HEINEKEN

HEINEKEN MALAYSIA BERHAD

Water Balancing Report 2020

OVERVIEW

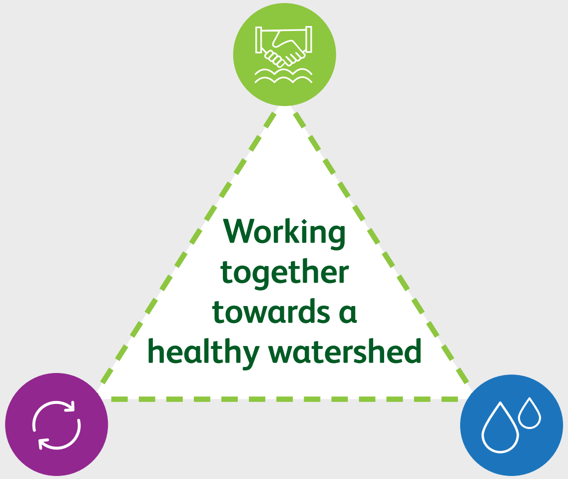
Without water, there will be no beer.

Water is an essential resource for our industry.

Protecting Water Resources is an important pillar in HEINEKEN's global Brew A Better World sustainability strategy.

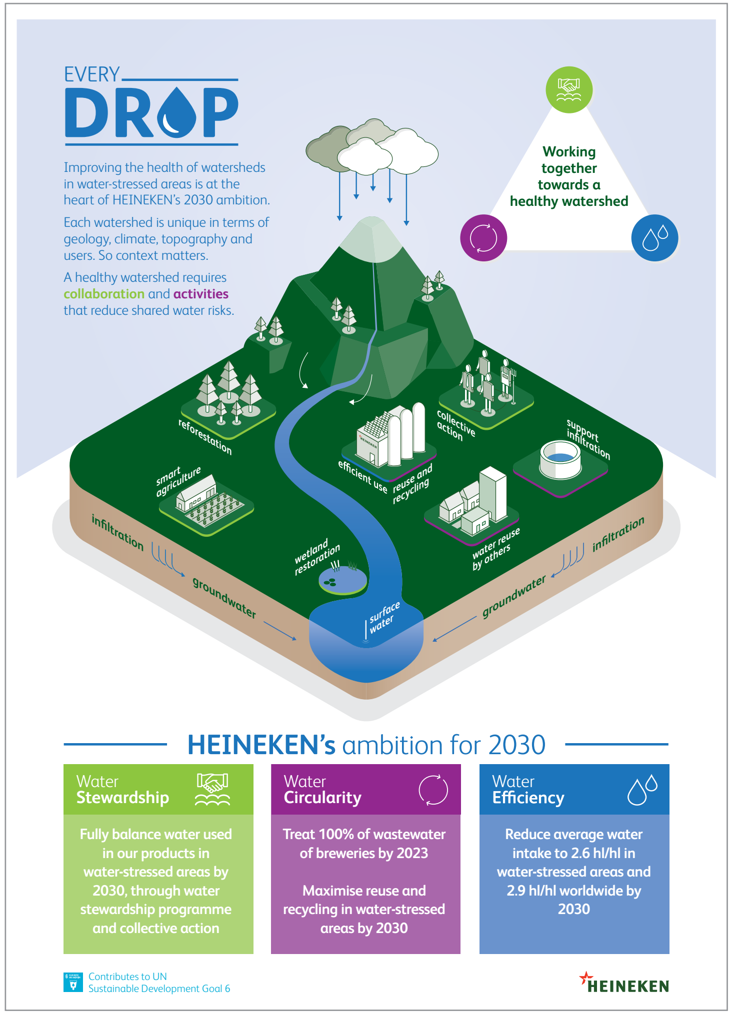
The HEINEKEN Every Drop water strategy ensures we look at water holistically:

Water Stewardship
to fully balance the water we use in our products



Water Circularity
maximize reuse and recycling of treated wastewater

Water Efficiency
minimise the usage of water in production



Striving to have a POSITIVE IMPACT

We will continue investing in science-based Water Stewardship initiatives for the long term to ensure the sustainability of our watershed.

Water is a crucial shared resource that must be protected. Based on projected demand, the world will face a 40% shortfall in fresh water supply within 10 years. Environmental sustainability is a key pillar of Brew A Better World, HEINEKEN's global sustainability strategy. Besides our bold commitments to become carbon neutral in production by 2030 and our entire value chain by 2040, we also focus our efforts in protecting healthy watersheds.

That is why in 2019, we launched Every Drop, our 2030 water strategy aimed at addressing our water vulnerabilities, especially in water stressed areas. We believe our long-term impact in water will be created by adopting three key principles of our 'water triangle': Water Stewardship (restore watersheds to absorb more water); Water Circularity (treat wastewater and reusing water); and Water Efficiency (using as little water as possible).

In Malaysia, I am proud to share that we've consistently improved our Water Efficiency over past years. Since 2014, we've reduced water consumption by 15.5% to 3.65 hectolitres per hectolitre (hl/hl) of beer we brew. Our target for 2030 is to reduce this by another 29% to 2.6 hl/hl. In terms of Water Circularity, we treat 100% of our wastewater beyond the standards required by the Department of Environment whilst continuing our efforts to maximise reuse and recycling of treated wastewater for non-potable use.

While improving efficiency and circularity are mainly confined within our brewery's operations, our Water Stewardship initiatives are carried out by our CSR arm SPARK Foundation, in collaboration with our partner, the Global Environment Centre (GEC). These initiatives enable us to balance the amount of water used in our products by replenishing water at source, rehabilitating rivers, reducing dependence on treated water through alternative water systems, as well as reforestation of carbon sinks to help retain more water for our watersheds.

Our efforts in protecting water resources over the years have now enabled us to fully balance water used to brew our beers and ciders. We have an ambitious target to balance 1.5 litres for every 1 litre of water used in making our products. In 2020, we achieved 267% versus our target. We are proud to reach this milestone 10 years ahead of our 2030 commitment, and we will continue investing in science-based Water Stewardship initiatives for the long term to ensure the sustainability of our watershed. I invite you to read this report to learn more about the impact created through our Water Stewardship initiatives.

Roland Bala
Managing Director
HEINEKEN Malaysia

Achieving real and LASTING CHANGE

Water is not an infinite resource. Water scarcity, wastage and pollution are real issues that confront the world and as a responsible brewer, we want to do our part to protect our watersheds. Through our CSR arm SPARK Foundation, we partner with the Global Environment Centre (GEC) to execute Water Stewardship projects that enable us to replenish and protect our water source, whilst reducing demand on treated water through alternative water systems for our communities. We are proud to give back more than what we take.

Our journey towards balancing more than 100% of water used in our products began in 2007. SPARK Foundation's collaboration with GEC has created significant impact along the way. Together, we've helped rehabilitate 5 rivers (Sg Penchala & Sg Way in Selangor and Sg Buntong, Sg Senam & Sg Kledang in Perak), engaged 180 local communities and over 54,000 Malaysians in river rehabilitation programmes, built 16 river care communities, and invested over RM13.5 million in W.A.T.E.R Project outreach programmes.

These Water Stewardship initiatives help balance the amount of water used in making our products, and I am proud that in 2020 we had achieved our 2030 target 10 years ahead of the goal. The initiatives that we carried out and maintained over the years have been quantified and independently verified by LimnoTech, a leading international environmental science and engineering firm based in the USA, who applied methodologies consistent with the Volumetric Water Benefit Accounting (VWBA) approach published by the World Resources Institute in 2019.

This report details the impact of our Water Stewardship initiatives, which resulted in more than 545 million litres of water being balanced in the Sungai Selangor and Sungai Penchala watersheds in 2020. Key initiatives include:

- **Rehabilitation of Sungai Way river**, an urban river in an urban industrial zone, resulting in the improvement of the river's water quality from Class IV – V (extremely polluted, not suitable for living organisms) to Class III (suitable for living organisms)
- **Construction of a 305-metre clay dyke** at the Raja Musa Forest Reserve that stores up to 136.1 million litres of water annually, contributing to the long term sustainability of Sungai Selangor
- **Installation of over 1,000 water thimbles for more than 500 households** in the Klang Valley, which resulted in water savings of 19 litres per capita per day on average
- **Installation of 16 rainwater harvesting systems for communities** in Selangor, thus providing them with an alternative water source and reduce reliance on treated water for non-potable usage as well as relieving pressure on our water resources
- **Reforestation of one hectare of degraded peatland** at the Raja Musa Forest Reserve, which reduces the risk of peat fires and increases the peatland's water table, contributing to the health of Sungai Air Hitam within the Sungai Selangor watershed

We recognise that the impact of Water Stewardship initiatives will need to be amplified through wider participation and action from various stakeholders. I take this opportunity to call upon other industries to start looking into sustainable water management practices. With collective action, we can be part of the solution to safeguard the sustainability of water supply for all.

Renuka Indrarajah
Corporate Affairs & Legal Director, *HEINEKEN Malaysia*
Trustee, *SPARK Foundation*

2030 Water Ambition for HEINEKEN Malaysia

Water **Stewardship**	Fully balance water used in our products in water-stressed areas by 2030, through water stewardship programme and collective action
Water **Circularity**	Treat 100% of wastewater of breweries by 2023 Maximise reuse and recycling in water-stressed areas by 2030
Water **Efficiency**	Reduce average water intake to 2.6 hl/hl in water-stressed areas and 2.9 hl/hl worldwide by 2030

WATER STEWARDSHIP GOAL IS ACHIEVED THROUGH

SPARK FOUNDATION | WATER PROJECT

CSR arm of Heineken Malaysia Berhad in partnership with Global Environment Centre (NGO)

WATER STEWARDSHIP AND WATER BALANCING DEFINITION

EVERY DROP

What is Water Stewardship?

- The socially equitable, environmentally sustainable and economically beneficial use of freshwater, achieved through a stakeholder-inclusive process that involves site-and catchment-based actions.

What is Water Balancing?

- Organisational goal or target to balance a volume of water equal to what is consumed by the organisation, through interventions in catchments and communities outside the four walls of the organisation.

Source: Volumetric Water Benefit Accounting (VWBA) by World Resources Institute (https://www.wri.org/research/volumetric-water-benefit-accounting-vwba-method-implementing-and-valuing-water-stewardship)

HEINEKEN Malaysia Target:

Balance Volume (m^3) = Water Intake (m^3) – Treated Effluent (m^3)

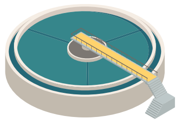
Balancing amount to be more than water used in our products

1 litres of water per litre produced plus unavoidable losses from evaporation and moisture included in by products like spent grains (~0.5 litre per litre)

Target Water Balancing 2020
(1.5 x water used in our products)

Watershed supplies water to communities and industries

Water consumption for production activities



100% of wastewater treated beyond standards of DoE

WATER PROJECT

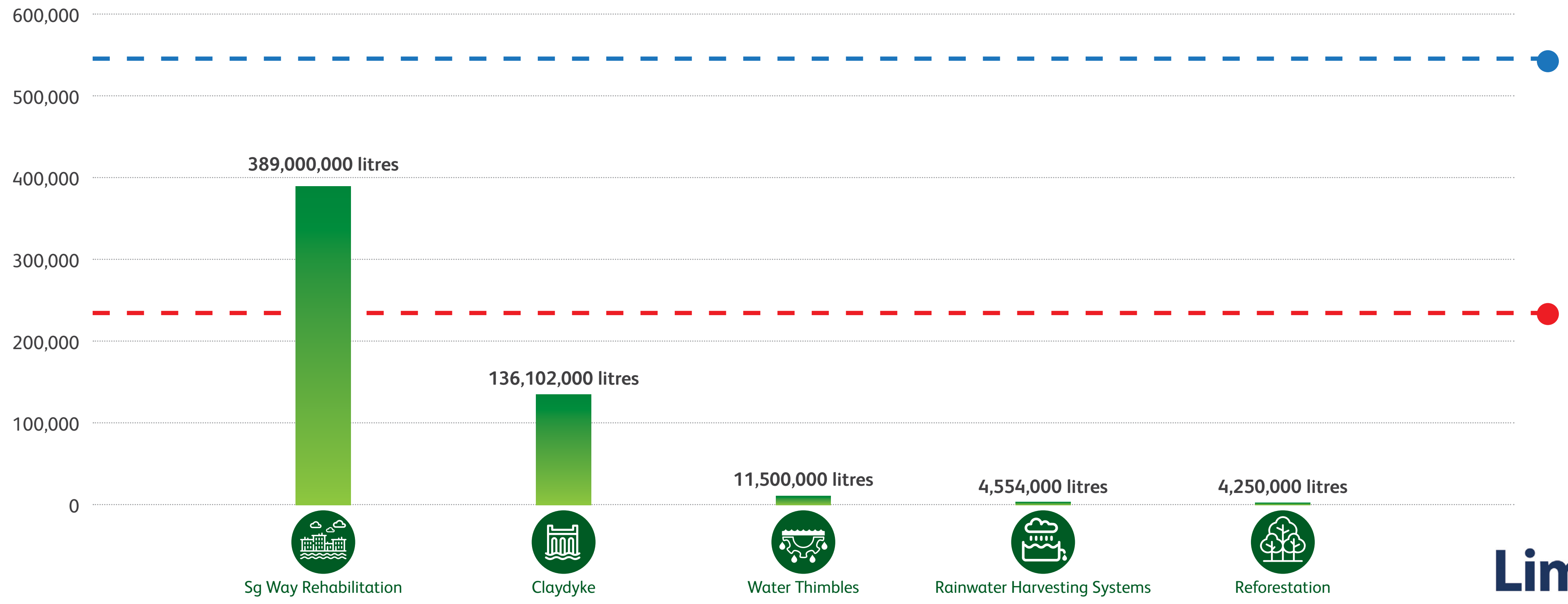
Water that goes to our products is replenished through water balancing programme.
1.5 litres of water is replenished for every 1 litre used in our products.

Long term watershed health protection

WATER BALANCING ACHIEVEMENT

In 2020, HEINEKEN Malaysia achieved 267% of our target balancing volume

2020 Water balancing achievement through Water Stewardship initiatives



Water Balancing Achievement
545,406,000 litres

267% vs 2020 target

Water Balancing Target
204,399,000 litres

Note:
Target= 1.5 x water used in our products

Water Balancing volumes are measured & quantified in line with the Volumetric Water Benefit Accounting (VWBA) framework by the World Resources Institute.
HEINEKEN Malaysia's water balancing volumetric benefit evaluation is independently verified by LimnoTech, a leading water sciences and environmental engineering consulting firm based in the United States.

LimnoTech
Water Environment | Scientists Engineers

KEY HIGHLIGHTS OF 2020 Water Balancing INITIATIVES

Sungai Way River Rehabilitation

WHERE

Sungai Way river

Petaling Jaya

WHY

Located next to HEINEKEN Malaysia's Sungei Way Brewery, this is where our **treated wastewater is discharged**

WHAT

Transformed water quality from Class IV-V (extremely polluted) to Class III (suitable for living organisms)

HOW

- Pollution reduction: point source mapping, rubbish traps, solid waste monitoring
- Water quality improvement: food oil grease (FOG) traps systems and biological treatment
- River within river concept/ Constructed wetlands to improve quality of water in the river

RESULTS

Reduction in pollution

- Improved habitat and biodiversity

VOLUMETRIC WATER BENEFIT

389,000 m^3

(389 million litres)

The full report can be read on page 16

Construction of Clay Dyke for Water Retention

WHERE

Raja Musa Forest Reserve
Hulu Selangor

WHY

Sungai Selangor watershed
as a key water resource

WHAT

Constructed
305-metre clay dyke
at Raja Musa Forest Reserve

HOW

- Built 4-5 meters vertical wall of clay below the peat surface to prevent peatland fires by promoting wetter soil conditions
- Retain water from flowing to disused mining ponds effectively raising water table in the peatland
- Expected to block water flow from the peatlands into the mining pond, effectively raising the water table in the areas up-gradient to the dyke

RESULTS

- Increase in soil water retention
- Decrease in the risks of peatland fires
- Restoration of peatland, contributes to the long-term sustainability of the watershed

VOLUMETRIC WATER BENEFIT

136,102 m³
(136 million litres)

The full report can be read on page 24

Water Thimbles Project, Low Cost Water Saving Innovation

WHERE

Klang Valley

WHAT

Low cost
water-saving devices, small, silicon discs are installed into faucets and shower heads to decrease flow and reduce water use

RESULTS

Water consumption savings of
19 litres per capita per day

WHY

To reduce treated water consumption

HOW

Over 1,000 water thimbles
were installed in more than 500 households

VOLUMETRIC WATER BENEFIT

11,500 m^3
(12 million litres)

The full report can be read on page 34

Rain Water Harvesting for Local Communities

WHERE

Klang Valley

WHAT

Rainwater Harvesting System

consists of an interconnected rooftop area that serves as a catchment for the rainwater and storage tanks to collect and store rainwater

RESULTS

- Reduced demands on treated water source
- Rainwater harvesting systems are linked to 10 community farming projects which helps in supplementing income and food

WHY

Help communities

get access to alternative water sources to reduce reliance on treated water

HOW

- The rainwater collected serves as non potable water supply including cleaning, landscaping and irrigation
- Increase water availability in the local community to reduce wastage on treated water and stress on our water resources

VOLUMETRIC WATER BENEFIT

4,554 m^3

(5 million litres)

The full report can be read on page 39

Reforestation of Degraded Peatland

WHERE

Raja Musa Forest Reserve

Hulu Selangor

WHAT

600 trees planted

and maintained on one hectare of degraded peatland

RESULTS

- Offsets 2,000 tonnes of soil carbon
- Prevent further degradation of the peat
- Increased soil water retention

WHY

Prevent peatland fires

by promoting wetter soil conditions

HOW

- Open planting techniques
- Cleared invasive weeds and plants

VOLUMETRIC WATER BENEFIT

4,250 m^3

(4 million litres)

The full report can be read on page 46

Water Balancing Project Benefit

FULL REPORT 2020

Executive Summary by LimnoTech

HEINEKEN MALAYSIA WATER BALANCING PROJECTS – VOLUMETRIC BENEFIT EVALUATION

HEINEKEN's Every Drop strategy aims to make a positive contribution to secure the health of local watersheds. As part of this strategy, Heineken Malaysia Berhad, a subsidiary of HEINEKEN International, has set an ambitious 2020 water balancing target to fully balance the water used in production by implementing high impactful water stewardship projects. The HEINEKEN Malaysia's water balancing target is based on 1.5 times the 2020 production volume. HEINEKEN Malaysia exceeded this target by funding five water stewardship projects that delivered about 545,406 cubic meters of volumetric benefit. The volumetric benefit evaluation was conducted by LimnoTech, a leading water sciences and environmental engineering consulting firm based in the United States.

The water stewardship projects implemented by HEINEKEN Malaysia vary by type and include rehabilitation of Sungai Way River, construction of a 305-meter clay dyke, installation of water thimbles in households, installation of rainwater harvesting systems for the local communities and reforestation of a degraded peatland.

Science-based, industry standard methodologies, consistent with the Volumetric Water Benefit Accounting (VWBA) framework published by the World Resources Institute were applied to quantify the water balance benefits of these water stewardship projects. The Sungai Way rehabilitation project was implemented to improve its water quality from Class V – IV to Class III local water quality standards. The water benefit for the Sungai Way project was calculated as the annual volume of polluted water restored to achieve Class III suitable for living organisms. At the Raja Musa Forest Reserve, Hulu Selangor, a 305-meter clay dyke was constructed in a peatland to promote wet soil conditions and increase water storage capacity. The water benefit associated with the clay dyke project was calculated as the additional volume of water stored in peat soils. Water thimbles, which are low-cost water saving devices were installed in households to reduce water use. Water benefit associated with thimbles was estimated as the reduced withdrawal volume. Rainwater harvesting systems were installed in the local communities to enhance water availability and reduce dependence on treated water for non-potable use. The water benefit associated with the rainwater harvesting systems was calculated as the annual volume of rainwater captured. At the Raja Musa Forest Reserve, Hulu Selangor, 1 hectare of peatland were reforested to preserve the peat swamp. The water benefit associated with peatland reforestation was calculated as the avoided loss of soil water storage.

The volumetric benefit quantification process involved reviewing the project information, gathering data, selecting an appropriate method based on project type, and conducting the evaluation. After completing the evaluation, benefit summary reports are developed containing relevant project details including background and objectives, pictures, quantification method, data, and results. The summary reports are finalised after addressing comments and feedback to HEINEKEN and its partner.

LimnoTech
Water Environment | Scientists Engineers

Water Project: Sungai Way River Rehabilitation

Sungei Way, Petaling Jaya, Malaysia

SUMMARY

Heineken Malaysia Berhad is a subsidiary of Heineken International (HEINEKEN N.V.). HEINEKEN N.V. is committed to promoting sustainable water use in watersheds where its breweries are located.

HEINEKEN N.V. aims to achieve water balancing by the production units that are located in water-scarce and water-stressed areas. Heineken Malaysia Berhad operates at the Sungei Way brewery in Petaling Jaya, Selangor. HEINEKEN has identified the Sungei Way brewery as being in a water-stressed area. This report describes the water balance benefits of Sungai Way river rehabilitation activities that was implemented to achieve water balancing goals for the Sungei Way brewery. A summary of 2020 volumetric water benefits of this activity and its contribution towards the 2020 and 2030 balancing goals is provided in Table 1.

Table 1. Summary of water balance benefits.

Year	Activity	2020 Benefit (m^3)	Balancing Goal (m^3)		Progress vs. Goal (%)	
			2020	2030	2020	2030
2012 - 2020	Sungai Way River Rehabilitation	389,000	204,399	429,144	190.3%	90.6%
TOTAL		**389,000**			**190.3%**	**90.6%**

Water Project: Sungai Way River Rehabilitation

Sungei Way, Petaling Jaya, Malaysia

Project Background

Sungai Way channel is situated in Petaling Jaya, Selangor. It is 12km long and 100% of the river has been concrete-channelized (therefore it looks like a drain). The channel begins as two small, separate channels in the SS1 area and meets to converge into one main channel in SS9 just before it flows underneath the Federal Highway and empties into the Penchala River. The land is mostly flat and highly developed. Sungai Way 'services' all the immediate neighborhoods in the area, draining and channeling all excess water into its channel.

Water quality in Sungai Way river has been adversely impacted by pollution from numerous sources of solid and liquid waste. The common pollution sources include domestic discharge, effluents and industrial/commercial waste (GAB, 2011). Surface water quality of Sungai Way had been classified as between Class V – IV (Class V indicates the worst water quality). The channel once served as a habitat for the diverse fauna and flora. Water quality deterioration had negative impacts on biodiversity. Sungai Way river had undergone substantial physical transformation from a natural to permanently concrete channel.

The W.A.T.E.R Project was established in 2007 to rehabilitate the Sungai Way channel and restore its water quality. The W.A.T.E.R project was initiated by the SPARK Foundation, the corporate social responsibility arm of Heineken Malaysia. Other project partners include the Global Environment Centre, government agencies and the local community.

Project Objectives

- The primary objectives are to improve water quality and enhance the aesthetic value of the Sungai Way river channel, increase awareness and develop a community participation model.

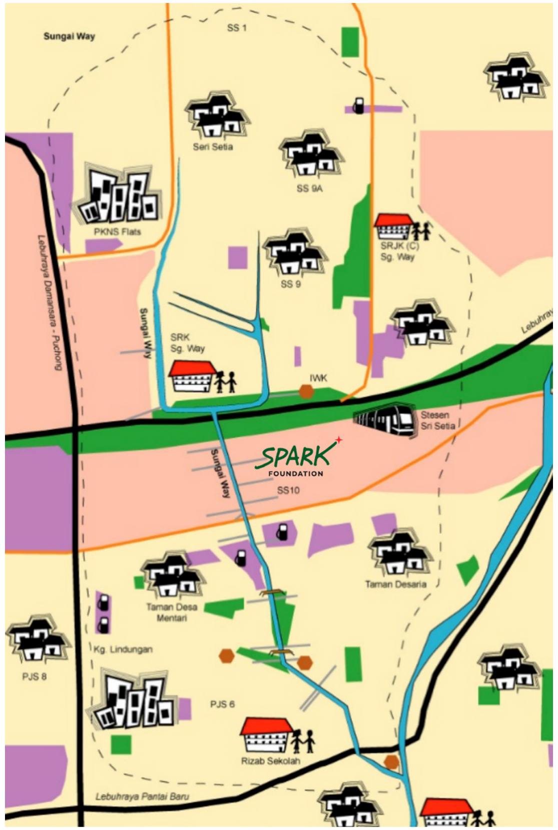


Figure 1. Schematic of Sungai Way channel in Petaling Jaya, Selangor

Water Project: Sungai Way River Rehabilitation

Sungei Way, Petaling Jaya, Malaysia

Project Activities

Several pollution reduction and treatment activities were implemented to improve the water quality of Sungai Way river. These are described as below.

Pollution reduction: point source mapping, rubbish traps, solid waste monitoring

- Point source mapping was carried out initially to identify the possible source of pollution to the Sungai Way. Point source mapping and education was funded from 2007 – 2017. This activity included training of select community members known as RIVER Rangers who are well versed on identifying pollutions. RIVER Rangers observe any solid waste or pollution activities and notify either Community Leader, Global Environment Centre or Heineken Community Engagement personnel.
- Rubbish traps and solid waste collection infrastructure was installed in upstream (in 2009) and downstream (2010) areas of Sungai Way.

Water quality improvement: food oil grease (FOG) traps systems and biological treatment

- Food, Oil and Grease (FOG) traps are designed to separate and capture waste fats, oils, grease (FOG) and food waste before they enter the drain and sewers. FOG traps are needed to stop these wastes from clogging the drains and sewers and to prevent environmental pollution of the waterways. Food, oil and grease traps were installed at one restaurant in Desa Mentari and in Seri Setia wet market in SS9 to reduce FOG pollutions in the streams (Figure 3).
- The biological treatment, include the use of microorganisms and wetland cells to improve water quality. The effective microorganism (EM) technology is used for treatment. The EM technology uses naturally occurring microorganisms which are able to purify and revive nature. Applications of EM using the formula known as effective microorganism activated solution (EMAS) have been experimented in several water bodies in Malaysia (Zakaria et al., 2009). The basic purpose of EM is the restoration of healthy ecosystem in water by using mixed cultures of beneficial and naturally-occurring microorganism. The EM is applied via spraying of the EMAS or throwing in of EM mudballs. The EM mudballs are made by mixing ordinary clay, red earth or top soil with EMAS. The EM mudballs prevent the growth of algae, break down sludge, suppress pathogens, and eliminate the foul odors caused by high levels of ammonia, hydrogen sulfide and methane. Besides, EM technology also helps control the levels of total suspended solids (SS), dissolved oxygen (DO), chemical oxygen demand (COD), biological oxygen demand (BOD) and pH.
- This project implemented Wetland Island to improve water quality. Wetland islands serve as biological filtration unit. Wetland islands are group of phytoremediation potential plants planted with support of gabion structures with stones for anchoring. Gabbions together with plants are anchored in riverbed. The initial plants were used were *Typhonodorum lindleyanum, Hanguana malayana (Jack) Merr. and Cyperus alternifolius*. Over the years, *Cyperus alternifolius* succeed over other species and surviving till now. Riffles and pools created before and after each island act as physical filtration unit as well as increase aeration and promote higher dissolved oxygen concentration in the channel.

FOG Trap

EMAS Solution

Water Project: Sungai Way River Rehabilitation

Sungei Way, Petaling Jaya, Malaysia

In addition to pollution prevention and water quality improvement, riparian tree planting and riffles and pools were created for enhancement of river ecosystem.

The specific locations of the pollution reduction and treatment activities implemented in Sungai Way river are shown Figure 3.

Figure 2. Wetland cells implemented in Sungai Way river

Figure 3. Locations of pollution reduction and treatment activities in Sungei Way

Figure 4. Locations of rubbish trap and log boom

Water Project: Sungai Way River Rehabilitation

Sungei Way, Petaling Jaya, Malaysia

Project Timeline

- 2007: Project initiation
- Year of initial VWB claim: 2019

Several partners are involved in this project including Petaling Jaya City Council, Department of Irrigation and Drainage Malaysia, Department of Irrigation and Drainage Selangor, Selangor Water Management Authority, Department of Environment, Fisheries Department, National Unity and Integrity Department, Indah Water Konsortium. The activities supported by the various partner agencies as listed in the following.

Long term Partners / One off Collaborator	Activities conducted
Department of Irrigation and Drainage, Petaling Jaya	▪ Built new rubbish log boom and maintains it (see Figure 4 for location) ▪ Build rubbish trap
Petaling Jaya City Council	▪ Maintenance of rubbish traps in Sg. Way ▪ Monitor and act on pollution cases involving Sg.Way river basin
The Star, leading English news publication in Malaysia	▪ Had river clean ups at least 2 times, partnering under the W.A.T.E.R project *(https://www.thestar.com.my/metro/community/2015/02/06/getting-dirty-today-for-a-cleaner-tomorrow-more-than-100-volunteers-learn-the-importance-of-preventi)*
Indah Water Konsortium Sdn. Bhd, Malaysian national wastewater and sanitation company	▪ Carried out river clean-up programme in 2015 and river awareness programme in 2019. *(https://www.thestar.com.my/metro/community/2015/02/06/getting-dirty-today-for-a-cleaner-tomorrow-more-than-100-volunteers-learn-the-importance-of-preventi)*
Department of Environment, Selangor	▪ Monitor and act on pollution cases involving Sg.Way river basin through issuance of warning letter on pollution reporting and illegal dumping. ▪ One of the key actions under the partnership was sending out a letter on the WATER Project umbrella to urge players to maintain their effluent discharge quality
Others	▪ Over the years, a number of Industries have increasingly compliance to the effluents standards as local Government has in place regulation on effluent Environmental Quality (Industrial Effluent) Regulations introduced in 2009 as well implementation of Guided Self-Regulation (GER) as environmental mainstreaming (EM) tool to monitor the industries.

Water Project: Sungai Way River Rehabilitation

Sungei Way, Petaling Jaya, Malaysia

- Monitoring and maintenance: The following monitoring and maintenance is noted.
  - Periodic maintenance work has been carried on wetland islands to remove accumulated silt and to maintain optimal performance
  - Water quality is routinely monitored twice a year in the Sungai Way river channel to ensure Class III water quality is met.
  - Training has been provided to community members on river monitoring, pollution mapping, water auditing and solid waste auditing and pollution reporting to agencies.
  - A working group committee formed in 2007 is headed by Department of Irrigation and Drainage (DID) and consist of multiple stakeholders. Project updates including progress and issues are discussed with the working group frequently through WhatsApp communication and biannual project working group meeting.
  - Establishment of river care community groups contribute to water quality improvements in terms of reduction of sullage and solid waste ending up in the river.

Project Costs

HEINEKEN cost share: 50%

- Total cost: Not available
- HEINEKEN cost: $693,000 USD

Note: This SPARK Foundation's W.A.T.E.R Project involved several governmental agencies and private stakeholders. The overall project cost is not known as Heineken Malaysia does not have access to confidential budget allocation details. However, a larger portion of the project funding was provided by Heineken Malaysia through the SPARK foundation. Therefore, conservatively, for the purpose of water benefit allocation, a 50% cost-share was assumed.

Volumetric Water Benefit Calculation

Methodology

The water benefits were calculated as the annual volume of polluted water restored to targeted local water quality standards.

Water benefit (m^3/yr) = Volume of polluted water restored to water quality standard (m^3/yr)

Data & Assumptions

Water Quality Standard

The applicable water quality standards are provided in Table 1 below. The Malaysia Department of Environment (DOE) has set a water quality index (WQI) as a basis for classification of water quality for Malaysia. A Water Quality Index (WQI) ascribes quality value to an aggregate set of measured parameters. Six water quality parameters are used to determine the level of water quality using Malaysia Water Quality Index (WQI). The biochemical oxygen demand (BOD5), chemical oxygen demand (COD), total suspended solid (TSS), ammoniacal-nitrogen (NH3-N), pH and dissolved oxygen (DO) are the six parameters used for WQI index calculation. As a result of WQI calculation, surface water quality is classified into Class I to Class V. Class I indicates a good water quality and the quality declines as the class is higher.

Water Project: Sungai Way River Rehabilitation

Sungei Way, Petaling Jaya, Malaysia

Class	Uses
I	▪ Conservation of natural environment ▪ Water supply I – practically no treatment necessary (except by disinfection or boiling only) ▪ Fishery I – very sensitive aquatic species
II A	▪ Water supply II – conventional treatment required. ▪ Fishery II – sensitive aquatic species
II B	▪ Recreational with body contact
III	▪ Water Supply III – advanced treatment required, ▪ Fishery III – common (economic value) and moderately tolerant species ▪ Livestock drinking
IV	▪ Irrigation
V	▪ None of the above

Water Quality Index (WQI)	UNIT	CLASS				
		I	II	III	IV	V
	-	< 92.7	76.5 - 92.7	51.9 - 76.5	31.0 -51.9	> 31.0

Water Quality Monitoring

Surface water monitoring results in the Sungai Way showed substantial improvements in water quality due to project implementation (Figure 4). The WQI for the Sungai Way from 2009 (pre-project implementation) and 2010 and beyond (post-project) are shown below. Following restoration, the WQI showed continuous improvements from Level V and IV to level III.

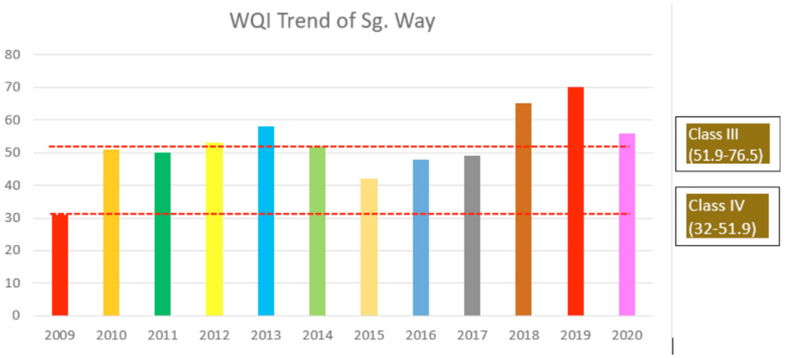


Figure 5. Results of surface water quality monitoring at Sungai Way

Volumetric Flow

Flow rate measurements are not available for Sungai Way. The Sungai Way channel is located within the Penchala Basin. The Penchala basin is heavily urbanized and share similar characteristics to the Sungai Way basin. Flow data reported for Penchala (Fadzilah, 2017) is scaled to the Sungai Way system using the drainage area ratio. The drainage are for Penchala basin is 50 km$_2$ (Fadzilah, 2017; Usman et al., 2014). Using Google Earth, an approximate drainage area for Sungai Way is estimated as 1.5 km$_2$, which results in a drainage area ratio of 0.03 (i.e., 1.5/50). The following steps are used in the calculation for flow through Sungai Way.

- Base-flow reported for Penchala (Fadzilah, 2017) = 2 m^3/s [Note: minimum discharge reported for the Penchala River during May 2013 is considered as the base flow.]
- Drainage area ratio = 0.03
- Estimated average flow for Sungei Way = 0.06 m^3/s = 5,184 m^3/day

Water Project: Sungai Way River Rehabilitation

Sungei Way, Petaling Jaya, Malaysia

Calculation

The volume treated to Class III water quality standards is calculated based on estimated flow for Sungai Way. Class III water quality is achieved for the surface water at Sungai Way throughout the year. Conservatively, only the dry season (i.e., 5 months from Feb – June, approximately 150 days) is considered in the volume calculations.

The volume treated is calculated as follows:

- The daily average flow is 5,184 m^3/day.
- Annual volume treated = 5,184 m^3/day x 150 days = 777,600 m^3 = 778 ML

Volumetric Water Benefit (2020)

- Total Benefit: 778 ML/yr
- HEINEKEN Benefit (based on cost share): 389 ML/yr

Volumetric Water Benefit Duration

- The maximum volumetric water benefit duration for this project is 10 years, with the year of initial claim (2019) counted as Year One. Therefore, if there is annual evidence that this project is functioning as intended (i.e., water quality maintained at Class III), benefits can be counted through the end of 2029.

Complementary Indicators

- Reduction in pollution
- Improved habitat and biodiversity
- Enhanced aesthetic value of the Sungai Way
- Total beneficiaries from 2012 - 2020

Year	Number of people engaged and educated	Number of active stakeholders’ groups
2012	500	-
2013	800	7
2014	1,300	10
2015	1,800	14
2016	1,300	34
2017	1,300	48
2018	3,280	16
2019	5,732	14
2020	2,590	23
TOTAL	**18,602**	**166**

Notes

- For volumetric water benefit claims to count in future years, monitoring and maintenance activities should continue as described in this Benefit Summary. Water quality should be routinely monitored to ensure compliance with Level II water quality standards.

References

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Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

SUMMARY

Heineken Malaysia Berhad is a subsidiary of Heineken International (HEINEKEN N.V.). HEINEKEN N.V. is committed to promoting sustainable water use in watersheds where its breweries are located.

HEINEKEN N.V. aims to achieve water balancing by the production units that are located in water-scarce and water-stressed areas. Heineken Malaysia Berhad operates the Sungei Way brewery in Petaling Jaya, Selangor. HEINEKEN has identified the Sungei Way brewery as being in a water-stressed area. This report describes the water balance benefits of a clay dyke project that was constructed to achieve water balance goals for the Sungei Way brewery. A summary of 2020 volumetric water benefits of this activity and its contribution towards the 2020 and 2030 balancing goals is provided in Table 1.

Table 1. Summary of water balance benefits.

Year	Activity	2020 Benefit (m^3)	Balancing Goal (m^3)		Progress vs. Goal (%)	
			2020	2030	2020	2030
2020	Clay Dyke	136,102	204,399	429,144	66.6%	31.7%
TOTAL		**136,102**			**66.6%**	**31.7%**

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Project Background

Malaysia is rich in water resources; however, in recent years the water supply situation has changed from relative abundance to one of scarcity. In Selangor State, areas around the Raja Musa Forest Reserve have seen the local water table lowered by the tin, clay and sand mining activities to the south east of the North Selangor Peat Swamp Forest (NSPSF). This alteration to the local hydrology causes significant drainage in the adjacent forest reserve, resulting in this location being repeatedly burnt and becoming one of the highest fire prone locations in the NSPSF (Figure 1).

The selected project area, near Forest Compartment (FC) 102, has been degraded and requires increased water retention in order to prevent further fire occurrences as well as to encourage natural regeneration (Figure 2). When peatland fires occur (Figure 3), large amounts of water are required to extinguish the fires. Avoiding these fires through increased water retention in the peatland can therefore reduce these water withdrawal pressures caused by the fires and consequently increase water availability for other uses, including domestic consumption.

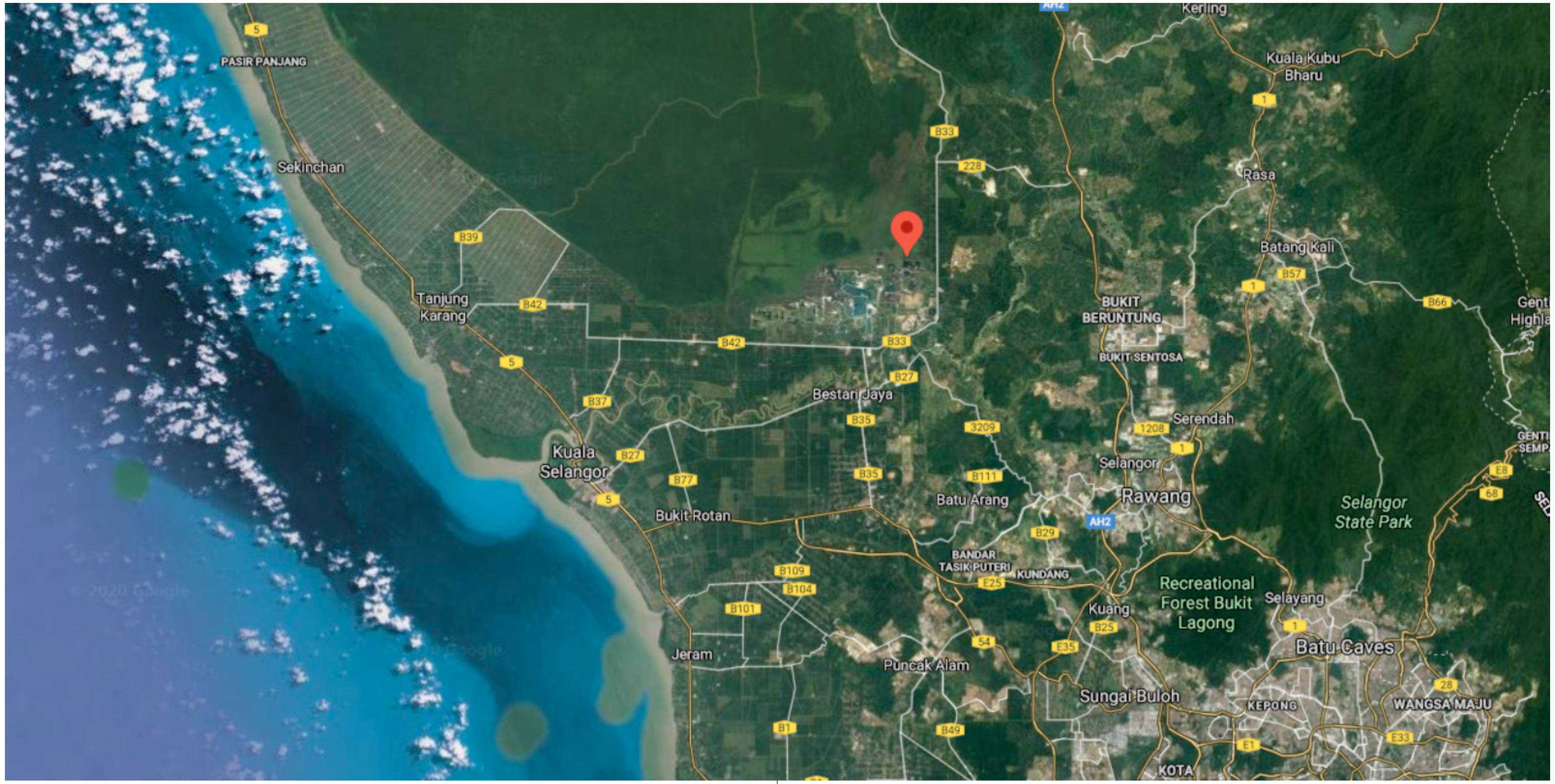

Figure 1. Location of the project area, with Kuala Lumpur in the lower right corner.

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

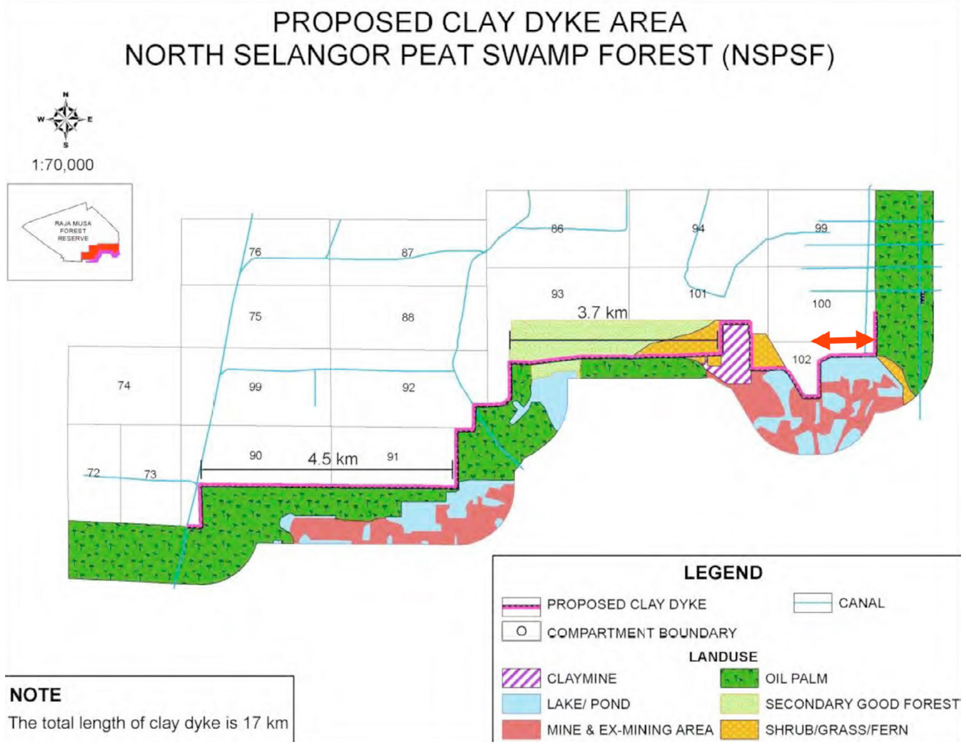

Figure 2. The proposed total length of clay dyke to be constructed between the ex-mining area and the Raja Musa Forest Reserve (the project dyke section is shown with a red arrow).

Figure 3. FC 102 burnt in August 2017; the fire scar is shown on the left side of the photo. The area where the clay dyke was built is denoted by the red arrow.

This area is an important catchment for the Selangor River, also known as Sg Selangor. FC 102 is located near a pond (see the water body in Figure 3) that is a component of the Hybrid Off-River Augmentation System (HORAS). HORAS serves as an alternative water supply scheme for Selangor state. This augmentation system allows water to be stored during wet seasons and accessed during dry seasons. Using this system, water is pumped from selected ponds to the nearest river (Sg Selangor in this case) where it can be used for domestic or municipal water intakes.

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Project Objectives

The following are the main objectives of this project:

- Prevent peatland fires by promoting wetter soil conditions
- Retain water during the wet season for slow release later, especially during times of dry weather

Project Activities

A clay dyke is a vertical wall of clay, usually 4 to 5 meters in height, and constructed mainly below the peat surface. Clay dykes are expected to block water flow from the peatlands into the mining ponds, effectively raising the water table in the areas up-gradient to the dyke. Figure 4 shows the area where the dyke was installed, denoted by the red arrow.

For this project, a clay dyke was built over a distance of 305 meters by excavating the peat layer down to the clay subsoil and then filling the resulting ditch with clay (Figure 5). This clay was then compacted. This structure stopped the rapid lateral outflow or seepage of water into the adjacent clay mine pond and raised the water level in the remaining peatland up to a more desirable level, allowing the vegetation to recover and minimizing fire risk.

Figure 4. Aerial photo showing the location of the clay dyke, prior to the project implementation.

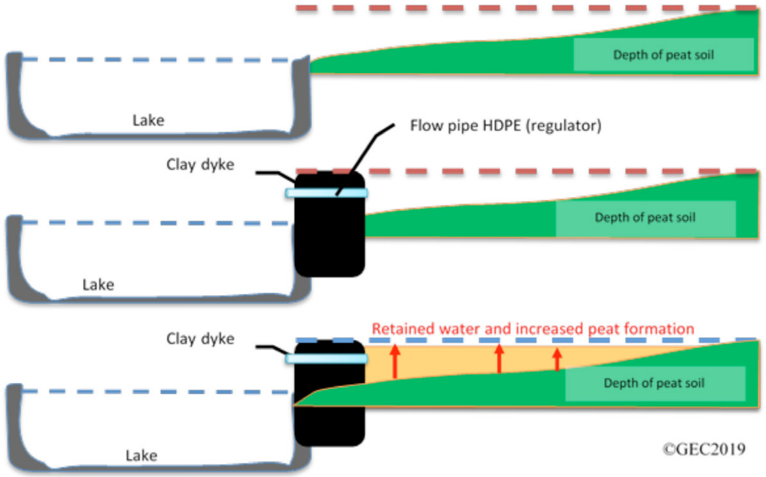

Figure 5. Clay dyke design, showing the previously existing water body (top), the area directly after construction (middle), and the intended water retention (bottom).

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Two additional project components, HDPE pipes (shown in Figure 5) and stick gauges, were installed in conjunction with the main clay dyke construction project. The clay dyke has five total outlets and each outlet has two HDPE pipes for channeling excess water to the ex-mining pond area in order to increase water supply when needed. Four stick gauges were installed to serve as water level indicators. These will provide a rough estimate during regular visits and patrols. When more accurate measurements are needed, piezometers will be used. Three stick gauges are located within the forest reserve (i.e., up-gradient of the clay dyke) and will indicate water levels within the reserve (Figure 6). The fourth gauge is located near the pond, down-gradient of the clay dyke, and will indicate water levels near the pond. These gauges will be used to decide whether water release or water retention is a higher priority. For instance, if the three up-gradient gauges show high water levels, and if there is no fire incident, water will be released to the pond provided the pond gauge indicates extremely low water levels. This will allow the team to balance the project objectives of avoiding peatland fires and releasing water during dry periods.

Figure 6. Location of stick gauges installed along and behind the clay dyke. The peatland is the area with higher levels of vegetation, in the background of the photo. The water body in the bottom of the photo is the area marked "lake" in Figure 5.

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Project Timeline

- 2018: Spark Foundation[1], with Global Environment Centre (GEC) and in partnership with the Selangor State Forestry Department, conducted an assessment to identify a suitable site to construct the clay dyke.
- September 2019: GEC secured formal permission from the Selangor State government to proceed with the construction of the clay dyke.
- October 2019: Construction begins on the clay dyke.
- November 2019: The construction moves into the second stage - digging to remove the peat soil down to the underlying clay layer.
- January 2020: Construction of the clay dyke completed. This included the installation of HDPE pipe as outlets at five points along the clay dyke, four stick gauges, a final cleaning, and an additional block to reduce peat water discharge from the forest reserve.
- Year of initial VWB claim: 2020
- Monitoring and maintenance: Maintenance plays a vital role in sustaining the main function of clay dyke. This clay dyke is considered a permanent structure and will be maintained by Heineken Malaysia Berhad annually up to the year 2030, as and when needed. The report by GEC indicates that maintenance of the constructed clay dyke will be carried out annually for the first 5 years. This annual assessment include a check for any leaks as well as any compaction or compression from the initial soil level. After five years, it is anticipated that there may not be a specific need for annual maintenance for the clay dyke structure itself, but it still recommended that the dyke be checked every 1-2 years for potential maintenance needs. In addition, maintenance is likely be needed from time to time for the other dyke accessories such as the outlets, waste traps, and stick gauges. GEC will produce a report every 6 – 12 months discussing the water table improvement in both the dry and wet seasons, as well as the rate of natural regeneration and a basic vegetation assessment.

[1] *SPARK Foundation is the corporate social responsibility arm of Heineken Malaysia*

Project Costs

HEINEKEN cost share: 100%

- Total cost: $112,329
- HEINEKEN cost: $112,329

Volumetric Water Benefit Calculation

Methodology

- The volumetric water benefit is calculated as the additional volume of water stored in peat soils behind the clay dyke.

Data & Assumptions

- The length of the clay dyke is 305 meters; it is 2 meters wide and 5 meters in depth. The overall depth of the peat soil in this area was found to be between 4 and 5 meters during excavation.
- Based on estimates provided by the project contact, the area of influence where the water table will be raised as a result of the clay dyke is 320,241 square meters. See the calculation section for more details.
- The report provided by GEC estimates that the long-term water table increase will be 0.5 meters. See the calculation section for more details.
- Peatland soils are generally a very porous media. Melling et al. (2016) reviewed tropical peatlands in Sarawak, Malaysia after their conversion to palm plantations and found the bulk density varied from 0.21 to 0.23 g cm^{-3}. Siong et al. (2019) measured the bulk density of peat surface layers in forest and plantation sites to be 0.6-0.7 g cm^{-3}. Porosity in tropical peat soil ranges from 80-90%. An average porosity of 85% is used in the calculations.

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Calculation

The water stored in the peatland soils behind the dyke is calculated as follows:

Zone of influence of the clay dyke (m^2) * average water table increase (m) * porosity of the peatland soils (%) = water stored in peat soils (m^3)

Zone of influence of the clay dyke

In the initial concept design for the dyke, the zone of influence was roughly estimated to be a rectangle extending 1,000 meters behind the dyke and the same width as the length of the clay dyke. This would result in an area of 1,000 m by 305 m totaling 305,000 m^2.

However, based on further assessment, the final area of influence was mapped in a slightly modified way by the project contact. This is because the water movement in the site will not occur in just a strict north-south rectangle, but will instead flow more broadly from the peat dome in the north towards the main outlet at the lake in the south. Blocking the drainage out of the soil to the pond will therefore raise the water across this area. The northern limit of the clay dyke is taken as the physical feature (called a 'track' in Figure 7) that runs roughly east to west across the peat, between 770 and 830 meters north of the clay dyke. The eastern boundary of the zone of influence is taken as the feature that runs northward from the eastern end of the clay dyke.

The zone of influence is thus estimated to be a trapezoid bounded by tracks on the east and northern sides and the clay dyke on the southern edge, as in Figure 7. The western edge is assumed to result from connecting the northern track to the western edge of the clay dyke. Based on this outline, the area of influence has been calculated as 320,241 square meters using the mapping function of Google Earth.

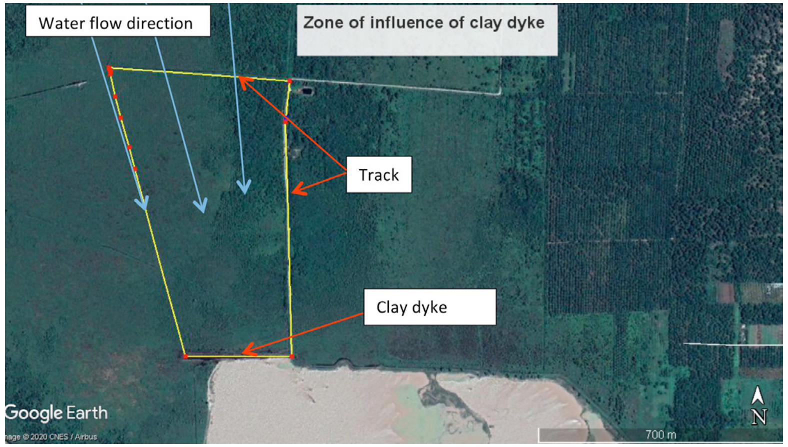

Figure 7. The direction of water flow across the landscape and the resulting 'zone of influence' of the clay dyke (shown by the yellow outline). Figure and associated area calculations were provided by the project contact.

Average water table increase

In the design stage, it was estimated that the construction of the clay dyke would lead water to be retained in the peat at a level about 0.5 meters higher, on average, than the pre-project conditions. This was based on observations from earlier years where the lake water level dropped by 1 to 2 meters during the dry season while, at the same time, the water level in the peat dropped 0.5 to 1.5m up to one kilometer away from the lake edge. This lowering of water levels in the dry season was the root cause of the frequent fires in the area; it also negatively impacted the long term water storage functions of the peat/forest.

The intention of the clay dyke is to maintain higher water levels in the peat and minimize the dry season drop in the water levels. It was conservatively estimated that an average increase in water levels of 0.5 meters could be maintained in the peat area throughout the project. The difference between dry and wet season water levels is shown in satellite images and ground photos from 2016 to 2020 (Figures 8 to 11).

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Figure 8. Satellite image of the clay dyke location from July 1st, 2016, showing the lake shore on the left (western) side and sand spit on the right (eastern) side.

Figure 9. Drone photo of roughly the same location as Figure 8, taken on August 15th, 2017. This image shows the low water level of lake (note the lakeshore and sand spit).

Figure 10. Areas of the lake edge, exposed in August 2017, but covered by water in January 2020.

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Figure 11. Aerial photo in the same location as Figure 8, taken January 1st, 2020. This image shows the nearly completed clay dyke as well as the high water level in lake. Note that the water (estimated to be about 1.5m higher than in August 2017) is covering the lake shore and sand spit.

The formal water level monitoring on the upslope and downslope sides of the clay dyke only started in January 2020 (after the completion of the clay dyke). Water levels behind the clay dyke were compared to water levels in the pond adjacent to the clay dyke. At the time of comparison, water levels were very high as the area experienced a flood in December 2019.

Based on the photos and satellite images, the lake water level in January 2020 was about 1.5 m higher than the lake level in August 2017. Based on measurements from the water gauges in January 2020, the water level in the peat was about 20 cm higher than the lake level in January 2020. This would be about 1.7 m higher than the level in the peat in August 2017 (which was similar to the lake level).

Initial readings taken after the dyke completion already show that the water levels behind the clay dyke are increasing. Over the first few months after dyke completion, measurements indicated an increase in the peat of about 0.2 meters over levels measured in the adjacent lake. This is because the period from January to May 2020 is regarded as the wet season; the dry season is expected to be from June to September. In addition, the lake is in the process of being turned into a water storage pond by the state Water Resources Management Agency (LUAS) and so higher-than-normal water levels are being maintained. Further measurement of water levels, as well as measurements of the lakeshore and sand spit during the dry season, will be made over the next 12 months. Data on water levels and usage in the lake by LUAS will also be collected, if available, to fully document the role of the clay dyke.

An estimated 0.5 meter increase in the water table across the entire zone of influence of the clay dyke was used for calculating the increased water storage, per the project contact.

Water Project: Clay Dyke

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Calculation

The calculation for 2020 is as follows:

*Zone of influence of clay dyke (m^2) * average water table increase (m) * porosity of the peatland soils (%) = water stored in peat soils (m^3)*

*320,241 m^2 * 0.50 m * 85% porosity = 136,102 m^3 = 136,102,000 liters*

So based on this calculation, the long-term volumetric water benefit is estimated as 136.1 ML/yr.

Table 2. Volumetric Water Benefit

Year in which VWB is counted	Timeline	Description of work completed	Cumulative Volumetric Benefit (ML/yr)
2020	Work completed through January 2020	Clay dyke installed	136.1

Volumetric Water Benefit (2020)

- Total Benefit: 136.1 ML/yr
- HEINEKEN Benefit (based on cost share): 136.1 ML/yr

Volumetric Water Benefit Duration

- The maximum volumetric water benefit duration for this project is 10 years, with the year of initial claim (2020) counted as Year One. Therefore, if there is annual evidence that this project is functioning as intended, benefits can be counted through the end of 2030.

Complementary Indicators

- Two types of tree species were planted on the top surface of clay dyke, namely *kelat paya* and *ramin melawis*.
- Construction of the clay dyke is expected to significantly reduce the risk of fires in FC 102 and maintain the current peat level and associated storage potential of the peat.
- Previous clay dyke projects have been shown to promote good natural regeneration of vegetation due to wetter conditions.
- Restoration of the peatland will help maintain the long-term water supply function and reduce the risk of water shortages in the Klang Valley during extreme weather conditions.

Notes

- For volumetric water benefit claims to count in future years, monitoring and maintenance activities should continue as described in this Benefit Summary.

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Water Project: Water Thimbles

Sungai Penchala and Sungai Selangor river basins, Malaysia

SUMMARY

Heineken Malaysia Berhad is a subsidiary of Heineken International (HEINEKEN N.V.). HEINEKEN N.V. aims to achieve water balancing by the production units that are located in water-scarce and water-stressed areas.

Heineken Malaysia Berhad operates the Sungei Way brewery in Petaling Jaya, Selangor. HEINEKEN has identified the Sungei Way brewery as being in a water-stressed area. This report describes the water balance benefits of the water thimbles project activity that was implemented to achieve water balance goals for the Sungei Way brewery. A summary of 2020 volumetric water benefits of this activity and its contribution towards the 2020 and 2030 balancing goals is provided in Table 1.

Table 1. Summary of water balance benefits.

Year	Activity	2020 Benefit (m^3)	Balancing Goal (m^3)		Progress vs. Goal (%)	
			2020	2030	2020	2030
2018	Waterthimbles (134 households)	3,800	204,399	429,144	1.9%	0.9%
2019	Water thimbles (cumulative total of 382 households)	11,500			5.6%	2.7%
2020 TOTAL BENEFIT		**11,500**			**5.6%**	**2.7%**

Water Project: Water Thimbles

Sungai Penchala and Sungai Selangor river basins, Malaysia

Project Background

Malaysia is rich in water resources; however, in recent years the water supply situation has changed from one of relative abundance to one of scarcity. Population growth, urbanization, industrialization and expanded irrigated agriculture are contributing factors. In addition to increased demand, water wastage is a significant problem in Malaysia, and there is a recognized need to educate Malaysians on the threat of water supply interruptions and ways to avoid them. This project reduces consumption through installation of water thimbles in households involving 11 communities. The project also managed to train individuals from six communities on water conservation. The thimbles are installed in communities within the Sungai Way River and Penchala River (tributary to the Klang Rivers) and Selangor River watersheds (Figure 1).

Project Objectives

The objective of this project is to engage with communities to reduce water consumption through the installation of water thimbles.

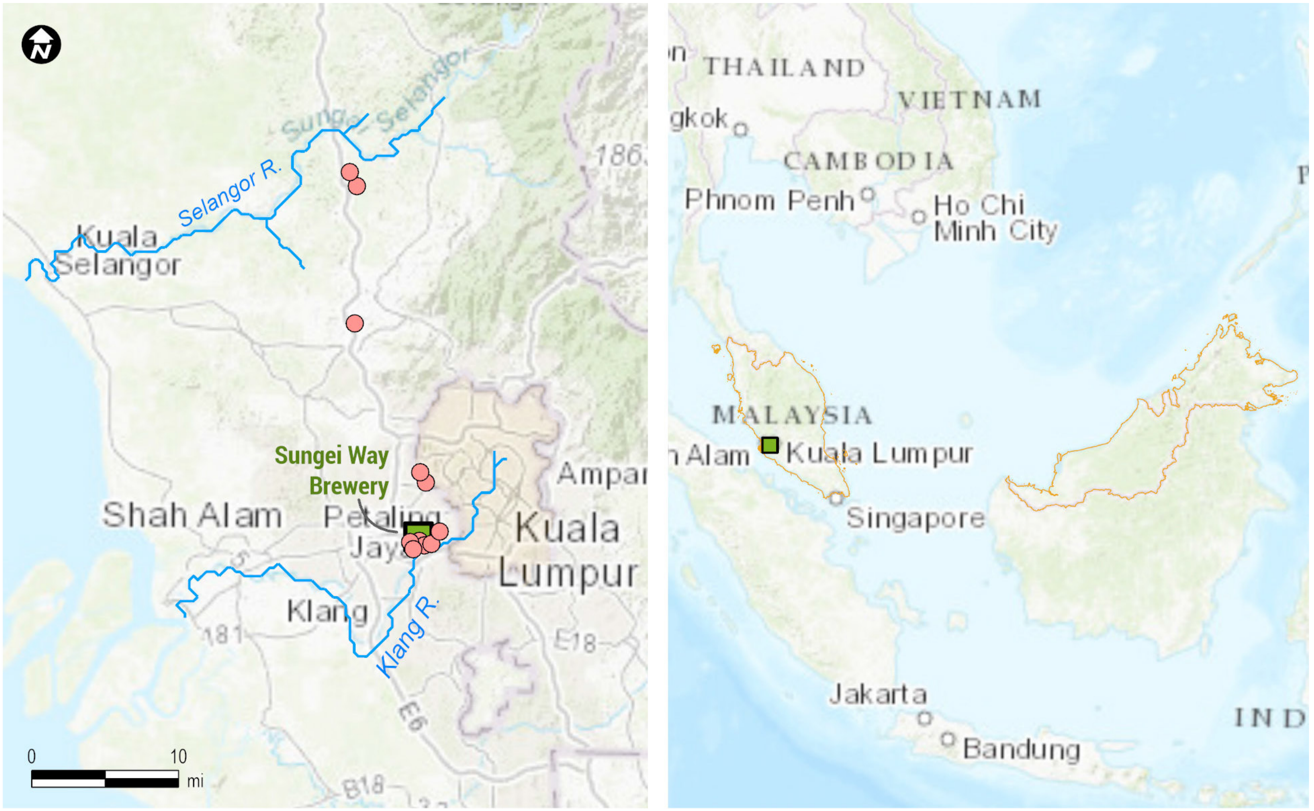

Figure 1. Project Locations (circles show the 11 communities where water thimbles were installed)

Water Project: Water Thimbles

Sungai Penchala and Sungai Selangor river basins, Malaysia

Project Activities

Water thimbles are low cost water-saving devices. These small, silicon discs are installed into faucets and shower heads to decrease flow and reduce water use (Figure 2). Through the end of 2019, water thimbles were installed in 382 households. For each household, one water thimble was installed on a kitchen faucet, and thimbles were also installed in a shower, although lower in number. Each household was provided with four thimbles. In some areas, the W.A.T.E.R project team installed the water thimbles, and in other areas community leaders and the local Member of Parliament encouraged installation of the water thimbles. As a result of this project, roughly 25% of the faucets in apartment/flat units had thimbles installed and 10% of the faucets in landed units had thimbles installed.

Figure 2. Water thimble installation

Project Timeline

- July 2018: Project initiation
- December 2018: Water thimbles installed in 134 households (553 beneficiaries)
- December 2019: Water thimbles installed in cumulative total of 382 households (1,660 beneficiaries)
- December 2020: Water thimbles installed in an additional 25 households
- Year of initial VWB claim: 2019
- Monitoring and maintenance: One year after installation, environmentalists from Global Environment Centre and community leaders will conduct random checks over the phone only due to Covid-19 to verify the thimbles remain in place. Proof of installation and impact will be validated through the trend of water reduction that is measured based on the submission of the monthly water bills by participating households or participating apartments Joint Management Board. Participants are educated on how to clean the water thimble and are provided with extra replacement thimbles, if cleaning or replacement are needed. Incentives are being provided to households with the highest water savings.

Project Costs

HEINEKEN cost share: 100%

- Total cost: $11,948.86
- HEINEKEN cost: $11,948.86

Costs (July 2018-December 2019) include water thimbles, planning, communications, workshops for communities, water thimble installation and monitoring.

Water Project: Water Thimbles

Sungai Penchala and Sungai Selangor river basins, Malaysia

Volumetric Water Benefit Calculation

Methodology

- The volumetric water benefit is calculated as the reduced withdrawal volume resulting from installation of water thimbles.

Data & Assumptions

- Number of households with water thimbles installed: provided by the project contact
- Number of days/year the households are inhabited: provided by the project contact
- Water use data (Spark Foundation and Global Environment Center, undated):
  - Pre-project, per-capita water use: based on water bills for 382 households for 90 days before thimbles were installed.
  - Post-project, per capita water use: based on water bills for the same 382 households for 90 days of water use after the thimbles were installed.
  - Water bills were obtained directly from households where thimbles were installed, or from meter readings from the Joint Management Board, management unit for the apartments.
- Assume measured water savings are due solely to the water thimble installation.

Calculation

The reduced withdrawal is calculated based on water use reductions in households where thimbles were installed. Water use reductions are calculated as the difference in pre-project and post-project water use.

- Pre-project water use: Metered volume for project households for 3 months prior to thimble installation = 231 liters/capita/day
- Post-project water use: Metered volume for project households for 3 months after thimble installation = 212 liters/capita/day

[Per capita pre-project water use (liters/capita/day)] – [Per capita post-project water use (liters/capita/day)] * # beneficiaries * 365 days/yr

(231 liters/capita/day – 212 liters/capita/day) * 1660 people * 365 days/yr = 11,512,100 liters = 11.5 million liters/yr

Because this project was implemented over several years, the volume benefits are presented annually below, and will be counted in the first full calendar year after the thimbles were installed. As shown in Table 2, the volumetric water benefit for 2019 is 3.8 ML/yr and the volumetric water benefit for 2020 is 11.5 ML/yr.

Table 2. Volumetric Water Benefit

Year in which VWB is counted	Timeline	Description of work completed	Cumulative Volumetric Benefit (ML/yr)
2019	Work completed through December 2018	Water thimbles installed in 134 households (553 beneficiaries)	3.8
2020	Work completed through December 2019	Water thimbles installed in 382 households (1,660 beneficiaries)	11.5

Volumetric Water Benefit (2020)

- Total Benefit: 11.5 ML/yr
- HEINEKEN Benefit (based on cost share): 11.5 ML/yr

Volumetric Water Benefit Duration

- The maximum volumetric water benefit duration for this project is 10 years, with the year of initial claim (2019) counted as Year One. Therefore, if there is annual evidence that this project is functioning as intended, benefits can be counted through the end of 2029.

Water Project: Water Thimbles

Sungai Penchala and Sungai Selangor river basins, Malaysia

Complementary Indicators

- 60 individuals in 6 communities were trained on water conservation module.
- 1,660 beneficiaries.
- Approximately $2,800 annual cost savings for 1,660 beneficiaries, based on the current water tariff.

Notes

- In 2020, water thimbles were installed in another 25 households only due to Covid-19. Considering the additional thimbles installed in 2020, a cumulative of 407 households and 1698 beneficiaries are impacted. Thimbles installed by the end of 2020 will be considered in the 2021 volumetric benefit evaluation.
- For volumetric water benefit claims to count in future years, monitoring and maintenance activities should continue as described in this Benefit Summary.

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Water Project: Rainwater Harvesting

Sungai Penchala and Sungai Selangor river basins, Malaysia

SUMMARY

Heineken Malaysia Berhad is a subsidiary of Heineken International (HEINEKEN N.V.). HEINEKEN N.V. is committed to promoting sustainable water use in watersheds where its brewery is located.

HEINEKEN N.V. aims to achieve water balancing by the production units that are located in water-scarce and water-stressed areas. Heineken Malaysia Berhad operates the Sungei Way brewery in Petaling Jaya, Selangor. HEINEKEN N.V. has identified the Sungei Way brewery as being in a water-stressed area. This report describes the water balance benefits of the water thimbles project activity that was implemented to achieve water balance goals for the Sungei Way brewery. A summary of 2020 volumetric water benefits of this activity and its contribution towards the 2020 and 2030 balancing goals is provided in Table 1.

Table 1. Summary of water balance benefits.

Year	Activity	2020 Benefit (m^3)	Balancing Goal (m^3)		Progress vs. Goal (%)	
			2020	2030	2020	2030
2012 - 2020	Rainwater harvesting	4,554	204,399	429,144	2.2%	1.1%
TOTAL		**4,554**			**2.2%**	**1.1%**

Water Project: Rainwater Harvesting

Sungai Penchala and Sungai Selangor river basins, Malaysia

Project Background

Malaysia is rich in water resources; however, in recent years the water supply situation has changed from relative abundance to one of scarcity. Population growth, urbanization, industrialization and expanded irrigated agriculture are contributing factors. In addition to increased demand, water wastage is a significant problem in Malaysia, and there is a recognized need to educate Malaysians on the threat of water supply interruptions and ways to avoid them. Heineken Malaysia has implemented rainwater harvesting projects to help communities to improve water availability in the Selangor and Sungei Penchala watersheds.

The Sungai Way Brewery is located in Petaling Jaya. The main source of water supply for Heineken Malaysia comes from the Selangor River. The treated wastewater from the brewery is channeled into the Sungei Way River, which is a tributary of Sungei Penchala (Figure 1).

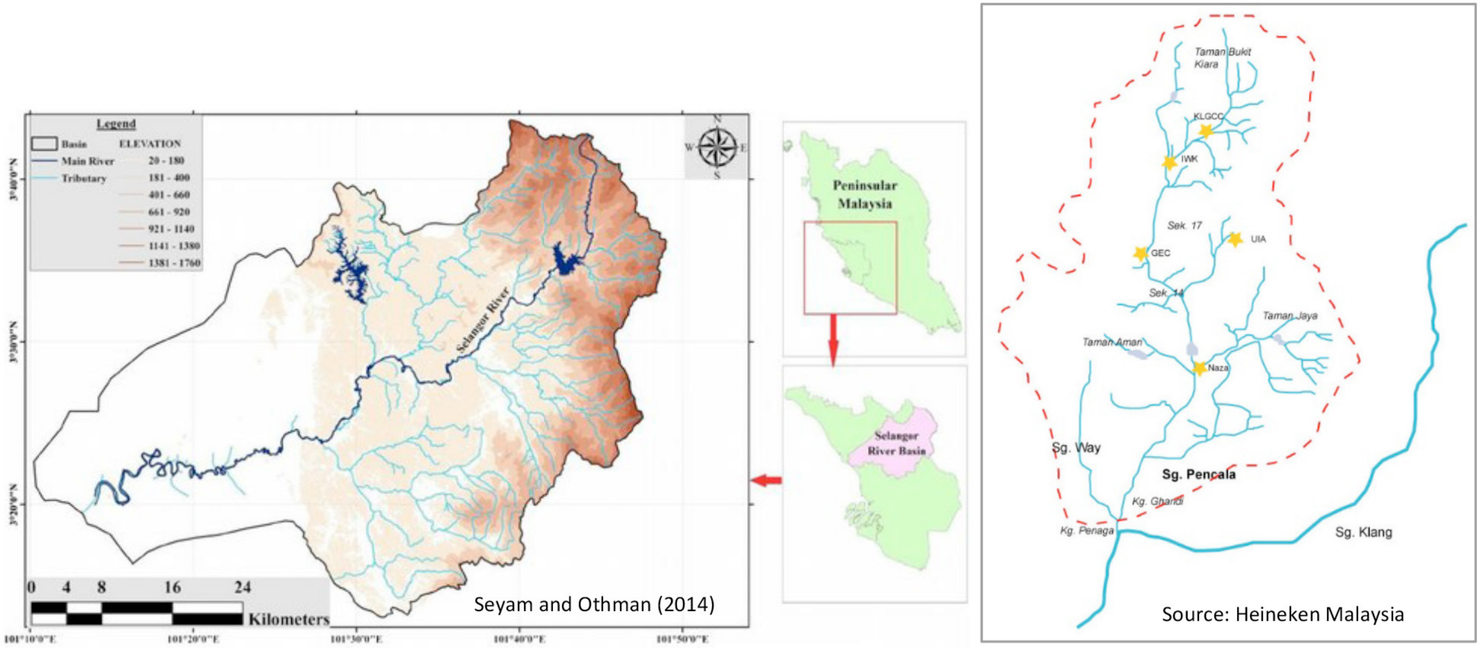

Figure 1. Selangor River Basin (left) which is the source of water supply for Heineken Malaysia, and Sungai Penchala (right) watershed where the brewery is located and channels its treated wastewater.

Water Project: Rainwater Harvesting

Sungai Penchala and Sungai Selangor river basins, Malaysia

Project Objectives

- The objective of this project is increase water availability in the local community to reduce wastage on treated water and stress on our water resources.

Project Activities

Heineken Malaysia, through its corporate social responsibility arm, SPARK Foundation, has implemented several rainwater harvesting (RWH) systems since 2012 in communities within the Selangor and Sungai Penchala basins. The RWH systems were implemented in collaboration with the Petaling Jaya City Council (MBPJ) and Global Environment Centre. The specific project locations in Sungai Penchala and Selangor and basins are shown in Figures 2 and 3, respectively.

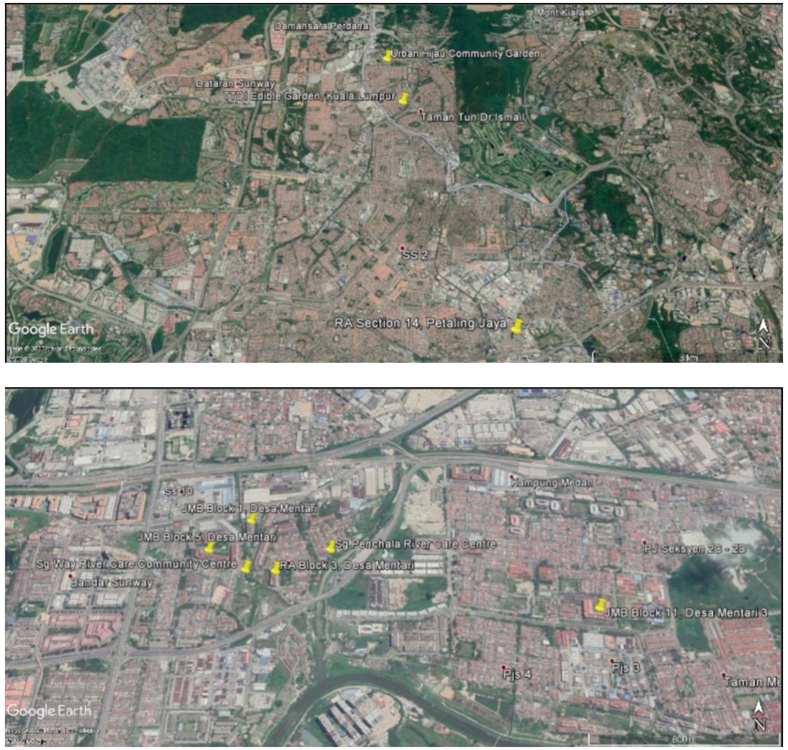

Figure 2. Rainwater harvesting locations in Sungai Penchala basin

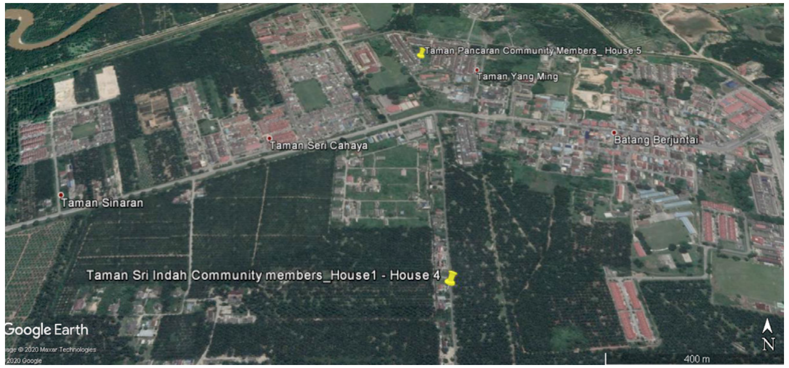

Figure 3. Rainwater harvesting locations in Selangor basin

Water Project: Rainwater Harvesting

Sungai Penchala and Sungai Selangor river basins, Malaysia

Table 2. Project locations in Sungai Penchala and Selangor basins

No	Basin	Residential Area	Communities
1	**PENCHALA**	Petaling Jaya	Joint Management Body (JMB) of Block 1 Desa Mentari
2			Resident Association (RA) of Block 3 Desa Mentari
3			Joint Management Body (JMB) of Block 5 of Desa Mentari
4			Joint Management Body (JMB) of Block 11 of Desa Mentari
5			Resident Association of Section 14
6			Sg Way River Care Community Centre
7			Sg Penchala River Care Centre
8			Urban Hijau Community Garden
9		Kuala Lumpur	TTDI Edible Garden
10	**SELANGOR**	Kuala Selangor	Four Systems@Taman Sri Indah Community members
11			One System@Taman Pancaran Community Members

The RWH system (Figure 4) consist of an interconnected rooftop area that serves as a catchment for the rainwater and storage tanks to collect and store the rainwater. The rainwater collected serves as non-potable water supply including cleaning, landscaping and irrigation. The water supply from rainwater harvesting system reduces the demand on traditional sources including surface and groundwater.

Figure 4. Rainwater harvesting systems in Sungai Penchala basin

Water Project: Rainwater Harvesting

Sungai Penchala and Sungai Selangor river basins, Malaysia

Project Timeline

- 2012: Project initiation
- Year of initial VWB claim: 2019
- Monitoring and maintenance: The rainwater harvesting systems are evaluated on an annual basis to assess maintenance needs to ensure optimum usage.

Project Costs

HEINEKEN cost share: 100%

- Total cost: $28,000 USD (RM 120,000)
- HEINEKEN cost: $28,000 USD (RM 120,000)

Volumetric Water Benefit Calculation

Methodology

- The water benefits were calculated as the annual volume of rainwater captured and provided for productive use.

The approach for calculating the annual volume of rainwater captured is as follows:

First, the available supply is estimated. The supply is compared with the volume available for storage. The storage volume depends on the capacity of the storage tanks and the number of times a year the tanks fill to its capacity. The minimum of supply and storage volume is estimated as the annual volume captured. The calculation approach is described below.

Supply (m^3/yr) = Roof Area (m^2) x Rainfall (m/yr) x Runoff Coefficient

Storage Volume = Capacity of the tank (m^3) x Number of Times Filled

Annual Volume Captured = Min (Supply or Storage Volume)

Water Project: Rainwater Harvesting

Sungai Penchala and Sungai Selangor river basins, Malaysia

Data Assumptions

- Data inputs related to roof catchment area, storage tank capacity and the roof type was provided by Heineken Malaysia (Table 3).

Table 3. Project locations in Sungai Penchala and Selangor basins

No	Basin	Communities	Rooftop size (m^2)	Storage Tank Capacity (m^3)	Roof Type
1	PENCHALA	Joint Management Body (JMB) of Block 1 Desa Mentari	688	1500	Genting clay roof + Metal deck
2		Resident Association (RA) of Block 3 Desa Mentari	96	200	Metal deck
3		Joint Management Body (JMB) of Block 5 of Desa Mentari	390	800	Genting clay roof + Metal deck
4		Joint Management Body (JMB) of Block 11 of Desa Mentari	82	200	Genting clay roof + Metal deck
5		Resident Association of Section 14	72	200	Metal deck
6		Sg Way River Care Community Centre	96	200	Metal deck
7		Sg Penchala River Care Centre	96	200	Metal deck
8		Urban Hijau Community Garden	96	200	Metal deck
9		TTDI Edible Garden	96	200	Metal deck
10	SELANGOR	Four Systems@Taman Sri Indah Community members	320	800	Genting clay roof + Metal deck
11		One System@Taman Pancaran Community Members	80	200	Genting clay roof + Metal deck

- The runoff coefficient for roof typically range from 0.7 – 0.95. Conservatively, a value of 0.8 is used in the calculations (Farreny et al., 2011).
- Rainfall data for 10 years (2010 – 2019) was obtained for the Sultan Abdul Aziz Shah International Airport, Malaysia (NOAA, 2020). The annual average rainfall is 2,828 mm/year
- It is assumed that the RWH system will be maintained routinely for optimal performance
- It is assumed that the storage tanks are filled to capacity once a year

Water Project: Rainwater Harvesting

Sungai Penchala and Sungai Selangor river basins, Malaysia

Calculation

For each site the supply, storage volume and the annual volume captured by the rainwater harvesting system is calculated. The results are summarized in Table 3. The total annual volume captured for all the rainwater harvesting system combined is 4,554 m3/year, which is 4.5 million liters (ML)/year.

Table 4. Summary of volume captured by the rainwater harvesting systems

Project Location	Supply (m^3)	Storage Volume (m^3)	Volume Captured (m^3)
Block 1 Desa Mentari	1557	1500	1500
Block 3 Desa Mentari	217	200	200
Block 5 of Desa Mentari	882	800	800
Block 11 of Desa Mentari	186	200	186
Resident Association of Section 14	163	200	163
Sg Way River Care Community Centre	217	200	200
Sg Penchala River Care Centre	217	200	200
Urban Hijau Community Garden	217	200	200
TTDI Edible Garden	217	200	200
Taman Sri Indah Community members	724	800	724
Taman Pancaran Community Members	181	200	181
Total	**4778**	**4700**	**4554**

Volumetric Water Benefit (2020)

- Total Benefit: 4.5 ML/yr
- HEINEKEN Benefit (based on cost share): 4.5 ML/yr

Volumetric Water Benefit Duration

- The maximum volumetric water benefit duration for this project is 10 years, with the year of initial claim (2019) counted as Year One. Therefore, if there is annual evidence that this project is functioning as intended, benefits can be counted through the end of 2029.

Complementary Indicators

- Reduced demand on traditional water sources included surface and groundwater
- Reduced water bills
- 6,750 beneficiaries
- Reduced storm water runoff and associated pollution
- Reduced wastage on treated water for secondary uses such as gardening, irrigation and cleaning

Notes

- For volumetric water benefit claims to count in future years, monitoring and maintenance activities should continue as described in this Benefit Summary.

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Water Project: Reforestation of Peatland

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

SUMMARY

Heineken Malaysia Berhad is a subsidiary of Heineken International (HEINEKEN N.V.). HEINEKEN N.V. is committed to promoting sustainable water use in watersheds where its breweries are located.

HEINEKEN N.V. aims to achieve water balancing by the production units that are located in water-scarce and water-stressed areas. Heineken Malaysia Berhad operates the Sungei Way brewery in Petaling Jaya, Selangor. HEINEKEN has identified the Sungei Way brewery as being in a water-stressed area. This report describes the water balance benefits of a clay dyke project that was constructed to achieve water balance goals for the Sungei Way brewery. A summary of 2020 volumetric water benefits of this activity and its contribution towards the 2020 and 2030 balancing goals is provided in Table 1.

Table 1. Summary of water balance benefits.

Year	Activity	2020 Benefit (m^3)	Balancing Goal (m^3)		Progress vs. Goal (%)	
			2020	2030	2020	2030
2020	Reforestation	4,250	204,399	429,144	2.1%	1%
TOTAL		**4,250**			**2.1%**	**1%**

Water Project: Reforestation of Peatland

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Project Background

The project site is located in degraded area of Raja Musa Forest Reserve (RMFR, Figure 1). Roughly fifteen years ago, a parcel in the southwest section of the RMFR area experienced illegal encroachment and was cleared and turned into a farming/plantation area. This left the landscape totally devoid of its original forest vegetation cover. Parcels of land in this area are bordered by drainage canals at 400m intervals. Drainage into the canals from the landscape generally comes from the peat layer. This water loss leads to loss of peat soils and associated CO_2 emissions through peat decomposition and peat fires.

Peatland areas are ecologically and hydrological sensitive to disturbances. Small changes in the hydrology can alter the fate of the entire ecosystem and cause frequent peat fires. If both hydrological and biological rehabilitation measures are not put in place, the peatland can burn, releasing large amounts of CO_2 to the atmosphere. A serious fire last affected the project site in 2014. The Global Environment Centre (GEC), with support from Heineken Malaysia, led the restoration efforts (i.e., The SPARK Tree Planting Project) at the fire affected peatland site. Following the fire, in the years 2015 to 2017, the drainage outlet was blocked by GEC and the water level in the peatland was progressively raised from about 70cm below the surface until it reached the current levels near the ground surface. This higher water level was intended to reduce the presence of the fire-prone *Lalang* grasses and make the site suitable for rehabilitation. The canal blocking and subsequent rewetting of the project area was completed before planting to prevent fire occurrence, create better survival rates for planted trees, and encourage natural forest vegetation growth.

Without the intervention, further disturbance of the project area would have accelerated CO_2 emissions. Lowering the water table in the peat by approximately 70cm would lead to an annual emission of about 63 tonnes of CO_2 per hectare per year, based on formulas provided by Hooijer et al. (2010). Conversion of the project parcel to an oil palm plantation would lead to increases in nitrous oxide (N_2O) emission. Combined, the potential emissions would be about 90 or 100 tCO_2 equivalent per ha per year (Cooper et al. 2020). If a fire occurs in the peatland, the emissions could be from 200 to 900 tCO_2 per hectare per fire event, depending on the severity and depth of the fire. Raising the water level and restoring the peat swamp forest will reduce the chance of fire occurrence and prevent CO_2 emissions.

The SPARK Tree Planting Project replanted one hectare of degraded peatland area and kept the water level of the peatland high by implementing and maintaining canal blockings (Figure 2). By employing the rehabilitation strategies of peatland rewetting, revegetation planting, natural regeneration, and fire prevention, the project serves not only to prevent further degradation of the peat (including peat oxidation and subsidence of the peatland), but also to help the natural succession of vegetation. This act will also help to retain soil moisture and raise the humidity of the air above the soil surface and prevent further peat fires as well as facilitate recovery of the peatland forest and re-activate carbon sequestration.

A few key characteristics made this particular one-hectare site a good location. First, this area was chosen because it was previously degraded and required replanting. Secondly, the rewetting of this area was completed before planting to prevent fire occurrence and this environment was expected to create better survival rates for the planted trees. Finally, the project area is within a Forest Reserve, which means it will be maintained as forest in the long term.

Water Project: Reforestation of Peatland

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

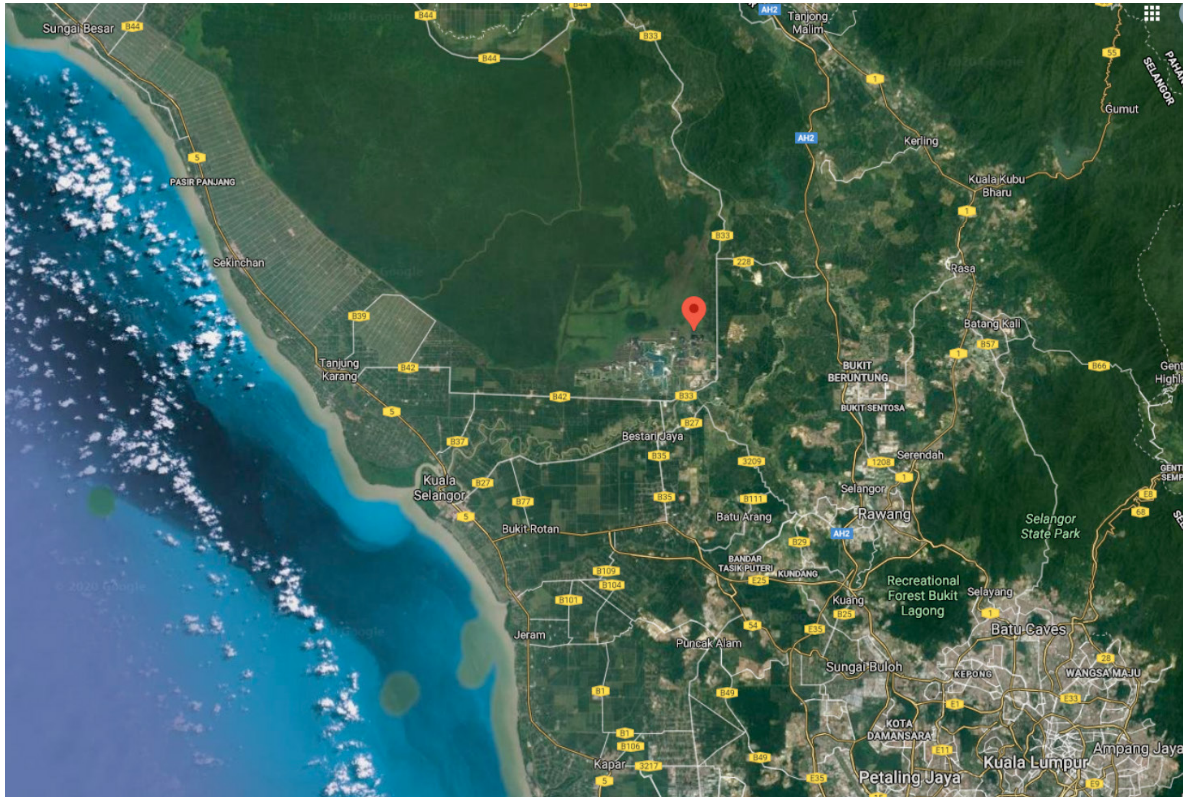

Figure 1. General location of the Raja Musa Forest Reserve, with Kuala Lumpur in the lower right corner.

Figure 2. Project site before planting, photo taken January 15, 2019

Water Project: Reforestation of Peatland

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Project Objectives

The following are the main objectives of this project:

- Prevent peatland fires by promoting wetter soil conditions and removing invasive grasses.
- Reforest the degraded peatland on the project site.

Project Activities

On a one-hectare project site within the forest reserve, revegetation planting, natural regeneration, and fire prevention/control were used to rehabilitate a segment of degraded peatland. The open planting techniques involved clearing of the existing plants (especially the invasive grass *Imperata cylindrical*), both to eliminate unwanted competition and to provide easy access for planting (Figure 3). The clearing was completed in strips of 1m width using machetes and a brushing machine (Figure 4). The existing vegetation was left uncut between rows to minimize direct sunlight to the planted seedlings. On the project site, a total of 600 saplings were planted with 3m between trees. Each lane was 100m long, with a 5m distance between the lanes (Figure 5). There was a total of 20 lanes with 30 saplings planted in each lane. Planting holes of about 10-15cm depth were dug prior to the planting. Then, the existing peat was utilized to cover up the planting holes.

Planted trees species are pioneer peat swamp forest tree species *Melicope lunu-ankenda* and *Alstonia scholaris*, which can survive in degraded and open areas. The tree saplings are selected for planting only when they reach a height of 1 meter and are supplied by the local community nursery.

Figure 3. The peatland landscape before planting.

Figure 4. The peatland landscape cleared for planting, with lanes.

Figure 5. The landscape after planting, June 2019.

Water Project: Reforestation of Peatland

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

The project also included the installation of piezometers to monitor water levels. Water table data was collected using three piezometers (SF1, SF2 & SF3) at the tree planting site (Figure 6). Regular water table measurements started in February 2019. This initial reading was taken after the planting of the first 300 trees, and routine monitoring will be continued. To obtain baseline comparison measurements, water table data from an adjacent piezometer (known as P7_002, 80m from the WATER project site) was used.

Figure 6. The location of the piezometers used in the study. The project site is included in the square box, while the off-site piezometer is included.

Water Project: Reforestation of Peatland

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Project Timeline

- May 2018: Project begins.
- October 2018 to January 2019: Average monthly water table measurements were taken to represent “before tree planting”.
- February 2019 to May 2019: Tree planting and water table measurements were conducted.
- May 2019: Planting completed with all 600 trees in place. Maintenance activities initiated.
- June 2019 to 2022: Continue water table monitoring.
- Year of initial VWB claim: 2020
- Monitoring and maintenance: There will be four years of maintenance to foster the natural forest regeneration and sequestration of CO_2 from the atmosphere thus contributing directly to the reduction of GHG and related climate change effect. GEC field staff are responsible for carrying out the maintenance activity (under supervision) which include:
  - cleaning the site at least 3 - 4 times a year by cutting the grass, weeds and other plants around the trees to reduce competition;
  - replacing dead trees with new trees (if the mortality percentage exceeds 20%);
  - removing creepers[1] to encourage natural growth; and
  - applying fertilizer to the trees to support the growth while undertaking replacement planting for dead trees.

[1] *“Creepers” are plants that grow along the ground and over trees and inhibit the tree growth rate. Typically, these plants will climb on the trees and make it difficult for them to survive. Therefore, removal of creepers is an important component of weeding the site.*

GEC field staff are also responsible for carrying out the monitoring activity under supervision. There are three main types of monitoring:

- At the planting site: There will be tree census activity to measure the observed tree heights, stem diameters, and survival rates. This will be carried out once every 6 months for two years, in order to observe the changes that may have happened. This involves measuring the growth rate of the survival and mortality rate of planted trees. The observation and assessment of the first tree census was carried out in October of 2019. The results observed were good, 65.8% of the seedlings survived (of which about 395 trees were growing well), with an overall mortality of 34.2% (about 205 trees). These losses are likely due to natural and site climatic conditions; some areas also have higher water levels over long periods of time and weak trees are unable to adapt. Replanting was efficient done to support at least an 80% survival rate at any point of time. An average height increase of 28cm was observed among the trees.
- Piezometer monitoring: Piezometers are used as a water monitoring tools at the project site to measure the below ground water level. These measurements are carried out, at minimum, on a weekly basis. The results will be documented in order to analyze data for use in the preparation of reports related to the recovery area.
- Fire patrolling and monitoring: Regular patrolling and monitoring is being undertaken at the project site to detect any disturbances. This includes identifying any fires in adjacent areas. Any fires should be quickly put out through a coordinated effort from different agencies.

Project Costs

HEINEKEN cost share: 100%

- Total cost: $9,400
- HEINEKEN cost: $9,400

Water Project: Reforestation of Peatland

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Volumetric Water Benefit Calculation

Methodology

- The volumetric water benefit is calculated as the avoided loss of soil water storage due to fire prevention.

Data & Assumptions

- The restored area is one hectare in size, 100m by 100m, and has an adjacent drainage canal.
- Prior to the restoration (in late 2017) the water table was, on average, 40-50cm below the surface. It was raised in early 2018 at the start of the current project discussions to make the area suitable for planting in 2019. If water table was not raised prior to the replanting, the area would be covered in fire-prone grasses (*Imperata spp*). During the project period, the water control structures are maintained to ensure that the water is near the surface to reduce fire risk and enhance suitability for restoration of the vegetation.
  - Measurements were not taken of the water level prior to raising the level in 2018, but it is estimated to have been 45cm below the surface.
- Water table data during the project period were collected using three piezometers at the tree planting site. These data are detailed in the reforestation report provided May 27, 2020.
- Tree planting is a key part of peatland rehabilitation and will increase the humidity in the vegetation, thus reducing the risk of fires which destroy the peat layer and so reduce the long-term storage capacity. In the longer term, the trees and the associated surface roots will increase the surface roughness and reduce the flow rate of water across the landscape and increase ponding, also contributing to a reduction in fire risk.
- The depth of the avoided peat loss is considered to be 0.50 meters. This is estimated based on literature studying the depth of peatland damage after fires as well as the probability of fire occurrences over ten years' time. Ballhorn et al. (2009) found burn depths of 0.33 ± 0.18m following severe peatland fires. Simpson et al. (2016) assessed depth of burn on tropical peatland and found a mean depth of 0.23 meters.
- Peatland soils are generally a very porous media. Melling et al. (2016) reviewed tropical peatlands in Sarawak, Malaysia after their conversion to palm plantations and found the bulk density varied from 0.21 to 0.23 g cm^{-3}. Siong et al. (2019) measured bulk density of peat surface layers in forest and plantation sites of 0.6-0.7 g cm^{-3}. Porosity of peatland soils in the tropics is recorded as 80-90%. An average porosity of 85% is used in the calculations.

Calculation

The avoided loss of soil water storage is calculated as follows:

*Area of peatland restored (m^2) * avoided peat depth loss (m) * porosity of the peatland soils (%) = avoided loss soil water storage (m^3)*
*10,000 m^2 * 0.5 m * 85% = 4,250 m^3 = 4,250,000 liters*

Based on the above calculation, the long-term volumetric water benefit is estimated as 4.25 ML/yr.

Table 2. Volumetric Water Benefit

Year in which VWB is counted	Timeline	Description of work completed	Cumulative Volumetric Benefit (ML/yr)
2020	May 2018 to December 2019	Peatland Restored	4.25

Volumetric Water Benefit (2020)

- Total Benefit: 4.25 ML/yr
- HEINEKEN Benefit (based on cost share): 4.25 ML/yr

Volumetric Water Benefit Duration

- The maximum volumetric water benefit duration for this project is 10 years, with the year of initial claim (2020) counted as Year One. Therefore, if there is annual evidence that this project is functioning as intended, benefits can be counted through the end of 2030.

Water Project: Reforestation of Peatland

Raja Musa Forest Reserve, Hulu Selangor, Malaysia

Complementary Indicators

- Peatlands are the most carbon dense of any terrestrial ecosystem in the world (Parish et al., 2008; Crump, 2017). They store about 500 tonnes of carbon per meter depth (Page et al., 2011). As the peat at the project site at Raja Musa Forest Reserve is about 4-5m deep, they store at least 2000 tC/ha. Construction of a clay dyke, raising of the water level in the peat through the series of canal blocks, as well as the restoration of the forest cover all help to reduce the risk of loss and degradation of this important carbon store, by decomposition or fire.
- As the restored area grows, it will help maintain biodiversity by allowing wildlife to move between fragmented forest areas. This movement can naturally disperse or transfer more seeds between habitats linked by corridors than between those that are unconnected through the landscape ecological processes.

Notes

- For volumetric water benefit claims to count in future years, monitoring and maintenance activities should continue as described in this Benefit Summary.

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HEINEKEN

www.heinekenmalaysia.com

HEINEKEN MALAYSIA BERHAD 196401000020 (5350-X)
Sungei Way Brewery
Lot 1135, Batu 9,
Jalan Klang Lama
46000 Petaling Jaya
Selangor Darul Ehsan

T : +603 7861 4688
F : +603 7861 4602