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Analysis of potential tourism development in perintis reservoir by using environmental approach, Suwawa, Bone Bolango

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Abstract. Perintis Reservoir has big potential with its amazing view, water coverage, and decent nature. However, the reservoir tends to be temporarily crowded by visitor when there is national event that held by government. Moreover, the majority of visitor is only local people. The objective of this study is to create a recommendation and guideline to enhance the future development of Perintis reservoir, so it can be regularly visited by local people, national tourist, and even international tourist. This study method employed various approaches, such as literature review, quantitative data collection, and observation. The identified problem in observation and data collection were solved by literature review. Research results show that there are some problems need to be solved such as inconvenient thermal conditions because of tropical climate and inadequate shading, unready urban facility, unorganized MSME, lack of walkability for pedestrians, and desolate tourism destinations. The environmental approach was chosen as the main solution because it's the most suitable. The improvement of sidewalk, people domination rather than vehicle, and adding forest bathing sensation by planting wide-crown tree is needed. The Riparian buffer system and rain garden can help to balance water conservation while increasing the naturalness of the landscape. Cycling and other physical activities have a correlation with walkability and should be emphasized. Social physical activities and MSME's integration with nutrition in wellness tourism themes can be a Perintis reservoir branding.

Keywords: *Environmental sensitivity; Perintis Reservoir; Sustainable tourism; Walkability; Wellness Tourism*

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1. Introduction

Reservoirs are an important element of the landscape which not only provide benefits to the natural ecosystem of the environment, but also have a direct impact and influence the quality of life and economy of the surrounding community. Ecology is always related to ecosystems and their building blocks, including abiotic (non-living) and biotic (living) factors, in environmental context [1]. Reservoirs contribute to water supply which is an important source of irrigation and agriculture as well as a natural filter to help improve the quality of river water and underground water, become a habitat for various plant and animal species, and become a recreation and tourism destination that contains historical and cultural value. surrounding areas [2]. The reservoir is contributing to a healthy ecosystem balance and indirectly help support the socio-economic needs of the surrounding area.

Perintis Reservoir is an artificial reservoir for water supply for agricultural irrigation. In accordance with the Perintis Reservoir technical document, the reservoir border zone's objective and criteria is to focus on maintaining sustainable functions from the pressure of development of cultivated land and cultivation. However, Perintis Reservoir is considered to have the potential to become an ecotourism area with the beauty of its natural landscape. Apart from the beautiful views, there are also adequate facilities available, such as gazebos along the reservoir, water duck rides, reservoir side villas and family picnic areas.

Perintis Reservoir (figure 1) has an area of ± 6 Ha and located in Suwawa District, Bone Bolango Regency, Gorontalo Province. Gorontalo Province is a province in Indonesia which is in the northern part of Sulawesi Island. Bone Bolango Regency itself is the result of the expansion of Gorontalo Regency and has the largest natural conservation area in Gorontalo Province. Bone Bolango Regency has two main rivers in Gorontalo Province, namely the Bone River and the Bolango River (2 Red Line on Figure 1).

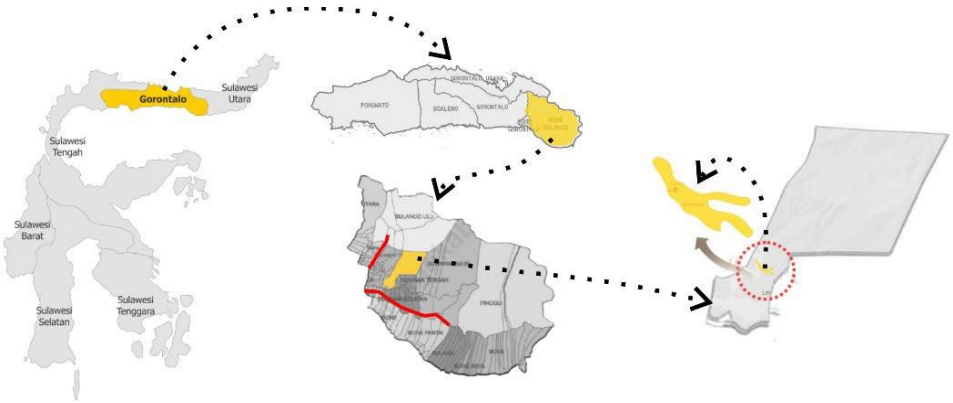

Figure 1. Research location, source: author, 2024.

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Adequate facilities are a crucial role to attract tourists visit a tourist attraction. Lack of necessary facilities, such as transportation, accommodation, and other supporting facilities, can reduce the attractiveness of the tourist attraction. This can cause a decrease in the number of tourist visits, due to inconvenience or access difficulty. Therefore, tourist attraction managers need to ensure that the facilities needed by tourists are available in good condition, so that they can improve the tourist experience and strengthen the position of the tourist attraction in the tourism market [3].

Tourism development planning at Perintis Reservoir was planned and included in the Regional Tourism Development Master Plan (RIPPDA 2022). In this case, the Bone Bolango Tourism Office is responsible for the management of Perintis Reservoir. The data shows that the number of visitors who come to Perintis Reservoir is around 1000 people every week, but the number of visitors can be hampered by unfavourable weather factors [4]. This is also related and influenced by thermal comfort and environmental sensitivity in the reservoir area. Therefore, special attention for environmental aspects will be needed for tourism development efforts.

Environmental sensitivity reflects the degree of vulnerability that can be expressed by components of the natural environment. The needs of natural element in a tourism destination are essential, so the wellness tourism has correlation with sustainability. However, tourism can also negatively affect the environment. Environmental sensitivity can help in analysing areas that may be sensitive to potential damage [5].

Therefore, this research aims to identify the potential and problem in Perintis Reservoir as a tourism destination that focus on a sustainable environmental approach. The results of the research will be an identification, findings, analysis, guidelines and design mood board. The guidelines and the mood board will not only beneficial for the tourism and economy, but also for environment.

1.1. Literature review for walkability

Walking has correlation with body physical activity, health, mind, and relaxation. Therefore, the walkability of a place is important to make a place wellness oriented and human friendly. Pathway is the main space to walk. There are 3 main keys to create comfortable pathway, which is security, convenience, and aesthetics. The research has shown that visual variety was the key in aesthetics. A very strict and formal design guideline can reduce formation or visual aesthetics variety. The building regulation shape must be regulated in the first place before any establishment and development, so it can increase the arrangement and design easiness [6]. There are difference viewpoints about pedestrian area design between single mature people and married mature people + having children. Parents tend to dislike sidewalks that have car parking spots. Both sides agree that the easiness of walking can be achieved if the sidewalks are wider [7].

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A liveable city and support the walking activity can potentially reduce the cognition ability loss in elders. Walkability and streetscape are one of the factors to create friendly pedestrian city. Social contacts often happen in a land with high green area coefficient. High cognitive activity usually occurs in a place with high diversity facility, especially in health and cultural facility. Every facility must be reachable in 15 minutes [8].

The potential of natural tourism is still a big branding prospect in Indonesia. The term “forest bathing” or “forest wellness tourism” has the tendency to increase the community’s activity nearby, preserving the nature for the environment and economy needs, as well as increasing the travelling experience. This tourism implementation also can show the environmental concern” [9].

Walkability will tend to increase the social activity with the support of pro-environment togetherness habit. Community will also tend to walk if there is any facility, destination, park, and open green area. Social activity can increase mental health and quality of life [10].

There are criteria for planting trees and planting trees that has correlation to reduce the impact of urban heat islands. It can be said that walkability is related to external thermal comfort [11]. Several research results in Lingnan Garden can be used in the case of Perintis Reservoir [12] :

a. More than 80% of people will feel comfortable if they are shaded.
b. More than 60% will feel comfortable in artificial shading such as canopies, pavilions, hallways, etc.
c. Dynamic water tends to bring better thermal comfort than static water. Wind speed must be considered. It shall not be too slow, otherwise it will become damp and increase discomfort.
d. Psychologically, water can give the impression that a place is cool.
e. The patio can be a place where the person is quiescent, so people tend to stop doing activities, enjoy their surroundings, and their body's metabolic activity decreases [12].

Streetscapes play an important role in the development of tourism areas. A landscape that is arranged with attractive tourist spots will attract many tourists. Trees are an important element for shading with a high density in the range of 1.5 meters. Apart from that, soundscape is one of the aspects to pay attention to. Don't let tourism disturb residents because of overtourism [13].

In material decision making for thermal comfort, there are several things that need to be considered [14]:

a. Wide crown plants will be very helpful to achieving thermal comfort because they have wide coverage for shading.
b. The distance between the base of the stem/soil and the upper crown of the plants must be far apart to not hinder wind movement at human height

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c. Using shrubs that are as tall as a person can prevent wind circulation & reduce air penetration into ventilation
d. Using materials that have a high albedo will help reduce thermal discomfort if the urban heat island is included.
e. Pine trees will not have much impact on thermal comfort.
f. Building shades can be a consideration for surrounding shading [14].

Riparian buffer systems can help maintain water resources and conserve surrounding ecosystem services. Riparian buffer systems can increase diversity and improve forest management. Although there are animals such as spiders and vascular plants whose existence may be less affected if a Riparian buffer system is used [15].

Cycling tourism could be an interesting topic to raise because walkability and wellness tourism have a strong relationship with cycling. A person's motivation for cycling tourism are self-development, physical challenge, and social interaction [16]. If it is related to walkability, the walkability of an area also has a positive correlation with social interactions surrounding it. By optimizing walkability, cycling tourism will also be optimized [16]. The fewer cyclists on a road, the greater the number of cyclist accidents due to the dominance of motorized vehicles [11]. Roads potential without cars or other motorized vehicles. If wellness tourism is placed in a place that is very noisy, full of pollution, lots of dangerous vehicles passing by, then it will not be a place that has branding for wellness. The impression of the forest will be inferior to the road. In addition, roads where there are no motorized vehicles will tend to have high walkability [11]. Limiting the movement of motorized vehicles on certain roads, can reduce ambient noise, reduce the urban heat island effect, reducing premature deaths, and increasing surrounding green areas. Apart from that, human activities such as walking, cycling, social interaction with the surroundings, and the economy have also increased [17].

1.2. Literature review for perintis potential and the research gaps

"Visitors' Perceptions of the Perinitis Reservoir Tourist Attraction, Suwawa District, Bone Bolango Regency" article states that the potential of Perintis Reservoir lies in [18]:

1. Ability as a place to relax and rest
2. Ease of transportation to the location
3. Road conditions are relatively good
4. Perintis Reservoir is a beautiful reservoir to enjoy
5. Most visitors agree that the parking space provided is good

The biggest attraction on the Perintis Reservoir tour is the reservoir. The accommodation available is a gazebo and tribune. Activities that are temporarily accommodated are places to relax. Telecommunications and road support services are good [19]. Secondary sources show that Perintis Reservoir was often used as a festival venue. For example, “Festival Produk Milenial” in 2023 [20], and “Festival Pesona Danau Perintis” in 2017 [21]. Perintis Reservoir is

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often busy when there are certain events, but relatively quiet when there is no major event. Cultural and religious aspects are not prominent.

However, Perintis Reservoir tend to be visited by local people who are close to the reservoir the reservoir to relax, not tourists outside the regency or those who have the intention of going on holiday nationally or internationally. There is a research gaps and contraries in the previous research. The previous research results said that Perintis Reservoir is deserved to be visited for holiday [18], but it is not in accordance with reality and the amount of visitor. There is also an attempt to design Perintis Reservoir [22]. However, the design paper was not explaining the reason of the design development result. There is no research that investigate the problem comprehensively, optimizing the potential, and what kind of branding or solution needed for Perintis Reservoir. The unsynchronized previous research result, baseless design attempt, and the big potential of Perintis Reservoir made Perintis Reservoir deserved to be studied comprehensively in multi dimension with multi-instrument.

1.3. Wellness tourism environmental approach literature review

Wellness tourism, as defined by the Global Wellness Institute, is a tourism that focuses on efforts to maintain, or enhance personal well-being. Wellness tourism aims to transform travel into an opportunity for overall health care and improvement. If the individual feel responsible for their own well-being (self-responsibility), they will require health and wellness services. Health tourism is categorized in 2 parts, which is wellness and medical. Wellness is related to something that is relaxing, recreative, and holistic. However, medical is related to something that is therapeutic and operation. Walkability is related to something leisure / entertainment or life/ work balance because it's one part of the sport or fitness [23]. Wellness tourism can be viewed as a strategy to address thermal discomfort issues in the tourism environment because it has environmental sensitivity aspect. In this context, a nature-based tourism design approach can be employed to create an environment that supports optimal thermal comfort. The need for health and wellness products will continue to grow and diversify, depending on social factors and environmental sensitivity.

Wellness tourism can be categorized into several groups (fig.3), including (1) mental activities/education, (2) nutrition/diet, (3) physical fitness/beauty care, and (4) relaxation/rest/meditation [24].

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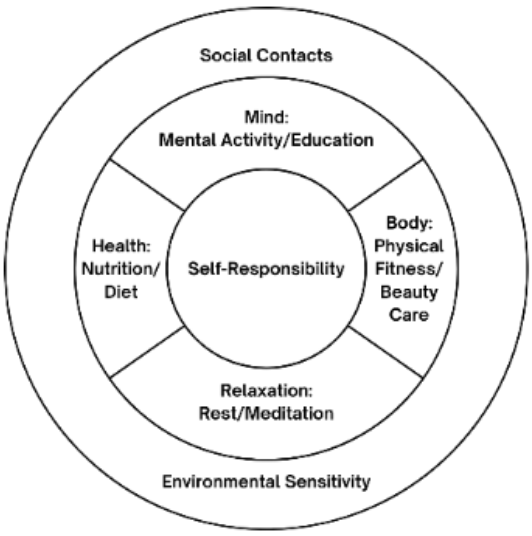

Figure 2. Wellness tourism categories [24].

2. Methods

The research methods in this research are mix-methods. There are literature review, observation, and quantitative data collecting. Literature reviews are the foundations for arguments, solution, theory, guidelines, and mood board to achieve environmental approach in Perintis reservoir. Literature reviews are also conducted to help analyse the potential of tourism in Perintis reservoir in different researcher perspectives. The data collection and observation will help with analysing the existing problem and act as a starting point, which research paper will be in literature review. Every analysis and literature review will be systematic, to find the best solution development in Perintis reservoir. Quantitative perspective (temperature and oxygen data) must be included because micro-environments also have correlation with spatial design and social dynamics [25]. The systematic process can be found in Fig. 3.

The walkability was surveyed on 4th ,10th, and 11th October 2023 by walking along all the path around Perintis Reservoir and taking picture as a proof for documentation. Based on observation in that period, the 58 chosen relevant checklist criteria in “Walkable City Rules:101 Steps to Making Better Places” was examined. The MSME was also surveyed at the same time while surveying the walkability. The soil data was taken to the environmental lab in Gorontalo from 30th October and was done processed on 1st November 2023. The oxygen and the thermal were quantitatively measured on 19th, 30th, and 31st October 2023 by using a Dissolved oxygen meter Lutron DO-5510. The pinpoint location of the oxygen and temperature measurement and the time is explained on result and discussion section. The literature review by using Scopus and Google Scholar to find the best solution was held from 31st October 2023 to 15th March 2024. Then, implementation of all the literature review by encode and decode all of the review began from 15th March 2024 to 25th March 2024.

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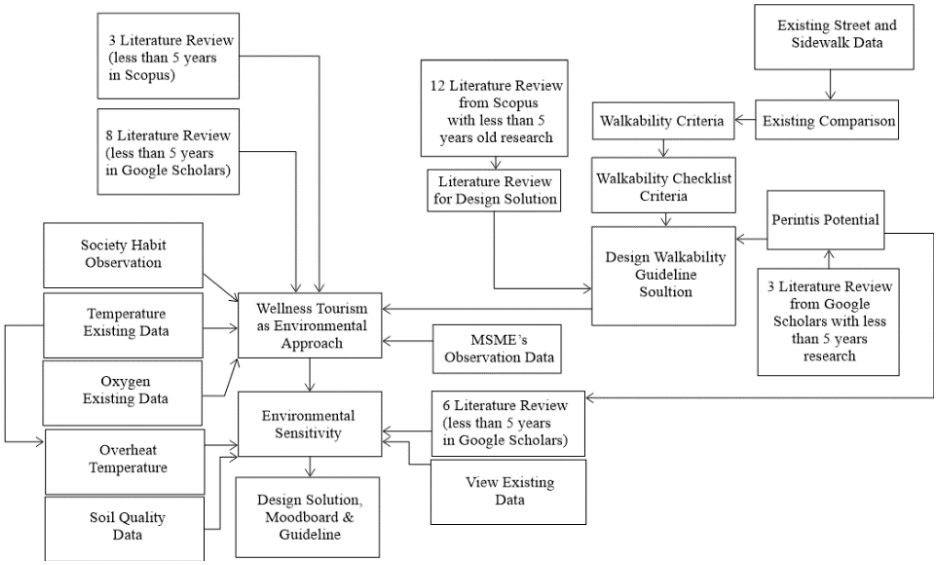

Figure 3. Research methods diagram, source: author, 2024.

3. Result and discussion

3.1. Result

3.1.1. Society habit observation. The stunning scenery of Reservoir Perintis is the main attraction for tourists. The natural beauty of the reservoir, accompanied by fresh air and a peaceful atmosphere, provides a captivating experience for visitors. This combination makes the reservoir a highly sought-after destination for enjoying the beauty of nature and relaxing. The dominant activity at Reservoir Perintis is picnicking, which reflects the basic human need for social interaction and relaxation in an outdoor environment. Tourists often visit the reservoir with the intention of spending quality time with family or friends while enjoying the natural beauty offered by the reservoir. Additionally, the emergence of a new habit among residents who sell local specialties in the afternoon enriches the culinary tourism experience at Reservoir Perintis. The role of local MSMEs in providing local specialties not only creates economic opportunities for the local community but also supports environmental sustainability using local ingredients and strengthens the local community.

The comparison of visitor observation was held during daytime, late afternoon (fig.4) to evening with 12 hours range at Reservoir Perintis. It can provide an overview of how visitation patterns differ depending on the time of day. The observation was held on 4th October, 10th October, and 11th October 2023 (weekdays). Here is a comparison of visitor situations during these two time periods:

a. Daytime:
    - There is almost no visitor during the daytime.

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- Due to the hot weather, it prevents people from visiting, as well as the lack of attractions or tourist facilities available to enjoy during the daytime.
- Due to the low number of visitors, activities around the reservoir also be less crowded during this period.

b. Late Afternoon to Evening:
   - Visitor number begin to increase towards late afternoon, and more people tend to crowd around the reservoir.
   - In this time range, many people have leisure time after work or school. So, they seek opportunities to relax and enjoy.
   - Picnicking with family or friends tend to occur more frequently.
   - The emergence of local MSME vendors that selling local specialty foods also attracts more visitors. This emergence adds the culinary experience and supports the local economy.

Figure 4. Comparison of visitor situations during daytime and late afternoon to evening, source: author, 2023.

Based on this comparison, it is a certain that visitation patterns and activities around Perintis are heavily influenced by time. Late afternoon to evening is a busier and more memorable time for visitors due to cooler weather and the emergence of various social and culinary activities. This also provides valuable insights for tourism managers to provide better services to enhance visitor experiences and supporting environmental sustainability around the reservoir.

3.1.2. Micro, Small and Medium Enterprise (MSME) observation. The tourism facilities at Perintis reservoir are only available at the reservoir side. There are facilities such as gazebos, street food cart, toilets, prayer rooms, and sunset viewpoint. In 2023, an event named *Festival Produk Milenial Danau Perintis* (FPMDP) took place at Perintis Reservoir. This event involved 100 Micro, Small, and Medium Enterprises (MSMEs) from the area. Currently, the MSMEs at Perintis reservoir are only focused on culinary activities. Most of them are selling local food using cart that was provided by *Bank Indonesia* (BI) during the event which are still used until today (as seen on fig. 6). An observation revealed that there are 22 permanent local culinary

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sellers out of the initial 100. However, the layout of the MSME area is not well-organized. Some sellers operating on the roadside, outside the designated reservoir border area (was made for MSME spot). This situation disrupts vehicle circulation and accessibility (as seen on fig. 7). Below this paragraph (fig. 5) shows the situation of the MSME spot on the reservoir side. The atmosphere there is quite comfortable in the late afternoon because there are lots of places to sit and watch the sunset. The presence of MSME areas in the middle of the reservoir's shoreline also provides opportunities for local communities to develop their businesses and showcase the region's culinary diversity to visitors. Even though it's not a place to buy local specialties, this area also often serves as a venue for organizing certain events or activities. Tourism managers often hold various events such as night markets, art exhibitions, music performances, and culinary festivals in this area. These events not only add diversity to visitors' tourism experiences but also increase income for local MSMEs and provide additional entertainment for visitors.

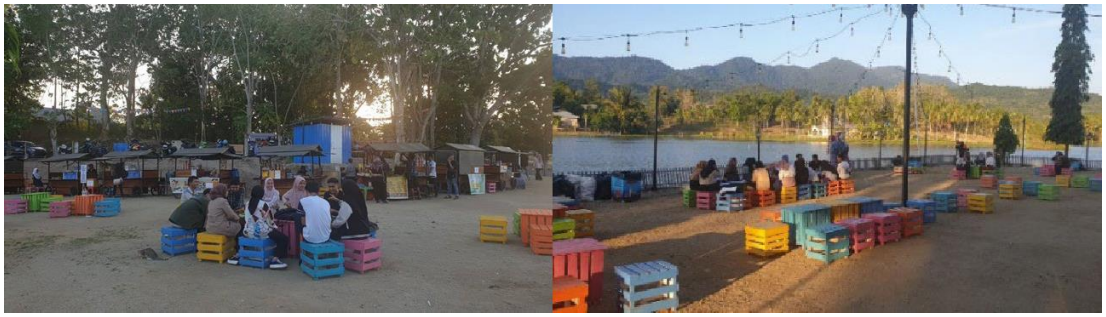

Figure 5. MSME spot on the reservoir side (left), view from the MSME spot (right), source: author, 2023.

Figure 6. One of the street food carts, source: author, 2023.

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Figure 7. MSME on the roadside (outside the MSME area), source: author, 2023.

3.1.3. Temperature existing data. The measurement of temperature in Perintis Reservoir serves as a critical component in understanding the environmental conditions of the reservoir area. Temperature variations can impact the ecosystem, water quality, and overall comfort of visitors and residents. The following temperature data around Perintis Reservoir can be seen in fig.8.

Location No.	Time	°C
1	4:00 PM	32.6
	7:00 PM	30.3
2	4:00 PM	33.5
	7:00 PM	30
3	3:00 PM	35
	6:00 PM	30.9
4	11:00 AM	34.7
5	2:00 PM	35.6
6	2:00 PM	35.2
7	2:00 PM	35.4
8	4:00 PM	31

Figure 8. Temperature measurement in perintis reservoir, source: author, 2023.

Referring to the Indonesian National Standard (SNI) for thermal comfort, all tested points indicate hot and uncomfortable temperatures, as they are all above 30°C. At the reservoir's edge, oxygen and temperature data sampling were conducted at afternoon and evening to sync with the fall and peak visitor hours, which usually begin in the late afternoon. It is held on 19thOctober, 30th October, and 31st October 2023 with variety of time sample (11.00 a.m., 2.00 p.m., 3 p.m., 4 p.m., 6 p.m., 7 p.m.). In the morning to midday, temperature is very high,

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reaching up to 35°C, making it extremely uncomfortable for activities. Preliminary assumptions suggest that this discomfort may also be due to the lack of shade trees at the reservoir's edge. Research results indicate that shade trees are only found on the edge of the reservoir, with only a few found along the water-land boundary.

Thermal discomfort is a major issue in the Perintis reservoir's environment. In the context of natural tourist attractions, thermal comfort plays a crucial role in enhancing visitor well-being and holistic experiences. Factors such as air temperature, wind direction and speed, as well as the orientation and geometry of urban forms, can affect thermal comfort. Improving thermal comfort can result in a more visitor-friendly environment, increase visitor stay duration, and enhance the appeal of natural tourist attractions [26].

In response to the thermal discomfort caused by high temperatures at Perintis reservoir, a nature-based tourism approach is utilized. Environmental sensitivity involves considerations and preservation of the natural environment, which can involve sustainable practices through experiences or activities provided to visitors in wellness tourism. These sustainable practices aim to minimize negative impacts on the environment.

3.1.4. Oxygen existing data. Measurement of oxygen levels was also conducted in the environment around Perintis Reservoir. The collecting data activity was held on 19th, 30th, and 31st October 2023 with time range of between 2-4 p.m. and 6-7 p.m. Oxygen, the second most common component in Earth's atmosphere, makes up 21.0% of the volume and 23.1% of the mass (approximately 1015 tons) of the atmosphere [27]. These measurements aim to understand the air quality conditions surrounding the reservoir, assess potential impacts from human activities, and ensure that the master plan design can maintain or improve good air quality for the environment and community welfare. The following oxygen data around Perintis Reservoir can be seen in fig.9.

No	Tested at 2 - 4 PM				Tested at 6 - 7 PM			
	Experiment -			Average	Experiment -			Average
	1	2	3		1	2	3	
1	20.2	18.1	-	19.15	-	-	-	-
2	15.5	-	-	15.5	-	-	-	-
3	23.5	-	-	23.5	-	-	-	-
4	18.9	19.1	19.1	19.03	-	-	-	-
5	20.9	20.8	20.6	20.77	19.5	19.6	19.7	19.6
6	21	21	20.9	20.97	19.8	19.8	19.8	19.8
7	21	21	21	21	20	19.9	19.8	19.9
8	20.6	20.5	20.4	20.5	20	20	20.1	20.03
9	20.9	20.9	20.9	20.9	20.1	20.2	20.1	20.13
10	21.1	21	20.9	21	20.9	20.7	20.6	20.73
11	21	21	21	21	20.6	20.5	20.5	20.53
12	20.4	20.3	20.3	20.33	-	-	-	-
13	21	20.8	20.9	20.9	-	-	-	-
14	20.7	20.8	20.8	20.77	-	-	-	-
15	21.1	20.9	20.9	20.97	-	-	-	-
16	20.8	20.8	20.9	20.83	-	-	-	-

Figure 9. Oxygen measurement around perintis reservoir, source: author, 2023.

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The results show that the oxygen levels are quite good, close to the average of 21% both during the day and at night. This indicates that the environmental condition around Perintis Reservoir is very good, suggesting its potential as a tourist attraction based on the environment.

3.1.5. Soil quality data. In this research, soil measurements were also carried out to determine the nutrient content of the soil around Perintis Reservoir. The purpose of this soil testing is also related to the concept plan for the riparian buffer system and rain garden which will be implemented on the borders of Perintis Reservoir. The following are the results (fig. 11) of soil sample tests around Perintis Reservoir:

The results of the soil tests above can be used as a measure to find out what plants can be planted in soil that contains these nutrients when planning riparian buffer systems and rain gardens in the future. Soil pH has a role in plant survival. With a soil pH of 5-6, the soil around Perintis Reservoir is low-acid soil, generally, this type of acidic soil is found in wet areas [28].

A good plant example to use in this soil pH is the Pterocarpus indicus tree. This species can grow in alluvial soil and is generally found in soil with a slightly alkaline pH [18]. However, it also can adapt to a wide range of oil conditions. Apart from that, the Pterocarpus indicus tree is very appropriate to plant in the rain garden area because it has a good ability to withstand rainwater runoff, which can hold 35.2 liters per year [29].

Applicant : Perintis Lake, Suwawa District
Sample Entry Date : October 30, 2023
Sample Test Completion Date : November 01, 2023

Sample 4

No.	Sample Location	Nutrient Content			
		P	K	pH	C
1.	Suwawa/Perintis Lake	Medium	Low	A Bit Sour (5-6)	Low

Figure 10. Soil quality lab result, source: author, 2023.

3.1.6. Existing sidewalk and street data. To measure walkability in Perintis reservoir, the data of the existing sidewalk and street must be collected. Any online maps platform is still not eligible for data collection because of the unavailable online data. There are some locations inaccessible online. The existing sidewalk and street development is still quite inequal in some areas. The west area tends to be more developed than the east area. The north side is more developed than the south side because the north side is because of the vehicle circulation intensity. Here are some documentations of the observation in the south side (fig. 11 left photos are east side & right photos are west side).

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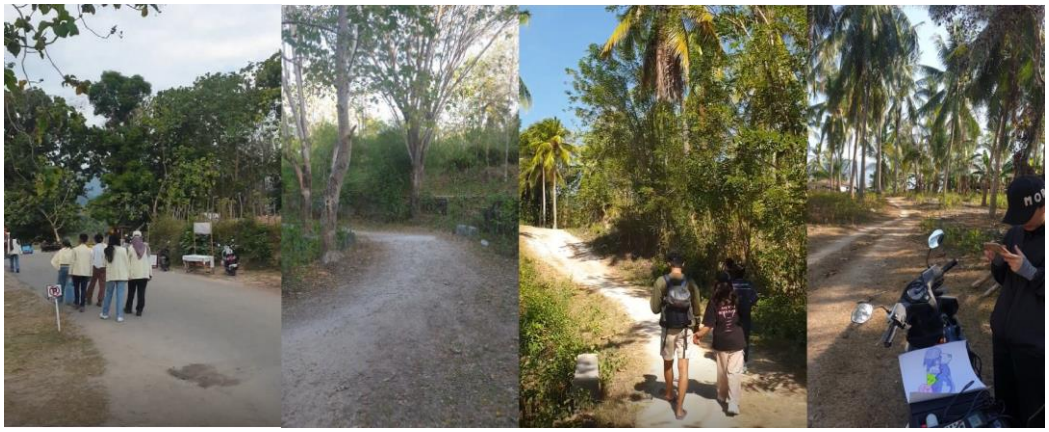

Figure 11. Photo comparison for west side (to the left) and east side (to the right), source: author, 2024.

3.1.7. Existing sidewalk and street data. An urban designer must consider the user characteristic (pedestrian, cyclist, young, old) of the urban spaces to suit the circumstance of the surroundings [28]. In walkability criteria context, it generalizes all users. There are 58 relevant criteria from 101 criteria in "Walkable City Rules: 101 Steps to Making Better Places" book that can be observed in Perintis reservoir, it will be an evaluation checklist in walkability aspect. 58 criteria were selected because it can be an evaluation in micro-meso scale of urban design. The evaluation only needs to be around Perintis reservoir, not a city. The aspect can also be tangible or intangible as long as it can be evaluated by doing observation. It must have the correlation with tourists as users who will be the pedestrian, driver, and cyclist around the reservoir. It also can assess the tourism facility not only in sidewalk, but also as the main part recreation of the Perintis reservoir.

Tabel 1. The Relevant Criteria in "Walkable City Rules:101 Steps to Making Better Places" for Perintis Reservoir, Source: Author, 2024.

	SELL WALKABILITY		**PARK ON STREET**
1	Sell Walkability on Wealth	30	Put Curb Parking Almost Everywhere
2	Sell Walkability on Health	31	Design Parallel Parking Properly
3	Sell Walkability on Climate Change	32	Provide Angle Parking Were Warranted
4	Sell Walkability on Equity		**FOCUS ON GEOMETRY**
5	Sell Walkability on Community	33	Avoid Swoops, Slip Lanes, and Sight Triangles
	MIX THE USES	34	Design Left-Turn Lanes Properly
6	Push for Local Parks	35	Use Roundabouts with Discretion
7	Do the Math	36	Do Not "Fix" Complexity
	GET THE PARKING RIGHT	37	Remove Centerlines on Neighbourhood Streets

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8	Eliminate On-Site Parking Requirements	38	Create Pedestrian Zones Properly
9	Price Parking Based on Its Value		**FOCUS ON INTERSECTIONS**
	LET TRANSIT WORK	39	Make Great Crosswalks
10	Coordinate Transit and Land Use	40	Keep Signals Simple
11	Consider the Transit Experience	41	Bag the Beg Buttons and Countdown Clocks
12	Create Bikeshare that Works	42	Build Naked Streets and Shared Spaces
	ESCAPE AUTOMOBILISM		**MAKE SIDEWALKS RIGHT**
13	Tear Down a Highway	43	Put Trees Almost Everywhere
14	Close a Street to Cars—Maybe	44	Select and Locate Street Trees Properly
	START WITH SAFETY	45	Design Sidewalks Properly
15	Focus on Speeding	46	Disallow Curb Cuts
16	Adopt Vision Zero	47	Introduce Parklets
17	Adopt a Downtown Speed Limit		**MAKE COMFORTABLE SPACES**
	RIGHT-SIZE THE NUMBER OF LANES	48	Make Firm Edges
18	Cut the Extra Lanes	49	Never Allow Front Parking
	SELL CYCLING	50	Use Lighting to Support Urbanism
19	Justify Biking Investment		**MAKE INTERESTING PLACES**
20	Understand that Cycling Follows Investment	51	Make Sticky Edges
21	Avoid Common Cycling Pitfalls	52	Limit Repetition
	BUILD YOUR BIKE NETWORK	53	Direct Your Public Art Budget to Blank Walls
22	Understand Bike Network Function		**DO IT NOW**
23	Turn Existing Corridors into Bike Paths	54	Do a Walkability Study
24	Build Bicycle Boulevards	55	Do a Frontage Quality Assessment and Locate Anchors
25	Build Cycle Tracks	56	Identify the Network of Walkability
26	Build Cycle Tracks Properly	57	Rebuild. . . or Restripe?
27	Use Conventional Bike Lanes Where They Belong	58	Do Some Tactical Urbanism
28	Build Conventional Bike Lanes Properly		
29	Do Not Use Sharrows as Cycling Facilities		

Haven't been implemented Implementation can be optimized Implemetation had been optimized

From 58 checklist criteria, there were only 4 criteria that had been implemented, 7 criteria can be optimized, and 47 criteria haven't been implemented in Perintis reservoir. The red and yellow criteria would be processed for the guideline recommendation in result and discussion

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section. Based on categorization of the criteria, Perintis reservoir tend to lack of the importance of walking as the main activity at nearby reservoir, attractive pedestrian area, attention deficiency to cyclist, bus transit, geometry and vegetation adjustment, security, and parking area.

In “Sell Walkability” themes, Perintis reservoir is still not pedestrian oriented. The easiness of accessibility is only for motoric vehicles. None of the criteria is fulfilled. In “Mix the Uses” themes, it has already seemed Perintis Reservoir shape like a semi local park, but still need some firmness to tell if there is a park appearance in Perintis Reservoir. In “Let Transit Work” theme, there has not been any transit area or station around the reservoir for bus or bicycle. The road is still dominated by cars and motorcycles. Pedestrians tend to walk at the edge of the street. There is no action to “Escape Automobilism” theme. “Start with Safety” theme is still not a main concern in Perintis Reservoir because it’s still a developing area and not matured yet. It just created any necessary things for accessibility. There has not been any speed limit signage, appliance of vision zero, etc. In “Right-Size the Number of Lanes” themes, the built street around reservoir just only has 2 lanes with opposite flow. It’s have already been optimal for current situations, but not matured as a place for tourism in the future. Because of the economic oriented street development and uncommon habit to cycling as primary transportation, the road isn’t fulfilled with “Build our Bike Network” themes. The available facility in Perintis Reservoir is still minimum. It has essential facilities for relaxation, but still allows front parking, lack of lighting support, and don’t have any firm edges. It’s not satisfied “Make Interesting Places” or “Do It Now” themes because there is a lack of assessments in Perintis Reservoir in urbanism. The lack of facilities and unintegrated situation makes “Make Interesting Places” theme can’t be assessed because there is nothing needed to be assessed and make the assumption completely fail in the theme.

3.2. Discussion on findings

3.2.1. Design guideline. In the previous explanation of wellness tourism, it was written that health and wellness can be categorized into several groups, including (1) mental activities/education, (2) nutrition/diet, (3) physical fitness/beauty care, and (4) relaxation/rest/ meditation. Social contacts (5) and environmental sensitivity (6) must also be considered in guidelines even though it’s as only part of the integration of the group. Every category contributes to the success of wellness tourism. Therefore, the following design guidelines for each category can be implemented for Perintis Reservoir tourism. The guidelines are written based on wellness tourism categories. There are two walkability themes (“Sell Walkability” {1,2,3,4,5} and “Do It Now” {54,55,56,57,58}) that can’t be proceed into guideline because it’s intangible and act as an evaluation rather than physical matter.

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Every square bracket in the guideline that listed below means it has correlation with the previous literature review. Curly bracket in the guideline section means that it has correlation with walkability criteria. Below is the specific guideline that concluded from previous findings, analysis, and literature review.

a. Mind: Mental Activity/Education
    1) Promoting activities that train the mind and learning to control thoughts can be done through mind-body therapy activities [24].
    2) Nature tourism can provide therapeutic effects on individuals, such as through viewpoints that provide a relaxation effect [9].
    3) Adding soundscape can reduce stress and attract tourists at Reservoir Perintis. Traditional Gorontalo musical games like Polopalo can enhance this experience, offering a unique and culturally rich environment for relaxation [13].
    4) Enhancing Scenic Viewpoints:
        a) Identify and enhance existing viewpoints around the reservoir to maximize the enjoyment of the stunning scenery [18].
        b) Install signage or designated areas at strategic points around the reservoir for visitors to appreciate the natural beauty, especially at east view side [18].
        c) Consider adding seating areas or observation decks for visitors to relax and immerse themselves in the picturesque surroundings [10].
    5) Ensuring Safety and Security [6]:
        a) Design facilities and amenities with safety in mind, including proper lighting, clear signage, and accessible pathways.
        b) Install security measures, such as surveillance cameras and emergency call boxes, to ensure the safety of visitors and prevent vandalism or theft.
        c) Collaborate with local authorities and law enforcement agencies to develop emergency response plans and protocols for managing emergencies.

b. Health: Nutrition
    1) MSME around Perintis Reservoir needs to improve food processing facilities to create a more positive perception for visitors [23].
    2) Development strategies can include providing a station for cleaning food utensils, arranging MSME areas properly, and providing proper food processing places [23].
    3) Promoting Culinary Tourism [23]:
        a) Develop designated areas for local MSMEs to sell and showcase their specialty foods.
        b) Provide infrastructure such as stalls, seating areas, and waste management facilities to support culinary activities.
        c) Incorporate elements of local culture and heritage into the design to create an authentic culinary experience for visitors.

c. Body: Physical Fitness/Beauty Care

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1) Wellness tourism can include physical activities such as jogging, cycling, horseback riding, skating, skateboarding, and water sports or other physical on water activity, etc.[23].
2) The main challenge is to zone each activity to avoid collision and interference with other activities, as well as to consider the need for good thermal comfort. The rule of thumb for thermal comfort is to plant tree with wide crown where tourist will often pass by or doing the main activity in Perintis reservoir [26].
3) In order to give more detail implementation for physical activities in jogging and cycling, here is the more specific guideline (keep in mind that pedestrian, parking and bicycle guideline might also overlap in Mind: Mental Activities, Environmental Sensitivity, & Social Contacts aspect categories, but the primary categories is still in Body: Physical Fitness):
4) Pedestrian guidelines (Make Sidewalks Right {43,44,45,46,47}):
    a) Design the pedestrian area along the reservoir rim with a minimum size of 1.5 meters [7].
    b) Provide tactile path for disabled people [11].
    c) Provide ramps for easier accessibility in pedestrian areas [11].
    d) Planting wide crown trees that the top crown far apart from the ground and plant forming a close distance for shading purposes. The relevant trees are Pterocarpus indicus, Albizia saman, Filicium decipiens, etc [12].
    e) Make running, jogging, or leisurely walking into a brand in the design of Perintis reservoir. Integrate forest bathing experience while doing other physical activity [9].
5) Parking guidelines (Escape Automobilism {13,14}, Get The Parking Right {9}):
    a) Try to park vehicles near the entrance so that the car route is not far extensively around Perintis Reservoir in order to reduce the number of roads occupied by cars. Main roads must be dominated by cyclists and pedestrians. It is recommended to design the parking zone at the west-south zone. Then, the zero-car zone can be implemented in the mid and east zone. The implementation of zero-car zone may increase probability human become the main actor of the street, not motorize vehicles [17].
    b) The parklet suggestion in the book Speck, 2018 can be adapted to Perintis Reservoir by changing existing excess parking areas or illegal parking into gazebos or benches [11].
    c) Provide a transit place for buses and cyclists on long-distance trips. This increases the possibility of Perintis reservoir being used as a basecamp for marathoners or cyclists.
    d) Providing on-site ticket parking to increase people's tendency to use public transportation, walk or cycle.
    e) Parking must have shade from trees.
6) Bicycle guidelines (Sell Bicycles {19,20,21}, Build Your Bicycle Network {22,23,24,25,26,27,28,29}):

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a) Providing parking for bicycles, scooters, or electric bicycle rental places [16].
b) Main roads are for cyclists and humans. Cyclists dominantly use sidewalk when the road is vehicle-oriented (100 meter after passing south entrance, or before the “Danau Perintis” existing signage), then can move to main road to use it as cycling track [17].
c) Provide weekly cycling events and brand Perintis Reservoir as a place to exercise for cycling while enjoying the view. Cycling must be branded as a lifestyle in Perintis reservoir [16].
d) For the road around the rim of Perintis Reservoir, use it as a bicycle highway. Make cyclist the main actor [16].
e) Something that needs to be noted regarding cyclists is that the streetscape around Perintis Reservoir or leading to Perintis Reservoir must be made attractive, so that cyclists who go around the city stopped at the reservoir because attractive event in Perintis reservoir. Streetscape is also one of the reasons cyclists choose a route [29].

d. Relaxation: Rest/Meditation
1) The development of the reservoir as a health asset related to nature is still not popular in Indonesia, but it has great potential to be explored. In the future, the water body can be used for water-based therapy. However, the function of Perintis Reservoir as agricultural irrigation constraint can’t be ignored. The water safety still the main consideration to implement water-based therapy [23].
2) The development of programs that emphasize spiritual and relaxation aspects such as yoga, meditation, and other spiritual activities can attract visitors' interest [23].
3) Adding a gazebo as a place to rest if pedestrians are tired of exercising or walking [12].
4) Add a place to picnic, relax, meditate, or just stare at the sky and enjoy the day with family, friends, or other visitors [10].
5) Water dynamics movement like fountains can be placed around rim of Perintis reservoir that is commonly passed by tourist and visitors. Water sound can increase naturalness and sense of coolness for people who is walking or pass by [12].

e. Social Contacts
1) Social interaction can increase involvement in health tourism by promoting social networks, increasing satisfaction with social life, and creating a sense of community [10].
2) Group activities such as workshops can encourage social interaction among visitors. Adding facilities such as open parks, playground, dining areas, or lounges can help foster interaction among visitors [10].
3) Creating Gathering Spaces:
a) Designate gathering spaces along the reservoir's shoreline for visitors to socialize and enjoy meals together [10].

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b) Integrate seating, natural structures, and recreational amenities to create comfortable and inviting spaces for relaxation and social interaction [8].

4) Hosting Events and Activities:
   a) Develop flexible spaces such as amphitheatre that can accommodate various events and activities, such as night markets, art exhibitions, music performances, and culinary festivals [20].
   b) Provide infrastructure such as stages, lighting, and sound systems to support event hosting (can be temporary or permanent) [21].
5) Site facility guidelines (Make a Comfortable Place {48,49,50}, Focus On Geometry {39,40,41,42}, & Make Interesting Places {51,52,53}):
   a) Use of a riverbank buffer system on the edge of the reservoir to increase the shady impression, protect the surrounding ecosystem and give the impression of natural health tourism at Perintis reservoir [15].
   b) Add hanging lights or garden lights to beautify the night atmosphere. At night, there tends to be lots of activity, walking around leisurely enjoying the evening [11].
   c) Making roundabouts at intersections [11].
   d) Creation of a children's playground, outbound with sports facilities [11].
   e) Don't make anything repetitive and excessive. For example, in arranging gazebos, lights, pedestrian motifs, etc [11].
   f) Accommodate artistic aspirations if there is a wall that can be used as a canvas so that the view when walking is not only the reservoir, but also enjoying art [11].
   g) Providing an amphitheatre for mass events for social gathering [8].

f. Environmental Sensitivity
   1) Implement green infrastructure practices, such as rain gardens and permeable paving, to manage stormwater runoff and promote ecological balance. The rain gardens can be implemented beside the road. The rain garden recommendation and types of plants can be adjusted as guidelines [30].
   2) Preserve and enhance natural habitats around the reservoir to support biodiversity and ecosystem health. The combination of rain garden, riparian buffer system, green wall, greening tree and landscaping for shading in environmental approach can indirectly help [15].
   3) Educate visitors about the importance of environmental conservation and encourage responsible behaviour through signage, interpretive displays, and educational programs [24].
   4) Use of high albedo surface materials. It is recommended to choose material with a high albedo but not dazzling such as stamped bright colour concrete, or white gravel for landscaping. Natural warm bright tone colour such as greyish wood, dried greyish thatch, limestone, river stone can also harmony in forest bathing and wellness tourism theme [14].

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5) Other facility buildings that support forest health tourism theme, the materials such as natural such as woods and rocks is recommended [9].
6) Consider incorporating sustainable design principles, such as using renewable/ second hand materials and energy-efficient lighting, to minimize environmental impact [9].
7) Add riparian buffer system at the rim of the reservoir if the view, economic development, and social activity isn't prospective and potential [15].

Based on the high amount of guideline that was produced, it is concluded that the facility isn't adequate. The resident perception around Perintis Reservoir facility might be true if the standard baseline is the local standard, but it's not for national or international tourism standard [18]. The guideline that had been produced is also not sync with the design implementation of previous design attempt [22]. The development of landscape and urban design is much more necessary than making a new big building. All of the literature review agree that the view and the reservoir is the main attraction and has big potential [19].

3.2.2. Design mood board. The mood board helps to visualize guidelines and facility. Every purple code in the picture refers to previous design guideline code. The red code for figure explanation paragraph below.

Figure 12. Mood board for activity, tree, and landscape, Source: Author, 2024.

Parking uses trees as shade so that vehicles don't get sunburned and overheat, especially for motorbike riders (fig 12.B). Apart from that, several spots are needed that require an open green area with a minimum number of trees to be able to carry out outdoor activities that mostly for social gathering (fig 12. C & F). Outdoor facilities are also shaded with trees with wide crowns to prevent exposure to radiation outdoors such as park and sport facilities (fig. 12 G). There are elements of pedestrian areas that are connected or in contact with water.

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Hubs for water activities is also kept simple and have flat berths, it will make landscape more natural and promote easiness and inclusivity of usage (fig. 12 E). Fig. 12 A & D are examples of a sidewalk. The forest bathing and connection with water is the main part of wellness tourism itself.

Figure 13. Mood board for outbound, water elements, and view spot, Source: Author, 2024.

Every outbound area uses natural and second-hand materials to create a synergy and harmony with nature and every instrument is connected to landscape (fig. 13 E, F, G). The design of water fountains can be placed at the rim of Perintis reservoir where people often pass by. The fountains can be quite tall, so the sound of the water can be heard quite far and visible to visitors (fig.13 B). The viewpoint can also be like a dock, so it can have a connection to the water body (fig.13 C). Fig. 13 A is an example of gathering spaces. Forest bathing and wide crown trees still dominate the environment.

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Figure 14. Moodboard for outbound, water elements, and view spot, Source: Author, 2024.

Most of the material uses warm and bright colours as the foundation. Material contains natural elements such as wood, thatch, limestone, river stone etc (fig. 14 D). Vernacular architectures that niche of Gorontalo also can be used to create a uniqueness, because it is coincidentally match to the mood board requirements such as Dulohupa Vernacular Architecture (fig. 14 A), Tambi Vernacular Architecture (fig. 14 B), Village Bubohu Architecture (fig. 14 C). The green wall (fig. 14 G) and planting high trees in amphitheatre landscapes can also help to create a wellness tourism atmosphere (fig. 14 F). If planting wide crown tree isn't possible in certain area, use outdoor shaded breezeway as shading alternative (fig. 14 E).

4. Conclusions

In conclusion, Perintis Reservoir have problems such as thermal comfort, limited facility development to develop outdoor activities such as sidewalk, poor shadings and roads, poor walkability, seasonal tourist attraction, quite poor soil conditions, and undeveloped economy potential. It also has potential in terms of view, natural environment yet uncomfortable, nice oxygen level, and existing facilities that quite adequate for locals, but still need to be optimized for national or international level. The environmental approach as the main theme solution that as a part of wellness tourism can enhance not only environmental sustainability, but also social and economic in Bone Bolango tourism. Tree, shrub, rain garden, riparian buffer, and sidewalk become the main integrated implementation solution for environment and socio-economic. Some facilities need to be added like outdoor out bond, parking, additional picnic area, a zone of car free area (human domination, not vehicle domination), cycling track,

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jogging area, camp, amphitheatre, flat berth for water facility, children park, MSME expansion.

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