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THE IMPLEMENTATION OF GUIDELINES AND STANDARDS FOR WATERFRONT DESIGN AND DEVELOPMENT AT LUMUT, PERAK, MALAYSIA

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Abstract

Waterfront development in Malaysia hasbecome an issue that is of wide concern anddiscussed extensivelyfollowing numerous new waterfronts developments for various functions. The developments were based on the land use zoning and the waterfront location whether facing theriver, wetlands, lake or the coast. These two factors create different impacts to the existing environment. Through literature study, the main consideration and objective of the guidelines was determined. Other indicators such as the effects of waterfront development to the local environment, ecosystem and the responsibilities to rehabilitate, as well as preservation of the existing waterfront were highlighted as part of the main concern towards supporting the sustainable built environment. The local authorities at each stage have set up the guidelines and standards for waterfront development. To limit the scope of study, the Lumut Local Structure Plan for 1998 – 2010 provided by the Manjung Town Hall was reviewed. In order to come up with the list of recommendations as an addition to the existing standards, an observation was carried out at the Lumut Waterfront in Perak, Malaysia to analyze the implementation of the guidelines and standards on the its design and development. The findings of this study maybe adapted in the guidelines used by the other states in Malaysia. The significance of this research is to foster better understanding and awareness by both Local Authoritiesand the public in preserving waterfronts towards rehabilitating the natural ecosystem by putting the accent of sustainable design at the proposal stage.

Keywords: Waterfront development, guidelines and standards, sustainable design, preservation

1. Introduction

Waterfront was formally known as a development nearby a riverside, estuary side, lakeside, wetland side and also coastal area which existed for a reason and function. It has been an issue of wide concern and extensive discussion since the 1970s.The waterfront development in early 1900s was mainly function as a main path for water transportation to port. Many coastal and riparian human settlements owe their origin and prosperity to water transport and trade (Hoyle and Pinder, 1992). The urban waterfront was also act as the focal point of urban activities (Hoyle, 1997). Recently, it is part of development trend that waterfronts is develop as a new attractive leisure place for locals and at the same time become a place of interest to be visited by tourist in certain country. Many cities with waterfront have turned to their array of regulatory tools – zoning, design guidelines and development agreements made by the local authority. As an impact, both private initiative and public prodding, public amenities (such as parks), walkway and others recreational facilities has develop within waterfront area. Often, the synergy between private uses, such as retail and entertainment, and public open spaces have reinforced each other and maximized public enjoyment of the waterfront (Vallega, 2001; Tunbridge and Ashworth, 1992; Acosta, 1990; Craig-Smith and Fagence, 1995). However, how far that those regulation or guidelines of waterfront development provided will help to sustain the natural ecosystem and environment has become a wide issue and concerned.

1.1 Significant and Scope of Study

The significant of the study is to have a better understanding to Local Authority / Board related guideline, as well as to increase public's awareness in preserving waterfront towards rehabilitating natural ecosystem by adopting the accent of sustainable design at the proposal stage. Recommendation listed at the end of the study

will perhaps give an idea to maintain and minimize the bad impact that can ruin the existing natural waterfront ecosystem and environment at new waterfront development. To limit the scope of investigation, only one guideline was review which is The Lumut, Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall, whilst Lumut Waterfront, in Perak, Malaysia have been chose as an area for field study and observation.

2. Literature Review

2.1 Definition

There are numbers of definition given from the previous researches through their study. However, the concrete definition somehow relate to each other's where waterfront means land that facing water whether seaside, lakeside, wetland side and also riverside with certain distance between land and water based on the connection and development of the waterfront.

2.2 Function and related problems

In several countries, which waterfront previously busy with industrial and transportation activities have become abandoning because of severe pollution, low accessibility and a poor image, leaving the dilapidated warehouses, factories and port facilities to decay. Crowded running accessibility at warehouses or railways located along the waterfront creates complex physical problems in historical usage of waterfronts (Forward, 1968; Gordon, 1997b). This is mainly caused by unfavorable conditions of proximity to water, such as unconsolidated soil, limited load-bearing capacity and the hazard of shoreline erosion and periodic flooding at waterfront area (Wrenn, 1983; Vallega, 2001) which leads to deterioration of waterfront structures and facilities (Goldrick & Merrens, 1990; Acosta, 1990). Gradually, it caused the poor image of the waterfront.
Today, the role of the waterfront has changed with the passage of time, the three aspects that affect the waterfront transition are the reforms in transportation technologies, the expansion of city size, and the changes in industry (Tsukio,1984).There was a demand of public spaces in cities for recreational and leisure uses after 1960s. Similar to the other leftover spaces, waterfronts became suitable urban lands to construct the new trends of society. Therefore, recreation – including commercial facilities, housing development, entertainment units, sport facilities, cultural centre and parks- became the most dominant concept in the definition of present-day waterfronts. There are few reasons of this public attitude; but, the most important one is the shift of cities from industrial to service economy and social culture, which brought a new thoughtful of waterfront usage. Vallega (2001) has categories the usage of waterfront and its relevance to sustainable development based on the location of waterfront development. (Refer Table 1). From the table, it can be conclude that the main focus of sustainable waterfront development is more related to economic efficiency and city's long-term purposes, but least concerned given on the ecosystem conservation. In fact, the relevance of sustainable development towards ecosystem conservation is somehow vital to support and sustain other categories of waterfront usage, for instance, fishing, tourism and cultural heritage.

2.3 Importance of sustainable waterfront design development

When we are discussing about the design development of a sustainable waterfront, it should be in regards of current exploitation of a waterfront within the deeper context of its ecosystem. Therefore, having to bid for a better design, we shall come to a better understanding of the ecosystem of each potential waterfront as every natural setting would have a different ecosystem in relations to its geographical location. Thus, the preservation on the natural ecosystem would actually depict the success of a sustainable waterfront. In waterfront development context, sustainable design is related in terms of how the development by the side of the waterfront will sustain the future development environment and also the existing natural environment either to preserve or to rehabilitate by adapting the energy efficiency technology, environmentally quality method, sustainable site planning, the use of the materials or recycling methods.
Guidelines were published by several Local Authority Department to ensure the development of a waterfront would be able to preserve the existing ecosystem without destroying the natural habitation. This guideline relates a study on culture and local weather in Malaysia for a standard preservation guideline of a local waterfront development, and furthermore set the precedent on a sustainable design.

Table 1: The Waterfront Use Framework

	Categories of Waterfront uses	Relevance to Sustainable Development			
		Ecosystem Conservation	Economic Efficiency	Cultural Heritage Conservation	City's Longterm Strategy
1	Ecosystem Enjoyment	√	√		√
2	Fishing		√		√
3	Tourism		√		√
4	Snorkeling		√		
5	Entertainment		√		√
6	Congresses		√		√
7	Media		√		√
8	Transport and Navigation		√		√
9	Trade and Finance		√		√
10	Research Areas	√	√	√	√
11	Education and Training	√	√	√	√
12	Cultural Heritage			√	√

Source: Vallega (2001)

2.5 Ecosystem

Naturally functioning ecosystems provide many society benefits that can include flood prevention, waste assimilation, nursery areas for fisheries, and habitat for migratory marine mammals and birds. Healthy wetlands provide a fringing buffer that filters contaminants or maximizes their degradation. The diversity and productivity of ecological system should be protected and restore through measures in order to:

i. preserve the genetic diversity of indigenous plants and animals
ii. restore healthy natural habitats and communities; and
iii. maintain natural ecological processes.

2.6 The Importance of Preservation and Rehabilitation

Many researchers have conducted research on this particular topic revealing a significant divergence of both positive and negative views. The following paragraph will discuss the Importance of preservation and also the impact of waterfront developments on property from these different perspectives; both positive and negative (Azlina Binti Md. Yassin, Prof. Chris Eves , John Mc Donagh , 2009)

i. Social aspects
The increasing number of waterfront development projects can cause social impacts. Previous research which focused on the social impact of waterfront development showed waterfront development significantly increased household income, job opportunities, regional business sales and tourism (Krausse, 1995; Parsons & Wu, 1991; Rexhausen & Vredeveld, 2003). However, waterfront developments also have a negative impact on society, especially among teenagers (Chang & Huang, 2005).

ii. Economic aspects
A few studies have been conducted in order to measure the impact of water and water quality on residential price. Oliva (2006), examined the impact of waterfront development on housing price. Using sales price data for six years (1996 – 2003), the result also established the positive relationship between waterfront development and house price, but the impact varied with distance accordingly. However, although most studies have shown a positive impact on view, a few studies also show a weak relationship between view and residential value. Scenic beauty and good water quality are essential for high property value along a river, in addition waterfront plays numerous roles in the world and the value of water has a different meaning in the context of wildlife habitat, angling opportunities and scenic view.

iii. Pollution aspects
In contrast, the growth of waterfront development is also causing a negative environmental impact, especially regarding pollution. Water pollution has also been attributing to waterfront development. Water pollution has become a matter of national and international threat since 1968 (Mann, 1973). This water pollution does not only impact on health and welfare of nearby urban population but also includes ground water and it is one of the most critical environmental issues nowadays.

iv. Cultural aspects
Usually, new waterfront developments attempt to create new cultural economies and community interaction (Chang & Huang, 2005; Forest & Johnson, 2002; Krausse, 1995).Cultural aspects are important in presenting and identity the country. Chang & Huang (2005) show that waterfront development in Singapore has transformed the waterfront landscape identity and affected people's relationship to the place, and it has also transformed waterfront culture in some areas (Crouch & Parker, 2003).

Although preservation is importance but sometimes in certain cases of waterfront development rehabilitation also could helps to bring back the naturalness of the environment and previous ecosystem. Cities in China for example, urban waterfront rehabilitation were part of sustainable development strategy. Though waterfront rehabilitation is increasingly being employed in developed world cities, the environmental benefits are not always clear. Nonetheless, China, like other developing countries, has shown interest in environmental strategy, for improving its local water quality, upgrading environmental waterfront management, and improving quality of life for urban residents. As developing world cities struggle to break from the traditional model of 'pollute first, clean up later', it is critical that they employ strategies which minimize or remediate environmental impacts while still promoting economic development (Vollmer, D ; 2009). As many problem especially focus on environmental as well as ecosystem issue was raised up, therefore for a new waterfront development a few factors or methods should be considered or must be included as part of waterfront guideline to make sure the existing environment of ecosystem and natural habitation is better to preserve rather than to rehabilitate.

3. Methodology

Few methodologies used in this case study, which include the process of understanding related facts through literature study, a review on the existing guideline and standards, site visit and observation, data collection and analysis. Initially, literature review was carry out to get a better understanding on the function or activities at waterfront, the importance of sustainable waterfront design development, preservation and rehabilitation. Besides that, the impact of the improper design to public / locals, ecosystem (in relation with economic values, appreciation on local culture, environment and regional architecture) and water quality was review. Then, a study on the contents of The Local Structure Plan for 1998 – 2010 guidelines and standards (provided by Manjung Town Hall) for urban waterfront development was done together with onsite observation to analyse the implementation of the guideline. The major factor causes the weakness indicator of waterfront development were summarised from the analysis. Finally, the study come out with conclusion and a list of recommendation on a preferred guideline for waterfront development towards the sustainability of waterfront design by avoiding or minimising the probability of each failure factor from occur.

4. Analysis of Case Study

In this study, it is more focus on coastal areas. This is because the location of the field study is at Lumut, Perak, which is known as the coastal area. Definition of coastal areas by the Department of Irrigation and Drainage (DID) is: a coastal region covers an area of 3km from sea to the land (back shore) and 16.1 nautical km to the sea from the average level of neap tides (shore front). Area on the land, including rivers and reserves river to areas affected by salt water (from sea). Generally, coastal areas (back shore) include the following features:

i. Sloping and sandy beach area
ii. Muddy areas such as mangrove forests and wetland
iii. Hilly and steep areas (<200 and> 60m contour line)
iv. Estuaries and rivers (up to area which influenced by salt water)
v. Islands

This coastal area is a sensitive area when has been disturbed either by development or natural waves or flooding.

4.1 Introduction of Lumut Perak

Lumut is a small town (population 31,880) in the state of Perak, Malaysia, situated about 84 km from Ipoh, 12 km from the town of Sitiawan. It also identified as the gateway to Pangkor Island. Lumut already known as famous local production for its beautiful seashell and coral handicrafts, besides that Lumut also has become the home base of the Royal Malaysian Navy.Development of Lumut, Perak is one of the planning block in the structure plan of Manjung Perak Darul Ridzuan. The formation of this planning block design is intended to ensure that land use, planning and control are more systematic. The planning block in local planning area in Manjung District has been divided as follows:

Table 2 : Planning block in local planning area in Manjung District

Planning Block	Area (hectares)	Percentage (%)
Planning Block – Lumut (BP1)	1,620.41	19.28
Planning Block – Seri Manjung (BP 2)	2,961.91	35.23
Planning Block – Lekir (BP 3)	2,038.99	24.25
Planning Block – Kampung Acheh (BP 4)	1,785.66	21.24
Total	8,406.97	100.00

Source : Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall

In this research, the study will be more focus on Lumut area which is BP1. Small planning blocks (*Blok Perancangan Kecil* – BPK) is designed to divide Lumut base on main land use as mentioned in following table. However for this study and analysis, it is covered for all type of land use in this case study area except for BPK 1.1 which is belong to Tentera Laut Diraja Malaysia (TLDM)/ Navy of Royal Malaysian where it was prohibited and private area.

Table 3 : Small planning blocks (*Blok Perancangan Kecil* – BPK) in Lumut area

Planning Block (BPK)		Land use	Area (hectares)	Percentage (%)
1	**BPK 1.1**	Tentera Laut Diraja Malaysia (TLDM)/ Navy of Royal Malaysian	827.70	51.08
2	**BPK 1.2**	Trade	148.57	9.17
3	**BPK 1.3**	Trade	85.67	5.29
4	**BPK 1.4**	Trade	60.86	3.76
5	**BPK 1.5**	Medium Density Housing	176.48	10.89
6	**BPK 1.6**	Public recreation / Reserve Forest	321.13	19.81
			1,620.41	**100.00**

Source : Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall

4.2 Planning Development of Lumut based on Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall.

Based on Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall, planning development for Lumut area can be divided into 4 main developments that a part of waterfront development in Lumut which has to follow the local waterfront guideline and standards that has been provided by various local authorities that has been mentioned in previous chapter:

i. Commercial development area.

ii. Facilities and recreation development area
iii. Housing development area
iv. Mangrove area

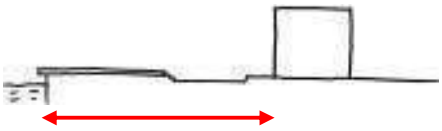
4.2.1 Commercial development area

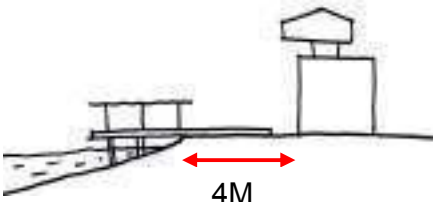
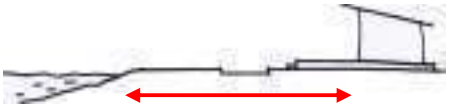
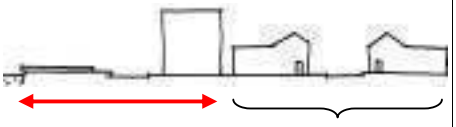
Proposed development of commercial areas in the Lumut city is to mix the existing commercial building (shop houses) and new commercial building with new arranging to optimize the use of land in the city which is facing coastal area and a part of Lumut waterfront development. The development of this commercial area is also one of the attractions for local and foreign tourists. In this commercial area the development are includes retail, hotel, food court, jetty terminal building and services. Special guideline stated in Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall:

i. Orientation of buildings should facing coastal area.
ii. Integration of commercial development area has balanced with landscape of development.
iii. Car park is provided based on guidelines and parking ratio.
iv. Building architecture design and building height based on building height control guidelines and standards of the commercial area planning

Based on our observation, the setback of the building and average level of neap tide are various (Refer Table 4). The actual setback building for waterfront development has to refer Department of Irrigation Drainage Malaysia (DID) which is minimum setback of building is 60M from average level of neap tide at sandy beach, however it has been stated the minimum setback requirements may be reviewed on account to site condition.

Table 4 : Position commercial buildings from coastal area and local guideline implementation

No	Building	Position From Coastal Area
1	 Orient Star Hotel	 45M Type of Coastal: Sandy Beach Building Set back: 45M from average level of neap tide. Building height: 16M (4 storey) 4M (1 storey–sub basement)
2	 Hotel Putra	 45M Type of Coastal: Sandy Beach Building Set back: 45M from average level of neap tide. Building height: 20M (5 storey)

3	 Lumut Ferry Terminal and Jetty	 4M Type of Coastal: Sandy Beach Construction of building: On stilt Building height: 4M (1 storey)
4	 MARA's Retail	 45M Type of Coastal: Sandy Beach Building Set back: 45M from average level of neap tide. Building height: 8M (2 storey)
5	 Old shop houses	 200M Old shop houses Type of Coastal: Sandy Beach Building Set back: 200M from average level of neap tide. Building height: 8M (2 storey)
6	 Marina Wing Waterfront	 80M Type of Coastal: Sandy Beach Building Set back:40M from average level of neap tide. Building height: 8M (2 storey)

4.2.2 Facilities and recreation development area

Lumut town was known as tourist main gateway to Pangkor Island. Thus the Lumut Ferry Terminal and Jetty and the surrounding areas have been redeveloped with the infrastructure and commercial building with proper circulation and arrangement. As a result of the redevelopment of the town will also introduce the Lumut town as a 'Maritime City'. Facilities provided are car park building, taxi stop, food court, tourist information centre children playground. Beside facilities, recreation area along Lumut waterfront provided are Waterfront esplanade, Lumut Waterfront and Marina Wing Waterfront.Facilities and recreation elements at coastal area which are a part of Lumut waterfront development are developed in various minimum set back. Even in generally the setback building for waterfront development has to refer Department of Irrigation Drainage Malaysia (DID) as stated in Guideline of Implementation for Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall, the minimum set back which is 60M is not fully implementing in Lumut waterfront development. Perhaps the coastal area has been concreted is a factor the setback area for new development is lesser than the requirement.

4.2.3 Housing development area

Based on observation, Lumut is an area that is more focused on tourism. Therefore, housing development located more than 200M average level of neap tide. The main housing development areas in Lumut district are Lumut Valley Resort Condominium, Taman Bukit Maju Lumut and Titi Panjang Lumut. Based on observation on housing development in Lumut area, the distance from shoreline are more than 60M and height of the housing are allowed as the location of the housing area are more than 60M. Therefore developments of housing in Lumut area are not a significant issue as the building guideline still adhere by the developer.

4.2.4 Mangrove area

The existing mangrove area still conserve as natural area and has been develop as tourist attraction with recreation facilities. The recreation facilities are design to serve a better function and conserve the environment and also the existing ecosystem at mangrove area. Special guideline has been mentioned in Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall for mangrove area includes:

i. Maintain and preserve the natural living of flora and fauna.
ii. Development of recreational facilities, which emphasize conservation and learning are the priority for the design.
iii. Improve the management and maintenance of recreational facilities to control environmental pollution.

The hard landscape elements of the mangrove area have applied the above guideline with the following criteria:

i. Boardwalk constructed on stilt to allow lighting and ventilation for flora and fauna under boardwalk.
ii. Boardwalk is designed with gap in between to allow lighting and ventilation through the boardwalk
iii. Grating also used as part of boardwalk design to maximize lighting and ventilation through the boardwalk.
iv. To minimize cutting mangrove trees, a part of boardwalk and grating are designed to allow mangrove trees to grow in between boardwalk.
v. The boardwalk is also provided with lamp and railing for public safety.
vi. 'Canopy walk' was provided to create the path through natural mangrove more exciting to the visitor

From the observation, the development next to mangrove area has been complied with Planning Standards And Planning Guidelines For Developments In Coastline - Approved By State Council Meeting (By Policy Unit, **Department** Town Planning of Perak), where the minimum setback for development next to mangrove area is 30M wide buffer. Developing mangrove area as eco-tourism and research purpose is allowed only 20% from the mangrove area which has also has been complied. Beside that the hard landscape elements which have been design in mangrove area are emphasized to minimize the implication to existing ecosystem in mangrove area. However, compare to the initiative by Toronto government action by providing Waterfront Aquatic Habitat Restoration Strategy, 2008 the strategies that have been taken not only concerned the set back and percentage of development area at natural waterfront habitat. The strategy also mentioned the habitat restoration techniques by provided illustrative and detailed information about construction materials and techniques needed to improve the existing aquatic habitats. Besides that the strategy also mentioned the aquatic and fish management objectives for each waterfront habitat type.

4.3 Prevention and control from coastal erosion

Erosion along coastal area at Lumut was not a major problem, however proper strategies should be planed and appropriate methods should be designed to prevent erosion due to new development and activities along the coastal has been developed. In Local Structure Plan for 1998 – 2010 provided by Manjung Town Hall has been mentioned that all development along coastal area should followed Guideline of Development Plan to avoid from erosion and pollution problem at coastal area includes:

i. Coastal areas suitable for reclamation purposes will be determined to optimize the tourist resort of development
ii. Environmental Impact Assessment (EIA) required before any of development (such as land reclamation projects) in the coastal hydraulic study undertaken and will be required for all infrastructure involved in the construction.
iii. If the development is built within the zone are not allowed as stated in the guidelines for the waterfront of development provided by the Drainage ang Irrigation Department (DID), a detailed study should be made to ensure the structural safety and minimize the effects of coastal erosion.
iv. Requirements and limitations to reclamation projects area should be designed based on the future socio-economic development taking into account environmental factors.

v. Development on sandbank has to avoid because coastal area has a potential to face with erosion problem.

vi. Environmental Impact Assessment (EIA) required for all activities relate with beach nourishment for or coastal protection.

Table 6 : Existing method to prevent and control from coastal erosion

No	Method
1	
	Description: The use of concrete block and stone along the coastal edge (next to Lumut Waterfront recreation park)
2	
	Description: Waterfront Esplanade has been concreted along the coastal edge.
3	
	Description: On stilt construction as method to avoid erosion
	
	Description: The use of floating deck at private jetty

Based on observation, the step that has been taken by local authority which is Manjung Town Hall is to minimize erosion along the coastal area. However the actions by the local town hall should not only emphasized in tourism places. Besides that, long term strategies and latest method to avoid erosion should be applied by the authorities. The action by the town hall is to ensure that erosion control always been monitored consistently.

5. Conclusion and Recommendation

5.1 Conclusion

The important coastal resource is coastal forests such as mangroves and others type of coastal forests. Muddy coastal areas and mangrove forests are productive as a home for a variety of fish and wildlife, and shellfish. Destruction of this area will cause the loss of marine habitat. Beside coastal forests activities, lately more developers have interest in land reclamation which is expected to return money to the developer. However land reclamation activities may impact within long term period if without careful planning and extensive research. These activities will cause environmental problems when cutting the hill, trimming offshore sandbanks and others related activities. Beside that it also will affect the loss of marine economy, flooding and coastal erosion in coastal areas. The coastal areas have a very significant problem, and involve high costs to overcome with erosion problem. According to sources from the Department of Irrigation and Drainage (DID) of 73 coastal areas in Malaysia are experiencing critical erosion. Based on DID research, the average of erosion in the range of less than one meter per year to more than 10 meters per year. The cost to overcome with erosion is very high which is about RM 2 million / km. depending on the type and the action taken. While action to overcome with erosion is not a long term solution for the same problem and at the same place can be happened anytime in the

future. It is therefore better effective resolution and planning should be taken. Proper coastal zone management is required to produce a structured planning for coastal development.

5.2 Recommendations

Based on the study on the existing local guideline and observation at Lumut, Perak, it shows that the existing guideline is more focus on:

i) the building set back from waterfront shoreline; and
ii) the requirement needs for waterfront development based on activities and type of development for waterfront area.

Even the requirements will absolutely give a positive impact towards sustainable waterfront design, but the concern factors towards rehabilitation and preservation to the existing waterfront habitat and ecosystem is still not present. This matter is vital to prevent waterfront environment from destruction by human activities. Some of the tools in the Green Building Index (GBI) was seen possible to be apply to the existing guideline requirement for waterfront development. Therefore, it is recommended for future study to look into sustainable waterfront design methods and technique as part of waterfront development approach towards rehabilitation and preservation of waterfront ecosystem.

5.2.1 Enhancement on Sustainable Design

Local guideline and standard can be improved by proposing the specification in term of material and design strategies to approach sustainable design. Designs that meet or comply with the Green Building Index (GBI) should be addressed as a tool and factor towards sustainable design in coastal development area.

5.2.2 Rehabilitation and Preservation of Existing Waterfront Ecosystem

The rehabilitation and preservation of waterfront ecosystem should be emphasized in local guideline and standard to make sure the existing ecosystem will not be disturb and extinct. This could be more focus in mangrove area, the development should provide appropriate setback from mangrove area to avoid the existing ecosystem from any obstruction from human activities but to develop mangrove area as eco-tourism activities are encouraged, but proper design guidelines should be take into account.

5.2.3 Water Quality Control

Development along the coastal area has to control and the waste water in this development area is strictly prohibited from connected to coastal area. The method and strategies to encourage living organism underneath coastal to make sure the need of oxygen is sufficient. Oxygen takes apart in oxidation and reduction process of chemical matter to be the simple compound. Atmosphere and photosynthesis by product are the main source of oxygen in waters. Dissolved oxygen (DO) and biological oxygen demand (BOD) are the most important parameter of water quality.

5.2.4 Application of Structure "Labuan Blocks" @ Coast Secure Block (CS Block) propose by Department of Irrigation and Drainage (DID).

Coastal Erosion Control Structure "Labuan Blocks" @ Coast Secure Block (CS Block) is effective in addressing the serious erosion. It reduce the wave energy and allow the country protected coastline.The waves that carry sand sediment to the coast will have the opportunity to embank the natural.The construction of 'Labuan Blocks' is simple, fast (six months per kilometre) cheap (costs for only 50% of construction costs using other methods) and provide maximum protection.

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