Identification of the Environmental Impacts and Management Strategies of Embung Bandungrejo

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Abstract. Water reservoirs in the form of artificial lake or embung are needed for water resources conservation and fulfilment of other functions. The development of Embung Bandungrejo is planned not only for conservation but also for irrigation and tourism potential. The construction of environmental conservation facilities has created new problems for the environment otherwise. This study aimed to identify the types and sources of environmental impacts and to analyze the environmental management efforts in Embung Bandungrejo. The method to collect data was carried out through a combination of primary and secondary data gathering. The results of data processing were then analyzed descriptively based on professional judgment. The environmental impacts are estimated to occur during the pre-construction, construction, and operation stages. The pre-construction stage consists of two activities that potentially have environmental impacts, namely planning, survey, and measurement as well as dissemination. The predicted impact of such activities is public perception and attitude. The construction stage consists of five activities with potential environmental impacts. The impacts of worker recruitment include the creation of employment and business opportunities and the emergence of social envy. The basecamp operation affects public perception and attitude as well as degraded environmental sanitation. The impacts of equipment and material mobility are increased dust deposits and vehicle exhaust gases, damaged roads, and public concern. The earthwork leads to land-use change and threatened wildlife habitat. The impact of construction activities is potential occupational diseases and accidents. The operation stage consists of two activities with the potential to cause environmental impacts. The embung utilization decreases environmental sanitation, increases the population of aquatic biota and flora, improves the standard of living for farmers and the community, as well as causes conflicts of irrigation water use and tourism management. The impact of embung maintenance is the good condition and well-maintained complementary facilities the environmental management strategies can be carried out on each type of projected impacts based on the form, location, and period of the management efforts.

Keywords: Embung, Environmental Impacts, Environmental Management, Conservation, Irrigation.

A. INTRODUCTION

The growing number of constructed areas and declining number of conservation areas with land-use change from agricultural use into non-agricultural purposes have led to an increase in water demand, while recharge areas tend to experience decrease in number (Heinma & Poder, 2010). In addition, there are other issues, such as the significantly different discharge rate in between the dry season and rainy season, changed flow patterns, sedimentation, and aggradation (Widodo, 2021).

The criticality of Progo-Opak-Serang River Basin (POS RB) as the site of Embung Bandungrejo construction plan has been affected by such factors as the non-compliance of land-use change with the Regional Spatial Planning, patterns of POS RB Water Resources Management, POS RB Water Resources Management plans, non-optimal results of water source protection, inadequate community empowerment, and reduced water quality. Given such conditions, it is deemed necessary to store water in reservoirs in an effort to conduct water conservation or to achieve various purposes. A water reservoir is expected to limit the
factors affecting the decreased capacity of watershed hydrologically, morphologically, and geologically (Arts, Runhaar, Fischer & Onyango, 2016).

Embung Bandungrejo has a crest height of 8 m with a reservoir volume of 9,371.8 million m$^3$. The construction plan of Embung Bandungrejo is carried out in the context of conservation and fulfillment of raw water demand in the area. Based on the design, the construction of Embung Bandungrejo consists of masonry with reinforced concrete. The benefits include a supplement to 34 hectare of agricultural land and an impact on increasing Planting Index (PI) from 258.7 to 300.

The development activities of Embung Bandungrejo consist of pre-construction, construction, and operation stages. Such activities have the potential for environmental impacts. Studies are required to analyze either positive or negative potential impacts, which include such environmental components as physicochemistry (air and water), biology (flora and fauna on land and life of aquatic biota), socio-economy, culture, and health of the surrounding community (Rozema & Bond, 2015). The study results are expected to provide input into the potential impacts of the activity plan and into the decision made on environmental management and monitoring plans to deal with, manage, and monitor these impacts (Widodo, 2020). This works on the principle of maximizing the potential positive impacts and minimizing the potential negative impacts to maintain favorable environmental conditions and improve the quality of the surrounding environment.

B. LITERATURE REVIEW

Development and sustainability of activities have a positive impact in that they improve the economy, but there is also a negative impact in the form of increased pressure on the environment. Pressure on the environment resulted from development that overlooks the carrying capacity and environmental capacity of the local area will eventually lead to environmental degradation (Yakin 1997; Wahyono, et al, 2012). Environmental degradation is a shared responsibility falling on any stakeholders, including the community, government, and initiators (Ross, et al, 2006).

Every development activity will assuredly have impacts. An impact is a change that occurs as a result of an activity and have natural characteristics be it chemical, physical, or biological (Soemarwoto, 1994). The impact can be both positive, offering benefits to human life, and negative, posing harmful risks to the community (Lyhne, Cashmore & van Laerhoven, 2016). Each business and/or activity which is estimated to have an environmental impact requires environmental management. The management, use, and utilization of natural resources should be balanced with the environment, thus requiring a comprehensive national policy on environmental management (Danusaputro, 1998; Sarbi, 2006). Environmental management can be described as conscious efforts to preserve and/or enhanced the environmental quality in order to fulfill basic human needs at its finest. Such efforts include integrated strategies in the utilization, design, preservation, monitoring, supervision, recovery, and development of the environment (Manik, 2003).

The planning of environmental management for a construction project is generally carried out based on estimates of the impacts potentially created by the project. Such method of environmental management planning is known as Environmental Impact Analysis (Anjaneyulu & Manickam, 2011). Environmental impact analysis is a means of assessing the feasibility of a project in the context of environment (Soemarwoto, 2004; Alshuwaikhat, 2005). Research by Runhaar et al. (2012) suggests that environmental impact analysis or assessment is mainly associated with legal requirements instead of the choice made by the developers. Meanwhile, Sari, et al. (2014) reveal that one of the preventive measures taken to
prevent environmental degradation is by requiring all business owners or developers to have an Environmental Permit.

The principles of environmental management in an area can be implemented using the four POAC indicators, namely Planning, Organizing, Actuating, and Controlling (Asdak, 2004). Jay S., et al. (2007) suggest that environmental impact analysis can provide a highly effective means to engage with the planning process and to achieve more sustainable development.

The analysis should involve the public, and this can be done through public announcement and public consultation (Mumtas & Wichien, 2013). The procedure for public involvement in the analysis process should refer to the applicable laws and regulations (Abbas, 2005; Alviya, et al., 2018) although according to Hourdequin M. et al. (2011) increased participation in a participatory analysis process does not guarantee better results of environmental management. Public participation is more frequently associated with the identification of important impacts for determination of the scope. Meanwhile, the extent to which an environmental management is implemented largely depends on the degree of the in-depth analysis conducted by the expert team.

C. METHOD

The data collection method was carried out through a combination of primary and secondary data gathering. The primary data was collected through a field survey technique, while the secondary data was obtained from related agencies. The results of data processing were then analyzed descriptively and qualitatively based on professional judgment (Brannen, 2005).

D. RESULTS AND DISCUSSION

1. Identification of the Environmental Impacts

The construction of Embung Bandungrejo is predicted to have both positive and negative impacts on the surrounding environment. Although the predicted impacts are not as significant and important, it remains necessary to make an effort to implement environmental management and monitoring. The environmental impacts are projected to occur during the stages of pre-construction, construction, and operation.

2. Pre-Construction Stage

This stage consists of two activities, namely planning, measuring, and survey as well as dissemination, which potentially have environmental impacts. The planning activities and site measurement are conducted to determine land boundaries and topographic data for the purpose of construction planning. The topographic data is also required to identify the construction volume and area.

The dissemination activities are carried out to provide the public and related agencies with a detailed explanation of the construction plan of Embung Bandungrejo. It is intended to prevent negative perceptions since the public can then receive accurate information instead of unclear information on the construction plan. Such activities not only provide information openness but also create positive public perception, including perceived convenience of access to irrigation and more employment opportunities during the construction stage. The activities at the pre-construction stage of which impacts are assessed include those for planning, survey, and dissemination, with the impacts described in the following table.
Table 1. Identification of the Impacts at the Pre-Construction Stage

<table>
<thead>
<tr>
<th>No</th>
<th>Activity</th>
<th>Type of Impacts</th>
<th>Magnitude of Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Planning, Survey, and Measurement</td>
<td>Public attitude and public perception</td>
<td>Most of the community members have positive attitude in accordance with the activity plan.</td>
</tr>
<tr>
<td>2.</td>
<td>Dissemination</td>
<td>Positive public perception</td>
<td>Most of the community members have positive attitude in accordance with the activity plan.</td>
</tr>
</tbody>
</table>

Source: Data proceed

3. Construction Stage

The construction stage includes five activities which have the potential to create environmental impacts, namely worker recruitment, construction and operation of basecamp, mobility of equipment and materials, land development, and construction work. The worker recruitment aims to meet the need for workers during the construction, which includes unskilled workers and skilled workers (experts). The number of workers required is determined by the development contractor according to the expertise and volume of work (Heuvelhof & Nauta, 1997). The worker recruitment should prioritize local residents/villagers where the construction site is located, while the remaining demand can be fulfilled by workers from outside the area. The construction has an impact in that it creates employment opportunities for the public surrounding the site although it can also cause social envy due to a status difference and differences in behavior between local workers and workers from outside the area (Kolhoff, Runhaar & Driessen, 2016).

The basecamp for the construction workers is full of various activities related to their domestic routines, including bathing, washing, and toilet activities. Inadequate complementary facilities and infrastructure for such activities can affect the quality of public health around the construction site.

To support the construction process during the development period, a number of vital equipment is required, including excavators, bulldozers, mixer trucks, and dump trucks. These heavy-duty vehicles are operated during land clearing, soil excavation, and transport of soil. Meanwhile, the building materials will be delivered to the construction site, predictably leading to frequent mobility of vehicles going in and out of the site to transport materials, which can increase dust deposits from the materials transported, exhaust gases, and vehicle noise. These can cause concern among the people who live nearby the route of the transport vehicles. Another potential impact is damage to the roadway of the access due to the load of the vehicles transporting materials/remains of excavated soil which exceeds the vehicle tonnage.

The construction of Embung Bandungrejo will be located on land dominantly surrounded by rice fields, moors, plantations, and bushes. For the initial stage, land clearing will be done followed by soil excavation, transportation, and disposal of surplus excavated soil. The location of disposal area is approximately 3 km away from the construction site. Land clearing and excavated soil disposal activities will have an impact on flora vegetation in that there is a decrease in plant density since previously grown vegetation in the construction site begins to disappear. Another impact is the destruction of existing wildlife habitat (Chanchitpricha & Bond, 2013). The loss of this habitat will be followed by the migration of some bird species or insects to other places, resulting in territorial competition among wild animals in the new habitat.

During the construction of embung and its complementary facilities, other potential impacts can occur, including occupational accidents and diseases, if the construction fails to
follow the established Standard Operation Procedures (SOPs). The identification of the environmental impacts at the construction stage is presented in the following table:

<table>
<thead>
<tr>
<th>No</th>
<th>Source of Impacts</th>
<th>Type of Impacts</th>
<th>Magnitude of Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Construction worker recruitment</td>
<td>Employment and business opportunities</td>
<td>Numerous workers will be involved in the construction activities.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social envy</td>
<td>Several workers from the surrounding villages are dissatisfied and go on strike.</td>
</tr>
<tr>
<td>2.</td>
<td>Basecamp construction and operation</td>
<td>Public attitude and public perception</td>
<td>A social conflict arises between the public and workers from outside the area who stay in the basecamp.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Decreased level of environmental sanitation</td>
<td>There is low awareness of environmental sanitation among the construction workers on the site.</td>
</tr>
<tr>
<td>3.</td>
<td>Mobility of materials and equipment</td>
<td>Increased level of dust deposits and exhaust gases</td>
<td>The dust deposit reaches ( \leq 230 \text{ g/m}^3 ) and the exhaust gas level exceeds the environmental quality standard for the site and residential area during the construction period.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Damage to the access roads</td>
<td>The damage to the roadway consist of potholes, grade depression, and slippery muddy roads.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Public concern</td>
<td>Many local residents block the vehicle access to the site.</td>
</tr>
<tr>
<td>4.</td>
<td>Earthwork</td>
<td>Land-use change</td>
<td>There is a conversion of vegetated land into open land</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Disrupted wildlife habitat</td>
<td>Wildlife habitat is damaged or lost</td>
</tr>
<tr>
<td>5.</td>
<td>Development activities</td>
<td>Potential occupational diseases and accidents</td>
<td>Occupational accidents and diseases can occur to the workers during the construction period.</td>
</tr>
</tbody>
</table>

Source: Data proceed

**4. Operation Stage**

The operation stage consists of two activities which potentially have environmental impacts, namely the utilization of Embung Bandungrejo and its maintenance. The embung utilization will result in a better level of physical water quality. This condition will also affect the land ecosystem around Embung Bandungrejo which is characterized by more vegetation/plants as a result of increased soil fertility. In terms of water quantity during the operation period, the embung utilization in agriculture will include water from Embung Bandungrejo for irrigation. With the fulfillment of irrigation water demand each year, there is a directly positive impact as farmers can have their standard of living improved. Embung Bandungrejo also has the potential as an ecotourism location.

Meanwhile, the maintenance is intended as an effort to take care of the construction of Embung Bandungrejo to protect it from damage due to such factors as natural causes or
irresponsible human interference. The identification of the impacts at this operation stage is presented in Table 3.

Table 3. Identification of the Environmental Impacts at the Operation Stage

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Type of Impacts</th>
<th>Magnitude of Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Embung utilization</td>
<td>Decreasing environmental sanitation</td>
<td>There is a decrease in embung cleanliness and an increase in water pollution.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Increasing population of aquatic biota</td>
<td>There is a balance in the ecosystem of aquatic biota characterized by an increase in the plankton diversity index.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Growing population of flora</td>
<td>There is an increase in the number of vegetation/plants which can grow well around the water area.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Improving standard of living for the farmers and the community</td>
<td>There is an increase in the standard of living of farmers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conflict of water utilization and tourism management</td>
<td>There are conflicts of the water utilization from Embung Bandungrejo.</td>
</tr>
<tr>
<td>2.</td>
<td>Embung maintenance</td>
<td>Well-maintained conditions of Embung Bandungrejo and its complementary facilities</td>
<td>There is a lower damage level in Embung Bandungrejo and its complementary facilities during operation.</td>
</tr>
</tbody>
</table>

Source: Data proceed

5. Environmental Management Strategies

Those identified environmental impacts should be managed to minimize the negative impacts and optimize the positive ones. The required strategies consist of the effort form, location, and period. The following table shows the strategies pursued in the environmental management of Embung Bandungrejo.

Table 4. Environmental Management Strategies for Embung Bandungrejo

<table>
<thead>
<tr>
<th>Source of Impacts</th>
<th>Type of Impacts</th>
<th>Magnitude of Impacts</th>
<th>Environmental Management Strategies</th>
</tr>
</thead>
</table>
| Planning, Survey and Measurement | Public attitude and public perception | Most of the community members (> 75%) have positive attitude in accordance with the activity plan. | • A survey notification is provided by the development proponents for the community representatives.  
• Surveyors are equipped with an authorized assignment letter.  
• Surveyors should be able to explain the survey purposes.  
Around the construction site of Embung Bandungrejo  
Once during the planning, survey, and measurement period. |
<table>
<thead>
<tr>
<th>Source of Impacts</th>
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<th>Magnitude of Impacts</th>
<th>Environmental Management Strategies</th>
</tr>
</thead>
</table>
| Dissemination    | Public attitude and public perception | Most of the community members (> 75%) have positive attitude in accordance with the activity plan | • Transparent dissemination of the construction plan is conducted by the authority for potentially affected residents.  
• Clear answers are provided for the questions from the residents.  
• Some residents are invited as the community representatives of the study location.  
• A process of participative land acquisition is conducted for affected land owners. |
|                  |                 |                      | Around the construction site of Embung Bandungrejo | Once during the period of pre-construction stage |
| Construction worker recruitment | Employment and business opportunities | Numerous workers will be involved in the construction activity plan (>50%) | • Local workers from the surrounding villages are prioritized in the recruitment with at least 50% of the requirement to empower local human resources.  
• Local residents are given business opportunities to open shops around the construction area  
• Deliberations (direct dialogues) with local residents around the construction site is conducted by inviting as well the community leaders. |
|                  |                 |                      | Around the construction site of Embung Bandungrejo | During the recruitment process and in each period of construction activities |
| Social envy      |                 | Several workers from the surrounding villages are dissatisfied. | • Open and transparent announcement about job vacancies is issued  
• Business opportunities are given by allowing local residents to open shops around the construction area |
<p>|                  |                 |                      | Around the construction site of Embung Bandungrejo | During the construction stage (during the recruitment process and in each period of construction activities) |</p>
<table>
<thead>
<tr>
<th>Source of Impacts</th>
<th>Type of Impacts</th>
<th>Magnitude of Impacts</th>
<th>Environmental Management Strategies</th>
<th>Form</th>
<th>Location</th>
<th>Period</th>
</tr>
</thead>
</table>
| Basecamp construction and operation | Public attitude and public perception | A social conflict arises between the public and workers from outside the area who stay in the basecamp | • The workers in the basecamp are required to maintain cleanliness and display clean and healthy life behavior.  
• The workers are encouraged to maintain good relationships with the local residents. |      | Around the construction site of Embung Bandungrejo | During the construction stage |
|                                  |                                  |                      | • Public bathing, washing, and toilet facilities are provided in the construction site boundaries.  
• Waste management is applied and trash bins are provided in the basecamp area.  
• The workers staying in the basecamp are obliged to keep cleanliness and apply a clean and healthy lifestyle.  
• The Covid-19 preventive health protocol is implemented in the basecamp. |      | Around the construction site of Embung Bandungrejo | During the construction stage |
|                                  | Decreased level of environmental sanitation | There is low awareness of environmental sanitation among the construction workers on the site | • The materials/soil are tightly covered with truck tarps during the transport.  
• The mobility of materials and equipment is scheduled.  
• Water is regularly sprinkled daily on dry areas around the construction site and the access |      | Along the routes/access roads to the construction site  
In the construction site and its surrounding area  
Around the settlement area and location of Embung Bandungrejo | During the construction stage |
|                                  | Mobility of materials and equipment | The dust deposit reaches ≤ 230 g/m² and the exhaust gas level exceeds the environmental quality standard for the site and residential area during the construction | • The materials/soil are tightly covered with truck tarps during the transport.  
• The mobility of materials and equipment is scheduled.  
• Water is regularly sprinkled daily on dry areas around the construction site and the access |      | Along the routes/access roads to the construction site  
In the construction site and its surrounding area  
Around the settlement area and location of Embung Bandungrejo | During the construction stage |
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<th>Environmental Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Form</td>
</tr>
</tbody>
</table>
| Damage to the access roads as a result of overloading | The damage to the roadway consist of potholes, grade depression, and slippery muddy roads. | • The vehicle load is checked to fit the capacity.  
• The truck drivers are directed to drive carefully as well as to adjust the speed and tonnage when passing through roads with potential damage.  
• Access roads are paved to enhance their carrying capacity for vehicle mobility.  
• Damaged access roads are repaired. | Entrance to the construction site | During the construction stage |
| Potential traffic accidents | The frequency of traffic accidents along the access routes becomes higher. | • Warning signage is installed along the in and out access routes to the construction site boundaries and the vehicle speed is limited  
• Truck drivers are directed to transport the materials carefully and wisely adjust their vehicle speed. | Along the access roads/route to the construction site | In the construction site and its surrounding area | During the construction stage |
<table>
<thead>
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</tr>
</thead>
</table>
| Public concern   | Public concern  | Many local residents block the vehicle access to the site. | • A social approach is proactively made to the local residents to find viable solutions.  
  • Warning signage is installed along the in and out access routes to the construction site boundaries and the vehicle speed is limited.  
  Along the access roads/route to the construction site  
  In the construction site and its surrounding area  
  During the construction stage |
| Earthwork        | Land-use change | There is a conversion of vegetated land into open land. | • Selective logging is done on the trees outside the reservoir area of Embung Bandungrejo.  
  • Flora/trees are replanted and reforestation is done around the construction site after the earthwork is completed.  
  The construction site of Embung Bandungrejo  
  During the construction stage |
| Disrupted wildlife habitat | Wildlife habitat is damaged or lost. | • Animal killing is avoided  
  • Animal burrows or bird nests are removed to a safer place.  
  The construction site of Embung Bandungrejo  
  During the construction stage |
| Construction activities | Potential occupational accidents and diseases can occur to the workers during the construction period. | • The construction workers are registered for labor social security program (BP Jamsostek)  
  • A maximum of 40 working hours and 7 overtime hours per week is implemented.  
  • Construction hoarding is installed in the project area.  
  • Workplace safety signage is installed and disseminated to the workers.  
  • The workers are facilitated and required to wear personal protective  
  The project boundaries of Embung Bandungrejo  
  During the construction stage |
<table>
<thead>
<tr>
<th>Source of Impacts</th>
<th>Type of Impacts</th>
<th>Magnitude of Impacts</th>
<th>Environmental Management Strategies</th>
<th>Form</th>
<th>Location</th>
<th>Period</th>
</tr>
</thead>
</table>
| Embung utilization | Decreasing environmental sanitation | • There is a decrease in the cleanliness of Embung Bandungrejo and the surrounding area  
• There is an increase in water pollution | • “Do not litter” signage is installed nearby the irrigation network.  
• Irrigation management and regulatory institutions are functioned to accommodate various environmental sanitation problems.  
• Clean and healthy life behavior is actuated among the public nearby the construction site.  
• Water depth signage is installed to prevent water-related accidents. | The location around Embung Bandungrejo | During the operation stage |
| Increasing population of aquatic biota | The plenty population of aquatic biota (phytoplankton, zooplankton, fish, and others) can breed well in the water area. | • Fish seeds are spread.  
• Poison-fishing prohibition and electrofishing prohibition signage are installed.  
• Trash littering around Embung Bandungrejo is prohibited.  
• Waste disposal into Embung Bandungrejo is prohibited. | The area of Embung Bandungrejo | Periodic management adjusted to the needs |
<table>
<thead>
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<th>Type of Impacts</th>
<th>Magnitude of Impacts</th>
<th>Environmental Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growing population of flora</td>
<td>Form</td>
<td>Animal hunting/killing and logging are prohibited around the construction site.</td>
<td>The area of Embung Bandungrejo</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>Every six months</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improving standard of living for the farmers and the community</td>
<td>Form</td>
<td>Education on how to utilize embung water efficiently and effectively is provided.</td>
<td>The area of Embung Bandungrejo</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>During the operation stage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conflict of irrigation water utilization and tourism management</td>
<td>Form</td>
<td>• An irrigation management institution, such as P3A, is established. • Irrigation water dispatchers and tourism management institutions, such as Pokdarwis, are optimized.</td>
<td>The area of Embung Bandungrejo</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>During the operation stage</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embung Maintenance</td>
<td>Form</td>
<td>• The fluctuations in water level and volume are regularly monitored. • Inventory/data of damage to the embung is made/recorded. • A special budget for embung maintenance and repair is relocated. • Maintenance checks on flap gates are regularly carried out in relation to the weather and lifespan. • The facilities and infrastructure buildings are painted.</td>
<td>The area of Embung Bandungrejo</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>Every year</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Period</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Environmental Management Strategies

<table>
<thead>
<tr>
<th>Source of Impacts</th>
<th>Type of Impacts</th>
<th>Magnitude of Impacts</th>
<th>Environmental Management Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dredging sediment/mud and trash are periodically removed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The operation and maintenance are monitored and evaluated.</td>
</tr>
</tbody>
</table>

Source: Data proceed

## E. CONCLUSION

The results of this study can be concluded as follows: The sources and types of impacts expected to arise from the development in the research area include:

1. Planning, Survey and Measurement activities: Public attitude and public perception;
2. Dissemination activities: Public attitude and public perception;
3. Construction worker recruitment: Employment and business opportunities, Social envy;
4. Basecamp construction and operation. Public attitude and public perception and Decreased level of environmental sanitation;
5. Mobility of materials and equipment: Increased level of dust deposits and exhaust gases and Damage to the access roads as a result of overloading;
6. Potential traffic accidents: Public concern;
7. Earthwork: Land-use change and Disrupted wildlife habitat;
8. Construction activities: Potential occupational diseases and accidents;
9. Embung utilization: Decreasing environmental sanitation Increasing population of aquatic biota;
10. Growing population of flora: Improving standard of living for the farmers and Conflict of irrigation water utilization and tourism management;

The environmental management strategies are carried out on each type of potential impacts based on the form, location, and period of the management.

## REFERENCES


