

**Benioff Ocean Initiative/Coca-Cola Foundation Project
Reducing River Plastic Waste in Kenya.**

Year 2 Report

Much of the second year of the project was also overshadowed by the global COVID pandemic, and the travel and movement restrictions that involved. Nevertheless, the project continued well, though with some required changes to sites and slow growth of the plastic re-purposing/remanufacturing operation, in part due to technical challenges. During the final third of the year, the overseas partner SVRG was able to travel to Kenya for the first time since February 2020, and provide more focused practical support to Chemolox on the ground.

The community engagement work, and riverside environmental improvement work has continued to be excellent during this year, and achieved much more than originally planned. The project is largely on-track. Volume of plastic extracted from the rivers is below the target (owing to slower than planned deployment of devices, overambitious target-setting, but mainly due to the success of public engagement greatly reducing the volume of waste in the rivers). Many other metrics are above target. Schools engagement was hampered by COVID.

We consider the project well positioned to enter year 3.

Detail

1.0 Site Survey & Evaluation

The Chemolox team surveyed and evaluated a further ten sites for River Plastic Capture Systems. For a variety of reasons, 6 of these, including 4 sites originally intended for the project, had to be discarded (mainly around challenges of accessing them). Nevertheless, surveys and permits were obtained for four new sites, in addition to the original 6 from year 1, and the environmental agencies have now granted Chemolox broader scope permits to operate anywhere on the relevant river systems.

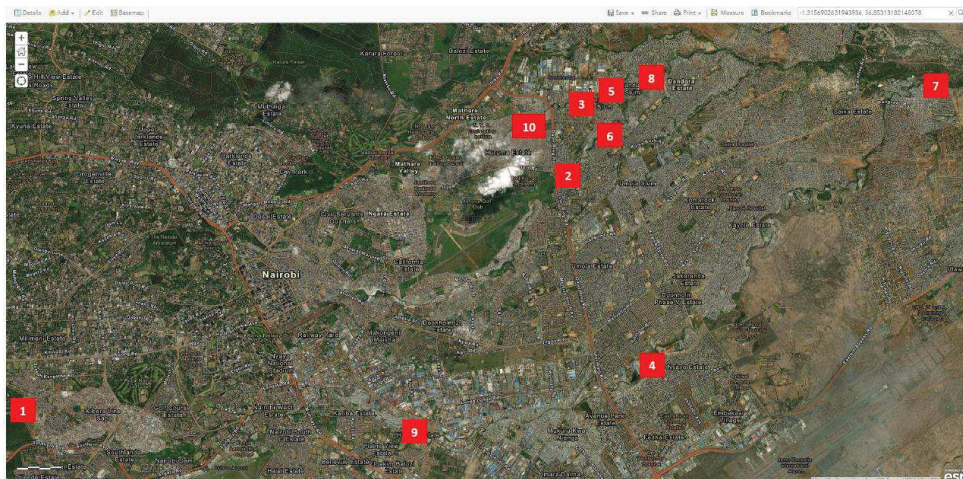


Fig 1: New sites (7-10) on a satellite image of Nairobi

2.0 Equipment Design and Development.

The team has continued to refine the design of passive plastic trapping technology, suitable for both small and medium-sized river environments, as well as designing, testing and implementing a second alternative electrically powered mechanical extraction system. Since these designs depend on grid electricity being available, and power cuts frequently disrupted their operation, the project team has designed, tested and implemented a further two manual extraction systems to remove trapped waste from the rivers. We still have plans for a fully-offgrid electrically powered system, which we aim to test at a new site in year 3 if access becomes possible.

2.1 Physical Plastic Capture Devices.

Plastic Capture Systems have now been installed in ten different river locations in Nairobi, both of the passive variety where the extraction from the river is done by hand with the help of community groups, and the active variety where plastic is extracted mechanically and by electrical power. The different locations include:

1) Kibra slum

Because of the size of the river in Kibra, there is no device installed here. But with the advent of the rainy season, the manual collection/clean-up activities will be complemented by a trap net being stretched across the small river to prevent any of the rubbish from being swept downstream.



2) Kiyambea

This is still Chemolex's main "research site" as well as being a key capture location on the Nairobi River, because of its proximity to the Chemolex offices. Two machines are installed here, the original conveyor design, and the improved bucket-lift design.



3) Kariadudu

This site on the Matheru River has the improved bucket lift device installed, and the Chemolex has also worked quite extensively with the community to eg prevent the local primary school from discharging raw sewage directly into the river.



4) Tassia

Originally this site on the Ngong River had one of the original conveyor devices installed. This was heavily damaged during last year's rainy season however, and changes to the riverbank profile made it difficult to install a new machine on the same site. The location has therefore moved slightly further downstream, where Chemolex is working with a new community organisation and has installed one of the new manual cantilever devices to remove plastic from the river.



5) Ngunyumu

This site on the Mathare River by the Ngunyumu and Misingo slums has one of the original conveyor belt devices installed. Chemolex is working with community groups on both sides of the bridge and river to remove waste from the river and riverside environments.



6) Komb Green

This site on the Nairobi River originally had one of the bucket lift devices installed, but due to issues with supply of power, this has not been replaced with a new vertical lift manual machine.



7) Njiru

One of the new sites, and the furthest downstream of any Chemolex site, this location has just had a manual cantilever device installed. Chemolex is working with community groups not only to operate the device and clean up the river, but also to encourage them to stop dumping refuse into the river in the first place.



8) Dandora

This new sites, next to the main municipal dumpsite for Nairobi, also has one of the new manual cantilever devices installed.



9) Industrial Area

This new site on the Ngong River has one of the new vertical lift devices installed. In conversation with community organisations and other local institutions, the device has been moved across the river in order to cause less disruption and concern to other community activities happening at the riverside.



10) Haruma

This new site on the Mathare River is very close to Chemolex's recycling facility, and serves to clear the river pollution in this particularly densely populated area. One of the manual cantilever devices is installed here.



Device Operation and Security.

Operation and security of the plastic extraction sites has been largely carried out in collaboration with community groups rather than by Chemolex staff. This engagement of the community has so far protected the sites, though we have experienced vandalism at a few sites. Since more community member than expected have been engaged, costs here have been higher than anticipated.

Device maintenance, including servicing and spare parts

So far, the installed devices have required only an expected amount of maintenance, however, some have been damaged by heavy rains and floods, and thus have required more extensive repair activity.

Continuous Device R&D

We continue to observe the performance of each device in situ, and optimize and adjust each design based on real-life use feedback. This year we produced two new designs of device.

Plastics Reprocessing Facility

In order to recycle and repurpose the waste material, we have both reached manufacturers of value-added products (such as floor tiles) and begun to work with women's organizations to produce crafts, as well as direct sales of sorted, cleaned waste plastic to third parties.

In order to begin the manufacture and marketing of the value added products, we spent a long time awaiting appropriate regulatory clearance and product quality assurance. In addition to the high quality plastic shredder to facilitate all the above activities, we now have a variety of other devices including a hydraulic press and hot plastic extruder. Towards the end of the year we begun manufacture, and are scaling this up and have some demonstration sites and projects.



Different designs of the pavement blocks produced by Chemlex Company from the Plastic waste



Extrusion/melting machine



Recycling facility

Plastic Waste Transportation Infrastructure

For most of the year, our requirement for transportation has involved taking the unrecyclable/ non-repurposed waste materials to landfills, and transporting the recycling material to the Chemolex store and recycling facility using rented transport. We continue to research alternative uses for all the waste material, to keep as much from landfill as possible. Late in the year we were able to acquire our own transport vehicle.

Technical and Political Advice

We have benefitted from appropriate technical and political advice during the first year of the project. In addition to this, the team in Kenya had to deal with the adverse consequences of threats and legal action from a former advisor, with whom settlement was finalized early in the year.

Communications and Outreach

Communication Strategy for the year 2021

While the year started positively, and on a high note, with hopes of the pandemic slowing down, there were still restrictions on several institutions especially with learning institutions like schools, colleges and universities. Our planned strategy was to visit at least 100 institutions to dissipate awareness on the impacts of plastic pollution through educational and informational campaigns. Through the strong network of our youth and women groups, we sought to use them as a powerful tool of word of mouth, ground activities as well as clean up campaigns to pass this crucial information to the communities they live and work in. In addition, we also strategically planned to exhaust the powerful media tool; social media, in engaging and informing different age groups of what Chemolex is doing, the impacts of poor waste management and the effect of plastic pollution on the rivers.

Activities

We have undertaken a robust and aggressive social media campaign focusing both online and offline media. With presence on all social media platforms including Facebook, Twitter, Instagram and LinkedIn, we have continued to share live videos, interviews, plastic data that we have captured and daily activities. Totally, we have reached an average population of **525522** over the course of one. Individually:

- Facebook we have had a total outreach of 236485
- Twitter we have had a total outreach of 157656
- Instagram we have had a total outreach of 131381

For the second half of the year, we came up with a Youtube channel that involves short videos where we identify a discussion topic amongst Chemolex's key deliverables. We also do a Q&A session where we answer some of the most pressing questions. Our team has also engaged in live interviews on national television like KTN and Switch TV, where we discussed on the state of our rivers, the effects of plastic pollution and how the masses can involve themselves in what Chemolex is doing. Our main focus in all our interviews includes the 3R's i.e Re-use, Repurpose and Recycle. We encouraged the public through a campaign dubbed "Wajibika" to be responsible of the plastic from the household level by sorting them into organic and inorganic. This is in a bid to curb the improper waste management currently experienced in the low income areas, and also where most of the waste ends up in rivers.

Stakeholder mapping

Chemolex Company has identified stakeholder groups that may be affected by and/or interested in the implementation of the Project, as well as proposed communication methods and media for each group, presented in Table 1.

- The National Environmental Authority (NEMA)
- Benioff Ocean Initiative and Coca Cola.
- County Government of Nairobi
- County Government of Kiambu
- Water Resource and Management Authority (WARMA)
- United Nations Environment Program Kenya (UNEP)
- Nairobi Metropolitan Services
- Politicians
- Local Community Leaders and Decision Makers
- Local Youth and Women Group
- Suppliers
- Project Team and Partners

Table 1:

STAKE-HOLDER	AREA OF ENGAGEMENT	PROJECT PHASE	STAKEHOLDER MANAGER	ENGAGEMENT APPROACH	ENGAGE TOOLS	FREQUENCY
BENIOFF OCEANS INITIATIVE	Funding and support	All	Benioff Team and Chemolex team	Report and assessments	Emails, Zoom calls, Field visits	Monthly
COCA-COLA	Co-funders/	All	Coca-Cola team lead	Report/Face to face interviews	visits, Emails Zoom Calls	Frequently
COUNTY	Act as oversight	At least a	Government	Consultations,	Phone	A month

STAKEHOLDER	AREA OF ENGAGEMENT	PROJECT PHASE	STAKEHOLDER MANAGER	ENGAGEMENT APPROACH	ENGAGE TOOLS	FREQUENCY
GVMTs:	bodies for the different rivers and water bodies that will be affected by our constructions	month before construction begins	officer in charge/ NEMA offices	regulation permits and authorizations	calls, email, visits	before said construction
NAIROBI	This is where most rivers and streams pass through: Nairobi, Ngong, Athi and Sabaki	All	NEMA county officer- Nairobi	Consult/ permit	Emails/phone calls/ Office visits	Frequently
NEMA	This is the authorizing body mandated with all environmental matters.	All	NEMA headquarters Nairobi.	Permits, authorization and assessments	Visits, emails, face to face, phone calls	Occasionally
WARMA	The regulatory body that comes up with water use policies and distribution	All	WARMA officers Nairobi	Permits/ Consultations, assessments	Emails, Phone calls Meetings	Quarterly.
UNEP	Environment body that specializes in the mitigation of pollution and climate change	All	UNEP officer- Nairobi	Consultations, partnerships,	Emails, Zoom, calls, visits, phone calls	Occasionally
NAIROBI METROPOLITAN SERVICES	Body mandated with improving key public services including spatial planning, waste management, and modernization	All	NMS offices	Partnership, consulting, assessments	Calls, office visits, Zoom calls,	Occasionally
POLITICIANS	Local political leaders with development interests within operating areas	Initial phases	Local offices	Permits, consulting	Calls, office visits	Occasionally
LOCAL COMMUNITY LEADERS & DECISION MAKERS	The direct people that our constructions may affect positively or negatively.	All	Local leaders and chiefs, village elders, "Nyumba-10"	Consult, advice, educate, participate, access, penetrate the community, pass message	Public participation, meetings, visits, public noticeboards, local media	Monthly
YOUTH & WOMEN GROUP	The vulnerable groups that we seek to empower and provide us with labor	All	Youth and women leaders	Educate, participate, employ,	Meetings, trainings, field work	Frequently

STAKE-HOLDER	AREA OF ENGAGEMENT	PROJECT PHASE	STAKEHOLDER MANAGER	ENGAGEMENT APPROACH	ENGAGE TOOLS	FREQUENCY
SUPPLIERS	Businesses and organizations that will provide us with all kinds of support and supplies.	Mid and final stages	Supply managers	Purchase, consult	Visits, phone calls and emails	Mid and final stages
PROJECT TEAM & PARTNERS	All the directors and people involved directly with oversight	All	Management	Official correspondence	Meetings, phone calls, emails, Whatsapp, Zoom meetings	Weekly

Youth Groups training & Sensitization

The youth and women groups we have been working with over the past two years have continued to be an integral part of the Chemolex system. They have greatly helped us and remain at the center of our success. To date, we have trained over 25 youth groups and empowered another 15 youth and women groups with local businesses and recycling/repurposing enterprises. In total we have reached over 1,500 youths and women and started ventures that are income generating for them. These businesses include recycling/repurposing ventures, waste management ventures, agribusiness ventures and others like construction of showrooms, collection points and car wash machines.

A good example is the Migingo Youth group who have a thriving vegetable farm, a Video showroom in their vicinity where they charge small fees for showing football matches. We have the Keyambea youth group who are running a successful public toilet and recycling club. We have the Greener Life Community group making handmade crafts from waste bottles and selling them through our platforms and contacts. We have the Kariadudu and Ngunyumu waste management group running an elaborate waste management system to curb plastic pollution and inappropriate dumping.

In addition, we have reclaimed dumpsites along the rivers where we work in and converted these areas to beautiful gardens and recreational facilities. The three most successful areas are Komb-Green, Ngunyumu and Greener life groups. We have converted such gardens from dirty and smell dumpsites to beautiful riverine gardens with grass, beautiful flowers, nice footpaths and benches where one can relax and have a beautiful view of the flowing river.

As a whole, we have managed to target a population of over 600,000 across the low income areas of Dandora, Kibera, Tassia, Njiru and Kariobangi. This is with the target of greatly reducing the improper waste management in these areas, and thereby reduce the ultimate dumping of plastic into the rivers passing through these spots.



Training session for all the Groups



Issuing of Certificates to Youths and Women Groups after the Training Session

Data Collection and Analysis

The team is manually collecting data from each site, reporting and analyzing it monthly. We have invested and installed more accurate measuring devices, and continue to experiment with options for automated data collection.

Licensing and Permits

Chemolex has obtained the necessary permits for all the operating sites. We have also obtained necessary permits for transporting and managing wastes and operating the recycling facility within Nairobi County.

Management and Operations

The project has been managed by Chemolex's senior management team of 8 people, responsible for management, operations, communications and finance.

Project Management and Oversight

SVRG has been overseeing project and financial management and contributing technical expertise, and since September 2021 have been able to spend time on the ground in Kenya with the local partner.

Travel

SVRG have carried out some travel. Since the conference was virtual, the Chemolex team did not travel internationally.

Metrics

Broad impact category	Indicator	Target	Year 2 achievement
Environmental	1. Plastics and other organic wastes captured in Nairobi-Athi river system	<p>1.1. In Y1 - 3,120 tons of waste captured</p> <p>1.2. In Y2 - 13920 tons of waste captured</p> <p>1.3. In Y3 - 14440 tons of waste captured</p>	<p>In 2021(Year 2) the total amount of plastic waste polymers collected and recycled by the Chemolex Company is 290.1 tons. This data only includes plastic wastes polymer trapped and captured from the various river sections and project sites where the plastic capture devices have been installed.</p> <p>The total amount of wastes(plastic, organics and all the various types of wastes) is 967 tons</p> <p>We ascribe this to a combination of over-ambitious initial target-setting, late implementation of some of the devices, but also to the success of our neighbourhood recycling programmes. We estimate that as a result now less than 20% of waste ends up in the river compared with the pre-project situation.</p>
Environmental	2. Increase in neighbourhood recycling in areas bordering Nairobi and Athi rivers	<p>2.1 100 neighborhood recycling points created by first year project</p> <p>2.2. 600 households recycle plastics by the end of the third year of the operation</p> <p>2.3. 200 tons/month of direct recycling collected by these households in year 3</p>	<p>150 strategic recycling points were established in 2021 which were operated by the households (+41 from year 1).</p> <p>According to the data collected by Chemolex organization in Dec 2021, 4900 households in the 10 project sites were directly involved in recycling and repurposing of plastic wastes generated from these households. This has therefore reduced the amount of plastic wastes dumped in the river athi and its tributaries by more than 80%.</p> <p>The households currently recycle up to 269.5 tons of wastes per month.</p>
Economic	3. Creation of direct employment opportunities	<p>3.1. Create 150 direct employment opportunities in Yr1</p> <p>3.2. generated up to 200 direct employment positions ourselves and in subcontractors by end of Yr3</p>	<p>In Year 2, we had 10 youths (5 young women) who were directly employed in the recycling facility to help in shredding, recycling and weighing of all the types of plastics wastes polymers.</p> <p>In the 10 sites where operated we had a total of 230 youths working to rehabilitate the riparian areas as well as securing and managing the plastic capture devices. (158 in year 1)</p> <p>The total number of people employed were therefore 240(84 were young women between 25-38 years)</p>

Broad impact category	Indicator	Target	Year 2 achievement																																										
Social	4. Creation of awareness on waste management and proper recycling techniques	<p>4.1. 10,000 participants in outreach and awareness programs by the end of year 1</p> <p>4.2. 30,000 youths and school going children sensitized on proper waste management by the end of year 2</p> <p>4.3 Further 100,000 people sensitized by social media and other indirect methods</p>	<p>In Year 2, we conducted a total of 11 community outreach and sensitization programs in the following locations;</p> <table border="1"> <thead> <tr> <th>Program</th> <th>Date</th> <th>Participants</th> </tr> </thead> <tbody> <tr> <td>Tassia</td> <td>23/01/2021</td> <td>165</td> </tr> <tr> <td>Njiru</td> <td>8/03/2021</td> <td>93</td> </tr> <tr> <td>Pipeline(Tassia)</td> <td>12/03/2021</td> <td>565</td> </tr> <tr> <td>Embakasi Mihango</td> <td>19/07/2021</td> <td>238</td> </tr> <tr> <td>Kariobangi(Pioneer 2)</td> <td>12/5/2021</td> <td>105</td> </tr> <tr> <td>Dandora Phase 4</td> <td>17/08/2021</td> <td>390</td> </tr> <tr> <td>Korogocho(Komb Green)</td> <td>21/09/2021</td> <td>86</td> </tr> <tr> <td>Korogocho(Komb Green)</td> <td>11/10/2021</td> <td>335</td> </tr> <tr> <td>Blue Kola (Greener Life)</td> <td>12/11/2021</td> <td>118</td> </tr> <tr> <td>Lucky Summer</td> <td>8/12/2021</td> <td>70</td> </tr> <tr> <td>Industrial Area (Mkuru Kwa Njenga)</td> <td>10/12/2021</td> <td>248</td> </tr> <tr> <td>Industrial Area (Mkuru Kwa Ruben)</td> <td>13/12/2021</td> <td>465</td> </tr> <tr> <td></td> <td>Total</td> <td>2878</td> </tr> </tbody> </table> <p>(17500 in year 1)</p> <p>As a result of the COVID 19 measures put in place by the ministry of health in different schools, we were not able to conduct any school visits in 2021.</p> <p>525,000 people reached by social media (as described in report above)</p>	Program	Date	Participants	Tassia	23/01/2021	165	Njiru	8/03/2021	93	Pipeline(Tassia)	12/03/2021	565	Embakasi Mihango	19/07/2021	238	Kariobangi(Pioneer 2)	12/5/2021	105	Dandora Phase 4	17/08/2021	390	Korogocho(Komb Green)	21/09/2021	86	Korogocho(Komb Green)	11/10/2021	335	Blue Kola (Greener Life)	12/11/2021	118	Lucky Summer	8/12/2021	70	Industrial Area (Mkuru Kwa Njenga)	10/12/2021	248	Industrial Area (Mkuru Kwa Ruben)	13/12/2021	465		Total	2878
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Broad impact category	Indicator	Target	Year 2 achievement
Social/ Economic	5. Creation of waste management social enterprises	<p>5.1. 100 community and youth groups trained in social enterprise opportunities in year 1</p> <p>5.2. 300 youths groups trained by the end of year 3</p> <p>5.3. By the end of the 3 years, 200 waste recycling projects will have been established by these groups</p>	<p>5 youth groups and 6 community based organizations were trained in 2021 (17 in year 1)</p> <p>All the youth groups and community based organizations established successful social enterprise</p> <p>We also established 250 strategic recycling points in various communities</p>
Environmental	6. Resource conservation as a result of waste recycling	<p>6.1 1000 tonnes/month of product sold/produced from collected wastes by project end</p> <p>6.2 1000 tonnes/month of natural resources (eg wood, charcoal) saved as a result of using recycled product</p>	500 pavement blocks were produced from the plastic wastes polymers(This was for testing and piloting in preparation for commercialization)
Economic	7. Revenue generation from collected waste recycling	7.1 \$40,000/month sales figures from waste products by project end	Not yet realised