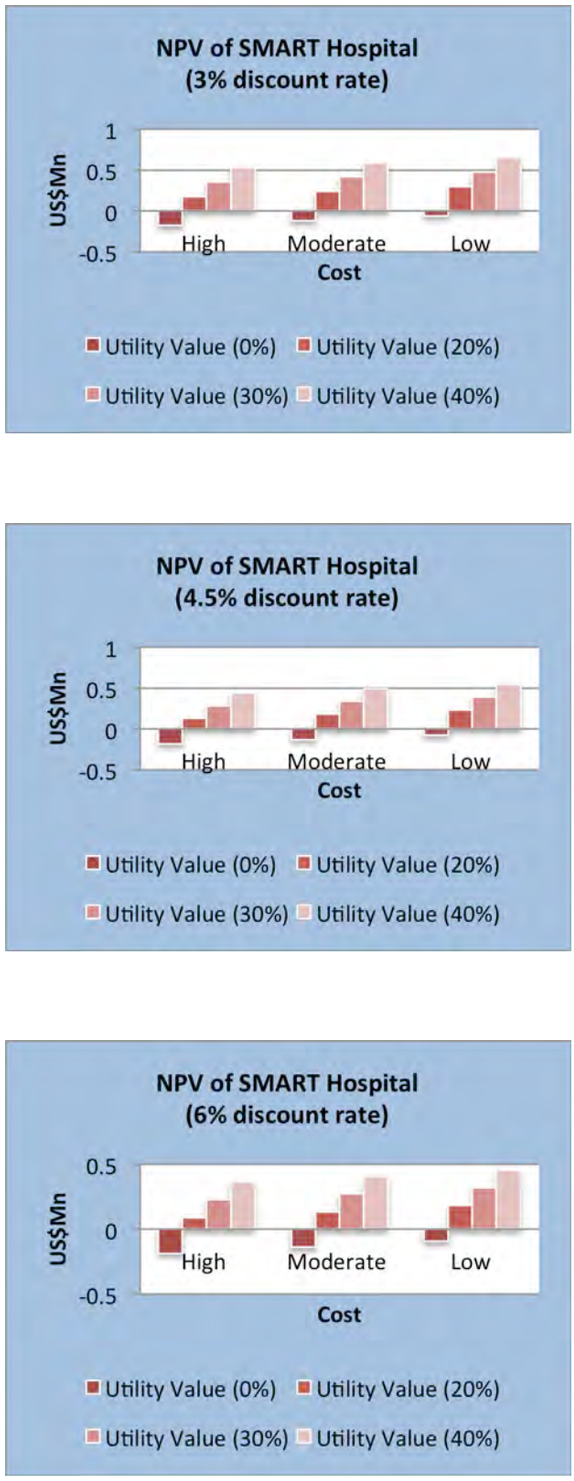
Discounting

In the context of climate change, the decision to invest in social and public projects, which are adaptation and mitigation strategies, are based on the prioritized needs of the society. Given the relevance of these strategies, great care must be taken when selecting the social discount rate[5], since the benefits of adaptation and mitigation strategies accrue over long periods of time and the choice of social discount rate can make a significant difference in whether the present value of an adaptation or mitigation strategy is positive or negative, or in other words, desirable or undesirable. Recognizing this, The Caribbean Community Climate Change Centre (CCCCC) estimated benchmarks for the Social Rate of Time Preference (SRTP) for selected Caribbean Countries.

Although, the CCCCC has benchmarked these rates, further research is needed to provide more precise and robust measure. Ramsey's equation is the methodology used to estimate these SRTP. When using Ramsey's equation (Ramsey, 1928) to estimate the SRTP, a major component/parameter is the growth rate of the economies of the Caribbean as such more scenarios related to the potential impact of climate change on the growth rate of the economies is desired. Furthermore, research is also needed to understand if and how the social discount rate differs across projects as well as its evolution with uncertainty and over time.

Discount rates of 3%, 4.5% and 6% were used in this analysis. CCCCC estimated that the SRTP for St. Kitts and Nevis is 5.61%; however, sensitivity analyses suggest it could range from 3% to 6%. Given the estimated lower and upper bounds for the SRTP, the discount rate was applied using three scenarios: the lower bound, midpoint and upper bound. This, it is believed, would better equip policy-makers to make an informed and reasoned decision.

Figure 4: ATP- Economic Analysis (Includes initial investment)



[4] The average presented here is the 5% trimmed mean.

[5] The social discount rate can be define at rate of at which a people is willing to forgo consumption now in order to derive benefits in future. It is also the rate at which funds are diverted from one alternative to another, i.e. the cost/benefit to society for investing in this project.

The economic value of the project is presented across four scenarios of utility[6]. The utility derived from the improved ventilation, security, safety, hygiene, accessibility, conservation, lighting, health, sanitation, aesthetics and morale is assumed as a percentage of household's willingness to pay (WTP) and ability to pay (ATP) for health services at the hospital (See Table 4).

Table 4: Values placed on Utility per Patient

Percentage	WTP (US$)	ATP (US$)
20%	3.9	4.0
30%	5.9	6.0
40%	7.8	8.0

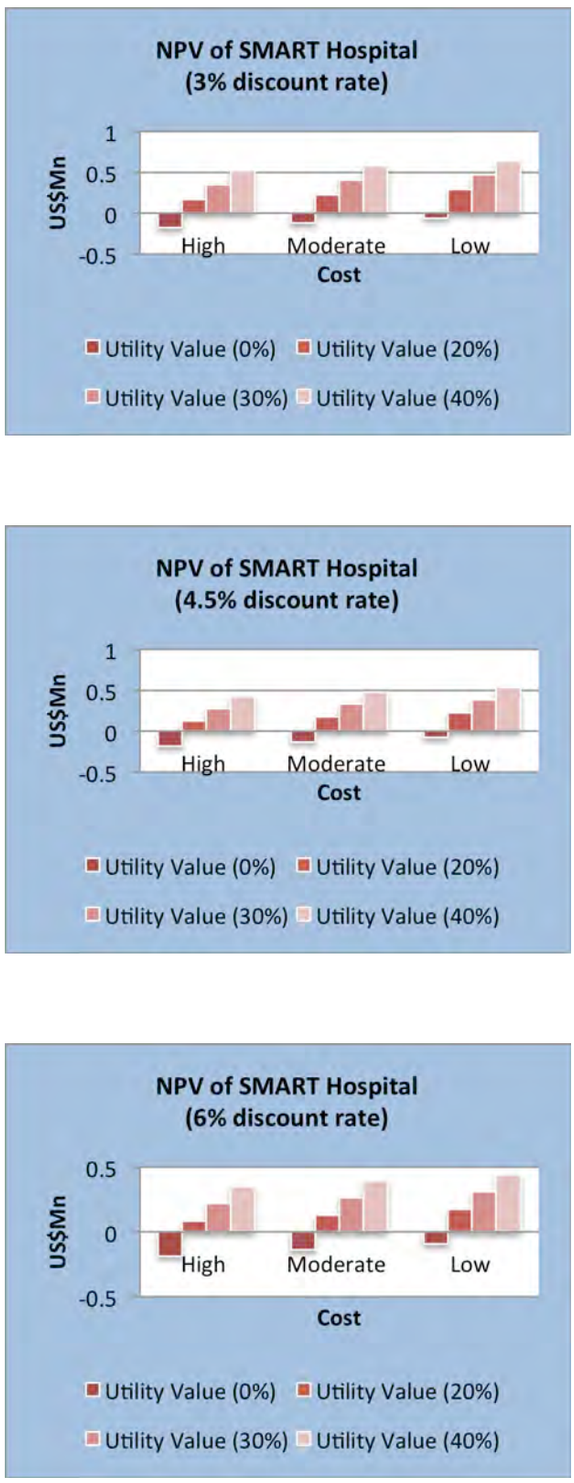
The project is found to have a positive NPV if the value utility per person is about 20% or more of the willingness and ability to pay for health services, which is greater than or equal to US$3.90 and US$4.00 per patient respectively (See Figure 4 and 5). With a zero discount rate, the analysis also suggests that the project viability is dependent on the internal rate of return, which range from 11% to 15%, i.e., the minimum rate of return that would make the project feasible falls within this range.

Sensitivity Analysis

The results of the CBA are sensitive to the assumptions regarding the value of the utility to be derived from those who use the facility and the costs associated with operating and maintaining the facilities implemented under this project.

- In this version of the analysis such utility is valued at 20%, 30% and 40% of the household's willingness and ability to pay for health services (US$3.90-4.00, US$5.90-6.00 and US$7.80-8.00 per person respectively). If the value is reduced below 20% of the household willingness and ability to pay for health services, the NPV of the project is negative irrespective of the operation and maintenance cost scenario applied.
- The operations and maintenance cost also play a significant role is determining the feasibility of this project. Increases in the operation and maintenance

Figure 5: WTP- Economic Analysis (Includes initial investment)



[6] Utility here refers to the willingness and ability of the individuals surv
better health service. In other words, it is the satisfaction that the community would derive if the hospital was retrofitted.

cost of the facilities implemented under this project could undermine the worthiness of the project; therefore, cost effective means must be found and pursued to maintain and operate the facilities.

Risk and Uncertainty

There are risks and uncertainty associated with retrofitting the Pogson Medical Centre that structural and can be classified within the following categories. These include:

- Extreme Events/Hurricanes - The retrofitting exercise is expected to be implemented during periods in which extreme weather events may be occurring. These carry appreciable construction delay risks.
- Human Resource Barriers - One of the biggest challenges is in identifying the right skilled contractors to carry out the works as some techniques are new and others require contractors with good experience and knowledge in Disaster Risk Reduction (DRR) and Climate Change (CC);
- Financial Barriers - The funding allocated for the demonstration component is specific and as such the scope of works had to be adjusted based on proposals received. The challenge here is ensuring maximum benefits and greatest impact from the limited allocations.
- Communication Barriers - Keeping all stakeholders involved and informed can be challenging as well as there are many players in the DRR and CC arena who must be part of the implementation and review process. Extensive administrative process within implementing agency contributed to delays.

Attribution to UK-DFID

DFID contribution to this effort is one that is timely and greatly appreciated. Like many of the other CARICOM countries, St. Kitts and Nevis is constraint fiscally due to indebtedness. In 2012, St. Kitts and Nevis had debt of 89.3% of GDP[7]. Given the fiscal constraints of the government of St. Kitts and Nevis, the contribution by DFID is making it possible for this intervention. Beyond improving the functionality of the Hospital, this contribution is also important as it aids the region to grapple with the effects of climate change whilst embarking on development in a sustainable way.

In support of the SMART Hospital Project being undertaken throughout the Caribbean, DFID is contributing a total of £913,750 between the year 2011 and 2013. In absent of such contribution from DFID, it would prolong inaction and hence the continued dilapidation of the hospital and substandard roofing, which put both staff and patients at risk.

Conclusion and Recommendation

In the analysis provided above, the Analyst utilized a variety of discount rates and differing assumptions to reach the conclusions drawn below. As one is prone to do in such analyses where actual data may not be readily available, the estimations tended to take the conservative route, only entering those benefits that are known, while over-estimating the costs.

With the currently identified revenue streams in the form of savings from efficient utilization of water and savings from the efficiency in energy usage, the project is not financially sustainable unless the capital investment is seen as a sunk

[7] Eastern Caribbean Central Bank (2013). Retrieved on June 4, 2013, from: http://www.eccb-centralbank.org/Statistics/

cost. Furthermore, even if the capital investment is seen as a sunk cost, the project is only feasible if the operation maintenance is below -3-4% of initial investment. It is therefore imperative that cost in minimized and other sources of revenue schemes are identified to financially support the project over its lifespan.

However, if treated as a financial venture, i.e., private sector or public private partnership (PPP) project the identified revenue streams from retrofitting the facility in the form of savings from the efficient utilization of water, savings that can be derived from savings in water and energy efficiency gains will only sustain the project financially over 20 years if significant cost effective measures are found. It is therefore imperative that the cost of maintenance and operation is minimized and other sources of revenue schemes are identified to financially support the project over its lifespan.

But the above finding also points to a fundamental issue that keeps occurring in the environmental economics literature. It is evident that for adaptation projects of this nature to succeed, moreover, given the limited fiscal space within which many governments in Small Island Developing States (SIDS) operate, funding for these types of initiatives either have to be of a grant or on a concessional basis.

From an economic, social and environmental perspective the project is desirable and it becomes even more desirable if the community (users and staff) derives significant utility from seeing the hospital retrofitted which includes improved ventilation, security, safety, hygiene, accessibility, wastage, lighting, health, sanitation, aesthetics and morale. This project presents a building code for St. Kitts and Nevis that other public buildings, schools and private building could adhere to.

It is important to note that when the economic analysis is done, when other benefits are added to the equation the project shows that is has a positive NPV, but as in the financial analysis, there must be scope for some level of cost recovery. The operations of the facility must be sustained and for this to occur, apart from cost recovery, the revenues saved from efficiency gains, avoided losses or avoided costs should all be fed back into the project to ensure its sustainability. Of significant, are the benefits derived from savings on energy consumed and enhanced energy efficiency. The Island has one of the highest energy costs in the region and this energy architecture makes most projects unsustainable. However, through building in energy efficiency criterion and utilizing a renewable energy source would allow the facility to be feasible. This is a significant lesson leaned for other such projects that may be undertaken.

Lastly, projects of this nature are likely to only succeed where there is stakeholder involvement. The willingness of the proponents to engage the members of the public and other support groups and educate them about this project about this project acted as a boon and is something that should continue to be promoted.

Annex 1: Summary and Justification of Key Analytical Parameters

Facts and Assumptions of the Model

- The initial cost to retrofit the Hospital is US$200,000.
- The model assumes a lifespan for the project of 20 years.
- All dollars are in US$ 2013 prices and inflation is assumed to be zero over the 20 years.

Costs Assumptions

- Maintenance and replacement cost is assumed to be 1%, 3% and 5% of the initial investment. It is assumed that 1% represents a low cost maintenance initiative, 3% moderate cost and 5% high cost. Note that operational and administrative costs are separate and apart from the maintenance cost and are estimated as detailed below.
- An additional scenario (identified maintenance cost) is provided where values are estimated for expected maintenance activities such as painting, roof checks and repairs and other provisional expenditure associated with the maintenance of the building.
    - Painting is assumed to be done every ten (10) years at US$60,000 per year.
    - Roof checks and minor repair is assumed to be done annually at a cost of US$1500 per year, starting in year two (2).
    - Other provisional maintenance expenditure assumed to be 0.5% of the initial investment.
    - Replacement cost related to door, windows, among other things is estimated to cost approximately US$2500 every three (3) years, starting in year three (3). This is against the background that some doors and windows may have to be replaced after a hurricane has pass.
    - Fillers and treatment cost assumed to be US$1000 per year.
- Administrative Cost - This is assumed to be 0.25% of the initial cost of retrofitting the hospital
- Insurance Cost - This is assumed to be 0.1% of the initial cost of retrofitting the hospital
- Labour Cost - It is assumed that one person will be hired to oversee the maintenance and upkeep (caretaker) of the SMART Hospital. This person is assumed to be paid US$600 per month.
- Carbon emitted when generator is used for emergency power (not measured and including in the analysis presented)
- Fuel needed of the generator. (not measured and including in the analysis presented)

Benefits Assumptions

- The Ability and Willingness to pay Survey conducted on the island in 2013 revealed that several persons travelled to the Hospital in Basseterre due to the dilapidated conditions among other things at Pogson Medical Centre. One of many household comments

> "Persons do not stay at Pogson for long, they tend to send you to Basseterre if you require long period for monitoring"

If the Hospital is retrofitted it will save some clients having to travel from the JFN Hospital in Basseterre. The average cost for transport from the windward side of the island to Kingston range from US$2.22 to US$3.70 (EC$6 to EC$10). It is assume that with the retrofitted Hospital, all other things constant, clientele could increase by 10%. Over the past 5 years admissions, casualties and nebulization average about 6000 patients per year.

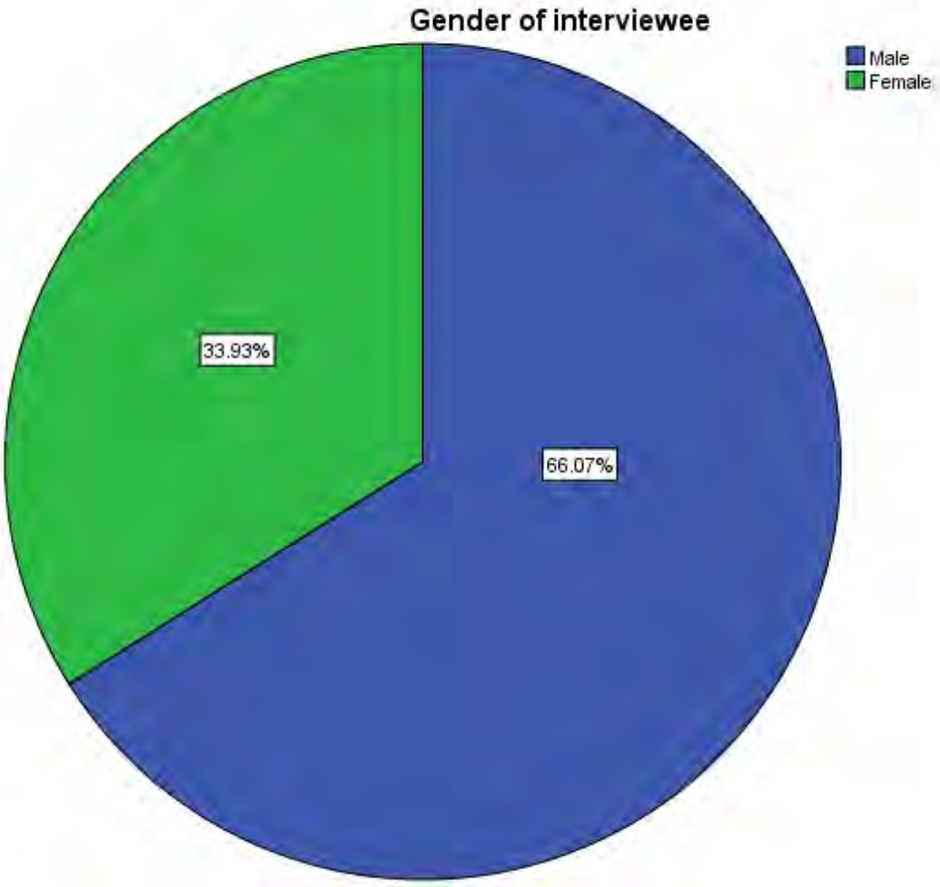
- With the proposed plumbing works and installation of more water efficient faucets and shower heads, it is assumed that water consumption will decrease by about 30% per gallons/bed/day. For the period 2009-2011 the average water consumption was 5400 gallons per day. Note that this assumption ignores the potential increase in water demand due to the potential increase in the take up of the Hospital services.
- With proposed electrical work (light and power) which includes re-wiring and installing light bulbs, switches, breaker panels, surge protector and a transformer unit, it is assume that energy efficiency will increase by 10% (assumed net result of intervention). The improved energy efficiency is valued at 10% of the current energy consumption and cost. The Hospital reportedly paid on average US$1000 (EC2$2,700) per month.

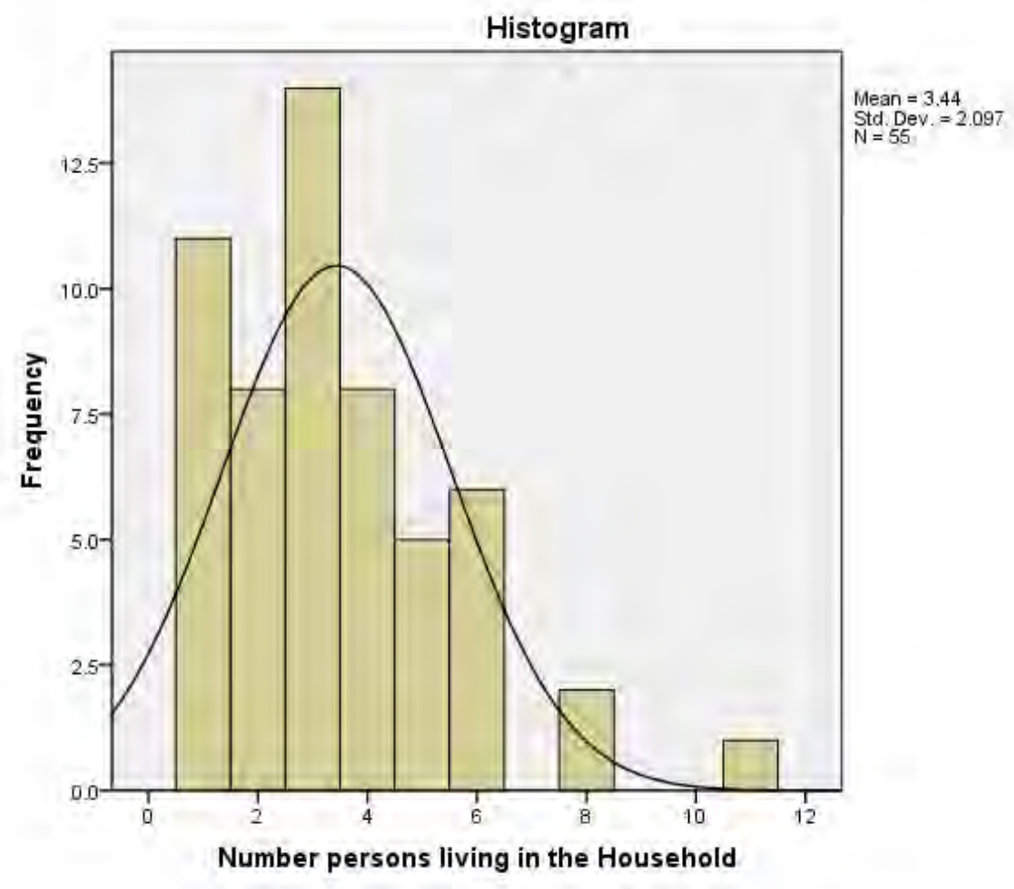
  The Ability and Willingness to Pay Survey also revealed that clients were on average able and willing to pay to US$20 and US$19 respectively for improve health service per visit. It is assumed that 20%, 30% or 40% of the aforementioned valued is placed on the value placed on the utility to be derived from the improved ventilation, security, safety, hygiene, accessibility, lighting, healthier, sanitary, aesthetics and morale. This value is multiplied by the average number of visitor to the hospital over the period 2009-2011.
- The value of energy produced during the periods of block out and or a natural disaster is used to represent to benefits of having an emergency supply. Note that no premium is added onto this. (not measured and including in the analysis presented)
- Solar system. (not measured and including in the analysis presented)
- It is estimated that St. Kitts and Nevis is affected by hurricane every 3.2 years and suffers a direct hit on average 23.5 years[8]. In 2010, Tomas, a category two hurricane, caused damages of US$3.3 millions, with no reported death. In 2004, Ivan, a category one hurricane, caused damages amounting to U$40million[9]. Included in these figures were damages to roads, houses, public buildings, schools, hospitals among other things. It is against this background that it assumed that 1% of US$3.3 million could have been avoid if the hospital and other public buildings adapt this building code. This new building code developed and adapted for this project will also have far-reaching benefits if retrofitting the hospital serves a pilot for public buildings and school.

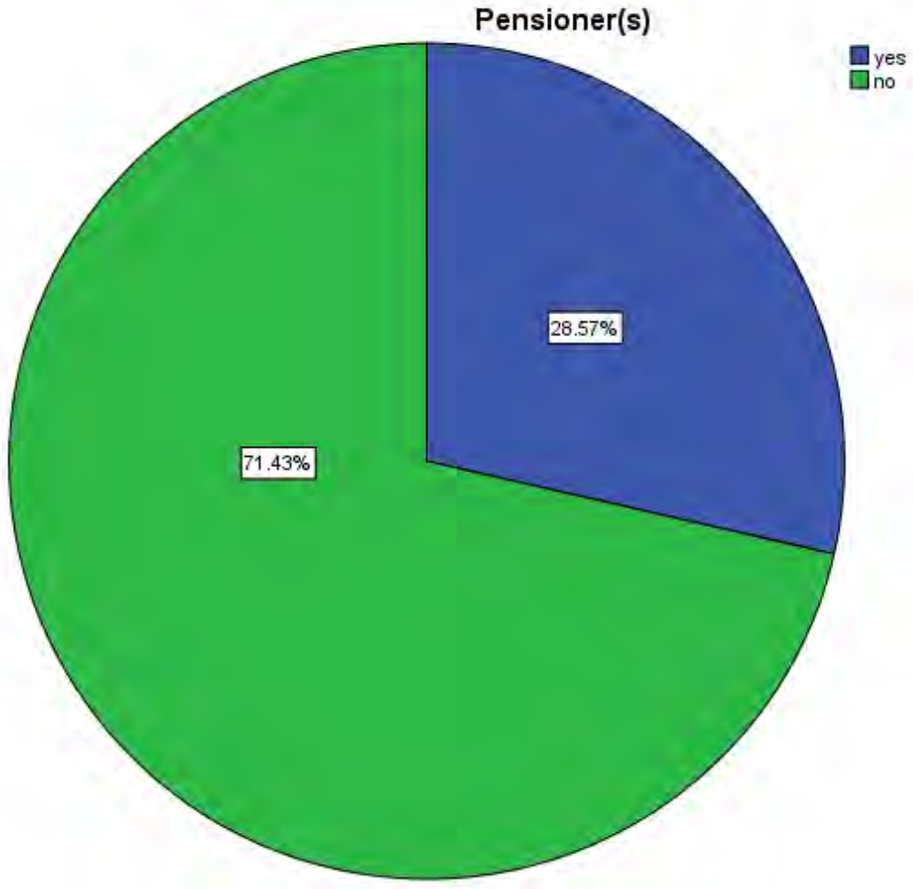
  Note that this estimate grossly underestimates the value of the building code as it ignores the multiplier effects associated with the injection of money each year into the economy as well as the positive externality associated with the improved aesthetics.

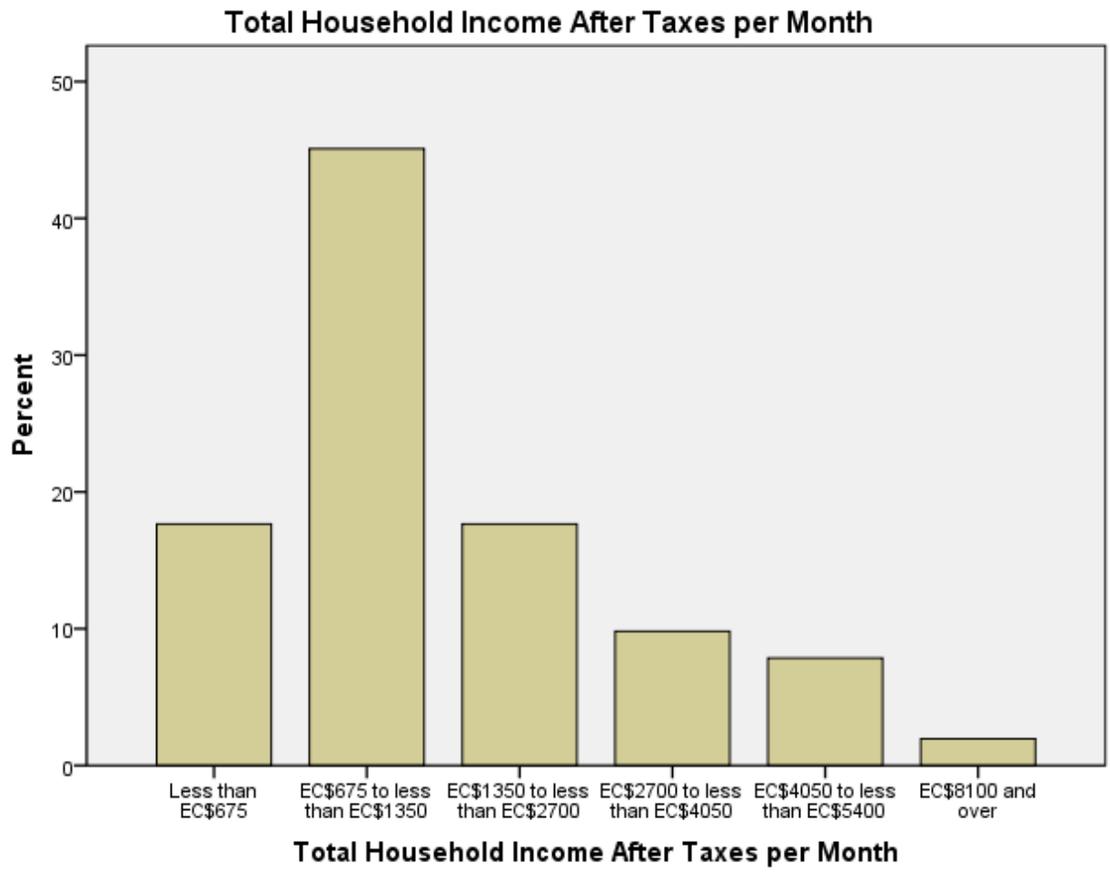
[8] Hurricane City , 2011. Retrieved on May 30, 2013, from: http://www.hurricanecity.com/city/saintvincent.htm
[9] NOAA, 2013. Retrieved on May 30, 2013 from: http://www.nhc.noaa.gov/2004ivan.shtml?

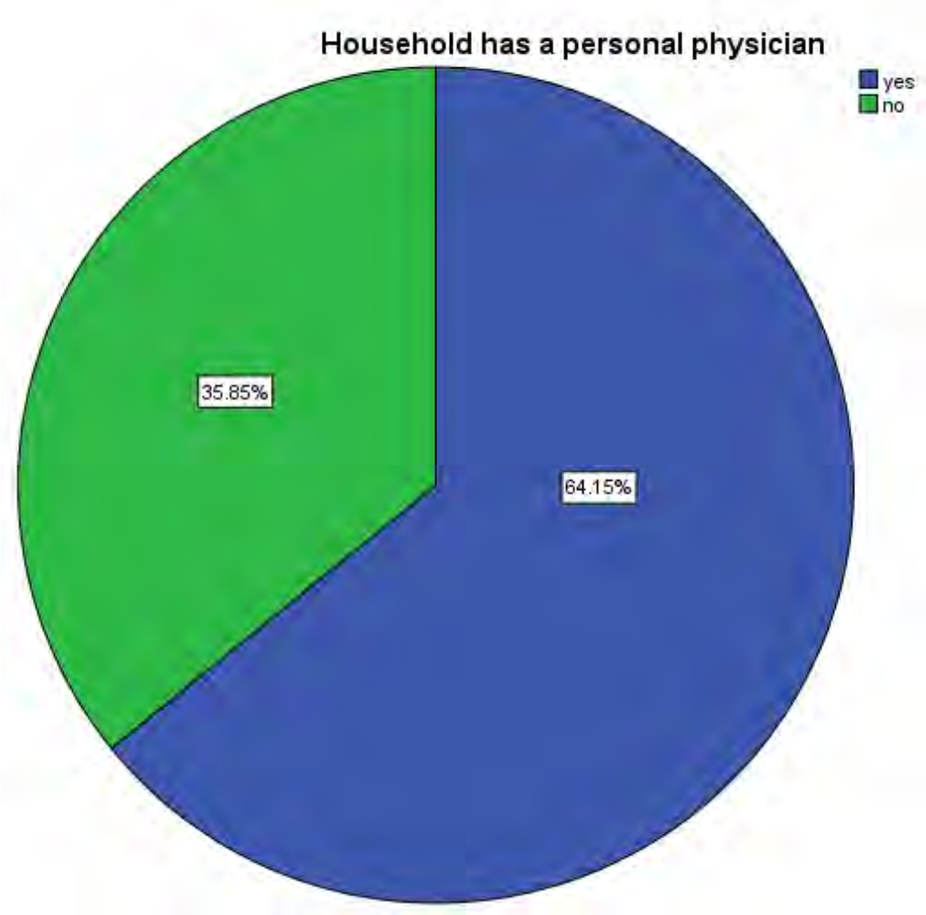
Annex 2: Some results from the willingness and ability to pay survey for Health Services, St Vincent and the Grenadines



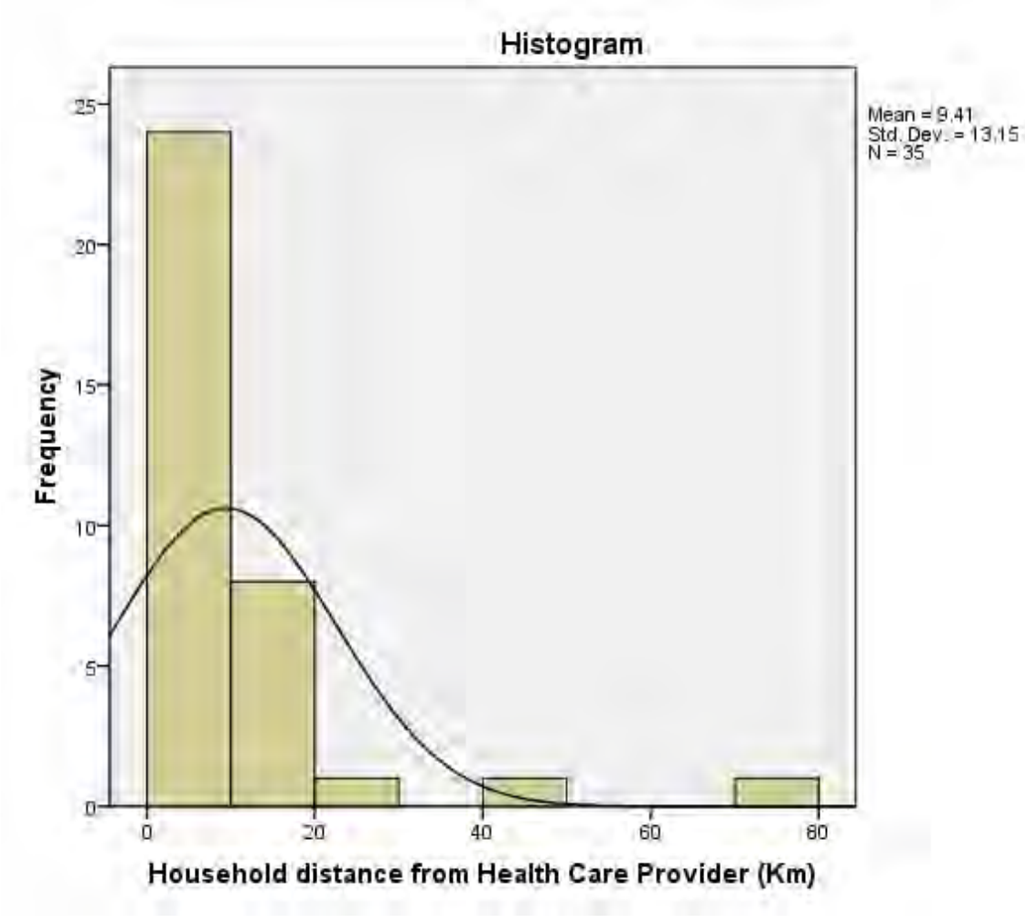



Pensioner(s)
yes
no
28.57%
71.43%


Total Household Income After Taxes per Month
Percent
50
40
30
20
10
0
Less than EC$675
EC$675 to less than EC$1350
EC$1350 to less than EC$2700
EC$2700 to less than EC$4050
EC$4050 to less than EC$5400
EC$8100 and over
Total Household Income After Taxes per Month



Number times the household visit the physician per year					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	9	15.0	28.1	28.1
	2	10	16.7	31.3	59.4
	3	9	15.0	28.1	87.5
	5	3	5.0	9.4	96.9
	12	1	1.7	3.1	100.0
	Total	32	53.3	100.0	
Missing	System	28	46.7		
Total		60	100.0		



Household's Maximum Willingness and Ability to Pay

			Statistic	Std. Error
Maximum household would be ABLE to pay per month for improved health services	Mean		63.4898	10.81862
	95% Confidence Interval for Mean	Lower Bound	41.7375	
		Upper Bound	85.2421	
	5% Trimmed Mean		54.0363	
	Median		50.0000	
	Variance		5735.088	
	Std. Deviation		75.73037	
	Minimum		1.00	
	Maximum		300.00	
	Range		299.00	
	Interquartile Range		75.00	
	Skewness		1.928	.340
	Kurtosis		3.340	.668
Maximum household would be WILLING to pay per month for improved health services	Mean		61.5510	10.16840
	95% Confidence Interval for Mean	Lower Bound	41.1061	
		Upper Bound	81.9960	
	5% Trimmed Mean		53.1293	
	Median		50.0000	
	Variance		5066.419	
	Std. Deviation		71.17878	
	Minimum		1.00	
	Maximum		300.00	
	Range		299.00	
	Interquartile Range		67.50	
	Skewness		1.794	.340

Household's Maximum Willingness and Ability to Pay

			Statistic	Std. Error
Maximum household would be ABLE to pay per month for improved health services	Mean		63.4898	10.81862
	95% Confidence Interval for Mean	Lower Bound	41.7375	
		Upper Bound	85.2421	
	5% Trimmed Mean		54.0363	
	Median		50.0000	
	Variance		5735.088	
	Std. Deviation		75.73037	
	Minimum		1.00	
	Maximum		300.00	
	Range		299.00	
	Interquartile Range		75.00	
	Skewness		1.928	.340
	Kurtosis		3.340	.668
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	95% Confidence Interval for Mean	Lower Bound	41.1061	
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	5% Trimmed Mean		53.1293	
	Median		50.0000	
	Variance		5066.419	
	Std. Deviation		71.17878	
	Minimum		1.00	
	Maximum		300.00	
	Range		299.00	
	Interquartile Range		67.50	
	Skewness		1.794	.340
	Kurtosis		2.879	.668

Household's main concern about the current health care provided at Pogson Medical Centre

Accessibility
Availability of District Doctors
Cost of healthcare too expensive
Cost of medication is too high

Current system is good; It just needs more sophisticated equipment eg. MRI Machines so that people do not have to travel overseas
Deteriorating structures, hospital needs upgrading

Have more trained staff and more medical equipment
Insufficient medication,more constant supply of certain diabetic drugs, especially Clybinde
Long wait on doctors and the facility could be made better

More specialized surgery doctors for better heart diagnosis
Our island should provide a variety of health care services that is adequate to save our lives
My insurance card should be valid for any services on the island
Needs more trained staff

No concern, the healthcare system has improved a lot
No confidentiality at pPogson Medical Centre

Persons do not stay at Pogson for long, they tend to send you to Basseterre if you require long period for monitoring Service is too slow, quality of services needs improvement The involvement of family in the health care service and not being dependent on the nurses The long wait to see a doctor
Too far away Try to make the health care more comfortable Unsatisfactory service from the workers

Annex 3: Internal Rate of Return

WTP IRR of the project over 20 years (US$)

	Identified Maintenance Cost	Scenario 1 (High maintenance cost)	Scenario 2 (Moderate maintenance cost)	Scenario 3 (Low maintenance cost)
	Discount Rate 8%			
Utility Value (0%)	N/A	N/A	N/A	N/A
Utility Value (20%)	6%	4%	7%	9%
Utility Value (30%)	13%	11%	13%	15%
Utility Value (40%)	18%	16%	18%	20%
	Discount Rate 5.5%			
Utility Value (0%)	N/A	N/A	N/A	N/A
Utility Value (20%)	8%	6%	8%	10%
Utility Value (30%)	14%	12%	14%	16%
Utility Value (40%)	22%	18%	20%	22%
	Discount Rate 3%			
Utility Value (0%)	N/A	N/A	N/A	N/A
Utility Value (20%)	9%	7%	10%	12%
Utility Value (30%)	16%	14%	16%	18%
Utility Value (40%)	22%	20%	21%	23%
	Discount Rate 0%			
Utility Value (0%)	N/A	N/A	N/A	N/A
Utility Value (20%)	12%	11%	13%	15%
Utility Value (30%)	17%	17%	19%	21%
Utility Value (40%)	25%	25%	25%	28%

ATP IRR of the project over 20 years (US$)

	Identified Maintenance Cost	**Scenario 1 (High maintenance cost)**	**Scenario 2 (Moderate maintenance cost)**	**Scenario 3 (Low maintenance cost)**
	Discount Rate 8%			
Utility Value (0%)	N/A	N/A	N/A	N/A
Utility Value (20%)	6%	5%	7%	9%
Utility Value (30%)	13%	11%	13%	15%
Utility Value (40%)	19%	17%	19%	20%
	Discount Rate 5.5%			
Utility Value (0%)	N/A	N/A	N/A	N/A
Utility Value (20%)	8%	6%	8%	10%
Utility Value (30%)	15%	13%	15%	16%
Utility Value (40%)	21%	18%	20%	22%
	Discount Rate 3%			

Utility Value (0%)	N/A	N/A	N/A	N/A
Utility Value (20%)	10%	8%	10%	12%
Utility Value (30%)	16%	14%	16%	18%
Utility Value (40%)	22%	20%	22%	24%
	Discount Rate 0%			
Utility Value (0%)	N/A	N/A	N/A	N/A
Utility Value (20%)	13%	11%	13%	15%
Utility Value (30%)	20%	18%	20%	22%
Utility Value (40%)	26%	24%	26%	28%

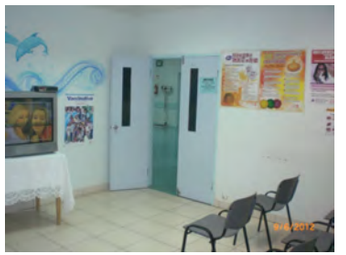
Annex 4: Scope of Works and Technical Specifications

ITEM NO.	AREA/ROOM	ITEM DESCRIPTION (DEFECT, ISSUE)	SCOPE OF WORKS REQUIRED	COST BENEFIT PHOTOGRAPHS AS ATTACHED AS GUIDE
2	**Roof Works**	**Defect:** • The main entry roof is very vulnerable to wind uplift. • Water damage and fading of the concrete parapet walls and to fascia boards. **Issue:** • No access is available to the roof of the facility; No ladder available. • The hip and gable roof sections have four (4) roof vents along the ridge beam of the roof. They are prone to water intrusion under high wind conditions. • Visually, there is cracking, peeling of paint and water damage along the concrete drain parapets. • The gable and hip roof sections have no guttering to control or capture the water flow off the roofs. • The concrete roof sections may be at risk of cracking.	**Works Required:** **General** a) Install a heavy duty aluminum retractable wall mounted access ladder to north side of the building. This is to be installed along the concrete roof sections and provide ease of access to the roof. b) Replace any damaged or badly corroded hurricane clips at all wood rafter and beam connections. c) Make provisions to repair or replace any damaged or corroded roof sheeting, flashing, or fastener. Make good any damages to ceiling boards, wood rafters or fascia boards (if necessary). d) Replace any damaged or missing insect screens located at the four (4) roof vent sections on the hip and gable roof sections. Make provisions to apply waterproofing seal with mold and mildew resistant silicone if necessary. e) Repair all water damaged parapet wall/drains and clear all drains of debris. Repaint and make good all parapet walls with same color paint as specified in Item No.11 – Wall finishes. f) Make provisions to clean and apply concrete roof surface with high quality waterproofing compound. (See roof drawings for location and concrete roof square footage). g) Install a water guttering system on the hip and gable roof sections to control the flow and harvest rain water. **Note: Gutters are to be installed along the south and west side (outer side) of the hip roof section and diverted to the proposed 300 gallon water storage tank on the south side of the building.** **Gutters are to be installed on the inner side of the hip roof section and on the gable roof section (main entry) and diverted to the concrete roof drains.**	**Benefit:** • To address any water damages to the exposed concrete roof, fascia board and parapet walls. • To eliminate the infestation of insects by repairing o replacing insect screens. • To minimize the wind uplift vulnerability on the roof an maintain its structural integrity. • To ensure effective capture of rain water for use and t control the flow of water to drains to minimize erosion o soil around the building. • To maintain the roof's integrity to accept the solar panel for the proposed Photo Voltaic (PV) system. • To reduce the transfer of heat radiation through th concrete roof sections into the building.  

			Specifications: a) All roofing material installation shall be conducted in accordance with the Manufacturers requirements and in strict compliance with the Local and International building regulations and guidelines. b) Roof Access ladder must be an aluminum heavy duty retractable ladder with side rails and safety cage. It must also be wall mounted and retractable to prohibit unauthorized access to the roof. c) For water guttering system, use commercial grade PVCu Sovereign style guttering system 117 x 55mm (70 cm2); white with all downspouts, parts, and fittings including debris screens. d) For any roof sheeting or flashing replacement, use 24 gauge pre-painted galvalume to match existing profile and colour with matching fasteners and flashing. e) For any other roof painting works, check paints for suitability, and where possible use non-toxic acrylic based paints designed for exterior and roof use. Do not use paints containing lead, chromate, tar/bitumen, fungicides or other toxins as they may pose a health risk and/or may impart an unpleasant taste to the water; colour to be approved by Project Manager or Check consultant. f) Concrete roof waterproofing compound must be a flexible, U.V. resistant elastomeric compound that is designed for all roofing and flashing applications. It must provide a long lasting, energy efficient surface. g) Do not allow runoff water from the first rainfall to enter the proposed water storage tank. It should be discarded or used for nondrinking purposes.	 **Main entry ceiling**  **Ambulance Port (Southern side of facility)** 

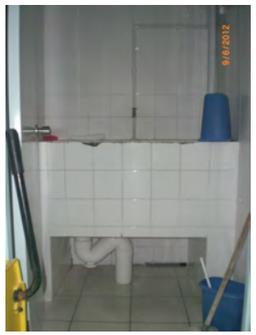
ITEM NO.	**AREA/ROOM**	**ITEM DESCRIPTION (DEFECT, ISSUE)**	**SCOPE OF WORKS REQUIRED**	**COST BENEFIT** **PHOTOGRAPHS AS ATTACHED AS GUIDE**

3	**Windows** **Hospital & Healthcare section**	**Defect:** • Some windows are inoperable; winder mechanism needs to be repaired or replaced. • Window in x-ray room is not lead lined to minimize radiation exposure. **Issue:** • Some of the windows are inoperable and require winder mechanism replacement or repair. • Windows are only tinted on the north (healthcare) side of the building. There is no tint or solar protection on the three (3) other sides of the building. • Windows in the x-ray room poses a high risk of radiation penetrating the room.	**Works Required:** **General** a) Inspect all windows and make repair to any damaged windows or winder mechanism. b) Make provisions to properly waterproof and insulate all window sills and encasements with silicone. c) Install new non-reflective solar protective window films to all windows. **X-ray Room** a) Remove existing window in room and enclose opening with cinder blocks. Fill all block cores with concrete and restore wall plastering and paint finish to both interior and exterior surfaces. **Specifications:** a) All window installation and repairs shall be conducted in accordance to Manufacturers requirements and in strict compliance with the Local and International building regulations and guidelines. b) Use mold and mildew resistant silicone for waterproofing seal to all windows. c) Window film shall be Solar Gard window films or equal substitute that provides low emissivity, maximum protection from solar heat and blocks up to 99% of UV rays.	**Benefit:** • To improve ventilation and provide an increase level o security. • To eliminate water intrusion through the windows durin high wind and heavy rain events. • It will show potential savings on the energy bill b keeping the building cool. • It will provide solar heat and glare protection fo improved comfort • It will provide protection by holding shards of glas together if broken • Protects employees, patients and property fron damaging ultraviolet rays. • Removal of window will eliminate the exposure an leakage of radiation from the X-ray room. **Windows on the Healthcare side of the facility**  **Windows in the X-Ray room** 
ITEM	**AREA/ROOM**	**ITEM DESCRIPTION**	**SCOPE OF WORKS REQUIRED**	**COST BENEFIT**

NO.		(DEFECT, ISSUE)		PHOTOGRAPHS AS ATTACHED AS GUIDE
4	**Doors: Interior and Exterior** **Hospital & Healthcare section**	**Defect:** • Some exterior doors have termite damage and lack sufficient security and safety features **Issue:** • The doors at all designated emergency exits are not adequately fire rated. They also lack security features and have no panic bar mechanism. • Some exit doors swing direction is inappropriate and require adjustment. • The facility is equipped with a key pad security system to most entry/exit doors. One code is used by staff to access all doors throughout the entire facility. • Some interior doors strategically require a security lock mechanism to prohibit unauthorized access from the healthcare area to the hospital area. • The louvered double doors at the emergency generator housing are termite damaged and require replacement with fire rate doors. • The door at the x-ray room may not be adequately lead lined to minimize radiation exposure and leakage.	**Works Required:** **General** a) Remove all designated emergency exit doors and make good all openings. b) Install (No. 7) new emergency exit doors with fire rated exit doors, panic mechanism and steel reinforced glass sash with door closures. (See floor plan and door schedule for exterior door type, quantity and location). c) Replace the existing key pad security system with a swipe card security system and make good all connections to emergency exits and designated interior doors (See Item no.14 – Code compliance for more information). d) Install new security (swipe card) lock mechanism to no. 2 existing interior doors to prohibit unauthorized access. (See floor plan for designated doors to be retrofitted). e) Remove two (2) existing 6'-0" double wooden louvered doors and jambs at the emergency generator housing and replace with pre-hung metal, fire rated louvered doors with jambs, heavy duty hinges and hardware (See door schedule for more information). f) Assess the existing door of the x-ray room for lead lined radiation compliance. If non-compliant, replace door with new pre-hung lead lined door and frame with hardware and door closure as specified. g) Make provisions to adjust door swing directions and replace door jambs; equip all doors with heavy duty door closures. **Specifications:** a) All doors and security installations shall be conducted in accordance to Manufacturers requirements and in strict compliance with the Local and International building regulations and guidelines. b) For all door sizes, quantity and retrofit specification, see floor plan drawings and door schedule for more information. c) Lead lined door for the x-ray room must be pre-hung and fire rated with hardware and door closure. It is mandatory that the contractor comply with the Manufacturer's instructions for receiving, handling, storing and protecting of such materials. Standard lead doors are manufactured with lead thickness of less than 0.25 inches.	**Benefit:** • To improve the facility's level of safety, egress accessibility and security. • To eliminate the exposure and leakage of radiation from the X-ray room. **Interior Door in Hospital waiting area to receive swipe card access**  **Generator Housing Doors to be replaced** 

ITEM NO.	AREA/ROOM	ITEM DESCRIPTION (DEFECT, ISSUE)	SCOPE OF WORKS REQUIRED	COST BENEFIT
				PHOTOGRAPHS AS ATTACHED AS GUIDE

5	**Plumbing Works & Sanitary Fixtures** **Hospital & Healthcare section**	**Defect:** • Most fixtures are leaky and not aerated. • Some sink traps require replacement. **Issue:** • Most of the faucets and shower heads in the restrooms not aerated. • Some toilets have minor damages and require repair. • Urinals are not operational and require replacement.	**Works Required:** **General** a) All plumbing installations shall be conducted in accordance to the Manufacturers requirements and in strict compliance with the Local building regulations and guidelines. **All Examination and Treatment Rooms in both Hospital & Healthcare** a) Remove the existing wall mounted or pedestal sink face basins from the wall and re-tile backsplash areas with matching tiles and grout. b) Refurbish existing sinks and replace to repaired tiled surface. Fill all spaces with mold and mildew waterproof silicone. c) Replace all face basin faucets with aerated faucets and antimicrobial handles as specified. d) Make provisions to repair or replace all traps, shut off valves, fittings and reseal all spaces with mold and mildew resistant silicone if necessary. **All Restrooms, Private and Change Rooms** a) Replace all face basin faucets in all restrooms (both floors) with aerated faucets equipped with water metering system capability as specified. b) Replace all existing (no. 3) urinals with American Standard Washbrook FloWise Universal Urinal and make good all connections. c) Replace all shower heads with aerated shower heads. d) Replace any damaged parts or mechanisms to all existing toilets. e) Make provisions to repair or replace all traps, shut off valves, fittings and reseal all spaces with mold and mildew resistant silicone if necessary. **Kitchen and Staff Lounge** a) Replace (no. 2) existing faucet with water efficient aerated gooseneck faucets with antimicrobial handles. b) Install grease trap interceptors to sinks. c) Make provisions to repair or replace all traps, shut off valves, fittings and re-caulk areas with mold and mildew resistant silicone if necessary.	**Benefit:** • The installation of aerated faucets and shower heads wi improve water conservation and hygiene. • The upgrades to all toilet and urinals will improv hygiene and water conservation. • Grease trap interceptors installed will minimize greas and solids from entering the environment and improv the efficiency of the wastewater treatment plant. **Wall mounted face basins in the examination an treatment rooms**  **Counter sinks in restrooms**   **Condition of Sluice Sink**

			Labor & Delivery Room and Ward Area a) Replace (no.1) face basin faucet in the Labor & Delivery Room with aerated faucet and antimicrobial handles as specified. b) Replace (no.2) face basin faucet in the Ward Area with aerated faucet and antimicrobial handles as specified. c) Make provisions to repair or replace all traps, shut off valves, fittings and re-caulk areas with mold and mildew resistant silicone if necessary. **Sluice Room** a) Remove existing built in place sluice tub and tank assembly from location. b) Install new stainless steel sluice unit with cistern tank and install new aerated faucet with antimicrobial handles. Include wall mounted storage racks for bed pans. c) Make provisions to repair or replace all traps, shut off valves, fittings and re-caulk areas with mold and mildew resistant silicone if necessary **Trauma Room** a) Replace (no.1) face basin faucet with aerated faucet and antimicrobial handles as specified. b) Make provisions to repair or replace all traps, shut off valves, fittings and re-caulk areas with mold and mildew resistant silicone if necessary. **X-ray Room**	  **Trauma Room Face basin** 

			a) Replace (no.1) face basin faucet with aerated faucet and antimicrobial handles as specified. b) Make provisions to repair or replace all traps, shut off valves, fittings and re-caulk areas with mold and mildew resistant silicone if necessary. **Specifications:** a) Aerated faucets with water metering capability must be ADA complaint, vandal resistant and provide water conservation of at least 0.35 to 0.50 gpm. b) Aerated faucets with antimicrobial handles must be ADA complaint, vandal resistant and provide water conservation of at least 0.35 to 0.50 gpm. c) All urinals shall be American Standard Washbrook FloWise Universal Urinal 0.125 GPF with selectronic exposed AC flush valve. d) The Sluice sink/Slop Hooper must be a wall mounted stainless steel unit with continuous flushing rim and conical bowl for the disposal of liquid and solid waste. It must be HTM compliant and include all waste trap assembly, sink waste fitting, cistern internals, brackets and other assemblies.	

ITEM NO.	AREA/ROOM	ITEM DESCRIPTION (DEFECT, ISSUE)	SCOPE OF WORKS REQUIRED	COST BENEFIT
				PHOTOGRAPHS AS ATTACHED AS GUIDE

6	**Electrical Works-** Lights & Power (Lights- Interior and Exterior, Light switches, Receptacles, Breaker Panels, Transformer, Surge Protection) **Hospital & Healthcare section**	**Defect:** • Breakers trips constantly. • Light fixtures and ballast units are replaced constantly • Some receptacles not working. **Issue:** • Most of the electrical light fixtures are being replaced prematurely. • The ballast units for the fixtures are 50hz and are burning out prematurely. Needs to be replaced with 60hz units. • Some of the receptacles are inoperable and require replacement • Some of the light switches are inoperable and require replacement. • Most of the perimeter and landscape lights are damaged and needs to be replaced. • The building electrical breakers trips when multiple appliances and equipment are in use. Breakers in panels need to be upgraded.	**Works Required:** **General** a) Conduct an overall electrical assessment of all light fixtures, switches, breakers and breaker panels, receptacles, transformer, surge protection and all grounds of the building. b) Upgrade or replace all electrical receptacles, lights fixture ballasts, switches, breakers and breaker panels, transformer, surge protection and all grounds (both floors). c) Replace light switches in designated rooms with occupancy sensor switches. (See electrical lighting plan for room locations and quantity) d) Replace (No.4) exterior perimeter light fixtures. Repair or replace all parking garage light fixtures and replace all (No.4) entrance/exit gate light fixtures and landscape photocell accent light fixtures. Upgrade all fixtures with energy efficient LED bulbs and fixtures. e) Replace all parking lot lights with energy efficient LED bulbs. f) Make provisions for additional wirings, conduits and any other electrical installations to be done. **Specifications:** a) All Electrical installations shall be in accordance with the Manufacturers specifications and in strict compliance with local and international building regulations and guidelines. b) All interior ceiling light bulbs shall be replaced with T8 LED fluorescent tubular bulbs. (See electrical light drawings for light fixture location and quantities). c) See electrical light drawings for other light fixture type to be replaced with energy efficient units as specified. **Note:** **It is the responsibility of the contractor to verify all electrical fixtures and items to be replaced. Some electrical fixtures and there locations may not be shown in the electrical drawings provided by the St. Kitts/Nevis Public Works Department**.	**Benefit:** • It will improve the poor lighting conditions and reduc energy consumption. • It will improve the life span of the light fixtures. • It will improve the safety - of the building and enhanc the buildings safety and security. **Perimeter light fixture to be replaced**  **Parking Lot Light fixture**   **Landscape light fixture To be replaced** 
ITEM	**AREA/ROOM**	**ITEM DESCRIPTION**	**SCOPE OF WORKS REQUIRED**	**COST BENEFIT**

NO.		(DEFECT, ISSUE)		PHOTOGRAPHS AS ATTACHED AS GUIDE
7	**Electrical Works –** Emergency Power Supply **Hospital & Healthcare section**	**Defect:** • Battery supply faulty **Issue:** • The battery supply to the generator may be faulty and may require replacement. • The diesel storage tank for the generator is not properly anchored to its foundation and its supply line is unsafely suspended to the generator housing. • There is no spill over protection in the event of diesel fuel spills. • The electrical meter for the facility is inside of the generator housing. It should be relocated, sheltered and mounted on the outside wall of the generator housing for ease of access by the electrical company.	**Works Required:** **General** a) Conducts an assessment of the emergency generator engine, main disconnect switch and all other electrical components. b) Make provisions to allow for minor engine repairs or replacements, maintenance works, electrical items and equipment and for any necessary trenching, concrete surroundings, sand bed earthling support and electrical service installations. Also include termite treatment for the housing. c) Refurbish existing diesel storage tank by removing all diesel fuel residue, treat all rust spots, reinforce all seals and repaint. Fuel storage tank must be properly anchored to its concrete supports. d) Construct a fuel spill-over catchment beneath the fuel storage tank as specified. e) Make provisions to repair any damages to the existing fuel line, its connections and fuel valve. Also reinforce the connecting fuel line (suspended) between the storage tank and the generator housing. **Specifications:** a) All Electrical installations shall be in accordance with the Manufacturers specifications and in strict compliance with local and international building regulations and guidelines. b) The exterior door shall be (no.2) pre-hung fire rated metal doors with fixed louvers to allow for ventilation. It must be equipped with heavy duty corrosion resistant handles, knobs and hinges. Width of doors should be 6' -0". Contractor to verify opening of existing door height. c) The interior lighting shall be energy efficient LED light bulbs with heat resistant industrial fixture covers. d) Fuel spill-over catchment area must be at least 8'-0" L X 8'-0"W X 8" D or sized to accommodate at least 40 cubic ft. or 1.5 cu. yards of sand. Catchment base must be made of 4" thick concrete slab reinforced with BRC wire mesh. Use 6" concrete blocks as parapet walls with ½" steel bars at 16" o/c. Fill all block cores and provide plaster finish to block wall surfaces. Catchment area should be centered of the existing storage tank support columns.	**Benefit:** • To provide a reliable, back-up supply of electricity to the facility when the public supply and the PV system are down. • To improve the generator efficiency through improved ventilation and increase its life cycle. • To protect the environment of any ground contamination from fuel spills. **Emergency Generator & Housing**  **Diesel Storage tank for emergency generator** 
ITEM	**AREA/ROOM**	**ITEM DESCRIPTION**	**SCOPE OF WORKS REQUIRED**	**COST BENEFIT**

NO.		(DEFECT, ISSUE)		
				PHOTOGRAPHS AS ATTACHED AS GUIDE

8	**Electrical Works –** Alternate Power Supply **Hospital & Healthcare section**	**Defect:** • Non-existent **Issue:** • The facility presently relies completely on electricity provided by St. Kitts Electricity Company Limited • No annual electrical consumption data was available. Only 5 months received.	**Works Required:** **General** a) Install a Photovoltaic system on the south facing roof of the facility. b) Electrical consumption data for the facility is limited to only 5 months. (September 2012 thru Jan 2013). See Energy consumption data in specifications below. c) The Electrical contractor is required to the size of the PV system based on the average energy consumption and the availability of roof area to safely and efficiently mount the solar panels. d) Make provisions to connect PV system to the existing lightning protection and equipment. **Note: Our aim is to achieve the most viable cost benefit from the PV system installation especially considering that the electrical consumption is very high in relation to the facility's available roof surface area.** **The Electrical contractor will be required to provide an impact study table to determine the environmental impact, economic assessment and financial return of the PV system.** **Specifications:** a) All Solar Panel and Electrical installations for the PV system and Lightning protection and equipment shall be in accordance with the Manufacturers specifications and in strict compliance with local and international building regulations and guidelines. b) See roof drawings for the roof configuration, size and roof access point. c) The available electrical consumption data is as follows: i. September 2012 – 65,000 kw/hr ii. October 2012 - 39,500 kw/hr iii. November 2012 – 46,000 kw/hr iv. December 2012 – 36,000 kw/hr v. January 2013 – 51,000 kw/hr **Average kw/hr consumption per month: 47,500 kw/hr**	**Benefit:** • Solar energy can significantly reduce energy costs and contributions of greenhouse gases, toxic chemicals and pollutants to the atmosphere. The utilization of renewable energy will result in a 'greener' facility with a reduced carbon footprint.
ITEM NO.	**AREA/ROOM**	**ITEM DESCRIPTION (DEFECT, ISSUE)**	**SCOPE OF WORKS REQUIRED**	**COST BENEFIT**

				PHOTOGRAPHS AS ATTACHED AS GUIDE

9	**Mechanical Works –** Ventilation, Hot water systems, Cooling systems and Water catchment **Hospital & Healthcare section**	**Defect:** • No backup water supply • Lack of water treatment • Lack of ventilation in restrooms **Issue:** • There is no back up water supply available at the facility. • There is no water treatment system available at the facility. • The kitchen gets very hot during day especially when in use. No proper ventilation to remove the heated air. • There is no rain water harvesting. The existing 500 gallon capacity water tank (rest on top of a concrete platform) is insufficient and not connected. It is dependent on the potable water supply to be filled. • Most restroom exhaust fans are not working and rooms are not properly ventilated. • The electric water heater and storage tanks leaks and not efficient. • Most of the spilt air condition units are either not working or not energy star rated. • Some split a/c units are also not mounted off the ground to avoid damage from flooding. • LPG cylinders are exposed to direct sunlight and pose a hazard in the event of an	**Works Required:** **General** a) Remove the existing electrical water heater and dual electric water storage tanks. b) Install new solar water heaters on roof and make allowance for pipe works, plumbing and electrical service installations through and in roofs, floors and walls and to existing connections. c) Assess all existing split and central air condition units for optimum energy efficiency and rating. d) Replace all non-efficient or non-operational units with energy star rated air condition units in their existing rooms and areas. Make provisions for any necessary cutting of holes, pipe works, cleaning of existing ducts, new duct installation, replacement of filters, plumbing and all electrical installations. e) Extend the reach of the central air condition ducting with air supply vents to include the EMS room, the Nurse Station and the Patient Ward Areas. (See floor plan for room/area location and the A.C plan for existing ducting locations) f) Replace all existing ceiling exhaust fans in all restrooms, sluice room, and water closet rooms as specified. g) Install an extractor fan system over the existing stove in the kitchen, as specified. Make provisions for cutting holes, ducts and any electrical and cabinetry installations. h) Relocate the existing LPG cylinders and gas line connection from the walkway area to a secure location. i) Install wall mounted bracket straps to the oxygen tanks located in the storage room and to those individual tanks that currently occupy other rooms (Ward area, Private rooms, Labour & Delivery Room, etc.) j) Install a 3000 gallon water storage tank with anchoring hardware on a concrete platform, as specified by manufacturers. Make provisions for all plumbing works, the installation of a water filtration system and the implementation of a pump room and concrete slab. k) Install and size a water pump for the storage tank. **Specifications:**	**Benefit:** • Retrofit of the Hot water supply will reduce energy consumption and improve hygiene through the sterilization/cleaning of utensils, bed pans and other items within the facility. • Improved ventilation and the installation of cooling systems will improve patient/staff use satisfaction and also improve indoor air quality. • Allow for the use, collection and increased water storag capacity of rain water throughout the facilities an minimize the reliance of potable water supply. **Split Air condition unit in the X-ray room**  **Existing water tank on top of platform**  **LPG cylinders**

		evacuation. They are not properly housed or secured. • Oxygen tanks in the storage room and in the treatment/trauma rooms are not properly secured.	a) All mechanical installations shall be in accordance with the Manufacturers specifications and in strict compliance with local and international building regulations and guidelines. b) The central and split air condition units must be energy star rated and qualified models with SEER (Seasonal Energy Efficiency Ratio) of 13 or higher and appropriately sized (BTU) for each designated room. c) The central air condition units should be equipped with an efficient air-cleaning, air circulation and dehumidifying capability. All central units must be securely elevated and anchored to roof. d) The Split air condition units must be ductless with hygienic air filtration capability. All split unit compressors must be elevated and wall mounted. e) The Solar water heaters must be energy star rated with a capacity to provide sufficient hot water supply to all showers and sinks. It must be securely anchored to roof. f) All exhaust fans shall be replaced with quiet motion, energy star rated units (See drawings for location). g) The exhaust hood must be placed over the existing Vulcan 6 burner commercial grade stove with a commercial grade, energy rated range hood with a stainless steel finish to compliment stove. Make provisions for cutting holes, ducts, exhaust fans and any electrical and cabinetry works. h) Relocate and properly secure LPG cylinders and gas lines connections to a suitable, secured location (see drawings for proposed location). i) All wall mounted anchor brackets for oxygen tanks must be constructed of high gauge steel with a powder coated finish and using polypropylene straps. It must also be OSHA, UFC, NFPA and CGA compliant. j) Water Storage Tank shall be a 3000 gallon fiberglass above ground water storage tank (Containment solutions brand or equal substitute) designed to store **drinking water or collected rainwater.** Manufactured with the resin that fits storage application and with added UV resistant gel-coating. Tank should be of Fiberglass Construction, Gel Coated in Two-Part Epoxy, UV Filtration Available for Safe Drinking Water, Dome Top with Little Site Preparation Required. Ensure that tank can hold at least 2 days worth of water calculated at: 250 - 400 gal/bed/day (see appendix and drawings for further specifications and details).	**exposed to direct sunlight and pose a hazard. Not properly housed or secured.**  **Split unit compressor on walkway next to emergency exit stairs**  **Exhaust fan in restroom not working** 

			k) Water filtration system shall be positioned between storage tank and point of extraction to improve removal of fine particulate matter (including microbes) that will not be addressed by the screens. Filters may be simple charcoal and cotton filters, UV filters or similar. Filters with clear housings must be placed in a light-excluding cabinet as algae will eventually grow within the housing, reducing the effectiveness of the filter and degrading the quality of the water. Also, UV filters will require a power source and should not be used if chlorine will be used.	**Oxygen tanks in storage room and treatment rooms unsecured**  

ITEM NO.	AREA/ROOM	ITEM DESCRIPTION (DEFECT, ISSUE)	SCOPE OF WORKS REQUIRED	COST BENEFIT PHOTOGRAPHS AS ATTACHED AS GUIDE
10	**Interior Furnishings** **Hospital & Healthcare section**	**Defect:** • Shelving units not secured **Issue:** • All storage and shelving units that stores medical files, medications, medical supplies and medical equipment are not properly secured	**Works Required:** **General** a) Retrofit all storage cabinets and shelves with shock cord restraints as specified. **<u>Specifications:</u>** a) Shelf and cabinet restraints shall be outfitted to all unsecured shelves and storage cabinets. The rooms will include the pharmacy, triage, all treatment rooms, nurse's station, labor & delivery room, administrations & records, clean and medication rooms, etc. Some rooms or areas may use restraints like high-friction, non-adhesive cut-to-size PVC foam mats' double grip, on both the shelf and its contents to prevent movement. b) In areas such as pharmacy storage shelves or overhead bookshelves, it will be most effective to use high-quality Bungee cord that is stretched taut by plastic connectors at either end to restrain shelf contents. The cord's holding power is enforced by aluminum tubing. The bar-like cord swings up easily for convenient access.	**Benefit:** • To improve the safety and resilience of the facility against earthquakes. **Unsecured shelving units in the Triage and Treatment Rooms**  

ITEM NO.	AREA/ROOM	ITEM DESCRIPTION (DEFECT, ISSUE)	SCOPE OF WORKS REQUIRED	COST BENEFIT PHOTOGRAPHS AS ATTACHED AS GUIDE
11	**Wall Finishes-** Exterior and Interior Walls **Hospital & Healthcare section**	**Defect:** • Fading, Peeling and moss/mold growth on walls **Issue:** • The paint on the parapet walls of the facility is fading and peeling. • Some interior and exterior wall surfaces are dirty and fading.	**Works Required:** a) Touch up exterior and interior wall surfaces that are fading, peeling or dirty with moss/mold resistant paint. Use same color paint on building. Make provisions to scrape and clean all wall surfaces prior to painting. b) Touch up all exposed wood rafter ceilings if necessary. **Specification:** a) All paint installations and disposal shall be in accordance with the Manufacturers specifications and in strict compliance with local and international building regulations and guidelines. a) Use paints that meet all three of the following health requirements should be used: low VOCs, low biocides, and natural pigments. b) All exterior paints have fungicides, and low-biocide paints are not available for exteriors. c) The desired choice for exterior paint is one that has zinc oxide as the fungicide. Next best choices are zero to very low-VOC paints, acrylic or latex paints, and recycled water-based paint. d) Milk paint and natural paints are the first choice for commercially available interior paint. e) Avoid oil-based paints because of their high VOC content. Also, use light colored paints.	**Benefit:** • To provide and maintain a healthier, moss/mold free use environment. • Improve morale of staff and present a clean appearanc to the public. **Fading/Peeling parapet wall on roof of the facility**  **Exposed wood rafters at main entrance** 

ITEM NO.	AREA	ISSUE	SCOPE OF WORKS REQUIRED	COST BENEFIT PHOTOGRAPHS IF NECESSARY OR APPLICABLE
13	**Ceiling Finishes** **Hospital & Healthcare section**	**Defect:** • Water/Mold damage on ceiling tiles **Issues:** • The ceiling tiles at the central air condition supply vents have water damage and shows signs of mold/mildew growth.	**Works Required:** **General** a) Replace all missing or damaged drop ceiling tiles in areas that are water damaged and showing signs of mold growth. b) Install water and mold resistant ceiling tiles to all air supply and return vent locations as specified. **Specifications:** a) All ceiling finishes installations shall be in accordance with the Manufacturers specifications and in strict compliance with local and International building regulations and guidelines. b) All air supply inlets and return vents must be installed with 2'x2' water and mold resistant ceiling tiles in all locations.	**Benefit:** • To improve the indoor air quality and maintain a mol free environment.  

ITEM NO.	**AREA**	**ISSUE**	**SCOPE OF WORKS REQUIRED**	**COST BENEFIT** **PHOTOGRAPHS IF NECESSARY OR APPLICABLE**

14	**Code Compliance** Fire/ Smoke Alarms, Emergency Lighting System, Emergency exit signage maps, Fire extinguishers and Security system **Hospital & Healthcare section**	**Defect:** • Emergency exit signage not adequate. • Fire extinguishers not charged and are inadequate. • No emergency backup lights **Issue:** • The emergency fire hoses are inferior and faulty and not compatible with local fire appliance equipment. • The fire extinguishers are not charged and not user friendly (instructions written in Chinese) • The emergency exit signs are not user friendly (Chinese writing overpowers legible wording) • The facility is equipped with a Honeywell fire alarm control system that is not operational due to damaged battery backup supply. • In the event of an emergency, power outage or backup generator failure, there are no emergency backup lights in the facility. • The facility is equipped with two access handicap ramps. The surface of the ramps may get slippery when wet. • The facility is equipped with two access staircases that are exposed to the elements. Its surfaces will get slippery when wet.	**Works Required:** **General** a) Replace the battery backup supply for the Honeywell fire alarm control system and conduct an overall assessment of the fire alarm system with all connected emergency equipment. b) Upgrade the existing security system to replace the existing key pad entry system with a swipe card system (See Item No. 4 - Doors of this scope of works for the areas for installation). c) Install Emergency Lights in strategic locations as specified in the reflective ceiling/electrical light drawings. d) Install Evacuation maps as specified. To be provided to the Contractor by the Project Manager/Check Consultant. Contractor to provide evacuation map wall frames and install. e) Replace all existing fire extinguishers in their locations as specified. f) Upgrade all fire hose assemblies and water supply valves in their locations as specified. g) Replace all emergency exit signage in their locations as specified. h) Apply a non-skid resistant coated surface to all ramps and emergency access staircases to prevent slipping. **Specifications:** a) All Code Compliance installations shall be in accordance with the Manufacturer's instructions and in strict compliance with the local and international building regulations and guidelines. b) All Emergency Lighting and exit signs shall be LED lamp type rated units. The exit sign shall be green in colour. c) The Evacuation Map holders shall be glow in the dark with emergency map labeling. Size map to accommodate will be 11"x 17". d) All Fire extinguishers shall be ABC rated (multi-purpose) units with a 10 lb. capacity. Make provisions to outline all mounting locations with adequate signage. For electrical rooms, use 10 lb. capacity Carbon dioxide extinguishers. e) All fire hose assemblies must be constructed with a woven jacket	**Benefit:** • This will enhance the level of fire safety throughout th buildings and maximize the fire/smoke detection. • This will aid in providing adequate lighting in the event c any emergency scenario. • To aid in the facilities compliance to safety and ris reduction and staff awareness and development. • To aid in the facilities compliance to Handica accessibility and safety. **Honeywell fire alarm control system**   **Existing fire extinguishers**  **Fire hose assembly**

			construction and impregnable against abrasion. Must meet a service life of not less than 5 years. Water valve and hose fittings must be compatible with local fire department appliances and equipment. f) All existing Handicap ramps and emergency access staircase surfaces shall be outfitted with ECO-TUFF Rubberized Non-Skid safety coating which has zero VOC and ultra tuff and waterproof.	 **Emergency exit doors with signs**   **Disability access ramps**  
ITEM	**AREA/ROOM**	**ITEM DESCRIPTION**	**SCOPE OF WORKS REQUIRED**	**COST BENEFIT**

NO.		(DEFECT, ISSUE)		PHOTOGRAPHS AS ATTACHED AS GUIDE
15	**External Works-** Drains, Landscaping **Hospital & Healthcare section**	**Defect:** • Drains are filled with debris. **Issue:** • There is no clear marking to differentiate between storm drain manholes and sewer manholes. • The storm drains and pipes are filled with mud and debris and needs to be flushed. • The landscape on the western side of the facility needs to be graded properly to avoid water runoff into the ground floor of the building.	**Works Required:** **General** a) Flush out all mud and debris out of all storm water drains and pipes. b) Level and grade (western side) landscape away from the facility to prevent potential flooding of the lower ground floor. **<u>Specifications:</u>** a) Any contact with contaminated water or sludge from the drains must be safely transport and disposed off-site. b) Make provisions for any ground works, drain pipe repairs or installations.	**Benefit:** • It will improve the drainage of the landscape and eliminate any potential flooding of the facility. **Condition of the Storm water drain**  **Western side landscape of the facility** 

ITEM NO.	**AREA/ROOM**	**ITEM DESCRIPTION (DEFECT, ISSUE)**	**SCOPE OF WORKS REQUIRED**	**COST BENEFIT** **PHOTOGRAPHS AS ATTACHED AS GUIDE**

16	**Sewerage Treatment** **Hospital & Healthcare section**	**Defect:** • Non-operational. **Issue:** • The facility is equipped with a wastewater treatment system but it is incomplete. • The sewer manholes are incomplete and require proper hunching of their bases to allow smooth transition or flow of sewage from the sewer lines to the wastewater treatment plant.	**Works Required:** **General** a) Complete and commission the existing wastewater treatment system. Include the installation of a treated effluent storage tank and a drip irrigation system to be incorporated into the landscape. b) Conduct an assessment of all sewer pipes, pipe inverts and manholes. Make provision to include any ground works, pipe works, concrete works and manhole repair and installations. **<u>Specifications:</u>** a) The sewerage treatment is manufactured **by Norweco Wastewater Equipment Company.** Type system: Singulair Bio-Kinetic wastewater treatment system. Local distributor is **J&S Environmental Services Ltd. P.O. Box 346 Basseterre, St. Kitts.** b) Installations shall be in accordance with the Manufacturers specifications and in strict compliance with local and international building regulations and guidelines. c) Handles odor control and filamentous bacteria; stabilizes the plant, improves settling rate of Biomass, good quality of treated water. Specifically the system should allow for the following: • Up to 95% reduction in Biochemical Oxygen Demand & 90% reduction in Chemical Oxygen Demand load. • Maximum odor control • Generates minimum sludge • Consist of various specialized microbial culture and enzymes which can digest even complex organic compounds. • Can handle toxic loads. • Can handle hydraulic loads • Cultures grow in either the presence or absence of oxygen. • Low treatment cost. Increases efficiency of the sewage treatment plant and saves energy costs. • Sewage treated with can be reused for irrigation purposes or recharging ground water. • Non-corrosive, non-pathogenic and low quantities of use, making it safe and easy to handle and store.	**Benefit:** • The system will properly treat and reuse all the sewerag water from the facilities and circulate the treated wate through a drip irrigation system into the landscape. • It will minimize the overflow and pumping of sewerag and eliminate the exposure of sewerage water flowin through open drains.