



# CLEAN CITIES, BLUE OCEAN

## 3R/SWM and Marine Debris Reduction Strategy Alignment Assessment | Indonesia



PHOTO: Jenna Jambeck / University of Georgia

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## Acronyms and Abbreviations

3Rs	Reduce, Reuse, Recycle
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
CCBO	Clean Cities, Blue Ocean
COBSEA	Coordinating Body on the Seas of East Asia
CMMA	Coordinating Ministry for Maritime Affairs
DLH	Environmental Agency ( <i>Dinas Lingkungan Hidup</i> )
DPU	Municipal Solid Works ( <i>Dinas Pekerjaan Umum</i> )
GDP	Gross Domestic Product
ISWM Platform	Indonesia Solid Waste Management Platform
LMI	Lower-Middle Income
MSW	Municipal Solid Waste
NPOA-CMPD	National Plan of Action for Combating Marine Plastic Debris
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
SBC	Social and Behavioral Change
SWM	Solid Waste Management
TIPs	Trials of Improved Practices
UNEP	United Nations Environment Program
USAID	United States Agency for International Development

## Executive Summary

Indonesia is an archipelagic country consisting of roughly 17,000 islands and 81,000 kilometers of coastlines. As the fourth most populous country on earth, Indonesia is experiencing rapid economic expansion and increasing urbanization, and the nation produces 64 million metric tons of municipal waste each year.<sup>1</sup> As this growth continues, it is estimated that between 2017 and 2025, marine debris leakage will increase by 30%, with roughly 780,000 tons of plastic entering Indonesia's waterways per year.<sup>2</sup> This projection poses a significant threat to the health and safety of Indonesian people, and it also incites economic concern. The livelihood of many Indonesian people is reliant on the fishing industry, and plans are being made to expand Indonesia's tourism industry, which is largely dependent on clean coastal waters. As such, the need to manage plastic waste is paramount to the health and economic wellbeing of Indonesia's populations, who face increased risk of illness when waste is mismanaged, and whose positionality as coastal communities make them increasingly vulnerable to flood-related disasters exacerbated by mismanaged waste.

In 2017, Indonesia's government released the National Plan of Action for Combating Marine Plastic Debris (NPOA-CMPD), which aims to reduce marine plastic debris by 70% by 2025. The NPOA-CMPD plan focuses on improving public awareness to inspire social and behavior change (SBC), reducing both land and sea-based leakage, reducing plastic use and production, and improving existing infrastructure between 2017 and 2025.<sup>3</sup> While the NPOA-CMPD plan is a comprehensive step towards mitigating marine debris leakage, there are significant gaps between government goals and the ability of local municipalities to reach them. The NPOA-CMPD plan is funded through national and regional budgets but is also dependent on funding from international partners and organizations. While this approach is more collaborative, it provides room for discrepancies in how policy and subsequent actions are implemented regionally, thereby clouding any one unified trajectory or plan.

The Government of Indonesian is also currently developing a waste management system platform, the Indonesia Solid Waste Management (ISWM) Platform, which is planned to be stipulated in a Presidential Decree. The purpose of this platform is to synchronize the national waste management system, provide a framework and guidelines for a sustainable waste management system, and establish a policy basis for waste management innovation. Consultations with key national stakeholder are still ongoing (as of early 2021). The final document is expected to publicly released in 2021.

In August 2019, Tetra Tech was awarded the Clean Cities, Blue Ocean (CCBO) Program, a five-year, \$48 million contract from the U.S. Agency for International Development Bureau of Economic Growth, Education, and Environment. CCBO is the Agency's flagship program to respond to the global crisis of marine plastic pollution and includes Indonesia as one of its seven focal countries. CCBO's objectives share alignment with Indonesia's recent commitments, including the NPOA-CMPD. To inform CCBO's approach, the program has produced this 3R/SWM and Marine Debris Reduction Strategy for Indonesia to highlight the ways in which CCBO can support existing marine debris strategies and to provide recommendations for increased impact.

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<sup>1</sup> UNEP, 2017.

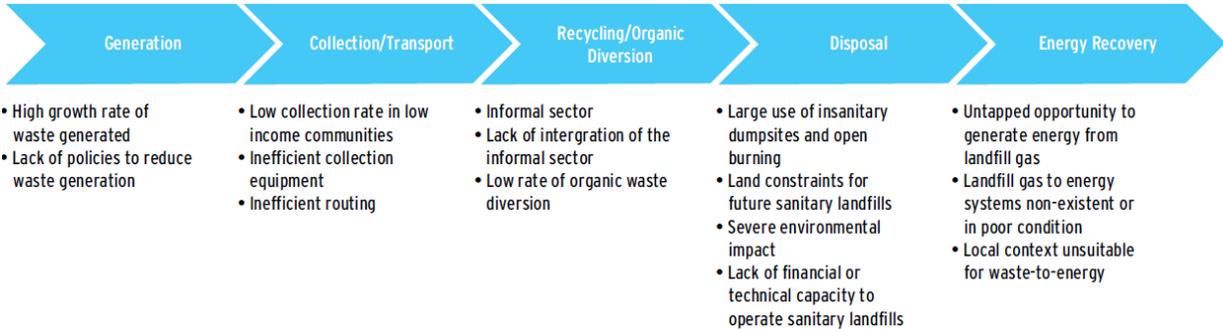
<sup>2</sup> World Economic Forum, 2020.

<sup>3</sup> NPOA-CMPD, 2017.

Indonesia’s NPOA-CMPD plan provides an opportunity for CCBO to align its goals and activities to help enhance, implement, and enforce existing policy, while also supporting the country in improving its solid waste management systems. More specifically, CCBO may provide support with improving solid waste management and 3R (reduce, reuse, recycle) practices through ensuring the longevity of stakeholder interests via educational and community engagement and establishing effective policy with sustainable implementation. The NPOA-CMPD plan consists of a top-down approach which can be maximized if supplemented with locally-specific technical and financial assistance—such as the local assistance provided by CCBO activities. All CCBO activities incorporate livelihood and inclusion factors such as gender, class, and geography into the implementation strategies and decision-making process.

In terms of prioritization and timing, the main barriers related to waste management include a lack of communication and resource exchange between nationally regulated standards and local municipalities tasked with implementing 3R/SWM improvements.<sup>4</sup> According to the World Bank, Indonesia faces five main barriers to optimizing SWM, including a lack of funding, a lack of operational capacity, general regulatory oversight, little land availability, as well as low rates of household waste collection.<sup>5</sup> Additionally, sustainable financing has proven to be problematic, as constituents are unwilling to pay for limited waste services, while conversely, cities and municipalities are unable to procure necessary fee collection rates until their services improve.<sup>6</sup> Therefore, centering community needs and encouraging community engagement is crucial throughout all aspects of the project implementation process. Other partnership creation can be cultivated in initial years but implemented in subsequent years after developing relationships. Simultaneously, infrastructure system design and implementation must address and incorporate the vulnerabilities that Indonesia has related to natural and environmental hazards. Projects can be synergistic and leveraged with a multitude of regional efforts (e.g., Asia Pacific Economic Cooperation, Association of Southeast Asian Nations, The Coordinating Body on the Seas of East Asia, etc.) that are also underway.

Figure 1. Common Challenges Along the MSW Value Chain<sup>7</sup>



In general, CCBO has the opportunity to build strong activity alignment with NPOA-CMPD as well as existing legislation and projects in the country. NPOA-CMPD implementation and the Indonesian SWM system will benefit from additional technical expertise, policy recommendations, and baseline research.

<sup>4</sup> United Nations Environment Programme (UNEP), 2017.

<sup>5</sup> World Bank, 2019.

<sup>6</sup> World Bank, 2014.

<sup>7</sup> Ibid.

Indonesia adalah negara kepulauan yang terdiri dari 17,000 pulau dan 81,000 garis pantai. Sebagai negara keempat dengan populasi penduduk terbesar di dunia, Indonesia mengalami pertumbuhan ekonomi dan peningkatan urbanisasi yang pesat sehingga menghasilkan sekitar 64 juta ton sampah perkotaan setiap tahunnya.<sup>8</sup> Selama pertumbuhan ini terus terjadi, diperkirakan sekitar tahun 2017 hingga 2025, kebocoran sampah laut akan meningkat sebesar 30%, dimana 780.000 ton plastik masuk ke badan air di Indonesia setiap tahunnya.<sup>9</sup> Proyeksi ini adalah ancaman yang signifikan untuk Kesehatan dan keselamatan masyarakat Indonesia, serta menimbulkan kekhawatiran ekonomi. Kehidupan masyarakat Indonesia bergantung pada industri perikanan, dan rencana-rencana telah dibuat untuk mengembangkan Industri Pariwisata Indonesia, yang sangat bergantung pada air laut yang bersih. Oleh karena itu, kebutuhan untuk mengelola sampah plastik sangat penting bagi kesehatan dan kesejahteraan ekonomi penduduk Indonesia, yang menghadapi peningkatan risiko penyakit ketika sampah salah kelola, dan masyarakat pesisir akan semakin rentan terhadap bencana terkait banjir yang diperburuk oleh salah kelola sampah.

Pada tahun 2017, pemerintah Indonesia merilis Rencana Aksi Nasional Penanganan Sampah Laut (RAN-PSL), yang bertujuan untuk mengurangi sampah plastik laut hingga 70% pada tahun 2025. Rencana RAN-PSL berfokus pada peningkatan kesadaran publik untuk mendorong perubahan sosial dan perilaku (SBC), mengurangi kebocoran di darat dan laut, mengurangi penggunaan dan produksi plastik, serta meningkatkan infrastruktur yang ada antara tahun 2017 dan 2025.<sup>10</sup> Meskipun rencana RAN-PSL merupakan langkah komprehensif untuk mengurangi kebocoran sampah laut, terdapat kesenjangan yang signifikan antara tujuan pemerintah dan kemampuan pemerintah kota setempat untuk mencapainya. Rencana RAN-PSL didanai melalui anggaran nasional dan daerah tetapi juga bergantung pada pendanaan dari mitra dan organisasi internasional. Meskipun pendekatan ini lebih kolaboratif, pendekatan ini memberikan ruang terjadinya ketidaksesuaian dalam menentukan bagaimana kebijakan dan tindakan selanjutnya diterapkan di daerah, sehingga mengaburkan jalur atau rencana terpadu mana pun.

Pemerintah Indonesia saat ini juga sedang mengembangkan platform sistem pengelolaan sampah, Platform Pengelolaan Sampah Indonesia (ISWM), yang rencananya akan ditetapkan dalam Keputusan Presiden. Tujuan dari platform ini adalah untuk melakukan sinkronisasi sistem pengelolaan sampah nasional, memberikan kerangka kerja dan pedoman untuk sistem pengelolaan sampah yang berkelanjutan, dan menetapkan dasar kebijakan untuk inovasi pengelolaan sampah. Konsultasi dengan pemangku kepentingan nasional utama masih berlangsung (mulai awal 2021). Dokumen final diharapkan dapat dirilis ke publik pada tahun 2021.

Pada Agustus 2019, Tetra Tech dianugerahi Program Clean Cities, Blue Ocean (CCBO) dengan kontrak lima tahun senilai \$ 48 juta dari Badan Pembangunan Internasional AS untuk Biro Pertumbuhan Ekonomi, Pendidikan, dan Lingkungan. CCBO adalah program unggulan Badan ini untuk menanggapi krisis global pencemaran plastik laut dan memasukkan Indonesia sebagai salah satu dari tujuh negara fokusnya. Tujuan CCBO memiliki kesamaan dengan komitmen Indonesia baru-baru ini, termasuk RAN-PSL. Untuk menginformasikan pendekatan CCBO, program ini telah menghasilkan Strategi Pengurangan Sampah Laut dan 3R / pengelolaan sampah untuk Indonesia untuk menyoroti cara-cara CCBO dapat mendukung strategi sampah laut yang ada dan untuk memberikan rekomendasi untuk peningkatan dampak.

Rencana RAN-PSL Indonesia memberikan kesempatan bagi CCBO untuk menyelaraskan tujuan dan aktivitasnya untuk membantu meningkatkan, menerapkan, dan menegakkan kebijakan yang ada, sekaligus mendukung negara

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<sup>8</sup> UNEP, 2017.

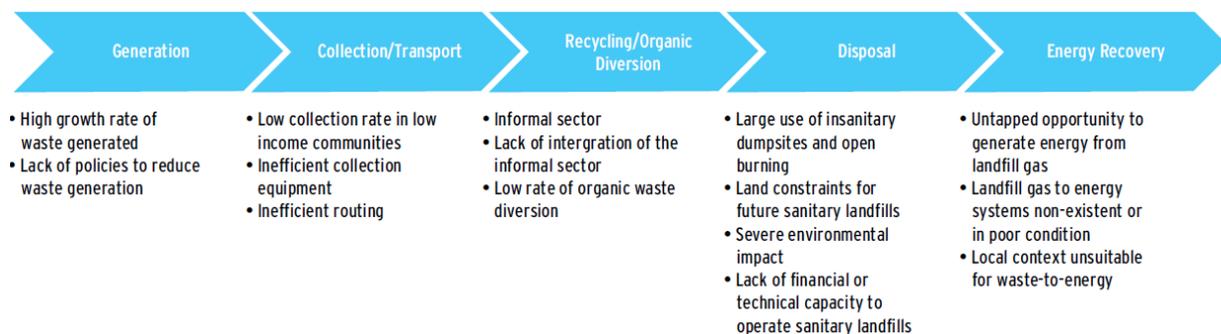
<sup>9</sup> World Economic Forum, 2020.

<sup>10</sup> NPOA-CMPD, 2017.

dalam meningkatkan sistem pengelolaan limbah padatnya. Lebih khusus lagi, CCBO dapat memberikan dukungan dengan meningkatkan pengelolaan limbah padat dan praktik 3R (kurangi, gunakan kembali, daur ulang) dengan memastikan keberlangsungan kepentingan pemangku kepentingan melalui pendidikan dan keterlibatan masyarakat serta menetapkan kebijakan yang efektif dengan implementasi yang berkelanjutan. Rencana RAN-PSL terdiri dari pendekatan top-down yang dapat dimaksimalkan jika dilengkapi dengan bantuan teknis dan keuangan khusus lokal — seperti bantuan lokal yang disediakan oleh kegiatan CCBO. Semua kegiatan CCBO memasukkan faktor mata pencaharian dan inklusi seperti gender, kelas, dan geografi ke dalam strategi implementasi dan proses pengambilan keputusan.

Dalam hal penentuan prioritas dan waktu, hambatan utama terkait pengelolaan sampah termasuk kurangnya komunikasi dan pertukaran sumber daya antara standar yang diatur secara nasional dan pemerintah kota setempat yang ditugaskan untuk melaksanakan perbaikan 3R / SWM.<sup>11</sup> Menurut Bank Dunia, Indonesia menghadapi lima hambatan utama untuk mengoptimalkan pengelolaan sampah berkelanjutan, termasuk kurangnya pendanaan, kurangnya kapasitas operasional, pengawasan peraturan umum, ketersediaan lahan yang sedikit, serta rendahnya tingkat pengumpulan sampah rumah tangga.<sup>12</sup> Selain itu, pembiayaan berkelanjutan terbukti bermasalah, karena konstituen tidak bersedia membayar untuk layanan sampah yang terbatas, sementara sebaliknya, kota dan kota tidak dapat memperoleh tarif pungutan yang diperlukan sampai layanan mereka membaik.<sup>13</sup> Oleh karena itu, memusatkan kebutuhan masyarakat dan mendorong keterlibatan masyarakat sangat penting di seluruh aspek proses pelaksanaan proyek. Penciptaan kemitraan lainnya dapat dikembangkan di tahun-tahun awal tetapi diterapkan di tahun-tahun berikutnya setelah mengembangkan hubungan. Secara bersamaan, desain dan implementasi sistem infrastruktur harus mengatasi dan memasukkan kerentanan yang dimiliki Indonesia terkait dengan bahaya alam dan lingkungan. Proyek dapat menjadi sinergis dan dimanfaatkan dengan banyak upaya regional (misalnya, Asia Pacific Economic Cooperation, Association of Southeast Asian Nations, The Coordinating Body on the Seas of East Asia, dll.) yang juga sedang berlangsung.

Figure 2. Tantangan yang Sering Terjadi dalam Rantai Nilai Sampah Perkotaan<sup>14</sup>



Secara umum, CCBO memiliki kesempatan untuk membangun keselarasan aktivitas yang kuat dengan RAN-PSL serta undang-undang dan proyek yang ada di negara ini. Penerapan RAN-PSL dan sistem pengelolaan sampah berkelanjutan di Indonesia akan mendapatkan keuntungan dari keahlian teknis tambahan, rekomendasi kebijakan, dan penelitian dasar.

<sup>11</sup> United Nations Environment Programme (UNEP), 2017.

<sup>12</sup> World Bank, 2019.

<sup>13</sup> World Bank, 2014.

<sup>14</sup> Ibid.

# I. Introduction

On August 28, 2019, Tetra Tech was awarded the Clean Cities, Blue Ocean (CCBO) Program, a five-year, \$48 million contract from the U.S. Agency for International Development Bureau of Economic Growth, Education, and Environment. CCBO is the Agency's flagship program to respond to the global crisis of marine plastic pollution. The objectives of CCBO are to:

**Objective 1:** Promote reduce, reuse, recycle (3Rs) and strengthen local and regional markets for recycled plastics;

**Objective 2:** Build social and behavior change (SBC) for 3Rs and sustainable solid waste management (3R/SWM);

**Objective 3:** Increase capacity and effective governance of (3R/SWM) and recycling systems; and

**Objective 4:** Support international fora, public-private partnerships (PPPs), and multi-stakeholder alliances.

As a cross-cutting objective, CCBO also works to support and enhance the livelihoods of those working in the waste and recycling sectors, particularly women, as well as advance gender equality within the sector and opportunities for women's economic empowerment.

Over the next five years, CCBO will collaborate with local USAID missions and key stakeholders to test and scale 3R/SWM solutions with an initial focus in seven focal countries: Indonesia, the Philippines, Sri Lanka, the Maldives, Vietnam, the Dominican Republic, and Peru. To inform CCBO's approach, the program is producing 3R/SWM and Marine Debris Reduction Strategies in each of the focal countries to highlight the ways in which CCBO can support existing marine debris strategies and provide recommendations for increased impact. The Jambeck Research Group at the University of Georgia was selected to produce Reduction Strategies for The Philippines, Vietnam, Sri Lanka, the Maldives, and Indonesia. These Reduction Strategies were generated through literature review of existing marine litter plans and strategies, review of proposed CCBO plans, interviews with CCBO staff, and additional desktop research.

While the focus of CCBO is on waste management, there are intersectional issues and USAID has several other initiatives in the Southeast Asia region that could be complementary to the work of CCBO. These include programs related to biodiversity conservation and the reduction of illegal fishing activity, such as USAID Wildlife Asia, the recently completed USAID Oceans and Fisheries Partnership, as well as programs related to gender equality and female empowerment. Issues of waste management are often closely tied to issues of environmental and social justice and there may be opportunities for CCBO to build upon existing work and partnerships of USAID in the region.

## 2. Scope and Background

The amount of plastic estimated to enter the ocean annually from mismanaged waste is 4.8 to 12.7 million metric tons.<sup>15</sup> This figure is projected to increase as plastic production grows. Plastic is a relatively new (~last 30 years) material used in Southeast Asia and its mismanagement has the potential to create

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<sup>15</sup> Jambeck et al., 2015.

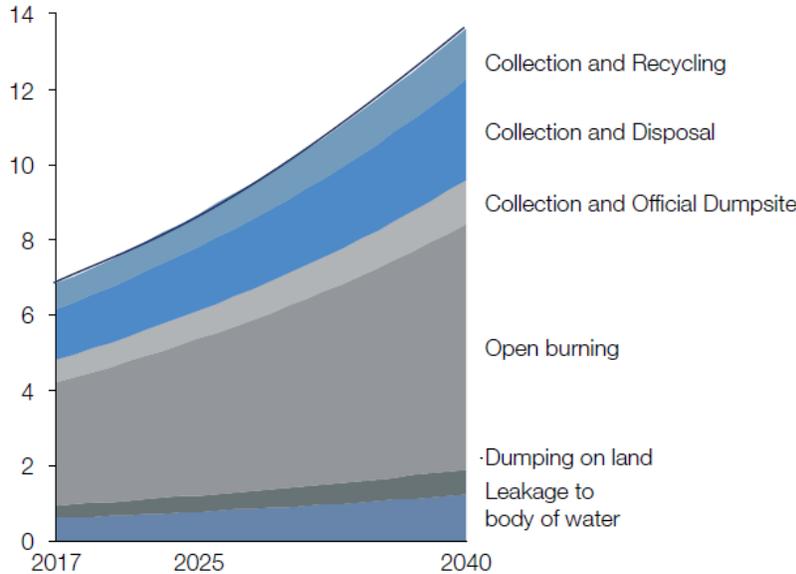
significant economic and ecological impacts. The United Nations Environmental Program estimates the financial damage of plastics to marine ecosystems globally is \$13 billion each year.<sup>16</sup> Studies show chemicals from plastics transfer to fish in a laboratory setting, and plastic particles and fibers can be found in fish and bivalves sold for human consumption, presenting a potential human health risk.<sup>17</sup> The impacts of plastic marine debris are particularly relevant to Indonesia, which relies, in part, on the richness and health of its marine environment to fuel its robust fisheries and tourism industries.

## 2.1 Overview of Waste Management

Indonesia is a linguistically and culturally diverse nation composed entirely of archipelagos, with a surface area of over 190,000 sq. km. It is the fourth most populous country in the world, and as of 2014, had a population of roughly 254.5 million.<sup>18</sup> Indonesia also has a growing tourist economy, and plans are underway to expand Indonesia's tourism capacity. With tourism being a significant driver of the economy (service industry accounts for an estimated 38.6% of GDP),<sup>19</sup> plastic pollution is at the forefront to keep the beaches and environment as clean as possible. Tourism also contributes to the generation of solid waste, exacerbating waste management issues if infrastructure to manage waste is not available.

The primary source of marine debris in Indonesia stems from inadequate SWM. It is reported that only 39% of Indonesia's waste is collected.<sup>20</sup> Figure 3 depicts the handling of plastic waste if collection rates remain at this rate until 2040.

Figure 3. Handling of Plastic Waste if Collection Rates Remain at 39% (million tons)<sup>21</sup>

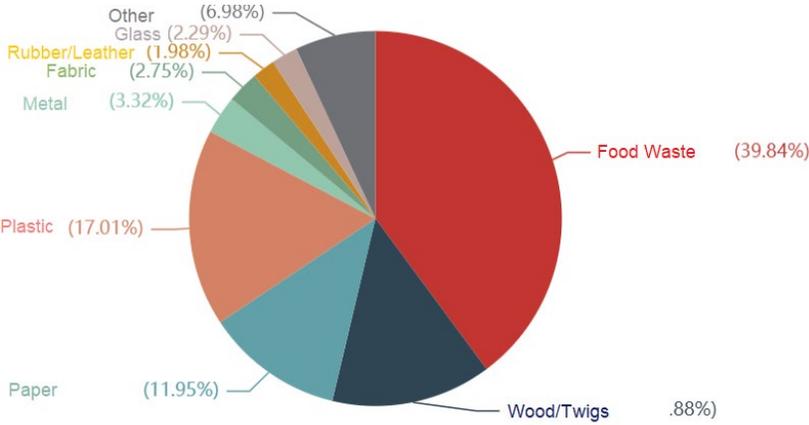


While abandoned and derelict fishing gear are also known contributors to marine debris, it is estimated that the majority of marine debris may come from land-based activities that are proximal to coastlines, including land-based municipal solid waste (MSW) inputs.<sup>22</sup> Additionally, despite a sharp growth in foreign waste imports in 2018, it is reported that approximately 95% of plastic in the environment or waterways of Indonesia comes from waste generated within Indonesia.<sup>23</sup> While

<sup>16</sup> Raynaud et al., 2014.  
<sup>17</sup> Rochman et al., 2013, 2015.  
<sup>18</sup> UNEP, 2017.  
<sup>19</sup> Ibid.  
<sup>20</sup> World Economic Forum, 2020.  
<sup>21</sup> Ibid.  
<sup>22</sup> Jambeck et al., 2015.  
<sup>23</sup> World Economic Forum, 2020.

systems for waste collection do exist, open dumping continues to be common practice across the country, for reasons explored below.<sup>24</sup> Indonesia produces roughly 64 million tons of municipal waste per year, made up of 39.8% organic food waste, 17% plastic waste, 11.9% paper waste, and the remainder made up of metal, glass, textiles, rubber, and others.<sup>25</sup>

Figure 4. MSW Composition (%) in Indonesia<sup>26</sup>



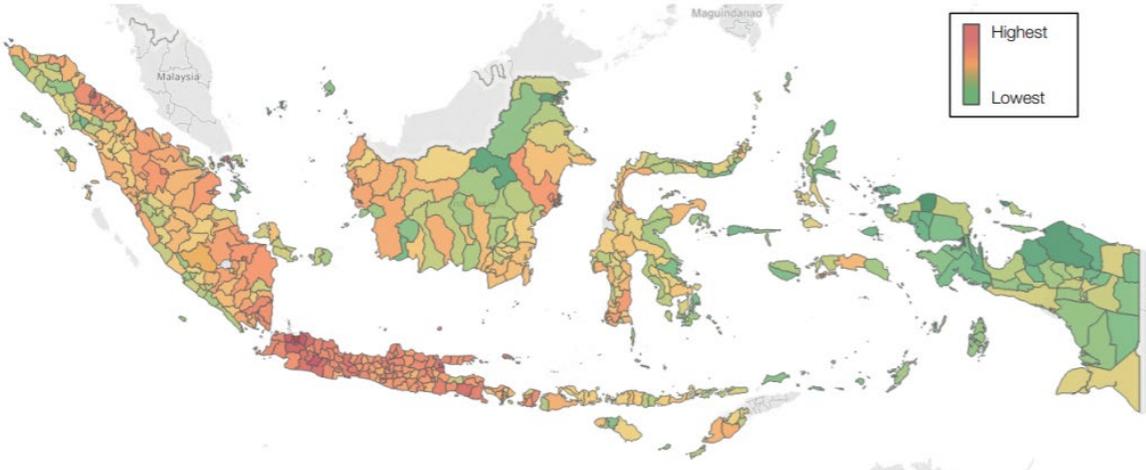
Individuals living in East Asia and the Pacific generate between 0.44 - 4.3 kg of waste per day, with an average of 0.95 kg of waste per day.<sup>27</sup> Indonesia’s average per capita waste generation rates fall below East Asia’s regional average, estimated to be around 0.68 kg/person/day.<sup>28</sup> Another study shows that by 2025, Indonesia’s solid waste generation per capita is predicted to grow to 0.85 kg/capita/day.<sup>29</sup> Similarly, Indonesia is classified as a lower-middle income (LMI) country by the World Bank, and it is projected that by 2025, MSW generation in LMI countries will nearly triple.<sup>30</sup>

Higher levels of waste generation are generally seen in more urbanized and higher income areas; as income and consumerism increase, so do waste generation rates.<sup>31</sup> Around half of Indonesia’s population (125 million people) live in cities.<sup>32</sup> Each day, urban residents produce around 97,000 tons of solid waste. Only about 40% (39,000 tons) of this is formally collected and managed; the remaining 60% is not.<sup>33</sup> Another study finds that Indonesian urban areas produce closer to 105,000 tons of MSW daily, and this number is expected increase to 150,000 tons of waste per day by 2031 due to urbanization and increased generation rates.<sup>34</sup> As such, Indonesia’s SWM system must extend collection services to roughly 40% of urban households currently without service while also anticipating an increased rate of waste generation per household assuming continued economic growth.<sup>35</sup> Across Indonesia, there is significant variation in waste generation (Figure 5), with the island of Java housing 56% of Indonesia’s population and subsequently

<sup>24</sup> Kaza et al., 2018.  
<sup>25</sup> SIPSN, 2020  
<sup>26</sup> SIPSN, 2020  
<sup>27</sup> Hoornweg & Bhada-Tata, 2012.  
<sup>28</sup> Kaza, et al., 2018.  
<sup>29</sup> Hoornweg & Bhada-Tata, 2012.  
<sup>30</sup> World Bank, 2014.  
<sup>31</sup> Hoornweg & Bhada-Tata, 2012.  
<sup>32</sup> World Bank, 2015.  
<sup>33</sup> World Bank, 2014  
<sup>34</sup> World Bank, 2019.  
<sup>35</sup> World Bank, 2019.

producing 64% of mismanaged plastic waste.<sup>36</sup>

Figure 5. Total Plastic Waste Generation in Each City or Regency of Indonesia<sup>37</sup>

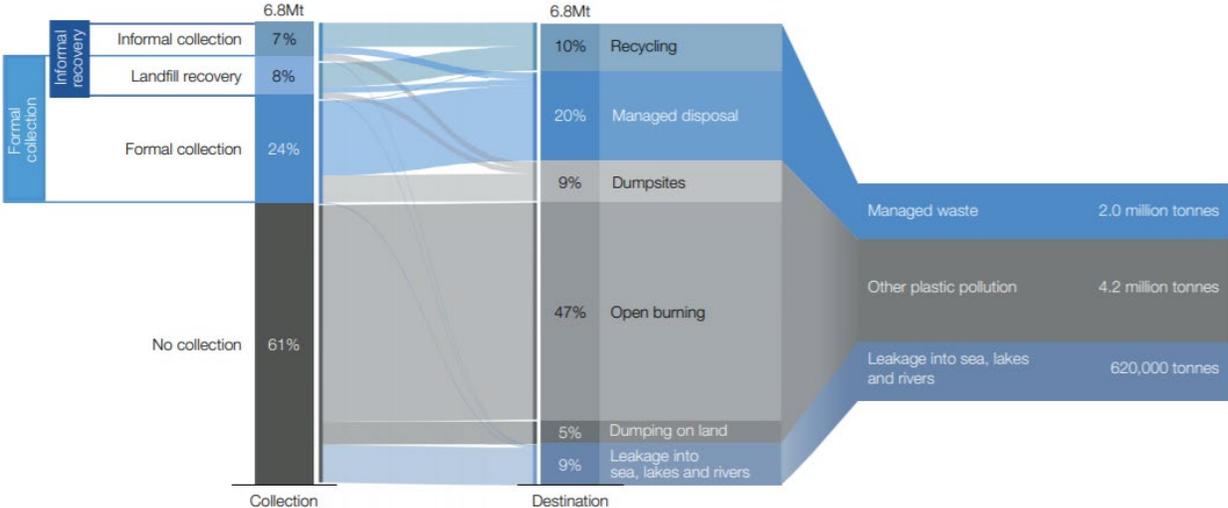


It is important to note that even while SWM exists in urban areas, these systems are not operating at full capacity. Conversely, rural areas have very little SWM infrastructure, and this is reflected in waste collection rates as well. Roughly 72% of Indonesia’s mismanaged plastic waste stems from what the World Economic Forum describes as *Medium* and *Rural* archetypes, i.e., cities over 1,500 cap/km<sup>2</sup> and/or areas that are adjacent to cities with over 1,500 cap/km<sup>2</sup>.<sup>38</sup> While existing SWM in cities needs to be strengthened and optimized, there also needs to be specialized plans for rural areas that are not near recycling facilities, and who rely on imported plastic products because of their far distance from urban centers.

Deficiencies in existing urban SWM infrastructure and a lack of rural SWM infrastructure leaves both urban and rural populations with no choice but to dispose of waste in ways that are harmful to the environment, as shown in Figure 6. Approximately 61% of plastic waste (4.2 million tons) are not collected in a SWM system after use.<sup>39</sup> Of the plastics not collected, households are reported to burn 78% (usually close to homes), while 12% is dumped in bodies of water, and 10% is dumped or buried on land—potentially ending up in waterways due to rainwater runoff.<sup>40</sup> Recent estimates conclude that in 2017 alone, roughly 620,000 tons of plastic entered Indonesia’s oceans.<sup>41</sup>

<sup>36</sup> World Economic Forum, 2020.  
<sup>37</sup> Ibid.  
<sup>38</sup> Ibid.  
<sup>39</sup> Ibid.  
<sup>40</sup> Ibid.  
<sup>41</sup> Ibid.

Figure 6. Where Indonesia’s plastic waste ends up today (percentage of total plastic waste generated)<sup>42</sup>



## 2.2 Role of the Informal Sector

Sembiring and Nitivattananon (2010) classify the informal sector in Bandung, Indonesia as: waste pickers collecting from any location in the city as well as landfills, maids and servants who collect recyclables from households, waste buyers that purchase recyclables door to door, MSW crews that sort and sell to scrap dealers, scrap dealers/junks shop owners, processors that buy from the scrap dealers or other intermediaries before reprocessing occurs.

The informal waste management sector in Indonesia is very active, and while these workers depend on waste for livelihood, they are generally not associated with or supported by formal organizational frameworks. In 1992, however, Indonesia’s government enacted legislation to support waste pickers for economic and environmental reasons, and since then, the government has supported the formation of waste picking cooperatives.<sup>43</sup> Although waste pickers were recognized, prior to 2008 (Waste Law No.18/2008), there was no national legislation on waste management, so there is still a disconnect between the informal sector and official waste management systems and laws.<sup>44</sup> Most studies on waste pickers in Indonesia have focused on population hubs in Java and Bali, and even then, existing research on the informal sector in Indonesia is very limited.<sup>45</sup>

While not entirely informal (recognized by communities), Waste Banks, or Bank Sampahs, are more informal alternative methods for managing waste that can be recycled in Indonesia. Resources were originally provided for some waste banks by Unilever Indonesia.<sup>46</sup> A reported 5,000 waste banks exist across the country and allow community members a location to deposit their recyclable waste where

<sup>42</sup> World Economic Forum, 2020.  
<sup>43</sup> Medina, 2000.  
<sup>44</sup> Sasaki et al., 2014.  
<sup>45</sup> Ibid.  
<sup>46</sup> Unilever Indonesia Foundation, 2020.

people get to “bank” the value of the waste they deliver.<sup>47</sup> The deposited materials are then sold to scrap dealers for recycling. The Indonesian government has reportedly endorsed the waste bank concept as ‘currently the best way of dealing with waste across the country.’<sup>48</sup>

### 2.3 Waste Management in CCBO Engagement Sites

**Semarang** - Semarang city is the capital city of the Central Java province, with a population of over 1.5 million people as of 2010.<sup>49</sup> A study in 2016 concluded that Semarang generates roughly 961 metric tons of waste per day, while only 844 metric tons are collected (a collection rate of 87%).<sup>50</sup> However, two years later, a study conducted by Andarani et al. (2018) suggested that Semarang only had a collection rate of 61%. Waste separation is generally not performed at the household level, and people who do not have access to collection services often turn to burning or dumping their waste in the surrounding environment.<sup>51</sup>

The Hygiene and Landscaping Agency—now part of the Environmental Agency (Dinas Lingkungan Hidup / DLH)—handles waste management in Semarang. However, because the city lacks necessary collection, transport, and sorting infrastructure, most SWM is handled by the informal sector.<sup>52</sup> Despite the collecting and sorting that the informal sector does, only 23.59% (53.54 metric tons) of plastic produced by households in Semarang were recycled.<sup>53</sup>

According to Atmanti et al. (2019), household waste accounts for 67% of Semarang’s daily waste generation rates, with the remaining 20% generated by markets and commercial areas generate, 7% by industrial areas, and 6% by public facilities, streets, and sewers. Waste composition in Semarang consists of 60.8% organic waste and 39.2% inorganic waste (Figure 7).<sup>54</sup>

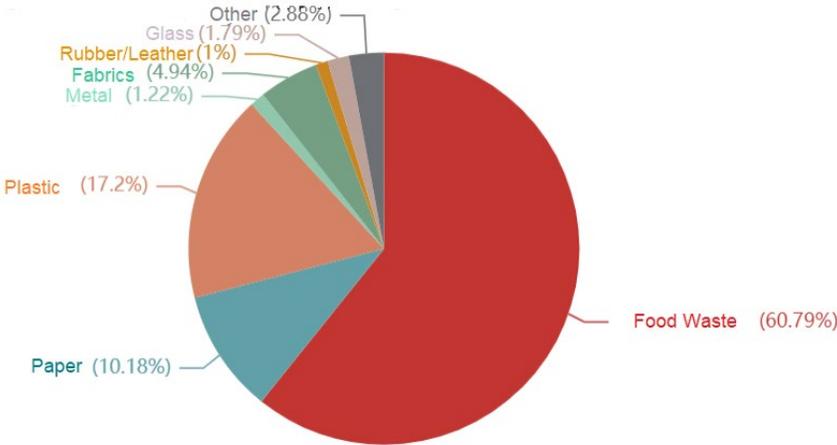


Figure 7. Waste composition in Semarang in 2020

Atmanti et al. (2019) concludes that the main constraints of SWM in Semarang include the decreasing lifespan of the Jatibarang Landfill (estimated at 4-5

<sup>47</sup> Ni'mah and Keller-Bischoff, 2020.  
<sup>48</sup> Ibid.  
<sup>49</sup> Semarang City, 2010.  
<sup>50</sup> Andriani & Prawara, 2016.  
<sup>51</sup> Andarani et al., 2018.  
<sup>52</sup> Ibid.  
<sup>53</sup> Ibid.  
<sup>54</sup> SIPSAN, 2020

years), damaged waste collection/transportation vehicles, and damaged containers and waste bins. The authors suggest that existing infrastructure must be rejuvenated and adapted to a large range of service areas. Estimates suggest that Semarang generates 1,012 m<sup>3</sup> of plastic waste per day, and most of this comes from households and is projected to continuously increase over time (Table I).<sup>55</sup> The Jatibarang Landfill is estimated to reach capacity by 2024.<sup>56</sup>

Table I. Plastic waste generation rates in Semarang from 2017-2030<sup>57</sup>

Year	Waste Generation (m <sup>3</sup> )	Plastic Waste Generation (m <sup>3</sup> )
2017	6394.96	1041.10
2018	6569.81	1095.84
2019	6746.80	1152.35
2020	6925.92	1210.65
2021	7124.03	1273.78
2022	7307.59	1335.83
2023	7493.28	1399.74
2024	7681.11	1465.56
2025	7888.53	1536.69
2026	8098.40	1609.96
2027	8292.95	1681.81
2028	8507.55	1759.36
2029	8724.59	1839.14
2030	8925.86	1917.28

Compared to other regions in Java Island, the Central Java region (Central Java and Jogjakarta Province), where Semarang City is located, have the least plastic waste collection and recycling. This is due to the small number of plastic recycling plants, compared to the number of plastic recycling plant in West Java region and East Java region. The small number of plastic waste collection and recycling may contribute to environmental plastic waste leakage.<sup>58</sup>

**Makassar** - Makassar is the capital city of South Sulawesi, with a population of over 1.5 million as of 2019.<sup>59</sup> As one of the largest cities in Indonesia, Makassar’s SWM system is not operating at peak efficiency, and marine debris litter has increasingly become a health and safety issue. In fact, recent studies have shown that anthropogenic plastic debris was found in 55% of all fish and shellfish and 28% of individual fish sampled in Makassar.<sup>60</sup>

As of 2016, Makassar generated 972 metric tons of waste per day, with 918 metric tons formally collected.<sup>61</sup> The waste composition in Makassar consists of 58.4% organic waste and 41.6% inorganic waste (Figure 8).<sup>62</sup>

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<sup>55</sup> Andarani et al., 2018.  
<sup>56</sup> Atmanti et al., 2019.  
<sup>57</sup> Andarani et al., 2018.  
<sup>58</sup> Darus et al., 2020.  
<sup>59</sup> Makassar City, 2019.  
<sup>60</sup> Rochman, 2015.  
<sup>61</sup> Andriani & Prawara, 2016.  
<sup>62</sup> SIPSNI, 2020.

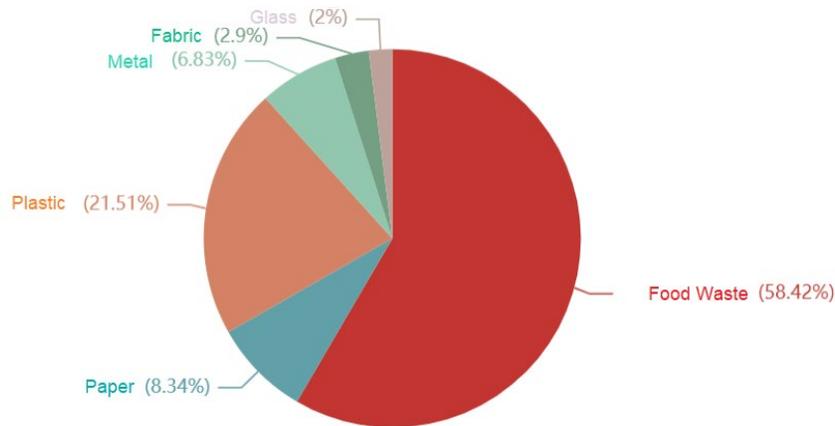


Figure 8. Makassar Waste Composition in 2020

As of 2012, it was estimated that 70% of waste (as generated, not as collected) is processed in Makassar, with the remaining 30% being discarded into waterways and channels, which makes the subsequent disposal of uncollected solid waste into

waterways and canals extremely common.<sup>63</sup> Dinas Lingkungan Hidup (DLH) Kota Makassar manages SWM. The garbage collection service picks up waste from designated collection points, which are usually shared by surrounding households. If collection is infrequent or if there is overflow, heavy rain during the wet season will disperse uncollected waste into the environment.<sup>64</sup> Absent among Makassar’s waste collection process is waste separation, waste to energy programs, composting, zero waste, and the 3Rs.<sup>65</sup>

In 2006, Makassar city released the Mamminasata Masterplan 2010-2030, which aims to improve SWM in Makassar. According to Tjandraatmadja (2012), this plan includes:

- The overall improvement of collection services, especially in low-income neighborhoods where collection trucks have a hard time navigating due to narrow streets.
- A new landfill site in Gowa, as the existing TPA Tamangapa landfill is at capacity. It should be noted that the residents of Gowa do not want a landfill being constructed near their homes.
- The separation of household waste, non-toxic waste, and toxic waste to avoid cross-contamination.
- Increased education for the surrounding communities pertaining to the 3Rs.
- Creation of a waste disposal system for commercial and industrial sectors.

**Ambon** - Ambon is part of the Maluku Islands, with an area over 770 km<sup>2</sup>. Ambon City comprises five districts, all of which are connected to the sea: Nusaniwe, Sirimau, Teluk Ambon, Teluk Ambon Baguala, and Leitimur Selatan. As of 2020, Ambon produced just over 270 metric tons of waste per day, generated by a population of 347,288 people.<sup>66</sup> Of this, 3% of the waste generated each day is not collected at the transfer station, and 19.7% of the waste that is collected at transfer station is not transported to the local landfill (destination was not specified).<sup>67</sup> The waste composition in Ambon consists of 58.4% organic waste and 41.6% inorganic waste (Figure 9).<sup>68</sup>

<sup>63</sup> Tjandraatmadja, 2012.

<sup>64</sup> Ibid.

<sup>65</sup> Permana et al., 2015.

<sup>66</sup> SIPSN, 2020.

<sup>67</sup> Ibid.

<sup>68</sup> SIPSN, 2020.

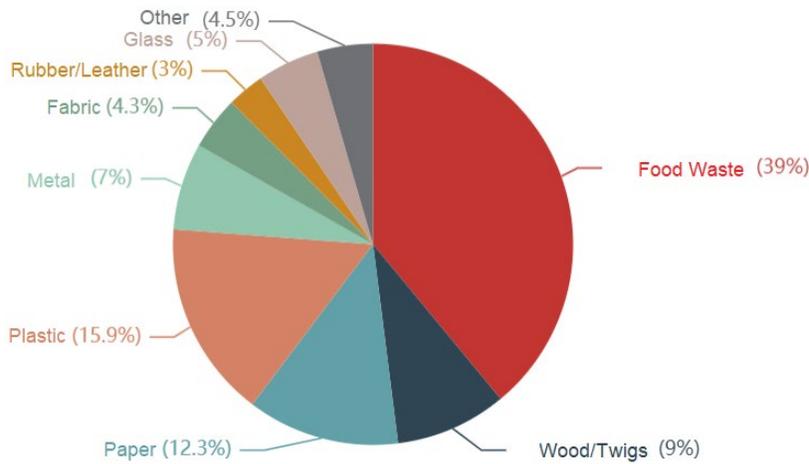


Figure 9. Ambon Waste Composition in 2020

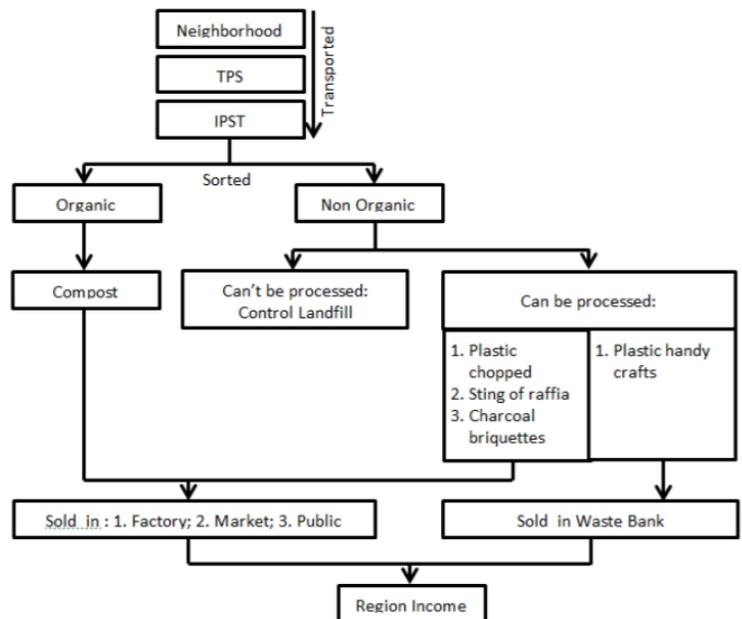
Waste collection and transportation is performed by Dinas Lingkungan Hidup dan Persampahan (DLHP)—translated to Environment and Solid Waste Agency. While the government plays a more formal role in waste collection services, the local community is

also integral to collection practices. Private citizens, groups, and even schools champion collection, composting, and recycling, and in the Teluk Ambon and Teluk Ambon Baguala districts, housing areas have their own waste collection initiatives.<sup>69</sup> Voluntary participation of the locals suggests that there is existing public interest in waste collection that CCBO can tap into. There are currently 146 transfer stations located in Ambon: 37 units in the Nusaniwe District, 24 units in the Teluk Ambon Baguala District, 26 units in the Teluk Ambon District and none in Leitimur Selatan District due to its mountainous geography.<sup>70</sup> Figure 10 shows the flow of waste processing in Ambon.

Based on the analysis performed by Maryati et al., 2017, Ambon’s SWM system is in good condition, but several improvements can be made, namely:

- Improving and expanding quantity and quality of personnel and infrastructure;
- Optimizing waste transport operations;
- Utilizing public support and instituting citations or disincentives for violations of waste disposal;
- Expansion of the controlled landfill area; and
- Improvement of the waste processing tools are needed so that all inorganic waste can be processed.

Figure 10. Waste processing flow in the city of Ambon<sup>71</sup>



<sup>69</sup> Ibid.

<sup>70</sup> Maryati et al., 2017.

<sup>71</sup> Ibid.

## 3. Relevant Regional, National and Local Actions

### 3.1 Regional Actions

There is significant cross-cultural collaborative interest in marine litter mitigation in Southeast Asia. The Asia Pacific Economic Cooperation (APEC) includes Indonesia and has a “Roadmap on Marine Debris” that the 21 APEC economies (including Indonesia) have agreed to work on together. Each hosting country often takes action over their host year, and meetings and workshops are held to share knowledge and build capacity to address marine debris. Indonesia is also part of UNEP’s Regional Seas Programme, which aims to encourage countries that share waters to develop comprehensive efforts and actions to help reduce degradation of oceans and has been identified as a pioneering program for developing action plans for combatting plastic pollution and marine debris. In 2018, Southeast Asia agreed to The Coordinating Body on the Seas of East Asia (COBSEA) Strategic Directions 2018-2022 plan, which is supported by UNEP. This plan focuses on reducing land-based pollution, strengthening coastal management and planning, and strengthening regional governance through the exchange of policies and experiences.<sup>72</sup> Additionally, Indonesia signed the COBSEA Regional Action Plan on Marine Litter (RAP MALL) during its revision in Bali, Indonesia in 2019. This plan emphasizes the importance of:

1. Reducing and preventing marine pollution in the East Asian Seas region
2. Moving towards a multi-stakeholder lifecycle approach to aid in debris reduction and prevention
3. Removing existing marine debris litter via environmentally responsible methods
4. Improving monitoring and assessment of marine litter
5. Improving awareness about marine litter among stakeholders in the region
6. Supporting collaboration among stakeholders on the national level to enhance policy.

Indonesia is also a member of Association of Southeast Asian Nations (ASEAN). The ASEAN Framework of Action on Marine Debris was developed based upon recommendations from the ASEAN Conference on Reducing Marine Debris in ASEAN Region in Phuket in November 2017, taking into account the East Asia Summit (EAS) on Combating Marine Plastic Debris in Bali in September 2017. The result of this is the ASEAN Regional Action Plan for Combating Marine Debris in the ASEAN Member States (ASEAN RAP), 2021-2025. The ASEAN RAP 2021-2025 focuses on reducing inputs, enhancing collection and minimizing leakage, and creating value for waste re-use. The plan includes four pillars:

1. Policy support and planning: best practices and standards;
2. Research, innovation and capacity building: knowledge, data and information;
3. Private sector engagement: regional platform, support implementation and investment; and
4. Public awareness, education and outreach: behavior change and labeling.

Indonesia also signed the Bangkok Declaration on Combating Marine Debris with ASEAN in 2019, which reaffirmed UN Sustainable Development Goal 14.1 of preventing and significantly reducing marine pollution, including marine debris. The declaration calls for a land-to-sea prevention approach, a focus on promoting the circular economy and the 3Rs, and collaboration among the ASEAN countries.<sup>73</sup>

In addition, Indonesia is a member of Partnerships in Environmental Management for the Seas of East Asia (PEMSEA). PEMSEA members include: Cambodia, China, the Democratic People's Republic of Korea,

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<sup>72</sup> COBSEA, 2018.

<sup>73</sup> ASEAN, 2019.

Indonesia, Japan, Laos, the Philippines, the Republic of Korea, Singapore, Timor-Leste, and Vietnam, which all gathered together to build capacity both at the Congress and in workshops in Busan, Korea, in 2019.

## 3.2 National Actions

While the country is moving towards locally improved policies and legal frameworks for sustainable waste management and marine protection, there are some established national legal efforts for SWM carried out under the Coordinating Ministry for Maritime Affairs (CMMA). The Ministry provides a top-down approach by implementing and monitoring policies and regulating through legal frameworks, projects and research, and building capacity and necessary infrastructure. Law No. 32 of 2014 on the Sea is a more recent framework stating that the government will undertake efforts to protect the marine environment through the control and prevention of marine pollution. It also classifies land, sea, and air pollution as contributors to the marine debris problem.<sup>74</sup> Additionally, one of the more recent national regulations published is the NPOA-CMPD plan, which focuses on improving public awareness to inspire behavior change, reducing both land and sea-based leakage, reducing plastic use and production, and improving existing infrastructure between 2017 and 2025 (NPOA-CMPD, 2017). This plan has the ability to provide comprehensive change to Indonesia's MSW infrastructure if adequately implemented at the local level. There are five core strategies for implementation outlined in the Plan, and CCBO has the opportunity to directly support Strategies A and B and facilitate Strategies D and E, below, through its engagement site activities and national-level support:<sup>75</sup>

- A. **Local governments** to take care of the waste management properly and reduce the amount of plastic waste leaking to the ocean.
- B. **National level**, Indonesia is promoting paradigm change within the society towards plastic waste and to respect the coastal areas through education curriculum and campaign, waste to energy, paid plastic bag, plastic debris as asphalt mix for "plastic tar road"
- C. **International level**, Indonesia has been working with the World Bank, some donors and plan to organize East Asia Summit Conference on marine plastic debris, on 6-7 September 2017 in Denpasar (Bali) and also executed already discussions on this matter under the Indian Ocean Rim Association.
- D. **Industrial sector** is designed to encourage these manufacturers to use recycled plastics as input materials as much as possible, while at the same time producing more biodegradable plastics.
- E. Involvement of **academics and community service organization (CSO)** for new and efficient technologies to cope with the problem, such as recycling technologies, and waste for energy and so on into practice.

In addition to these aforementioned regulations, the World Bank summarizes the following laws and regulations aimed at mitigation marine plastic debris (2018).

- Regional Development Act (No. 23/2014) details the responsibilities of local government in SWM
- National Medium Term Development Plan (RPJMN 2015-2019) aimed to achieve 100% SWM collection, treatment, and disposal services in urban areas by 2019.

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<sup>74</sup> Maurf, 2019.

<sup>75</sup> Burhanuddin, 2017.

- Marine Debris Handling - Presidential Regulation No. 83/2018 establishes the commitment of Indonesia to reduce 70% marine plastic by 2025.

The Medium-Term Development Plan (RPJMN) has been updated to cover the years 2020-2024—under which targets for MSW management have been updated to achieve 80% MSW handling and 20% MSW reduction by 2024. This target is under the Environment Quality Improvement agenda of the Environment, Climate Change, and Disaster Resilience Improvement agenda of the RPJMN 2020-2025 development agenda. In addition to the MSW management target, there is also an expressed goal to reduce marine pollution, but a specific target is not stated.

Additional regulations, particularly Act 18/2008, Government Regulation 81/2012 on MSW, and Regulation 13/2012 on 3Rs are acts that provide additional guidance and support for strengthening SWM. Permana et al. argues that these three specific regulations are sufficient in implementing sustainable SWM, as proved by the three cleanest cities in Indonesia, which are Surabaya, Palembang, and Tangerang (2015). Therefore, implementing sustainable SWM is dependent on the capacities of local levels of governance.

Besides these three regulations, there are new national regulations that also provide guidance and support for strengthening SWM—the Presidential Decree No. 97/2017 on SWM National Strategy and Policy and the National Plastic Waste Reduction Strategic Action.

### 3.3 Prior USAID MWRP Work

Projects funded under the USAID Municipal Waste Recycling Program (MWRP) (2017-2021) are continuing to address issues related to waste management and plastic pollution in Indonesia, including Comprehensive results of these projects are not available at the time of writing, but a summary of the projects based upon a USAID publication is below. Further insight will be gained once all projects are complete and results are made available. It is understood that CCBO will build upon progress made under the MWRP program, leveraging its learnings, continuing efforts or scaling them to new locations, and continuing to support select MWRP grantees that have demonstrated significant achievements.

According to USAID, with an investment of \$1.4 million by the U.S. government, seven MWRP grantees are innovating local approaches to improve SWM in Indonesia. Grantees work to scale up urban coastal recycling across Indonesia. MWRP and its grantees are reducing ocean plastics by partnering with the private sector, bolstering sustainability and self-reliance, developing scalable models and innovation using geospatial data and technology in seven locations: Thousand Islands, Jakarta, Semarang, Bandung, Sorong City, Gowa Regency, and Denpasar.<sup>76</sup>

## 4. CCBO Alignment

The activities proposed in the CCBO Year One+ Work Plan for Indonesia (January 2020 to December 31, 2021), including focused work at key engagement sites, largely complements existing legislation, national action plans, and projects. Through its work, there is an opportunity to align CCBO's values of promoting

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<sup>76</sup> "Partnering with Cities to Reduce Ocean Plastics: The Municipal Waste Recycling Program: Indonesia," May 2020. <https://urban-links.org/wp-content/uploads/20200608-USAID-MWRP-Indonesia-Country-Profile.pdf>.

and providing support for strategies to reduce, reuse, recycle, and better manage solid waste through SBC strategies. Additionally, CCBO’s goals of enhancing policy and governance and building partnerships with the private sector can be achieved through continuous engagement with local communities. CCBO activities that work to establish 3Rs/SWM systems and implement infrastructure development will support the efforts of the NPOA-CMPD as outlined in the table below.

The following table maps CCBO Activities to related NPOA-CMPD pillars and objectives. The table is intended to provide an overview of areas for potential collaboration and alignment and only highlights those areas of the policy relevant to CCBO collaboration.

Table 2. CCBO Program Alignment with NPOA-CMPD Objectives

NPOA-CMPD Pillars	NPOA-CMPD Objectives (from Burhanuddin 2017)	CCBO [Work Plan] Activity
<p><b>1) Improving Behavioral Change</b></p>	<ul style="list-style-type: none"> <li>• Educating young people</li> <li>• Increasing stakeholder awareness</li> <li>• Inter-governmental collaboration</li> <li>• Cross sector collaboration</li> </ul>	<p><b>Objective “Build Social and Behavior Change for 3R Practices and Sustainable Waste Management”</b></p> <p><b>Activity 3.1 – Develop SBC plans in CCBO engagement sites based on localized research</b></p> <ul style="list-style-type: none"> <li>• 3.1.1 - Conduct formative research for SBC in engagement sites and capacity building of CCBO grantees, as appropriate, to contribute to the research</li> <li>• 3.1.2 - Begin to conduct Trials of Improved Practices (TIPs) for key behaviors</li> <li>• 3.1.3 - Develop SBC plans for each engagement site(s) [Semarang, Year One]</li> </ul>
<p><b>2) Reducing Land-Based Leakage</b></p>	<ul style="list-style-type: none"> <li>• Reduce plastic debris coming from housings and city streets carried into the ocean through the canals</li> <li>• Reduce impact of marine pollution to sea life, ecosystem, and humans</li> </ul>	<p><b>Objective “Promote 3R Practices and Strengthen Local and Regional Markets for Recycled Plastic”</b></p> <p><b>Activity 1.1 - Identify and initiate dialogue with key government stakeholders (national and local)</b></p> <p><b>Activity 1.2 - Share international and domestic best practices through virtual or in-person training and consultations</b></p> <p><b>Activity 1.2.4 - Provide data and technical assistance to begin developing or strengthening local SWMPs</b></p> <p><b>Activity 2.1 Increase uptake of 3Rs in CCBO engagement sites</b></p> <ul style="list-style-type: none"> <li>• 2.1.1 - Assess potential, locally viable technology and infrastructure solutions that may be recommended in future program years or support local/international decision making</li> <li>• 2.1.2 - Promote 3Rs by identifying and testing new local business models</li> </ul>

		<ul style="list-style-type: none"> <li>• 2.1.3 - Identify scalable best practices for the 3Rs</li> <li>• 2.1.4 - Establish opportunities for 3R market development by assessing current commodity and reuse markets, quality control specifications, and capacity</li> </ul>
<b>3) Reducing Sea-Based Leakage</b>	<ul style="list-style-type: none"> <li>• Reduce garbage coming from multiple locations</li> <li>• Bilateral and regional collaboration</li> <li>• Improve relevant technology for monitoring and collecting plastic debris from the ocean</li> </ul>	<p><b>Objective “Promote 3R Practices and Strengthen Local and Regional Markets for Recycled Plastic”</b></p> <p><b>Activity 1.2 (and all sub-activities)</b> – Support the development and/or strengthening of long-range SWM plans in engagement sites</p> <p><b>Activity 2.2.1</b> - Identify strategic actions for 3R/SWM and marine debris reduction in support of national plans</p>
<b>4) Reducing Plastic Production and Use</b>	<ul style="list-style-type: none"> <li>• Introducing plastic bag fee</li> <li>• Encouraging manufacturers to use recycled plastics as input</li> <li>• Producing more biodegradable plastics</li> <li>• Developing plastic tar-road</li> <li>• Waste to energy</li> </ul>	<p><b>Objective “Promote 3R Practices and Strengthen Local and Regional Markets for Recycled Plastic” &amp; Objective “Increase Capacity and Effective Governance of 3R/SWM and Recycling Systems”</b></p> <p><b>Activity 1.4 (and all sub-activities)</b> – Improve local implementation and enforcement of laws, policies, and regulations</p> <p><b>Activity 2.1 (and all sub-activities)</b> – Increase uptake of 3Rs in CCBO engagement sites</p> <p><b>Activity 2.3 (and all sub-activities)</b> – Engage the private sector on 3Rs</p>
<b>5) Enhancing Funding Mechanisms, Policy Reform and Law Enforcement</b>	<ul style="list-style-type: none"> <li>• Indonesia is structuring a budget to address the land-based management of waste over a period of 4 years with finance of up to 1 Billion USD</li> <li>• Policy reform based on NPOA</li> <li>• Law Enforcement</li> </ul>	<p><b>Activity 1.5 (and all sub-activities)</b> - Strengthen the financial sustainability of SWM in CCBO engagement sites</p> <p><b>Activity 2.3 (and all sub-activities)</b> - Engage the private sector on 3Rs</p>

## 5. Recommendations and Gap Identification

The following recommendations are made with the acknowledgment that this report is based on CCBO’s first-year work plan, with three additional program years to follow, and are meant to inform long-term

project planning. In terms of prioritization and timing, addressing historical barriers should come first and any projects related to data gathering, monitoring and assessment (especially if baseline data is desired before starting other projects). Furthermore, although addressing gender disparity and women's empowerment is described as its own unique approach, this, along with other livelihood considerations, should be incorporated into each program activity so that this is not an afterthought or add-on, but part of the overall CCBO context. Community engagement is also critical at all stages of the program; community involvement in this process will help to strengthen and build local partnerships while also ensuring sustainability and success long after the CCBO project ends. Finally, other partnership creation can be cultivated from initial years, but implemented in subsequent years after developing partnerships early to see if there is alignment with goals and initiatives. CCBO should continue to assess the regional context to leverage projects and programs conducted at those scales as well across all intervention points.

**Strengthening of Policy Frameworks and Enforcement in Local Contexts.** While efforts to establish 3R/SWM have been undertaken in the country, there are some doubts as far as their effectiveness. The national policies outlined in the NPOA-CMPD are expansive but provide a top-down approach that may not provide enough definitive actions for Local Government Units (LGUs), which bear the responsibility of SWM in Indonesia. Multiple pieces of literature in this report cite lacking institutional capability as well as a lack of funding to help municipalities improve existing 3R/SWM infrastructure. As a potential strategy for countering these challenges, the study recommends using improved policy measures applied in the 3R/SWM context and targeted at addressing administrative problems. These include aiming for improved livelihood, health, and safety for SWM workers, proper training and incentivization for increased motivation among workers, support from political leadership, education for and contribution from both the public and business communities. CCBO activities that assess implementation and enforcement of laws at the local level as well as conducting Trials of Improved Practices (TIPs) may help to identify ground level realities of political strategies and help to support and enhance regulations to make them more effective.

**Measurement and Evaluation.** The NPOA-CMPD plan details interests in Reducing Land-Based Leakage (pillar 2) and Reducing Sea-Based Leakage (pillar 3). A key strategy for meeting these objectives, particularly in the longer term, will likely need to include technical assistance that incorporates local data collection and analysis of existing 3R/SWM systems (or lack thereof) and potential strategies going forward. While many previous studies have focused on Indonesia's waste generation rates generally, there is typically little attention paid to the discrepancies and unique barriers that rural areas face. For example, while shipping waste to already existing recycling hubs in urban areas might seem like a good solution to decreasing land-based leakage, it could subsequently increase sea-based leakage. Potential solutions must take into consideration geography and local infrastructure capacities. Data collection over time will be particularly applicable for impact assessment and determine whether the country is meeting its goals and staying on track. Additionally, data collection will aid in developing regionally specific plans. The utility of CCBO's expertise in assessing gaps and barriers and developing effective policy is evident in this context. Gap Analysis of 3R/SWM Laws, Policies, and Enforcement Mechanisms could be implemented to monitor what works, what does not work, and what can be improved in real time. Knowledge of enforcement mechanisms from the initial review could be beneficial for analyzing national level 3R/SWM policies.

**Household Research.** The World Bank states that sustainable financing has proved to be problematic in Indonesia, as residents are unwilling to pay for poor waste services, while at the same time, cities and

municipalities are unable to procure necessary fee collection rates until their services improve (2014). CCBO can perform household-level research with TIPs to assess ability and willingness to pay, sort/segregate waste at the source, and other solutions to reduce waste leakage. This model is participatory and works with local partners to test adaptive behavioral alternatives. The current NPOA-CMPD plan does not address access to waste collection services, and poor and rural areas are still less likely to have access to waste collection services. We recommend addressing this divide in access to waste management services in the household research and TIPs studies.

**Scaling Community Engagement.** The World Bank notes that one of the main barriers to improving SWM in Indonesia is poor primary waste collection among communities. CCBO's model of engagement sites with projects across multiple modes of engagement with the 3Rs and SWM could be valuable in demonstrating effective policy. Plans developed by CCBO should be participatory and unique to individual community contexts. While education and community accountability are called for in Objective 1 of the NPOA-CMPD, it is mostly through somewhat vague high-level recommendations. CCBO could also explore models to engage local partners to quickly scale effective participatory approaches in conjunction with a national educational strategy. At a minimum, CCBO's research in sites across Indonesia could inform a clear call to action for the targeted education or training efforts called for in the NPOA-CMPD.

**Support for Livelihoods, Gender, and Safety Considerations.** Women are often involved in SWM in Indonesia, yet local governments do not typically address the safety concerns or health problems related to the working conditions. Notably, the NPOA-CMPD does not mention gender disparities associated with 3R/SWM or strategies for empowering women in waste, suggesting a gap in policy that if addressed could strengthen the health and safety for much of the workforce, provide formal recognition, and provide occupational protections. Potential CCBO activities that may address these issues include the TIPs model for increased safety, income, and living conditions among waste pickers. Research activities from CCBO that engage youth and women's organizations for implementing SBC plans, while also identifying ways to increase safety, income, and living conditions for waste workers could be useful for informing 3R/SWM developments in the country that are sensitive to local contexts and needs. Incorporating findings related to worker health and safety throughout the CCBO project will be highly beneficial.

**Climate Change and Natural Hazards.** Because of its archipelagic makeup, Indonesia has been increasingly susceptible to sea level rise, and its urban locations, particularly Jakarta, have been prone to extreme flooding in recent years. Thirteen major rivers flow through Jakarta, and these rivers have increasingly been bogged down with garbage and debris, resulting in increasing natural hazards. For example, landslides and flash flooding in Jakarta in January 2020 resulted in the deaths of dozens of people. Key CCBO activities that may address the challenge of resilient waste infrastructure in the country include technical assistance for strengthening 3R/SWM plans, developing local infrastructure solutions, and identifying ways to improve safety conditions for waste workers in the country, all of which offer context-appropriate and anticipatory implementation of 3R strategies in the country.

## Annex I. References

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