Rural Reality:
A snapshot of the state of wastewater management situation in Bario, Sarawak, Malaysia

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RG557-18HTM (University of Malaya Transformation Research - Bario Programme)
What is wastewater?

Water supply that has been contaminated coming from housing, industries and institutions like schools, government buildings, shopping complex etc.

Wastewater from toilets → Black water → Go to septic tanks
Wastewater from tap, bathroom, washing machine → Greywater → Go to the ditch @ ‘parit’
What is the state of wastewater management situation in Bario?

- Domestic wastewater
- Leaking septic tank
- Open sewer system @ ‘parit’
- No wastewater treatment system
- Disposed directly into the river
### How was the water in Bario?

<table>
<thead>
<tr>
<th>Samples</th>
<th>pH</th>
<th>TSS (mg/L)</th>
<th>DO (mg/L)</th>
<th>COD (mg/L)</th>
<th>BOD (mg/L)</th>
<th>Ammonia Nitrogen (mg/L)</th>
<th>Phosphate (mg/L)</th>
<th>E.Coli (CFU/100 mL)</th>
<th>WQI Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>River Water (Standard)</td>
<td>5-9</td>
<td>&lt; 150</td>
<td>&gt; 3</td>
<td>&lt; 50</td>
<td>&lt; 6.0</td>
<td>&lt; 0.10</td>
<td>NR</td>
<td>&lt; 400</td>
<td>I - III</td>
</tr>
<tr>
<td>Ditch (at Kg. Bario Asal)</td>
<td>5.8</td>
<td>62</td>
<td>4.7</td>
<td>203.8</td>
<td>6.50</td>
<td>0.90</td>
<td>0.17</td>
<td>500</td>
<td>III</td>
</tr>
<tr>
<td>Ditch (at local shop)</td>
<td>5.7</td>
<td>60</td>
<td>4.9</td>
<td>243.3</td>
<td>6.94</td>
<td>0.96</td>
<td>0.12</td>
<td>700</td>
<td>III</td>
</tr>
<tr>
<td>Ditch (at Frazier’s house)</td>
<td>5.8</td>
<td>65</td>
<td>4.9</td>
<td>223.3</td>
<td>6.62</td>
<td>0.93</td>
<td>0.14</td>
<td>800</td>
<td>III</td>
</tr>
<tr>
<td>Sg. Arur Dalan (upstream)</td>
<td>7.1</td>
<td>2</td>
<td>6.9</td>
<td>79.8</td>
<td>7.91</td>
<td>0.28</td>
<td>0.08</td>
<td>430</td>
<td>III</td>
</tr>
<tr>
<td>Sg. Arur Dalan (downstream)</td>
<td>6.5</td>
<td>4</td>
<td>6.5</td>
<td>80.3</td>
<td>7.93</td>
<td>0.56</td>
<td>0.11</td>
<td>620</td>
<td>III</td>
</tr>
<tr>
<td>Sg. Merarui (upstream)</td>
<td>6.8</td>
<td>4</td>
<td>5.5</td>
<td>126.7</td>
<td>8.02</td>
<td>0.37</td>
<td>0.07</td>
<td>540</td>
<td>III</td>
</tr>
<tr>
<td>Sg. Merarui (downstream)</td>
<td>6.3</td>
<td>17</td>
<td>5.0</td>
<td>174.6</td>
<td>7.83</td>
<td>0.56</td>
<td>0.13</td>
<td>750</td>
<td>III</td>
</tr>
<tr>
<td>Sg. Dapor (water intake)</td>
<td>6.5</td>
<td>48</td>
<td>5.6</td>
<td>176.8</td>
<td>7.49</td>
<td>0.65</td>
<td>0.14</td>
<td>410</td>
<td>III</td>
</tr>
</tbody>
</table>

### What was the problem?

1. **High BOD & COD** → means that the rivers are polluted with organic matters.
2. **Excessive ammonia** → believed to be originating from (i) human excretion due to the leaking septic tank and (ii) fertilizer used for agricultural purposes.
3. **High pathogen (E.Coli) content** → believed to be originating from human excretion due to the leaking septic tank.
Where was it coming from?

- Penan settlement with outhouse toilet
- Buffalos wallowing site
- Leaking septic tank
- Sullage from Bario residents
- Dumping site
- Fertilizer from paddy field
What are the solutions that we can offer to Bario locals?

(1) **The need to change the leaking septic tank**

First, the 200L drum barrel that are being used as septic tank need to be replaced with a proper septic tank.

(2) **The improvement of the existing open sewer system @ ‘ditch’**

Second, in order to make the open ditch become self-treating, it needs to be sparsely planted with vegetation (i.e. water lily) that can absorb the nutrient from the wastewater and increase the aesthetic of the ditch.

(3) **Proposing a new wastewater management system**

Third, we proposed a constructed wetland for treating the wastewater before being released into the river.
Conclusion

• What are the economical-related issues in this situation?
  • Bario is one perfect example of a pollution under the category of pollution of poverty.
  • Indicator of pollution of poverty:
    - The existence of sanitation related bacteria (E.Coli).
    - No proper wastewater management system.
      Kelabit people that lives in long houses still using a very primitive septic tank.
      Penan people that lives at the edge of the jungle still do not have access to a decent and proper toilet, hence, making them relying on outhouse toilet.
    - Lack access to reliable drinking water.
      Clean water resource for drinking water is still coming from the river without being treated.
  • What is the solution?
    - Ecological engineering approach as the most economical solution.
    - If the black wastewater (sewage) can be treated in proper septic tanks, and the grey wastewater (sullage) is treated using wetland, Bario has huge potential to facilitate more sustainable, economical and effective wastewater management system.
Thank you
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