Analysis of operation and maintenance cost flood handling system of Badung River

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Abstract. All of Badung River with a wide width of 10-40 meters is a typical urban river that has very important meaning to the flood handling system in the Denpasar City area. The results showed that the buildings on the Badung River included 2 trash racks, 1 rubber dam, 2 movable weirs and a 42 km long river wall with an average height of 3-5 m. The flood handling system has been carried out with control of the existing discharge through motion weirs and rubber weirs. While reducing waste that can cause flooding is done by building garbage filters. From the results of the analysis the operating and maintenance costs indicate the cost of routine inspection of 57,772,800 IDR / year, routine search fees of 27,936,000 IDR / year, additional eviction fees of 100,550,400 IDR/ year, monitoring and evaluation costs 27,360,000 IDR / year, flood material costs 7,240,000 IDR/ year, routine operations and maintenance of 3,306,067,750 IDR/ years, the need for periodic fees every 5 years is 2,200,000,000 IDR and the cost of dredging sediments and river stone repairs amounting to 1,113,566,000 IDR every five years.

1. Introduction

Badung River is a typical urban river whose flows in the middle of Denpasar City has a main river length of 19.2 km and has a watershed area of 53 km2. Badung River has multiple functions, namely as an irrigation water source, as a city drainage and function as a source of raw water in its estuary through the estuary reservoir. Bali river council and ministry of Indonesia Public Work have authority in managing the rivers in Indonesia. The author analyzes the data that already exists in the two institutions based on the current conditions [1, 2].

For the purposes of flood management, the Bali Provincial Government, Denpasar City Public Works Agency and the Bali Penida River Council have built several types of flood control buildings including dikes (± 42 km), 2 movable weirs, 2 garbage filters and 1 weir rubber. Until now, the financing analysis of the operation and maintenance of the Badung river flood handling system has more financing characteristics for repairs and construction of damaged buildings or the construction of new buildings. In other words, the costs for special operations and maintenance do not yet exist.

In order to maintain the function of the river and avoid the occurrence of floods, it is very necessary to do an analysis of the operating and maintenance costs needed to arrange the river to prevent the flooding that occurs. Analytical financing needs are reviewed based on the needs of routine costs and the periodic costs needed.

Based on the explanation of the background above, it can be conveyed several problems with the operating costs and maintenance of the flood management system of the Badung River, namely the type

of flood management building found on the Badung River and an analysis of the amount of operating and maintenance costs for flood management systems in the Badung River. Figure 1, 2, 3 show the condition of Badung River.

Figure 1. The condition of Badung River in the Oongan region.

Figure 2. Settlements in the Wanasari area.

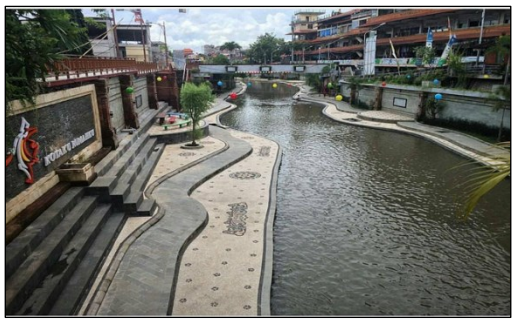

Figure 3. Arrangement of grooves around the Kumbasari market.

2. Methodology

The research was carried out through several stages, namely the analysis of river cross section conditions, analysis of structure performance and calculation of operating and maintenance costs for routine conditions and periodic conditions. In this case, several things are considered, namely the river as a watershed unit, river ecology, hydrological analysis, hydraulics analysis and the relationship between the river and the socio-cultural aspects of the local community. Trancois has explained the management of the river clearly in a river. The author in this case tries to display river management with

a typical urban river [3]. Phipilipus has also conveyed the problems and ways of resolving river management. In this case the authors convey the management of the Badung river management in terms of operating and maintenance [4]. Meis has conducted studies related to hydrostatistics in several rivers in Panama and Uruguay, while the authors conducted a hydrological analysis to obtain data on flood plans [5].

3. Results and discussion

The Badung River flows in a north-south pattern flowing from the Badung Regency area in the Sempidi region and empties into the southern part of the mangrove forest in Benoa Bay. Most of the river flows in urban areas so that most of the river walls are made of stone pairs. The width of the river varies between 10-40 m. In the downstream section of the river is a double cross section with a river height varying from 3 to 5 m. In general, this river has a rather sloping typical starting from the middle to the downstream. This river functions as a source of irrigation water and raw water besides being the main drainage channel in the city of Denpasar. Free intake Mergaya towards the Teba River and Badung River Dam in the Pemogan Village area is a source of irrigation water for rice fields in irrigated areas around the south and west of Denpasar City. Aside from being used as a source of irrigation water this river is used as a source of raw water for the Jimbaran, Nusa Dua and surrounding areas through estuary dam which has an area of 35 ha. The Badung River has grooves that tend to be straight downstream.

The flow of the Badung River initially had a function as an irrigation channel for several rice fields in Denpasar, namely the irrigation area of Badung Dam and the irrigation area in the Mati River. As a result of the development of the city of Denpasar caused the conversion of agricultural land into non-agricultural land which affected the increase of surface runoff to the river body of the Badung River. Likewise, the development of Denpasar City, which demands wider land, has caused land prices to be very high, including land along the Badung river channel. Related to the existence of the Badung river groove, some data and facts can be conveyed in the field as follows: the number of complementary structure across the river has the potential to cause disruption to river flow. This condition occurs in several river segments. Limited river boundary conditions were found in all river bodies where the existing border was very limited so it was very difficult to normalize the river to the side to widen the existing river body.

Performance appraisal is one of the ways to estimate the cost of maintaining existing buildings. Maintenance recommendations in the form of repairs will be given to buildings with moderate damage (damage 50-60%) and severe damage (damage above 70%). The presence of silt in the river affects the capacity of the river, which is to reduce the wet cross-sectional area which has the potential to reduce overall river discharge.

3.1. Hydrological analysis

Hydrological analysis is needed to estimate the amount of discharge that occurs in the river. This analysis uses the maximum rainfall data that occurred in several years of observation.

3.2. Hydraulics analysis

Hydraulics analysis is an analysis to estimate water movement in several river segments. This analysis is very dependent on the cross section and the slope of the river.

3.3. Operations and maintenance costs

Operations and Maintenance (OM) activities are carried out continuously and continuously to maintain the function of infrastructure in accordance with the age of the plan. Estimated cost of OP controlling flood. Made Sudiarsa conducted a value engineering analysis for irrigation projects to get the lowest price. The author conducts this analysis for work on the river [6].

3.4. Routine inspection

Routine inspection is carried out to ensure that river and river infrastructure and other facilities function properly. This activity includes an inventory of the conditions of river troughs and banks both physically and functionally as well as suggestions for improvements to existing damage. Budi Hari has conducted an analysis of the effect of flooding using the GIS method, the author in this case analyzes the affected area that is considered as an additional operating and maintenance cost [7].

3.4.1. Activity Description. Routine inspection is a river inspection activity carried out by an interpreter in his working area. Routine inspection is carried out at least once a month in the first week of the beginning of the month. This frequency is the same in all types of rivers, both natural, developing and urban rivers. Indah Susilowati has conveyed her approach in managing the Babon River. The author analyzes the approach more to rivers in urban areas. [8]. Man Kyu Huh has done an analysis of the river and some of the vegetation in it. The author analyzes the river with little vegetation because most of the river channels have been built [9]. Man Kyu Huh has made an analysis of river health in terms of the morphology and vegetation aspects of the river. The author has done a description of the river with the type of urban river as one of the bases in financing operations and [10].

3.4.2. Procedure for Activities. The procedure for this activity refers to the standard of Indonesian Public work concerning the preparation of operation and maintenance costs that divide rivers into several groups, namely natural rivers, developing rivers and urban rivers. Natural rivers, assuming a river width of 20 meters, have steep terrain and are difficult to reach. Interpreters carry out routine inspections on foot or by boat. The natural river requires 4 interpreters per 10 km.

Development River is relatively easy to reach compared to natural rivers. Routine tracking is carried out by interpreters as far as 5 km per month. And every 10 km long the river requires 2 interpreters. Urban rivers have adequate access to routine search activities. Therefore, one interpreter is needed with an inspection using a vehicle. The need for routine inspection costs includes costs for transportation inspection officers, reporting costs for documentation costs, fuel costs and supporting equipment costs. The total cost required for this activity is 57,772,800 IDR.

3.5. Routine search

Routine search is carried out to determine the level of damage in order to make a proposed maintenance according to the Operation and maintenance costs.

3.5.1. Activity description. Based on the proposed damage sent by the field interpreter during routine inspections, a routine search is carried out. The executor of the activity is the formation of the Head of the Office whose members are elements of planning, implementation, operation and maintenance, governance, and if necessary can be added from the relevant agencies or the community that builds in the river area. Routine tracking is carried out at least once a year at the end of the rainy season.

Field staff must document and list the things he encountered in the form of River Search Results in accordance with Standard Indonesian Public work No. 01 / SE / D / 2013 [5]. The search results must be reported to officers in charge of operations and maintenance at the River Basin Office to be followed up.

3.5.2. Procedure for activities. Natural rivers, assuming a river width of 20 meters, have steep terrain and are difficult to reach. Routine tracking is carried out for 4 days by 10 observers together with 4 interpreters. Development River is relatively easy to reach compared to natural rivers. Routine tracking is carried out for 2 days by 10 observers together with 2 interpreters.

Urban rivers have adequate access to routine search activities. Therefore, it takes 1 day by 10 observers together with 1 interpreter. Routine search costs consist of 10 cost items, namely personnel costs, transportation costs, reporting costs, communication fees, documentation fees, consumables, equipment and support costs with a total cost of 27,936,000 IDR.

3.6. Additional search

Additional searches are carried out at two different times, namely before and after the flood. The search before the flood was carried out to determine the damage in the framework of preparedness anticipating the occurrence of floods, while the search after the flood was carried out to determine the damage that occurred and the cause of the damage and to take emergency response actions.

3.6.1. Activity description. Additional searches are carried out at least 10 times per year, specifically to monitor damage before and after a flood. The field clerk must document and list the things he encountered in number 3 Results of the Search for the River Standard Indonesian Public Work No. 01 / SE / D / 2013. The search results must be reported to officers in charge of operations and maintenance at the River Basin Office to be followed up.

3.6.2. Procedure for Activities. Natural rivers, assuming a river width of 20 meters, have steep terrain and are difficult to reach. Routine tracking is carried out for 4 days by 10 observers together with 4 interpreters. Development River is relatively easy to reach compared to natural rivers. Routine tracking is carried out for 2 days by 10 observers together with 2 interpreters.

Urban rivers have adequate access to routine search activities. Therefore, it takes 1 day by 10 observers together with 1 interpreter. The cost items needed for this activity include personnel costs, transportation costs, reporting costs, communication costs, documentation fees, consumables, and supporting equipment costs. The cost required for this activity is 100,550,400 IDR.

3.7. Monitoring and evaluation

In the Standard Indonesian Public Nork No. 01 / SE / D / 2013, monitoring and evaluation activities are included in the operating costs component. Monitoring and Evaluation activities aim to monitor and evaluate OP activities for a year that has passed.

3.7.1. Activity description. Monitoring and evaluation in the form of field visits carried out by 10 team members formed by the Head of the Office.

3.7.2. Procedure for activities. Monitoring and evaluation activities for each river classification are carried out 1 time per year for 4 days for natural rivers, 2 times per year for 2 days each for developing rivers, and 2 times per year for 1 day for urban rivers. The financing items needed for this activity include personnel costs, transportation costs, reporting costs, communication fees for documentation costs, consumables and supporting equipment costs with a total cost of 27,360,000 IDR.

3.8. Flood forecast

Flood forecast is carried out with the aim of compiling and determining the material needed for floods during the coming flood season of one year. Forecast needs in the form of a coordination meeting which is conducted once a year before the flood season arrives. Financing items for this activity include incentives for personnel meetings, meeting logistics costs, documentation costs, reporting costs with a total cost of 7,240,000 IDR.

3.9. Operational costs and routine and non-routine maintenance of the Badung River

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Figure 4. Silt in river bodies.

3.10. The relationship between the river and the social culture of the community
In general, people view the river as a blessing for human life. However, as the population grows, it starts to draw less attention to the river with low awareness. There are still some people who throw trash into the river.

4. Conclusion

Based on the results of the discussion of the analysis of the operating costs and maintenance of the Badung River flood handling system can be presented as follows:

The types of flood control structure in Badung River are: trash rack 2 pieces that control waste in the river located in the Balun area and in the Pedungan area with good conditions. The 2 pieces of weir which can reduce the water level quickly exist in the Pedungan area and are in the estuary reservoir with good conditions. Free intake of 2 pieces that can reduce flood water, namely Batan Nyuh free intake and Buagan free intake. In addition, there are good conditions. However, in the upstream free intake, there is a lot of sediment. 1 rubber dam weir found in the estuary reservoir in good condition. Channel walls on two sides of the river with a total length of about 42 Km. Most are in good condition but at some point damage occurs.

From the results of the analysis of the operating costs and maintenance of the Badung river flood handling system with the type of urban river, the amount of the need for operating and maintenance costs is as follows: Operational costs and routine maintenance of rivers: 3,306,067,700 IDR/year, operating and maintenance costs are not routine rivers for: 2,200,000,000 IDR/event. The cost of repairing channel walls and dredging of sediments is 1,113,566,000 IDR/event.

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