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Sabang-Weh Island Spatial Planning With Environmental Carrying Capacity Method

Azhar Abdullah Arif, Izarul Machdar, Bastian Arifin and Ashfa

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Azhar A Arif[1], Izarul Machdar[2], Prof. Bastian Arifin[3], Ashfa[4]

[1.] Architecture and Planning Department, Engineering Faculty, Syiah Kuala University

[2.] Chemical Department, Engineering Faculty, Syiah Kuala University

[3.] Chemical Department, Engineering Faculty, Syiah Kuala University

[4.] Architecture and Planning Department, Engineering Faculty, Syiah Kuala University

Abstract. Sabang City is located in Weh Island, Aceh Province, as the end city of western Indonesia. Today it is known as a natural tourist destination, nautical and relics of the Dutch colonial period, the Japanese colonial period which is often found in Japanese bunkers or caves. As an island city, Sabang has a natural seaport with an ideal depth to dock between intercontinental ships that cross the Malacca Strait every day. But why does the city of Sabang not rise its economy, while the interest of foreign tourists seems to be endless to visit Sabang to date. Realizing this, the author will present the research process that is being carried out in relation to Weh Island Spatial Planning. The research methodology is based on the design development, by assessing the environmental carrying capacity and analysis related to the input and output of materials for the daily needs of the residents of Sabang which are still very much related to supply from the mainland of Aceh and other regions in Indonesia. The supply of goods from abroad has not significantly affected of the environment. Through the Material Flow Analysis analysis, it will greatly assist the control and spatial planning of Sabang City in terms of providing land for the built environment in the urban area of Sabang City. small island is an important asset for the growth of economic activities, especially the tourism sector and seaports in Indonesia. Coastal area is a transitional area between terrestrial and marine ecosystems concerning management of coastal and small islands. Marine Coastal Conservation Areas (MPAs) have developed rapidly in the world since the 1980s. This is related to the world summit on sustainable development. Sabang including Marine Coastal Conservation Area. Position of Sabang - Weh Island area is an international maritime track connecting the Indian Ocean, the Malacca Strait, and the Pacific Ocean.

I. INTRODUCTION

As a developing city in line with the growth of economic activities of the community, the city of Sabang is currently experiencing economic activity development, especially in the downtown area and the port area. This phenomenon of change must be controlled through urban area planning tools through the Sabang City Spatial Plan (RTRW) products and the design of urban space areas in more detail through the Guidelines for Detailed Spatial Planning Areas (RDTRK) of Sukajaya District and Sukakarya District, as well as Building and Environmental Planning (RTBL) the central area of Sabang city.

The city must always have the identity and character. Image of the city of Sabang which is very well known as a natural port in the heart of the Weh Island. If the spatial planning of the city of Sabang as a tourist city is done well, it will be accepted by the community because it provides a real contribution to the development of the quality of people's lives. However, how is the response of the community if

the arrangement of the central area of Sabang city which has been visited by many foreign tourists so far is not as beautiful as in photos and design drawings, even eliminating elements of urban spatial structure and space patterns that have been formed for a long time and have been included in the Qanun of City Spatial Planning Sabang in 2007-2027 (RTRW Sabang, 2007-2027). Spatial Planning has explained the spatial function to get a safe, comfortable, productive and sustainable atmosphere and environment that must be achieved in every region of the Republic of Indonesia in accordance with the mandate of the 1945 Constitution, namely to prosper the lives of Indonesian people.

II. Methods Research Based on the City Planning Process and Environmental Carrying Capacity.

The philosophy of science is thought to search for the truth by the human mind, where such thinking is always evolving in line with the development of human civilization. In line with the development of the evolution of philosophical view of the world, it also affect the development of the theory of urban planning, in the following order:

1. **Positivism.**Takes place in the era of the 19th century (nineteen) where there have been massive city development and spacious. Urban was born in this period is the Regional Planning (Regional Plan) City of New York by Thomas Adam. Planning the expansion of the City of London by Patrick Abercrombie in Greater London Plan.
2. **Phenomenology.**In the science of Urban Planning also known as term Phenomenology. City Planning peak of modern thought are in the form of comprehensive, Rational planning and Procedural Planning Theory by Faludi (1973). And this concept in Indonesia applied the policy intentions Spatial Plan (RTRW) and City Spatial Plan (RTRK). The phenomenon that occurs is a gap of the government's desire and expectations of society such as evictions in arranging a city park, river border area. (Sudaryono Sastrosasmita-ITB 1998)

The application of the Urban Planning can learn how the process of development and change happens according to this time. Furthermore, will try to review the development of Sabang city according to the City Planning Theory mentioned above. Similarly to the philosophy that comes amid civilization Acehnese culture that live and thrive based on Islam embraced by the people of Aceh. As the physical manifestation of that philosophy, the author tries to explain the link between ecosystem consisting of Weh Island Protected Area or Region Cultivation as initial ideas and concepts to apply science and technology that can be developed in Sabang-Weh Island. The research methodology will do is use the Environment Carrying Capacity and Material Flow Analysis of the solid waste and garbage in the city of Sabang. As for the building of infrastructure and development activities and construction of roads and ports in Sabang requires the material brought in from the mainland of Aceh as well as from other areas in Indonesia.

III. Results and Discussion

3.1 Small Island Management in Indonesia

The coastal area is also a center of human activities with various activities contained in it. Changes occur very quickly in coastal areas both naturally and by development activities (Dahuri, 1997; Mujio et al, 2016).

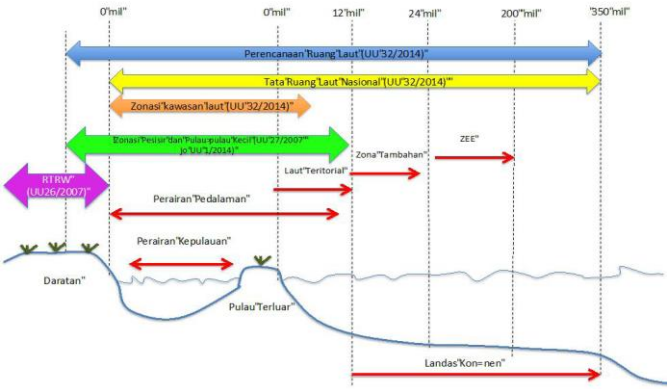

Figure 3.1. The National Spatial Planning Policy (Land and Sea Room) based on Law No. 26/2007, Law No. 27/2007 and Law 32/2014 (Mujio et al, 2016)

As an archipelagic country, the Government of the Republic of Indonesia has also signed a 2006 UN international sea law Convention, the Weh-Sabang Island waters area as a territorial sea border with neighboring countries (India, Thailand, and Malaysia) marked on the Indian Ocean maritime border map, Weh-Sabang island, and Rondo island like the map below:

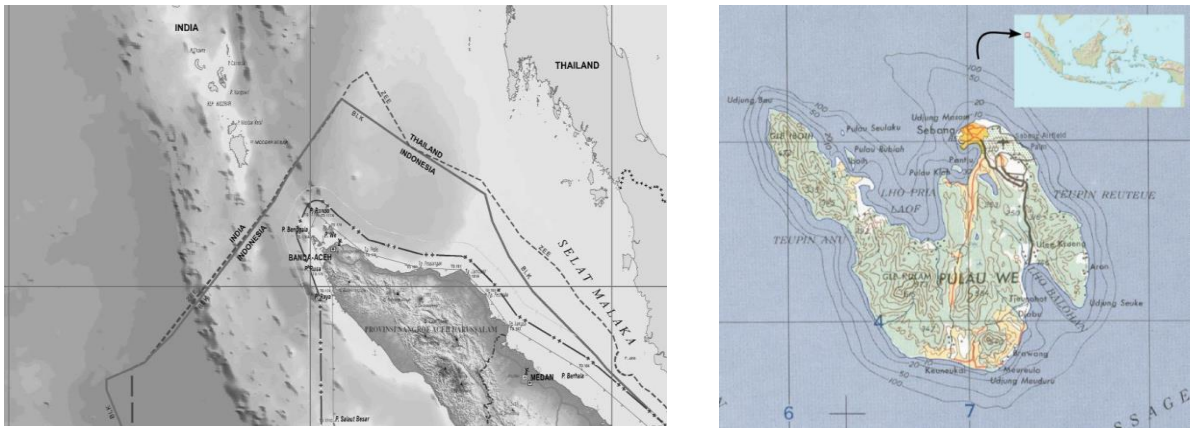

Figure 3.2 Map of the Outermost Island Region Bordering India, Thailand and Malaysia (Arsana, 2014)

Table 3.1. Stakeholders' participation on Research Environmental Carrying Capacity of Sabang-Weh Island (BPS Sabang-Weh Island,2017)

Questionnaire item (on Progress 2018)	Fisherman		Marine Tourism Operators	
	Traditional	Modern	Coastal Area	City Area
Fishers and tourism operators considered their participation				
Number of fishing boat	242	471		
Number of village			8	10
Number of hotel and cottage			85	23
Number of fisherman households			512	883

3.2 Application of Science and Engineering in Traditional House (Rumoh Aceh) Design

Architectural Engineering Sciences is a scientific field that resulted from the achievement of science has undergone a process of development from the past to the present. Therefore, it is inseparable history and social life of the community served by the works of engineering and architecture. In this case the author tries to discuss the philosophy behind the establishment or creation Rumoh Aceh in terms of aspects of engineering *(tectonics)* and the form and design of the typical architecture Rumoh Aceh.

When we study the design and architectural forms Rumoh Aceh, it will get a lot of meaning philosophical as building orientation to Qiblat, use ventilation *(tulak angen, the term of aceh language)* can cool the atmosphere in the building, houses on stilts to avoid the danger of flooding and beasts as aspects of disaster mitigation. This is the intellectual property and technology that are stored in Aceh Rumoh design philosophy. However, it is now no longer a major concern and many buildings Rumoh Aceh lost with age. This is a record of architectural typologies Rumoh Aceh should be researched and studied further, and is in accordance with ecological aspects contained in Sabang City-Weh Island. Due to the utilization of wind flow in the form of Aceh Rumoh roof will drain the air is cool and save energy utilization (*Green Building*). While the use of building materials are increasingly difficult to obtain will stimulate researchers to obtain alternative use of wood materials are increasingly hard to come by. As utilization Foam Bricks that are currently being carried out by an expert study of the Structures and Materials Laboratory of Engineering Faculty of the Syiah Kuala University.

3.3 Space Structures And Pattern Region of Weh Island

Structure of Space District of Sabang City in shape by structural spaces artificial or natural.

- Natural Structural space
  Formed by the hills area that stretches from the west - middle - east and Aneuk Laot Lake and the Embung Seunara Paya

- Space Structural Artificial
  Structural Artificial District of Sabang consists of an activity center that became the center of the growth of this district and the city of Sabang. The structural space are:

1. Urban area Sabang

Urban areas is a city center Sabang because in this area there are the Central Government, trade and services, Offices, Social and Cultural town of Sabang. Urban Settlement Region.

Figure 3.3 Urban area Sabang

2. Settlement Region Fishermen

Fisherman's and PPI Settlement Region is located in the Village of Aneuk Laot. Based on the Master Plan Review Kota Sabang, the area had developed as a Free Port of Sabang Zone (2018)

Figure 3.4 Settlement Region Fishermen

3. Area Tourism in Gapang - Village Iboih – Coastal Area

This area has the potential for beautiful beaches, clean and clear sea water. Beach tourist area is equipped with facilities and amenities cotage-cotage boat tour. On the beach there are several marine park dive sites.

Figure 3.5 Area Tourism

3.4 Research journal of Built Environment Sabang, Weh Island

Existence of human activity in subsistence would generate waste or waste. Along with the rate of population growth and increased demand for life, the production of waste produced by humans is expected to tend to increase from year to year. Waste will cause many problems if not handled properly. As a town on a small island in the province of Aceh Weh island, Sabang city located on the western tip Indonesia can not be separated from the problem of waste, especially solid waste.

Since it was founded by the Dutch in 1881, Sabang serves as a port city that is used for international shipping. Sabang was became as the Free Port and the Free Trade Area in 1970, but was closed in 1985. Sabang is located in the economic development in the South Asian region with the establishment of the Regional Economic Cooperation Indonesia-Malaysia-Thailand Growth Triangle (IMT-GT) on 1993. After the establishment of Sabang as Integrated Industrial Development Zone (KAPET) in 1998 and in 2000 passed Law No. 37 of 2000 on the Free Trade Zone and Free Port of Sabang, an increase in the activity of the free port. Then Sabang also experienced Earthquake and Tsunami disaster on December 26, 2004 (Sabang in Figures, 2011).

Sabang is also known as a tourist area under the sea and the unique nature and the "Ground Zero" of the Indonesian archipelago. The rate of population increase and the intensity of the current number of tourists who visit Sabang, causing the need clothing, housing and food increased. The number of tourists per year who visit Sabang reach 4 times the population of Sabang, where the population of Sabang 30 653 people and the number of Travelers to Sabang travelers as much as 121 646 people locally and 3,932 people of foreign tourists in 2010 (Sabang in Figures, 2011). While the amount of additional tourist arrivals in 2017 has experienced a surge in the number of residential and tourist facilities are built sporadically by the public and investors. For it is necessary to study the built environment as aspects of Sabang city environmental capacity.

As an island, geographically the island of Weh Sabang limited land and Natural Resources , so it is very dependent and requires a supply of raw materials and foodstuffs from outside the island, especially the city of Banda Aceh. As in the know that the agenda of the UN 21 signaled the many challenges faced in the planning and implementation of sustainable development on an island, limited natural resources, is also geographically isolated and highly dependent on other regions (PJ Deschenes, .2004).

Sustainable development of an island can be reached by the management of the resources consumed and the protection of ecosystems resulting in minimization of pollution. Waste generated, both liquid and solid waste, including aspects that significantly affect the ecological degradation of the island, let alone alternative treatment and waste management in an island very limited (Weslynne Ashton, 2004).

Based on early studies that focus on this study is the quantity of solid waste, particularly solid waste public consumption results Weh island, Sabang. Solid waste is calculated mainly enter the final disposal (landfill), assuming that the main contributor comes from domestic waste. Solid waste is related to the goods consumed, so to determine what material is consumed Sabang community has made observations and research in the port of Ulee Lheu Balohan -Banda Aceh and Sabang as a gateway out of the goods from and to the island of Weh. (Machdar, et.al. Syiah Kuala University,2009).

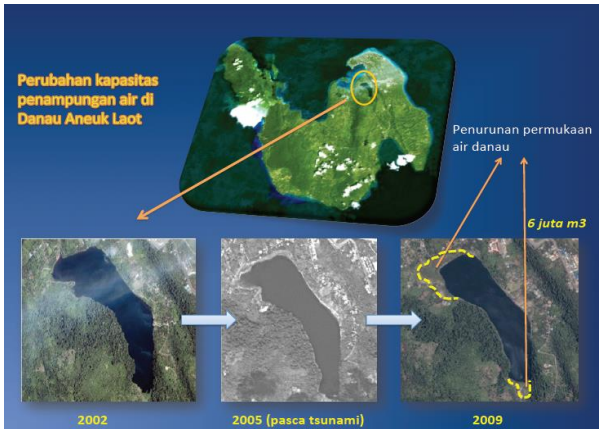

Figure 3.6. Water storage capacity in Lake Aneuk Laot, 2009

Figure 3.7.Water Use in Pulau Weh, Sabang (m3 / year)

The most dominant changes in land use and land cover from 2000 to 2015 were the area of built land which increased by about 85%, water bodies experienced a 27% shrinkage, agricultural land reduced by 11% and forest area reduced by 42%. Land cover around the lake aneuk laot decreases, it will affect the condition of the availability of raw water on the lake. Based on the results of the Land Use Cover (LUC) 2000-2015 analysis, the body area of water was reduced rapidly. In 2000 the water body had an area of 56 hectares and was reduced to 41 hectares in 2015. (Ashfa, et. al, 2016)

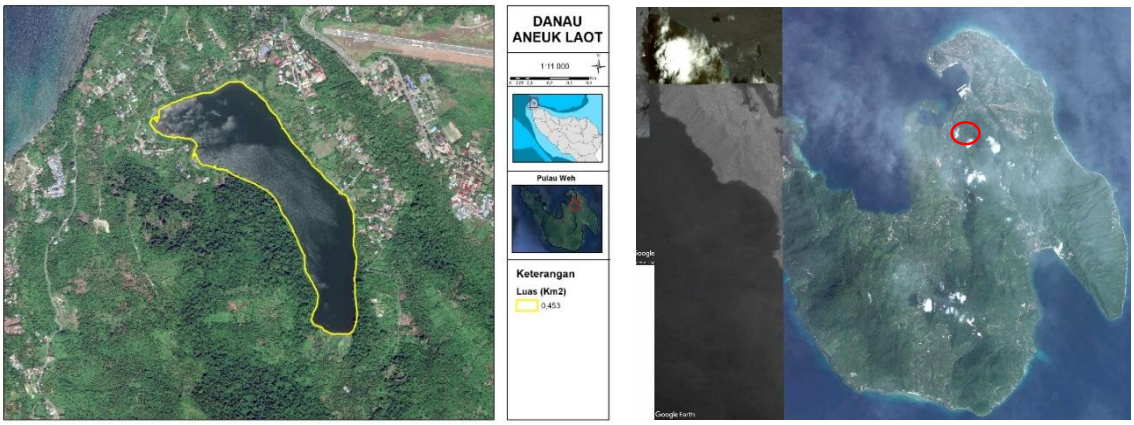

Figure 3.8 Water storage capacity in Lake Aneuk Laot, 2017

The body area of water in Lake Aneuk Laot was reduced rapidly. Land cover around the lake aneuk laot decreases, it will affect the condition of the availability of raw water on the lake.

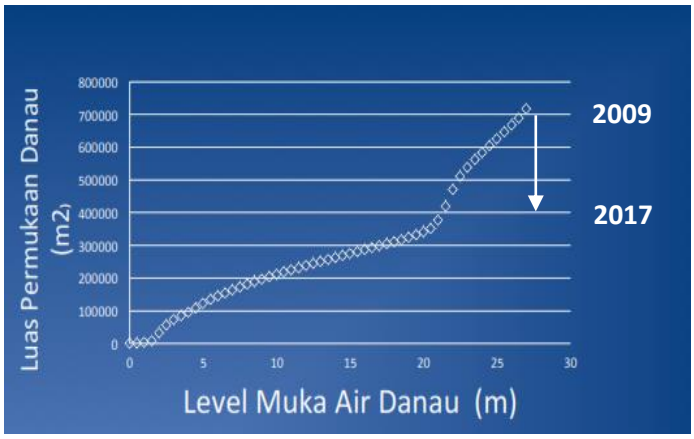

Figure 3.9 Water level in Lake Aneuk Laot, 2017

The body area of water in Lake Aneuk Laot was reduced rapidly. In 2000 the water body had an area of 56 hectares and was reduced to 45,25 hectares in 2017. Lake water reduced based on the calculation of the amount of raw water used PDAM Tirta Aneuk Laot and the amount of water that can be accommodated by the lake amounting to 735,000 m3 per year. Using storage capacity data the lake is around 6 million m3 (2009), so in 2017 storage capacity the Lake Aneuk Laot is around 4 million m3, the next 10 years the lake water will dry out (Azhar, Izarul. 2018).

3.5 Heritage Old Building In Sabang – Weh Island

Addition to spatial aspects in structuring the city area to consider is the environmental character*(genius loci)*. Each building keep the collective memory of the passage of time attached to them. We often visit historic sites or buildings that are preserved with a creative design approach, so the old building can be used as a forum for new activities. Even with the approach of the conservation design of buildings, new buildings can coexist with the old building*(heritage)*.

Sabang city government is promoting conservation by renovating the old city heritage buildings of the past. Today we are witnessing a number of old buildings has been lost and replaced with new buildings such as shops or offices, but the old building is a lot to contribute historical continuity and the creation of architectural, aesthetic value since the Dutch colonial period, early independence until the era of the early construction of the city of Sabang-Weh Island. Efforts to rescue and preservation of old and historic buildings that have been made by various groups of observers of the cultural heritage in Weh Island. While the town of Sabang is commonly found building colonial heritage that is worth preserving with changes in the function as service activities such as lodging and restaurants and souvenir shops to support tourism activities in Sabang, while the use of recycled waste domestic waste to be used as alternative to the addition of income for the local population in place final disposal (TPA) Sabang city should be encouraged.

IV. Conclusion

Through research paper theories of spatial analysis using the method of Environmental Carrying capacity will be obtained traces of policy decisions taken by the City of Sabang. As a city endowed with Divine mainland land, protected forests, oceans and natural harbor and beautiful beaches, then it should approach urban design products*(urban design guidelines*) Sabang noticed aspects of environmental carrying capacity. As for as the cover can be stated that the research to be conducted are expected to gain an overview of solid waste management in Weh island contributing to protect the environment the ecosystem of the island itself and preserving the environment were passed on to the generations to come. As mandated in the Environmental Act No. 32 of 2009 in which one of the instruments to protect the environment are products such as spatial. What has been stated in RTRW (Spatial Planning) is the result of a study to be the concept of zoning and environmental carrying capacity. Currently the treatment of solid waste that goes to landfill Sabang still mixed between organic and inorganic solid waste and from the observations of the land location compost provided did not work to produce compost. Solid waste management in Sabang done by local goverment. Efforts to restore the good image for the town of Sabang as Indonesia's western gate described above is done by encouraging the implementation of the cultural element of Aceh, especially in government offices and other public facilities.

The mechanization and standardization in building industry has its positive aspects, such as are all components can be produced faster and more accurate size. Implementation can be accelerated, especially with the growing sophistication of mechanization in construction. In this case we would need to get back on the science underlying technology Rumoh Aceh that has proven resistant to earthquakes and floods. So that as a world tourism destination, Sabang-Weh Island will have more image of the region of Aceh preserved culture and architecture reflection Aceh implement environmentally friendly and hospitable towards disaster.

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