Wangsa Maju

Carbon Neutral Growth Centre

ACTION PLAN

KUALA LUMPUR CARBON NEUTRAL

Wangsa Maju
Carbon Neutral Growth Centre 2050
Action Plan

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Foreword from the Minister

As made clear in the Intergovernmental Panel on Climate Change's 6th Assessment Report, the whole world without choice, needs to positively respond to the imperative of achieving global carbon neutrality by 2050, in order to avert the catastrophic impacts of global warming of 1.5 degrees Celsius above the pre-industrial global average temperature.

Mitigating and adapting to climate change, striving to achieve net-zero emission by mid-century will continue to be the most pressing challenge facing humanity not only today, but certainly into the future. We can no longer delay our actions – we must act now!

The Malaysian Government has swiftly responded to this with a pledge to become a carbon neutral nation by 2050 in the recently launched 12th Malaysia Plan. I am honoured that the Ministry of Federal Territories has been tasked with leading Malaysia's transition into carbon neutrality – this is a task which the ministry and I take very seriously.

Cities play the most important role towards achieving carbon neutrality. To that end, cities need to implement concrete carbon neutrality policies and action plans that must be formulated based on good research and scientific evidence.

As the Minister of Federal Territories, I am most delighted to see the Federal Territory of Kuala Lumpur pave the way towards becoming a carbon neutral city by 2050, with Wangsa Maju being strategically selected as the pioneering case for the demonstration of accelerated transformation into a sustainable, vibrant, liveable and carbon neutral growth centre. It is intended that the Wangsa Maju model will be scalable as an example to other strategic growth centres of Kuala Lumpur and other Malaysian cities.

Malaysia is fully committed to being a key part of the global transition to a low-carbon, and eventually carbon neutral society, with ambitions of achieving this by 2050. In order to stand by our pledges, our actions have to be planned, informed and coordinated across different cities, townships and communities. We have to ensure that future generations inherit a place that is not only fit for human habitation, but also conducive for future growth and prosperity.

May this initiative serve as an effective working model for other cities within Malaysia and beyond.

YB Dato' Seri Dr. Shahidan bin Kassim
Minister of Federal Territories

Foreword from the Mayor

Kuala Lumpur is at the cusp of embarking on one of its most crucial journeys to become a sustainable city.

In our history, we have come a long way in promoting economic growth and unlocking the value of this fine city.

As the capital of Malaysia and one of the foremost regional cities in Asia, Kuala Lumpur is ever mindful of its role as a core enabler to enhance the quality of urban life for all KL-ites, while strengthening our sustainability efforts in the face of climate change.

As the Mayor of Kuala Lumpur, I am ever mindful that the prosperity of our communities can no longer be at the expense of sustainable urban growth. We only have one planet, and we must do everything in our power to mitigate climate change. Hence, it is all the more important that we co-create a concrete foundation and clear pathway to transform Kuala Lumpur into a carbon neutral society by 2050—a pledge I made in 2020 with the realistic vision of a carbon neutral world by mid-century.

Kuala Lumpur first embarked on this ambitious journey in 2015, with a target to reduce its greenhouse gas (GHG) emission intensity by 70% by 2030, guided by the Kuala Lumpur Low Carbon Society Blueprint 2030 (KLLCSBP2030). Building on this sound foundation, Kuala Lumpur has raised the bar in taking affirmative action towards achieving its carbon neutrality goal.

In a world that is continuously evolving at the behest of climate change and COVID-19, Kuala Lumpur faces even bigger challenges to sustain rapid economic growth while reducing GHG emissions with a view to achieve carbon neutrality. All this we have to overcome with increasingly contested and stretched resources.

This calls for a more strategic approach to optimise financial resources, develop human capital, adopt innovative green technology and most importantly, accelerate implementation of carbon neutrality projects on the ground. The implementation of projects that yield real and direct positive impact on the economy, the environment and especially the community are of particular importance.

These are some of the core considerations that gave birth to the Wangsa Maju Carbon Neutral Growth Centre (CNGC). The Centre will be a pioneering, innovative and forward-looking carbon neutral urban experiment showcasing accelerated implementation of carbon neutral projects that significantly cut GHG emissions. The exemplary work at Wangsa Maju CNGC will serve as a source of inspiration, motivation and lessons-to-be-learnt for cities in Malaysia and other developing countries, to materialise their climate and sustainability ambitions.

We can expect the Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan to outline concrete, dynamic and sustainable decarbonisation projects that will yield tangible and evident outcomes. Most certainly, the Wangsa Maju community will be the first beneficiary, but more importantly, it is our aspiration that the outcomes here will be able to be replicated in other cities across our nation. To this end, I call upon all parties to work together in transforming Wangsa Maju into a prosperous, thriving, and resilient growth centre. The future success of this project will undoubtedly serve as a stepping stone to greater achievements in sustainability across Kuala Lumpur and for our nation. Kuala Lumpur City Hall is honoured to be part of this journey.

YBhg. Datuk Seri Hj. Mahadi bin Che Ngah
Mayor of Kuala Lumpur

Preface

Cities are increasingly recognised as the most effective and important non-state actors in mitigating global climate change in terms of yielding real cuts in urban Greenhouse Gas (GHG) emissions. Malaysia is fully committed to being a key part of the global transition to a low-carbon, and eventually carbon-neutral society, with ambitions of achieving this by 2050. Kuala Lumpur, as the Capital City and economic powerhouse of rapidly developing Malaysia, needs to lead the way to reducing GHG emissions of rapid economic growth, KLCH aims to reduce the intensity of GHG emission up to 70% by 2030. To that end, the formulation and implementation of a holistic, scientifically grounded and people-centric city-level carbon neutral action plan – using the 'Science to Action' (S2A) approach are highly essential.

Being scientifically grounded, the internationally-recognised Asia-Pacific Integrated Model (AIM) has been used to project Kuala Lumpur's GHG emission intensity reduction potential under various scenarios (with different sets of parameters and justified assumptions for the proposed Measures and Programs). The model shows Kuala Lumpur can potentially reduce its GHG emission intensity by up to 92% by 2050 (compared to the 2010 level), which is equivalent to an absolute reduction of 57,594 ktCO2eq from the business as usual scenario.

As a people-centric plan, the proposed sectors and initiative have been put under scrutiny and review by multiple stakeholders in the Focus Group Discussion (FGD) workshop. The Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan is therefore the outcome of review by, and feedback from, the multiple stakeholders engaged in the workshops.

As a holistic plan, the Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan proposes 5 key Actions and 20 Proposed Initiatives for implementation that consist : 1) Energy ; 2) Waste; 3) Mobility; 4) Community; and 5) Green.

Ultimately, the Carbon Neutral Growth Centre 2050 Action Plan seeks to be a people's action plan that is grounded in scientific research with practical implementation in mind. It will provide a strategic direction and clear framework for coordinating and consolidating various related to faces challenges of needing to simultaneously meet competing needs of sustaining rapid economic growth, strengthening climate resilience and reducing greenhouse gas (GHG) emissions towards carbon neutrality by 2050, with increasingly contested and stretched resources.

UTM-Low Carbon Asia Research Centre
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Faculty of Built Environment
Universiti Teknologi Malaysia
Johor Bahru
Malaysia

Executive Summary

The latest report on the physical science basis of climate change (IPCC, 7 August 2021) from the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report (AR6) cycle presents compelling evidences and concrete findings pointing to a high possibility of a breach of 1.5°C rise in global temperature above the preindustrial level by as early as the 2030s. Described as a code red for humanity, "there is no time for delay and no room for excuses." (António Guterres, United Nations Secretary-General, 9 August 2021)

A global transition into carbon neutrality by mid-century is therefore no longer an option in order to avert irreversible catastrophic impacts of a global warming beyond that of 1.5°C, and cities will continue to play an indispensable role in accelerating such a transition.

As the national capital of rapidly developing Malaysia, and a leading city in mitigating Greenhouse Gases (GHG) emissions and advancing the SDGs, Kuala Lumpur (KL) presciently announced its mid-century carbon neutrality vision at the end of 2020. Kuala Lumpur is well positioned and committed to leading other Malaysian and Asian developing cities towards achieving carbon neutrality by 2050.

This report outlines UTM-Low Carbon Asia Research Centre's proposal (via Uni-Technologies Sdn Bhd, UTSB) to support and materialise KL's carbon neutrality ambition by 2050, focusing on immediate implementation of projects in the proposed Wangsa Maju Carbon Neutral Growth Centre, through the Wangsa Maju Carbon Neutral Growth Centre 2050 (Wangsa Maju CNGC 2050) Action Plan.

To that end, the proposed Wangsa Maju CNGC 2050 Action Plan will be guided by four key principles:

1. Going beyond policies into real implementation of projects that will socially and economically benefit the community and result in direct and indirect cuts in GHG emissions;
2. Adoption of a focused acceleration strategy to judiciously channel limited resources for effective implementation of projects in the proposed growth centre;
3. Integrative approach that balances emissions cut, community needs and continuous economic growth towards the creation of a prosperous carbon neutral society; and
4. Replicability and up-scalability of project implementation to the other KL strategic zones and growth centres.

The report begins with outlining the foundation and crucial need for KL to transition into carbon neutrality by 2050, followed by the background of Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan as a showcase for KL. The report then continues with presenting the baseline modelling for a carbon neutral KL by 2050 as a basis for estimating the potential GHG emission reduction for Wangsa Maju CNGC. The report then explains Wangsa Maju Growth Centre contextual background in terms of transportation and accessibility, infrastructure and utilities, buildings and lastly green spaces and recreational areas. The project proposals for Wangsa Maju CNGC are outlined and this report concludes with the summary of report and the list of stakeholders.

Kuala Lumpur at A Glance

Location

On the central west coast of Peninsular Malaysia, enclave within the State of Selangor and Klang Valley

Coordinate: **3.1390° N, 101.6869° E**

Function

National Capital of Malaysia. One of the major commercial, financial, education, entertainment, healthcare, cultural, and tourism centres of Asia.

Area

- **Kuala Lumpur:** 242.2 km^2
- **Wangsa Maju-Maluri Strategic Zone:** 46.1 km^2
- **Wangsa Maju Growth Centre:** 10.72 km^2

Population

- 2010: **1.67 million** (Source: PSKL 2020)
- 2030: **1.98 million** (Source: PSKL 2040)
- 2050: **2.46 million** (Source: UTM-LCARC Projection)

Gross Domestic Product

- **2010:** RM84,852 million
- **2030:** RM349,992 million
- **2050:** RM603,006 million

Administration

Kuala Lumpur City Hall

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Abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
AIM	Asia-Pacific Integrated Model
APAD	Land Public Transport Agency
CM	Countermeasure
BaU	Business as Usual
CO_2	Carbon Dioxide
COP	Conference of the Parties
DOE/JAS	Department of Environment
DOSM	Department of Statistics Malaysia
EC	Energy Commission
EE	Energy Efficiency
ExSS	Extended Snapshot Tools
FGD	Focus Group Discussion
GHG	Greenhouse Gases
GDP	Gross Domestic Product
IWK	Indah Water Consortium
IPCC	Intergovernmental Panel on Climate Change
KL	Kuala Lumpur
KL CAP	Kuala Lumpur Climate Action Plan 2050
KLCH	Kuala Lumpur City Hall
KLCP	Kuala Lumpur City Plan 2020
KL LCSBP	Kuala Lumpur Low Carbon Society Blueprint 2030
LNG	Liquefied Natural Gas
MSW	Municipal Solid Waste
NIES	National Institute for Environmental Studies
PIQOS	Pedestrian Infrastructure Quality of Services
PSKL	Kuala Lumpur Structure Plan
PTKL	Kuala Lumpur Local Plan 2040
RE	Renewable Energy
SEDA	Sustainable Energy Development Authority
SWCorp	Solid Waste and Public Cleansing Corporation
TNB	Tenaga Nasional Berhad
UNFCCC	United Nations Framework Convention on Climate Change
Wangsa Maju CNGC	Wangsa Maju Carbon Neutral Growth Centre

Unit	
kg	Kilogram
ktoe	Kilo tonne oil equivalent
tCO_2eq	tonne carbon dioxide equivalent
$ktCO_2eq$	Kilo tonne carbon dioxide equivalent
km^2	Kilometer square
RM	Ringgit Malaysia

CHAPTER 1

INTRODUCTION

1.1

The Challenges of Climate Change

Climate change has been the greatest threat in history to human health, the economy, and the environment. Due to the growing awareness and concern over global warming and it impacts, adoption of low carbon society has captured the attention of the whole world. For cities and urban regions that are developing rapidly, initiatives towards decarbonising their development and economic activities are highly essential. Hence, global warming and climate change pose new challenges to nations, cities, and regions to rethink their growth path towards enabling continuous growth while contributing to mitigating greenhouse gases emissions.

The world was shaken up earlier this month by the release of the Intergovernmental Panel on Climate Change's (IPCC) Climate Change 2021 – The Physical Science Basis report *(refer to Figure 1.1)*. The report presents compelling evidences that human influence on the climate has reached a critical state, that the 1.5°C temperature rise above the preindustrial level may be reached as early as 2030, and humanity must race to reduce CO_2 and other GHG emissions to net zero by mid century to avert irreversible consequences of climate change. At the global level, various sustainable development and climate agenda are recognised as centres of converging global frameworks that relate to climate change mitigation, i.e. the Paris Agreement 2015, the Sustainable Development Goals (SDG) 2030 and the New Urban Agenda (2016).

The Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) was adopted on December 2015 in Paris, France, at the 21st session of the Conference of the Parties (COP) to the UNFCCC *(refer to Figure 1.2)*. The agreement, adopted by 196 Parties to the UNFCCC, entered into force on 4 November 2016 and as of May 2018 had 195 Signatories and was ratified by 177 Parties. One of the goals of the Paris Agreement is 'Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels', recognising that this would significantly reduce the risks and impacts of climate change.

The SDG 2030 is the United Nations' new global development agenda that comprises 17 goals for sustainable development for the next 15 years in areas of critical importance for humanity and the planet *(refer to Figure 1.3)*. The 17 Sustainable Development Goals (SDGs) have been adopted by global leaders in 2015 at the United Nations Sustainable Development Summit in New York. The SDGs signify the need for countries, and in particular cities where populations are concentrated, to take an integrative and holistic approach to tackling climate change, which needs to also embrace competing social and economic needs. As climate change worsens, the challenge facing cities are forever becoming greater.

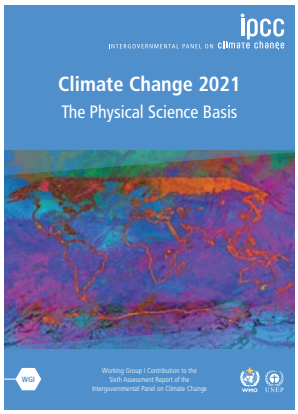


Figure 1.1: Intergovernmental Panel on Climate Change's (IPCC) Climate Change 2021 – The Physical Science Basis report

Figure 1.2: Paris Agreement

In order to become a carbon neutral city by 2050, it is important to ensure the future development of Kuala Lumpur i s aligned with the SDGs especially SDG 11 and 13. SDGs underpin the fundamental philosophy for the implementation of the KL LCSBP 2030, and therefore has guided Kuala Lumpur's development up to 2030. It is important to mitigate global peaking of greenhouse gas emissions as soon as possible in order to achieve a climate neutral world by mid-century.

Figure 1.3: The 17 Sustainable Development Goals (SDGs)

SDG 11: Sustainable Cities and Communities

Due to their high concentration of people, building urban resilience is crucial to avoid human, social and economic losses while improving the sustainability of urbanization processes is needed to protect the environment and mitigate disaster risk and climate change.

SDG 13: Climate Action

Global warming is causing long-lasting changes to our climate system, which threatens irreversible consequences if we do not act. These actions will be integrate disaster risk measures, sustainable natural resource management, and human security into national development strategies.

Many countries around the world are updating their Nationally Determined Contribution (NDC) under the Paris Agreement in response to the 2018-2019 IPCC reports towards increasing their GHG emission reduction and cities are expected to continue contributing significantly to the revised NDC targets, including towards carbon neutrality by mid-century.

Figure 1.4: New Urban Agenda

The New Urban Agenda (NUA) calls for an urban paradigm shift to readdress the way to plan, finance, develop, govern and manage cities and human settlements towards achieving sustainable development and prosperity for all *(refer to Figure 1.4)*. A part of sustainable development and climate agenda, a series of national-level climate change and low carbon initiatives have emerged in the form of policies, frameworks and guidelines such as the National Policy on Climate Change (NPCC) 2009 and the Low Carbon Cities Framework and Assessment System (LCCF) 2011.

Following the earlier mentioned IPCC Climate Change 2021 – The Physical Science Basis report as well as the three 2018-2019 IPCC Special Reports, it is apparent that countries and especially cities can no longer delay and give excuses in taking actions towards reducing GHG emission to net zero by 2050. This is with a view to keeping global temperature rise to within 1.5°C of the preindustrial level. Many forward-looking cities, especially those in the developed world, have announced some form of carbon neutrality ambition, with some already putting in place official policies and plans. The proposed Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan will be Kuala Lumpur's first showcase to the world concrete carbon neutral projects to be implemented that will contribute to the city's eventual achievement of carbon neutrality by 2050.

1.2

Concept of Carbon Neutrality

Climate change is already affecting the entire world, with extreme weather conditions such as drought, heat waves, heavy rains, floods and landslides becoming more frequent, including in Malaysia. Other consequences of the rapidly changing climate include rising sea levels, ocean acidification and loss of biodiversity. Cities in particular play a major role in reducing greenhouse gas emissions. On a global scale, 70 % of all greenhouse gas emissions are caused by cities. Thus, it is essential for major cities to consider achieving carbon neutrality by a certain period of time.

According to the definition of the IPCC (2018), carbon neutrality is achieved when anthropogenic CO_2 emissions are balanced by anthropogenic CO_2 removals over a specified period *(refer to Figure 1.5)*. A city can be regarded as 'climate-neutral' if its greenhouse gas emissions can keep global warming below the dangerous threshold of 1.5°C. As key activities contributing to GHG emissions (e.g. energy, transportation, waste) are mostly located in the urban area, city governments play a crucial role in influencing the transformation of these sectors by translating the national policies and implementing the policies on the ground.

To date, many cities have globally committed to achieving climate neutrality by 2050 or earlier, such as Copenhagen, London, Tokyo, Helsinki and Glasgow, *(refer to Figure 1.6)* and the list is expanding. Building on the low-carbon growth pathway emphasised by the KL LCSBP 2030, Kuala Lumpur aspires to lead the way among rapidly developing cities towards achieving carbon neutrality by 2050.

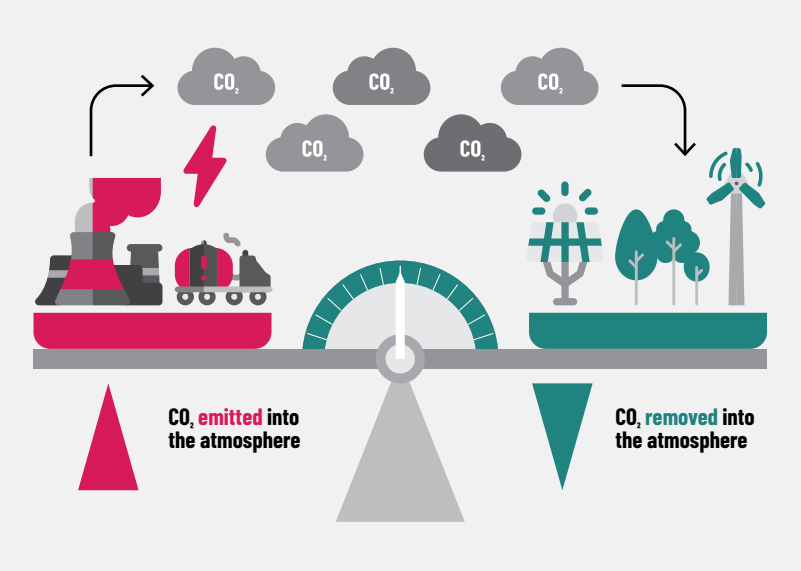


Figure 1.5: Carbon Neutrality Definition

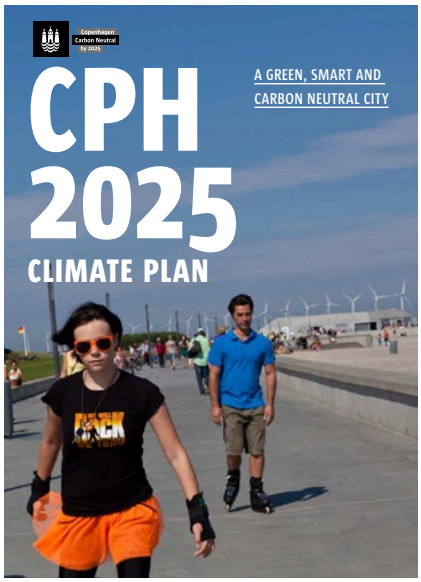


Figure 1.6: Copenhagen Climate Plan

1.3

Kuala Lumpur towards Carbon Neutrality by 2050

The 12th Malaysia Plan, 2021-2025 will be formulated to set the way forward for national development agenda along with the implementation framework over the next decade *(refer to Figure 1.7)*. This is to ensure an inclusive and meaningful socioeconomic development towards a more prosperous society.

Figure 1.7: 12th Malaysia Plan, 2021-2025

Aligned with the shared prosperity initiative, there are three (3) dimensions to be emphasised *(refer to Figure 1.8)*. Of the dimensions, environmental sustainability will be part of the national development agenda. Under this dimensions, there are various components that will be included such as (1) Climate change mitigation and adaptation, (2) Carbon tax, (3) Sustainable consumption and production, (4) Disaster risk management, (5) Green technology, (6) Biodiversity conservation, (7) Renewable energy (RE), (8) Energy efficiency (EE), (9) Integrated water resource management and the list goes on.

In the 12th Malaysia Plan mention that Malaysia will advance green growth by implementing the clean, green and resilient development (Chapter 8: Advancing Green Growth for Sustainability and Resilience) agenda through the whole of-nation approach. As Malaysia commits to conserve planetary health and aspires to become a carbon neutral nation in the long term, priority will be given to low-carbon and climate resilient socioeconomic development as well as conservation of natural resources and ecosystems. Kuala Lumpur is proud to be a part of the international movement to act against climate change. The city began its journey to combat climate change through community engagement and carbon emissions reduction programmes in the early 2000s.

Hence, Kuala Lumpur has been selected as Target Cities in The National Low Carbon Cities Masterplan (NLCCM) *(refer to Figure 1.9)*. This document is prepared to address the gaps in policies to meet the country's GHG reduction goals in mitigating climate change. The master plan outlines absolute GHG reduction targets for the 33 biggest cities and regions in Malaysia in three (3) different phases of implementation. Under this master plan, the 3M Approach *(refer to Figure 1.10)* is introduced to guide Kuala Lumpur as major players in climate change mitigation, as well as set an example for the development of emission reduction strategies at the local level. The ambitious GHG reduction target of Kuala Lumpur which exceeds Malaysia's GHG reduction commitment is intentional to drive more impactful GHG mitigation projects in meeting the targets.

Figure 1.8: Three Dimensions Included in 12th Malaysia Plan 2021-2025

Figure 1.9: Malaysia NLCCM Report

MEASUREMENT
of the GHF emissions by establishing a baseline and providing periodic and providing periodic monitoring

1

MANAGEMENT
of the low carbon development in terms of policy, targets and planning

2

MITIGATION
of the GHG emissions through design and implementation of programme and projects

3

Figure 1.10: 3M Approach of NLCCM

- Goal 1 **Innovative and Productive City**
- Goal 2 **Inclusive and Equitable City**
- Goal 3 **Health and Vibrant City**
- Goal 4 **Climate Smart and Low Carbon City**
- Goal 5 **Efficient Mobility and Environmental Friendly City**
- Goal 6 **Integrated and Sustainable Development**

Figure 1.11: Six (6) Main Goals for PSKL 2040

Figure 1.12: PSKL 2040

PSKL 2040 contains details of all the relevant separate components that make up the city by adopting a holistic, inclusive, equitable, liveable and sustainable approach. Envisioning to be, there are six (6) goals that have been identified encompassing social, economic, living and natural environment and physical planning aspects *(refer to Figure 1.11)*.

The 4th Goal: Climate Smart and Low Carbon in PSKL 2040 are focuses on the efforts towards reducing GHG emissions and transforming KL into a global city that efficiently manages resources and enhances its competency to drive future green growth. This document also emphasises the importance of resource-efficient infrastructure development and the utilisation of green and clean technology. Towards achieving this goal, the future development of KL will also be given priority to improving EE system, waste and water management, low carbon buildings and green mobility, introduce low emission release zone, smart technology and low carbon community development.

To ensure the goal is achieved, the Wangsa Maju CNGC 2050 Action Plan should be in line with the PSKL 2040 *(refer to Figure 1.12)* through the identification of initiatives or projects that will serve as a guide to other growth centers towards achieving KL's aspirations as the first carbon neutral city in Asia by 2050.

As the national capital and leading city in Malaysia in the aspects of economy and infrastructure development, it is essential that Kuala Lumpur leads the way and becomes a best practice for creating a better living environment in the future in Malaysia. To realise its growth vision and at the same time contribute to meeting Malaysia's global commitment to reducing carbon emissions, the Kuala Lumpur Low Carbon Society Blueprint 2030 (KL LCSBP 2030) was formulated *(refer to Figure 1.13)*.

Figure 1.13: KL LCSBP 2030

The KL LCSBP 2030 was officially launched by the Mayor of Kuala Lumpur and adopted by the Kuala Lumpur City Hall in December 2018. With a target to reduce the city's carbon emission intensity of GDP by up to 70% by 2030, 3 thrusts *(refer to Figure 1.14)*, 10 actions, 37 sub-actions, 82 measures and 245 programs have been identified for implementation.

The KL LCSBP 2030 effectively sets a clear and practical pathway to guide Kuala Lumpur towards becoming a low carbon society by 2030, carbon neutral ready by 2040, and carbon neutral by 2050 *(refer to Figure 1.15)*. Beyond 2030, Kuala Lumpur aspires to achieve carbon neutrality by 2050 through the transition into a low-carbon, sustainable and climate resilient future. This will require serious and concerted efforts across the industry, economy, and society. Kuala Lumpur will pursue its efforts to maximise the potential emission reductions from all sectors. Therefore, it is important to demonstrate the implementations of KL LCSBP 2030 programs and develop necessary steps to become a carbon neutral city by 2050.

Transformational approaches will be needed that go beyond conventional thinking. This needs a decisive and ambitious range of actions that are low cost and short-term (quick results) as well as long-term transformational initiatives that will require significant investment. It is in this view that the current proposed Wangsa Maju CNGC 2050 Action Plan is conceptualised. Projects that will be proposed in the Action Plan will progressively transform Wangsa Maju from a largely suburban dormitory neighbourhood into a thriving, prosperous, carbon neutral growth centre.

Figure 1.14: Three (3) Thrusts in KL LCSBP 2030

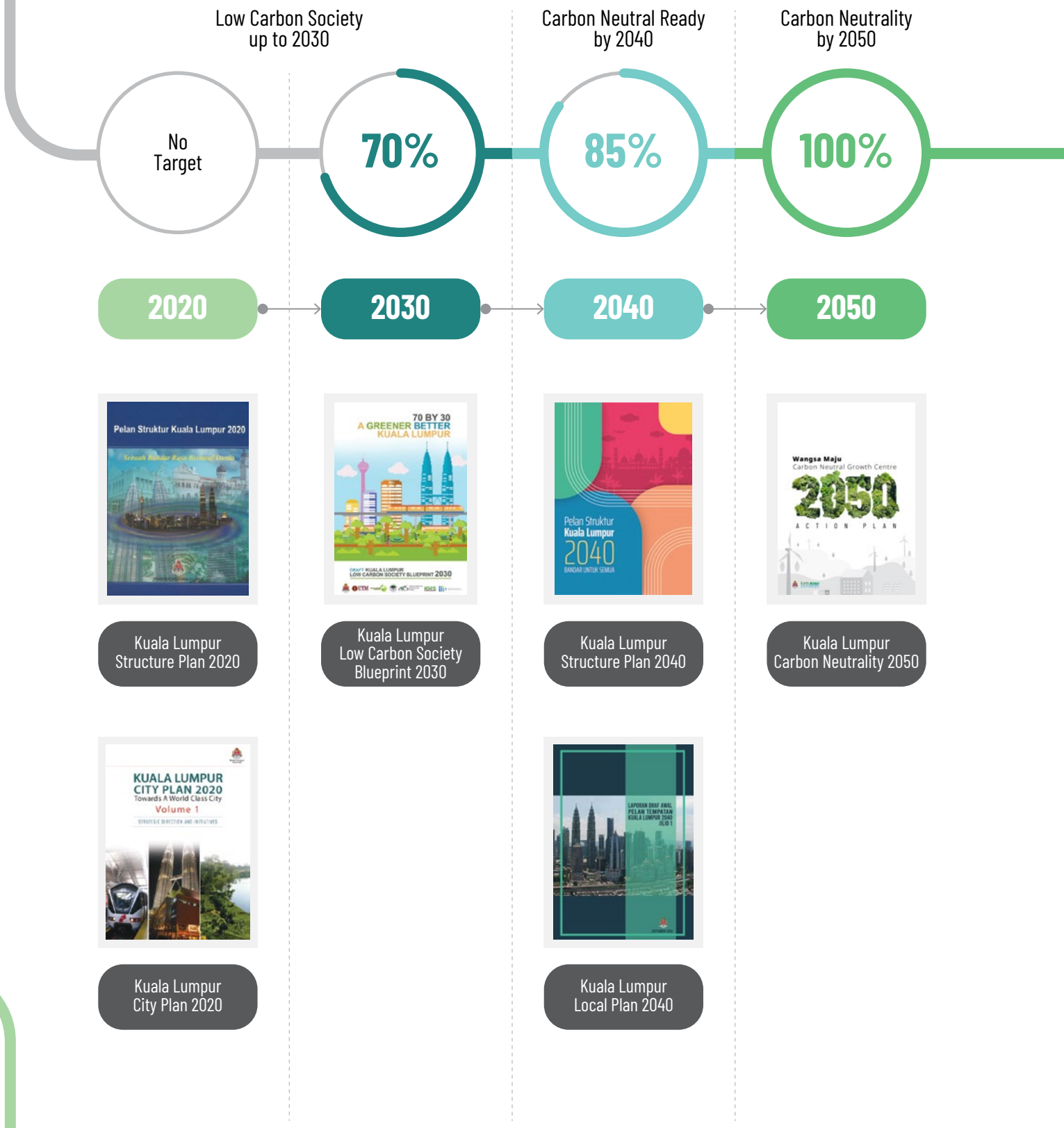


Figure 1.15: GHG Emissions Intensity Target for Kuala Lumpur

1.4

Commitment of Kuala Lumpur Towards Climate Change

2006

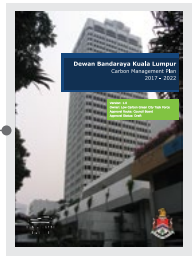
Local Agenda 21

KLCH established its LA21 unit, responsible for managing community engagement programmes and develop public private partnership

2016

KLCH Carbon Management Plan 2017-2022

KLCH developed its Carbon Management Plan (CMP) to deliver 20% absolute carbon emissions reductions from KLCH owned, managed & operated assets



2018

KLLCSBP2030 Summary For Policy Makers

KLCH prepared the Summary for Policy Makers (SPM) to guide the delivery of the KLLCSBP2030

2019

KL Joined The C40 Climate Action Planning Programme

In collaboration with C40, KLCH developed a Kuala Lumpur Climate Action Plan to achieve carbon neutrality by 2050 via inclusive planning and multistakeholder collaboration

KL joins GCOM

GLOBAL COVENANT of MAYORS for CLIMATE & ENERGY

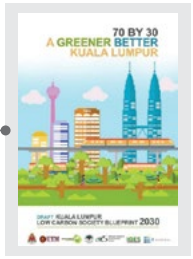
2017

KL joins C40 City

C40 CITIES

KL Low Carbon Society Blueprint 2030

KLCH and UTM develops the KLLCSBP2030, which contains 245 programmes or actions, to deliver 70% carbon emissions reduction per unit GDP by 2030



KL declares commitment to New Urban Agenda and SDGs

SUSTAINABLE DEVELOPMENT GOALS

2021

KL Climate Action Plan 2050

Through KLCH's strong governance and effective collaboration with C40, the Kuala Lumpur Climate Action Plan is formulated

Current Action Plan

KL Carbon Neutral Climate Action Plan 2050- Wangsa Maju

Aspiring to become a carbon neutral city by 2050, KLCH in collaboration with UTM is formulating KL carbon neutrality action plan 2050- Wangsa Maju

1.5

Global Cities Towards Carbon Neutrality

Low carbon and carbon neutrality best practices involving ten global cities across the same spatial scales (i.e., state capital city) have been reviewed. Each of these plans includes specific carbon reduction actions and environmental target s and the timeline towards achieving carbon neutrality city. To sum, these policies identify key sectors with potential emissions reduction targets *(refer to Table 1.1)*.

From the review, policies most relevant and applicable in the context of Kuala Lumpur and Wangsa Maju CNGC are sorted and classified into sectors including renewable energy; green building; transportation, clean and green technology; sustainable waste management and green lifestyle. For instance, in the renewable energy sector, the introduction and implementation of renewable energy sources such as solar power, waste-to-energy and biomass have been identified as feasible renewable energy alternatives in Kuala Lumpur and Wangsa Maju CNGC. For the green building sector, the case studies show that most cities have designed and implemented various policies for the building sector given its high contribution to energy consumption.

Policies such as practicing passive design and building retrofitting for higher energy efficiency can be integrated in Kuala Lumpur's policies towards becoming a carbon neutral city. For the transportation sector, active mobility, public transport planning and the use of electric vehicles are among the prioritised initiatives which can be adopted as Wangsa Maju CNGC strategies. In conclusion, the synthesis of the benchmarking studies across 10 global sustainable cities provides a concrete and holistic framework in terms of how wide-ranging low carbon and carbon neutrality options and opportunities can be adopted in transforming Wangsa Maju CNGC into a carbon neutral city by 2050.

Table 1.1: Profile of Global Cities Towards Carbon Neutrality

Global Cities Towards Carbon Neutrality										
Cities										
	CPH	AMT	BLN	HLS	BTN	TKY	LDN	NY	PRS	ADL
Population	799,000 (2021)	821,175 (2015)	3.56m (2020)	656,250 (2021)	650,281 (2015)	37m (2020)	8.96m (2021)	8.43m (2015)	2.2m (2020)	25,456 (2019)
Land area (km^2)	180.0	219.3	891.8	213.7	232.1	2,190.90	1,572.0	783.8	105.0	15.57
Density (person/km^2)	4,400	3,744	3,991	3,070	2,801	16,888	5,701	10,751	20,952	1,634
GDP (US$ Million)	127,000 (2020)	233,000 (2015)	181,322 (2020)	59,289 (2018)	380,000 (2015)	1.8tn (2020)	691,146 (2019)	1.7tn (2019)	804,009 (2020)	194,700 (2020)
Year adopted	2015	2020	2014	2018	2019	2019	2018	2017	2016	2019
Base year	2009	1990	2010	1990	2015	2013	1990	2005	2004	2015
Target year	2025	2030, 2050	2050	2035	2050	2050	2050	2050	2050	2050
Reduction Target	Carbon Neutral 2025	55% by 2030, 95% by 2050	Climate Neutral 2050 (85%)	Carbon Neutral (80%)	Carbon Neutral 2050	Carbon Neutral 2050	Carbon Neutral (80%)	Carbon Neutral (80%)	Carbon Neutral (80%)	Carbon Neutral 2050
Spatial scale	Capital City	Capital City	Capital City	Capital City	Capital City	Capital City	Capital City	City	Capital City	Capital City

Source: UTM-LCARC

Note: CPH: Copenhagen, AMT: Amsterdam, BLN: Berlin, HLS: Helsinki, BTN: Boston, TKY: Tokyo, LDN: London, NY: New York, PRS: Paris, ADL: Adelaide

Table 1.2: Key Sectors and Strategic Sectors

Global Cities Towards Carbon Neutrality											
Cities		CPH	AMT	BLN	HLS	BTN	TKY	LDN	NY	PRS	ADL
Energy	Renewable energy	✓	✓	✓		✓	✓		✓		✓
	Solar PV	✓	✓	✓	✓	✓		✓	✓		
	Districts cooling / heating systems	✓	✓	✓							
	Smart technology							✓			✓
Transportation	Pedestrian and Cycling	✓	✓	✓	✓	✓		✓		✓	
	Public transport services	✓	✓	✓	✓	✓		✓	✓	✓	✓
	Electric vehicles	✓	✓	✓	✓		✓	✓	✓	✓	✓
	Parking management			✓							
Buildings	Green buildings	✓	✓		✓	✓	✓				✓
	Energy efficient buildings		✓	✓	✓	✓		✓	✓	✓	✓
	Building retrofit	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Community	Public awareness and education	✓	✓								
	Partnerships	✓					✓				
	Education at school	✓			✓						
	Urban farming				✓						
Green	Increase green areas	✓									✓
	Carbon reporting system				✓						
Urban Development	Dense and compact city	✓									
	Sustainable planning	✓									
Waste	Waste incineration	✓				✓					
	Waste recycling				✓	✓	✓			✓	✓
	Waste management				✓		✓			✓	✓

Source: UTM-LCARC

Note: CPH: Copenhagen, AMT: Amsterdam, BLN: Berlin, HLS: Helsinki, BTN: Boston, TKY: Tokyo, LDN: London, NY: New York, PRS: Paris, ADL: Adelaide

1.6

Carbon Neutral Kuala Lumpur 2050 Scenario

Kuala Lumpur leads the way to reducing GHG emissions of rapid economic growth through the formulation and implementation of the KL LCSBP 2030. The concept of Low Carbon Society (LCS) underpins the fundamental philosophy for the implementation of the KL LCSBP 2030, and guides Kuala Lumpur's development up to 2030. Till today, Kuala Lumpur continues its effort to maximise the potential emission reductions from all the sectors. This aligns with the Paris Agreement's aim to mitigate global peaking of greenhouse gas emissions as soon as possible to achieve a climate neutral world by mid-century.

The KL LCSBP 2030 sets Kuala Lumpur on the path towards a more ambitious target to be Carbon Neutral by 2050. Hence, it is important to go beyond low carbon development towards carbon neutral ready by 2040 and to set a concrete pathway to achieve carbon neutrality by 2050 *(refer to Figure 1.16)*. This aspiration to achieve carbon neutrality by 2050 is crucial and is in line with the Leaders Summit on Climate where countries announced ambitious new climate targets and committed to reducing emissions to keep the goal of limiting global warming to 1.5-degrees C. Global climate leaders emphasise the urgency of major economies to strengthen their ambitions as well on the road to the United Nations Climate Change Conference (COP 26) in November 2021 in Glasgow.

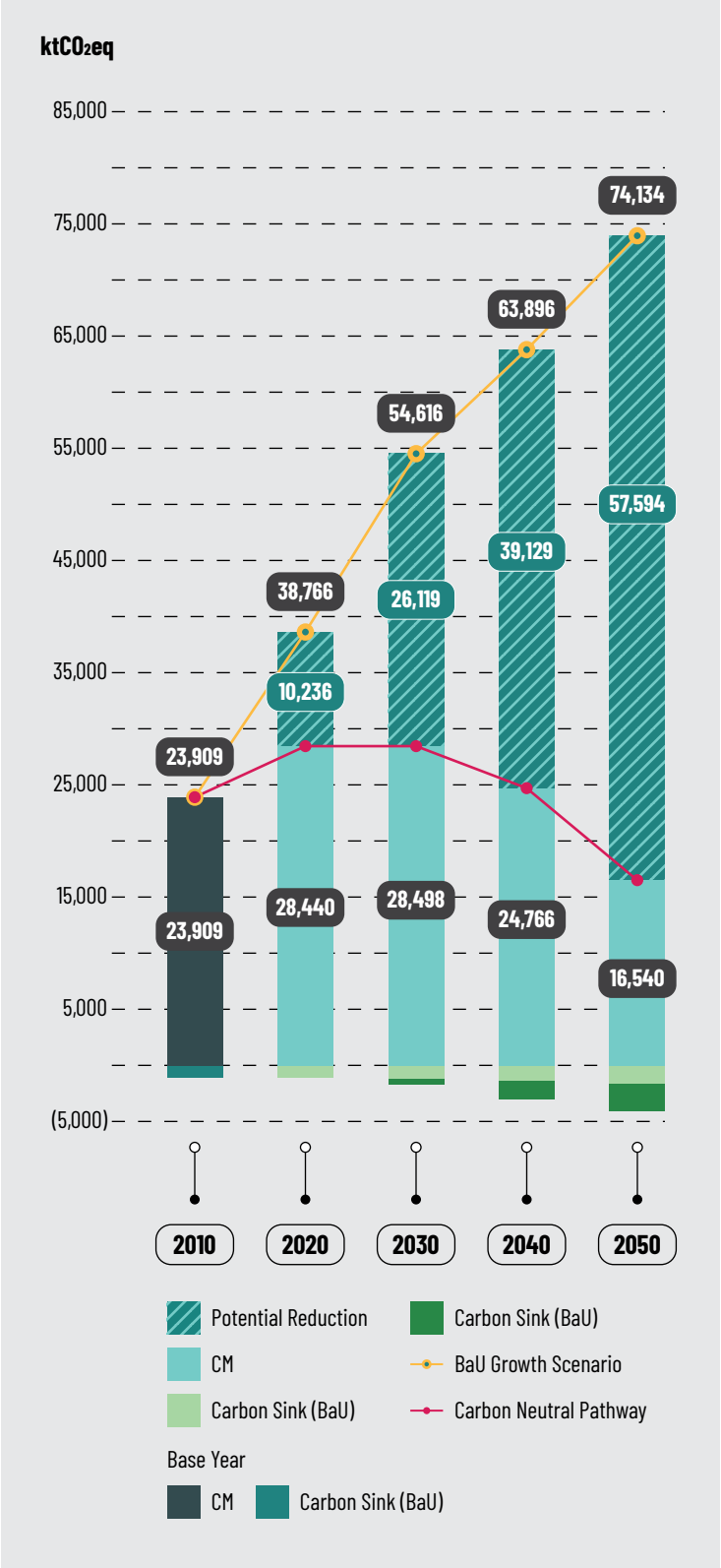
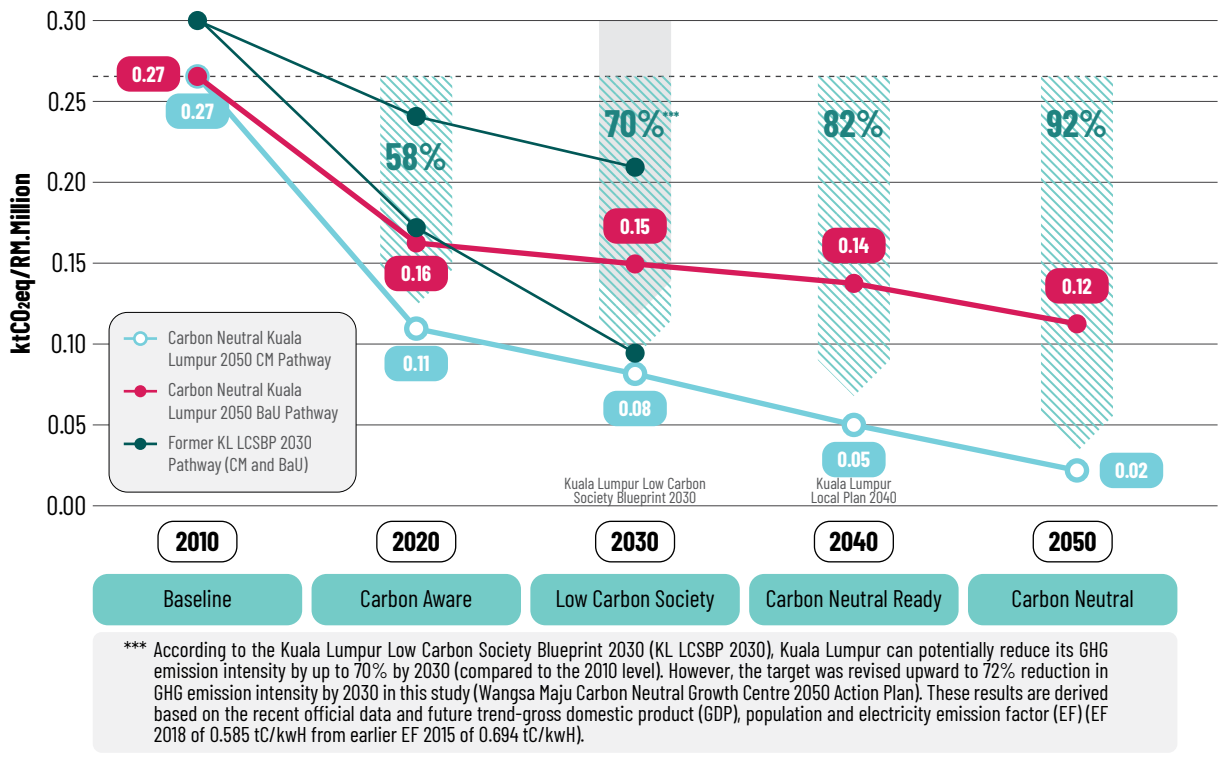


Figure 1.16: Kuala Lumpur Carbon Neutrality Pathways
Source: UTM-LCARC Projections

Referring to *Figure 1.17* and *Figure 1.18*, Kuala Lumpur can potentially reduce its GHG emission intensity (compared to the 2010 level) by up to 72% by 2030 (equivalent to an absolute reduction of 26,119 $ktCO_2eq$ from the BaU scenario), as well as 82% by 2040 (equivalent to an absolute reduction of 39,130 $ktCO_2eq$ from the BaU scenario) and 92% by 2050 (equivalent to an absolute reduction of 57,594 $ktCO_2eq$ from the BaU scenario). Based on the modelling estimation over the course of 20 years (from 2030 to 2050), it shows a significant and steady increase in terms of absolute GHG reduction from the BaU scenarios where 2050 CM including the carbon sink is expected to have the highest absolute reduction (i.e., 58,176 $ktCO_2eq$). This increasing trend of emissions reduction fits well with the carbon neutrality trajectory; to feasibly realise the 2050 target (i.e., becoming a full-fledged carbon-neutral city), Kuala Lumpur has been set to transition into a low carbon city by 2030, and by 2040, the city is expected to be more carbon-neutral ready.

These results are derived from the AIM model and based on the recent official data and future trend- gross domestic product (GDP), population and electricity emission factors. The most significant reduction in GHG emissions in 2050 CM comes from the commercial sector compared to the 2050 BaU scenario. It is expected that the remaining net emissions of 16, 540 $ktCO_2eq$ will be offset by carbon sink as well as other technologies means and carbon trading mechanisms that will be progressively available to Kuala Lumpur.

As such, proper implementation of the KL LCSBP 2030 and Kuala Lumpur Carbon Neutrality action plan 2050 are essential to enable Kuala Lumpur to significantly contribute to Malaysia's global commitment to mitigating climate change and achieving carbon neutrality while maintaining strong economic growth.



*** According to the Kuala Lumpur Low Carbon Society Blueprint 2030 (KL LCSBP 2030), Kuala Lumpur can potentially reduce its GHG emission intensity by up to 70% by 2030 (compared to the 2010 level). However, the target was revised upward to 72% reduction in GHG emission intensity by 2030 in this study (Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan). These results are derived based on the recent official data and future trend-gross domestic product (GDP), population and electricity emission factor (EF) (EF 2018 of 0.585 tC/kwH from earlier EF 2015 of 0.694 tC/kwH).

Figure 1.17: GHG Emission Intensity of GDP and Potential Reduction for 2010, 2020, 2030, 2040 and 2050
Source: UTM-LCARC Projections

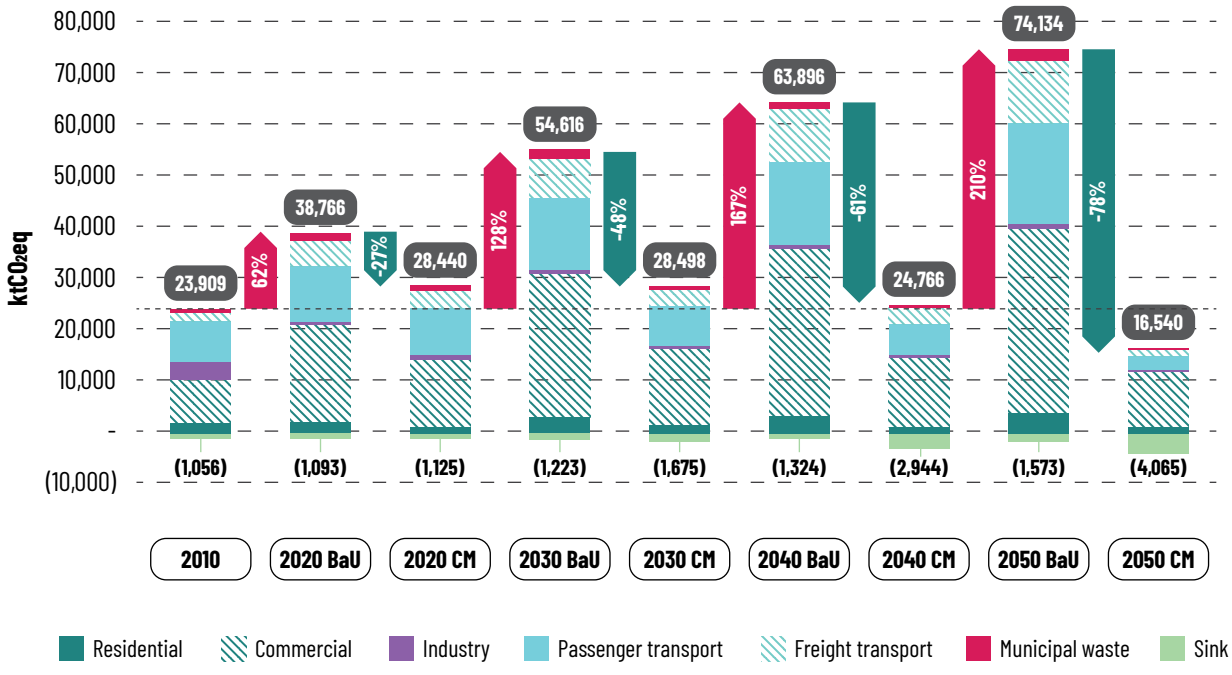


Figure 1.18: Absolute GHG Emission of Kuala Lumpur 2010, 2020, 2030, 2040 and 2050
Source: UTM-LCARC Projections

CHAPTER 2

WANGSA MAJU CARBON NEUTRAL GROWTH CENTRE ACTION PLAN – A SHOWCASE

2.1

Background of Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan

Kuala Lumpur is a Federal Territory and the economic capital of Malaysia. It is the largest city in Malaysia, covering an area of 242.2 km^2 with an estimated population of 1.98 million as of 2030 (Source: PSKL 2040) that is projected to grow to over 2.46 million by 2050.

For efficient, effective, and sustainable growth planning, the city is divided in to six strategic zones *(refer to Figure 2.1)*. A key strategic zone that is seeing steady growth and accounting for over 20% of Kuala Lumpur's population is the Wangsa Maju-Maluri Strategic Zone which is in the north-eastern part of the city (Source: PTKL 2040).

The Kuala Lumpur City Plan 2020 identifies the Wangsa Maju CNGC, covering an area of 2,649.20 acres and located in the northern part of the Strategic Zone, as a key growth centre. In line with Kuala Lumpur's aspiration of becoming a carbon neutral city by 2050, it is strategic and timely to explore sustainable, innovative, green, and smart growth opportunities to transform the Wangsa Maju CNGC from its presently largely dormitory function to becoming the first thriving, prosperous, carbon neutral precinct in Malaysia. The Wangsa Maju CNGC will play a crucial pioneering role to lead the other five strategic zones of Kuala Lumpur, as well as other Malaysian cities, to progressively transition into carbon neutrality by 2050.

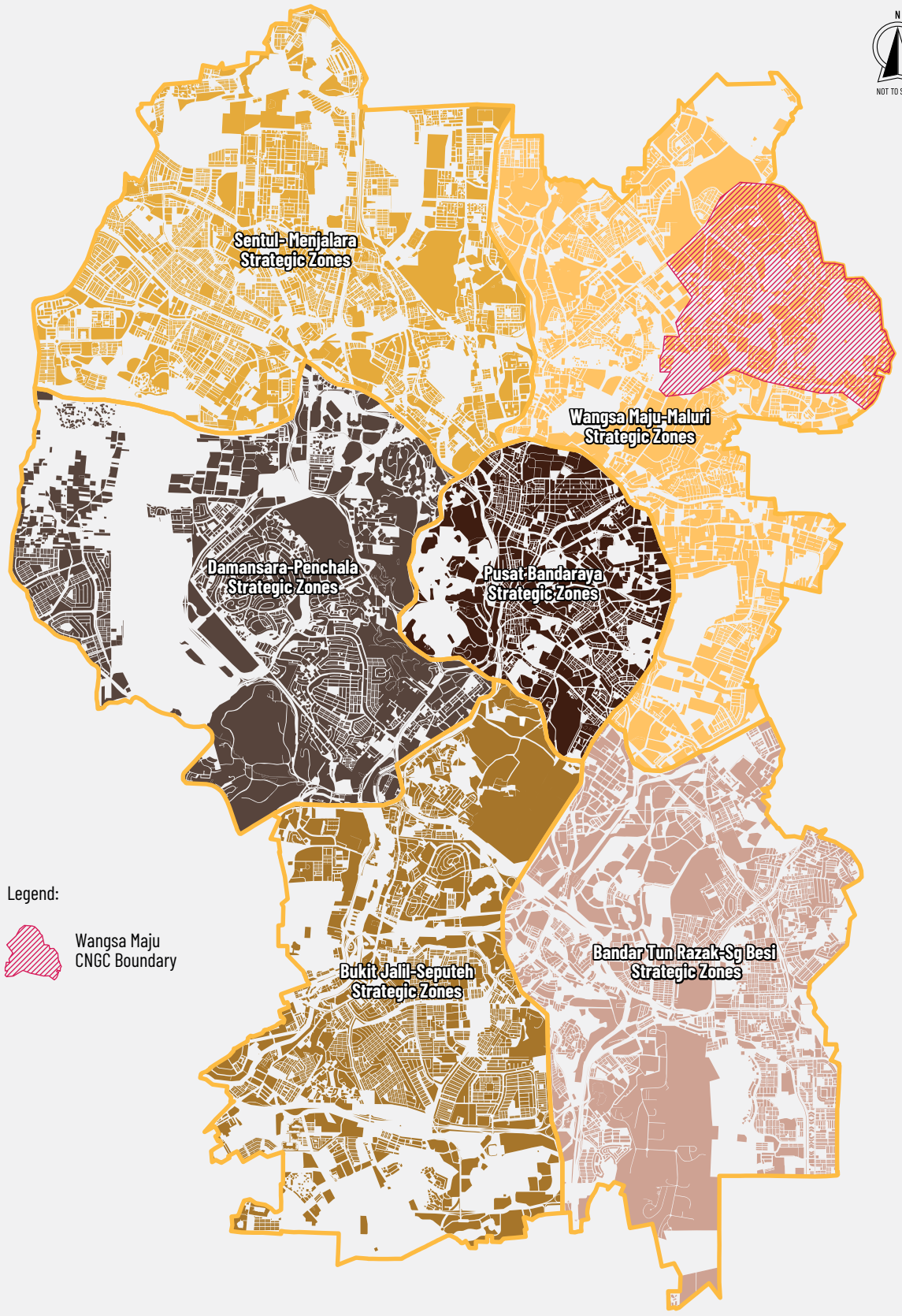


Figure 2.1: Six (6) Strategic Zones in Kuala Lumpur

2.2

Wangsa Maju Carbon Neutral Growth Centre Profile

2.2.1 Landuse

Based on *Figure 2.2*, the three (3) main land uses in Wangsa Maju CNGC are housing (31.53%), transportation (30.24%) and vacant land (16.28%) (Source: KLCH, 2021). This study area is not limited to the Wangsa Maju CNGC area only, this study will also consider the catchment area (with 2km parameter) as a potential area in the study to ensure the proposed initiative can be implemented.

2.2.2 Transportation and Accessibility

There are several types of roads that connect Wangsa Maju CNGC with the surrounding area and others strategic zones in Kuala Lumpur. There are two (2) highways that pass through and Wangsa Maju CNGC also can be connected through existing main roads such as Jalan Genting-Kelang, Jalan Mohamad Yatim Yahya, Jalan Setiawangsa and Jalan Kilang.

2 Highways

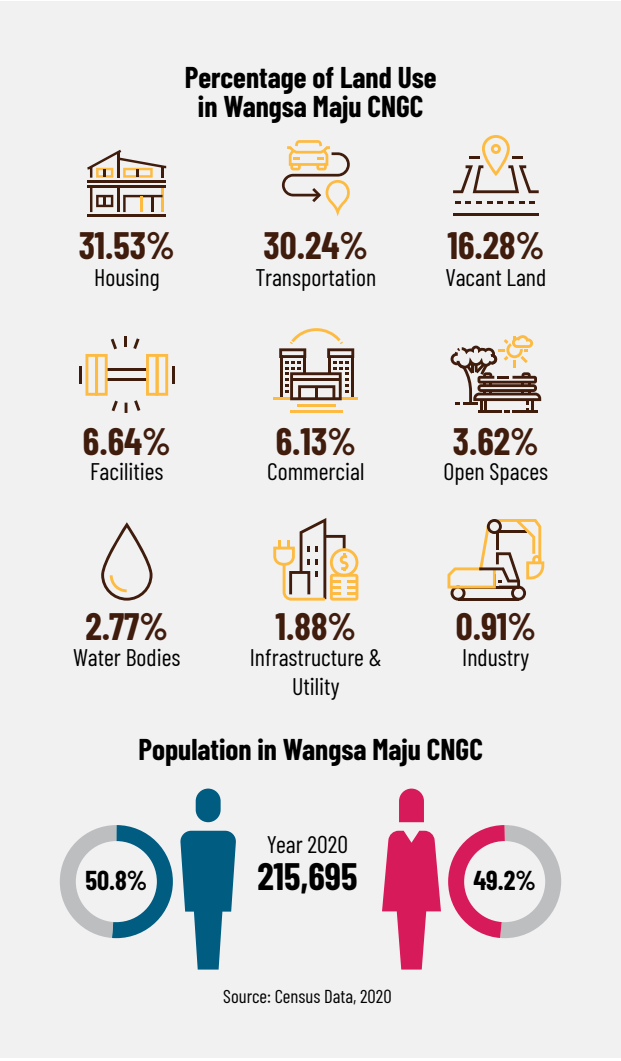
Lebuhraya Duta-Ulu Kelang (DUKE)
Jalan Lingkaran Tengah 2 (MRR2)

4 Main roads

Jalan Genting-Kelang
Jalan Mohamad Yatim Yahya
Jalan Setiawangsa
Jalan Kilang

The provision of pedestrian and cycling pathways in residential and commercial areas should be improved to minimise vehicular disruptions and enhance pedestrian and cyclist safety. There is a need to connect pedestrian and cyclist to the existing transportation nodes and recreational areas such as Tasik Sri Rampai, Sungai Bunus and Bukit Dinding. The pedestrian and cycling network should connect its user to the services or places with comfortable and safe environment.

There are two (2) types of public transportation services that serve Wangsa Maju CNGC residents: public buses and Light Rail Transit (LRT). The two (2) existing LRT stations namely Wangsa Maju LRT Station (elevated platform) and Sri Rampai LRT Station (subsurface platform) serve the Kelana Jaya Line that connects Gombak to Petaling Jaya to the South via KLCC and KL Sentral.



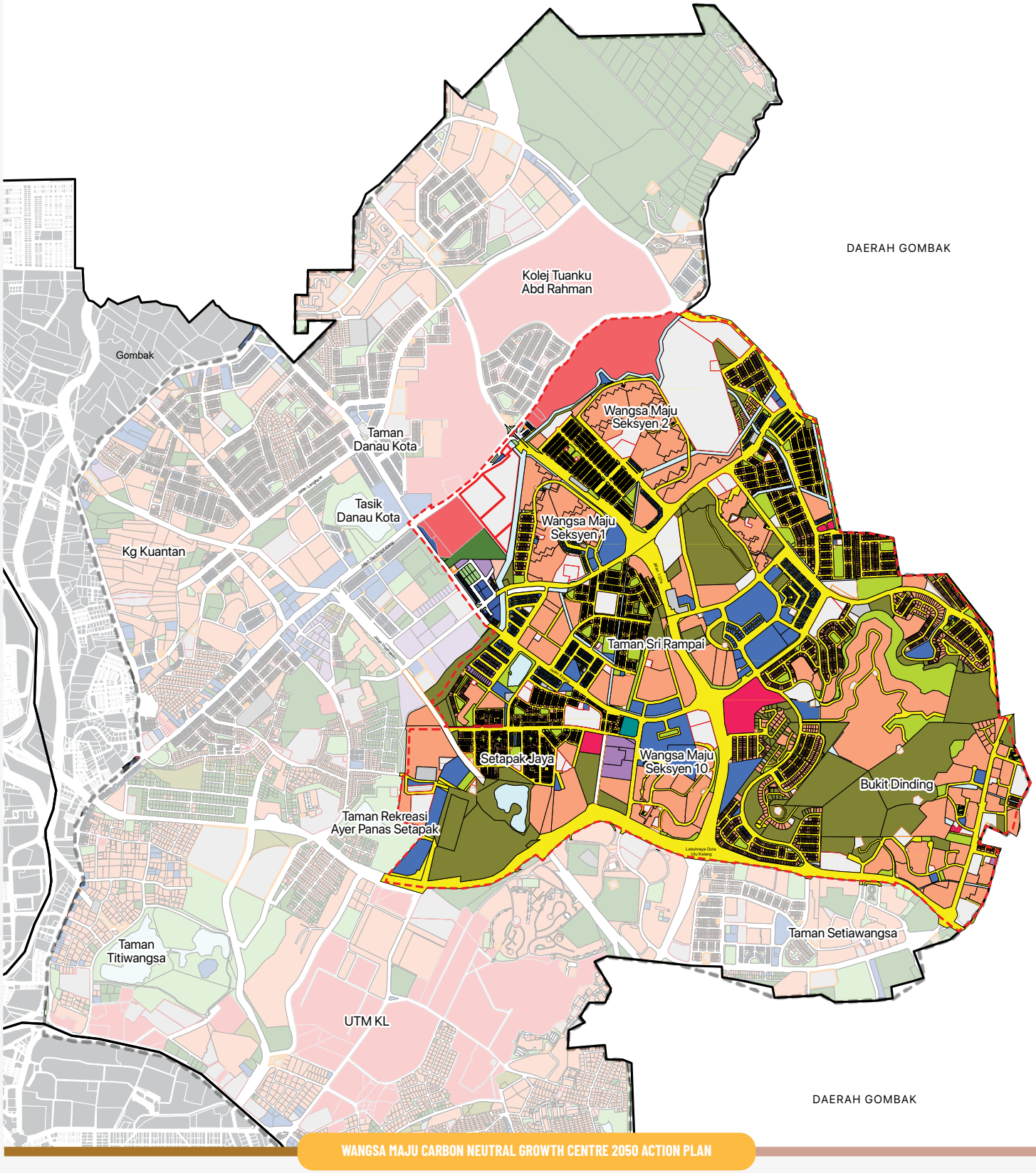


FIGURE 2.2

Wangsa Maju Growth Centre with the Buffer 2km Parameter Catchment Area

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant Land
- Transportation
- Wangsa Maju CNGC Boundary
- 2km Catchment Area

N

NOT TO SCALE

Source: **KLCH, 2021**

2.2.3 Infrastructure and Utilities

Infrastructure and utilities in this section refer to six (6) categories which are: i) energy supply, ii) water supply, iii) gas supply, iv) solid waste, v) sewerage system and vi) telecommunication.

There are existing infrastructure and utilities in the radius of 500 metre around the Wangsa Maju CNGC. The electricity supply provided through existing main intake station (PMU) with capacity 132/33kV is sufficient to cover the Wangsa Maju CNGC area. The Wangsa Maju CNGC gets access to natural gas supply from the Petronas Gas Utilization (PGU), Sector 1 (Port Klang-Lumut). Besides that, there are four (4) sewerage treatment plants (STP) in Wangsa Maju CNGC managed by Indah Water Konsortium Sdn Bhd.

Solid waste is managed by SW Corporation Sdn Bhd. The solid waste that has been collected will be sent to the Taman Beringin Transfer Station (1,800 tonne per day) before disposal to the Bukit Tagar Sanitary Landfill, Selangor.

2.2.4 Buildings

There are five (5) dominant uses of buildings which are residential, commercial, facilities, industry and institutional buildings in Wangsa Maju CNGC. Majority of buildings in Wangsa Maju CNGC are residential buildings that are distributed in 17 residential areas and comprise mostly medium and low cost housing. Besides that, for commercial building, there are three (3) type of buildings namely single, double and 3 storey shop offices and the main activities are mostly retail and services. Institutional refer to government agencies building. Five (5) institutional buildings in Wangsa Maju CNGC are DBKL offices, JPJ, military camp, fire station and police station.

Large footprint institutional and commercial buildings offer potential for rooftop solar PV installation. Preliminary analysis shows Aeon Big Mall and Wangsa Walk Mall have the biggest rooftop area (more than 1000m^2) and shade-free area in Wangsa Maju CNGC. It can generate more energy supply by using renewable energy sources on building. In conclusion, renewable energy programme on buildings can be proposed especially solar PV on rooftop is one of the most strategic technology can be implement to generate green energy for Wangsa Maju CNGC.

Facilities in Wangsa Maju CNGC include four (4) categories which are education, health, religious and community complex. There are a hospital, five (5) community complexes, six (6) primary schools and five (5) secondary schools *(refer to Figure 2.3)*. All the facilities are located within 500 metre and present good potential for carbon neutrality related community program.

Neighbourhood

1. Wangsa Maju (Seksyen 1-10)
2. Taman Andaman
3. Taman Sri Rampai
4. Taman Desa Setapak
5. Taman Wangsa Melawati
6. Taman Setapak Jaya
7. Taman Setapak Permai
8. Taman Megan Setapak

Public Housing

1. PPR Wangsa Sari
2. PPR Seri Semarak
3. PPR Desa Rejang
4. Flat WM Seksyen 1-10

Community Complex

1. Dewan Awam Seksyen 1 Wangsa Maju
2. Dewan Awam Seksyen 2 Wangsa Maju
3. Dewan Awam Seksyen 4 Wangsa Maju
4. Dewan Awam Seksyen 10 Wangsa Maju
5. Pusat Komuniti Taman Ibu Kota

Schools

1. SR Desa Setapak
2. SRK Taman Sri Rampai
3. SRK Sek 10 Wangsa Maju
4. SRK Sek 4 Wangsa Maju
5. SRK/M Wangsa Melawati
6. SR Sek 1 Wangsa Maju
7. SMK Sek 2 Wangsa Maju
8. SMK Sek 1 Wangsa Maju
9. SMK Sek 5 Wangsa Maju
10. SM Tmn Sri Rampai
11. SMK Setiawangsa

Figure 2.3: List of Buildings Based on Categories in Wangsa Maju CNGC

2.2.5 Green Spaces and Recreational Areas

Urban green spaces serve diverse purposes, ranging from neighbourhood and city parks, to river, pedestrian and cycling pathways and street trees which help to reduce the GHG emissions.

The green space in Wangsa Maju CNGC can be categorised into four (4) which is open space, streetscape, green and forest land. The green space covers 27% of the total land area in Wangsa Maju CNGC.

There is an one key recreational area namely Tasik Sri Rampai located at Setapak Jaya that can be connected with pedestrian pathway. There are also two (2) green park areas within Wangsa Maju CNGC namely Bukit Dinding and Bukit Wangsa Maju with the total area of 372.22 acres. Based on the analysis, if Bukit Dinding designated to be one of the recreational area in Wangsa Maju CNGC, there is a need to improve the pedestrian and cycling networks to provide continuous access to Tasik Sri Rampai and other neighbourhood parks.

It is also important to utilize Sungai Bunus as one of the recreational areas. Currently, pedestrian and cycling pathways are provided along Sungai Bunus but discontinuous at Jalan Ayer Keroh. The combination of green space, street planting and pedestrian and cycling pathways will create green linkages in Wangsa Maju CNGC. This will provide shade and shelter to the pedestrians, mitigate the urban heat island effect and sequestrate carbon.

Green Area in Wangsa Maju CNGC

Open Space (neighbourhood parks and recreational areas)	**103.57 acres**
Green Land (undeveloped land or vacant land)	**184.70 acres**
Urban Park (Bukit Dinding and Bukit Wangsa Maju	**246.68 acres**

2.3

Positioning of Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan

Kuala Lumpur is well planned and positioned with respect to transitioning into carbon neutrality by 2050 and becoming a leading city that will inspire other Malaysian and developing Asian cities to achieve the same ambition. It started with the formulation and official adoption of the KL LCSBP 2030 by KLCH in 2018. The KL LCSBP 2030 sets Kuala Lumpur on a trajectory to reduce the city's GHG emission intensity of GDP by 70% by 2030 based on the 2010 emission level.

The KL LCSBP 2030 provides a concrete policy framework to decarbonise the statutory development plans: Kuala Lumpur Structure Plan (PSKL 2020) and Kuala Lumpur City Plan (KLCP 2020) *(refer to Figure 2.4)*.

The KL LCSBP 2030 is also mainstreamed into the city's new statutory development plans: Kuala Lumpur Structure Plan 2040 (PSKL 2040) and Kuala Lumpur Local Plan 2040 (PTKL 2040), which will be used as the basis for planning control and development approval in the city for a period of 20 years *(refer to Figure 2.5)*.

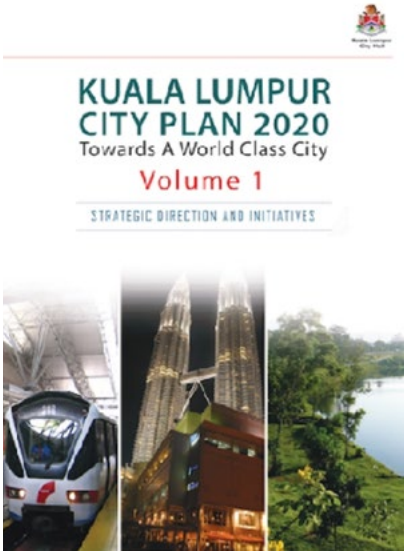
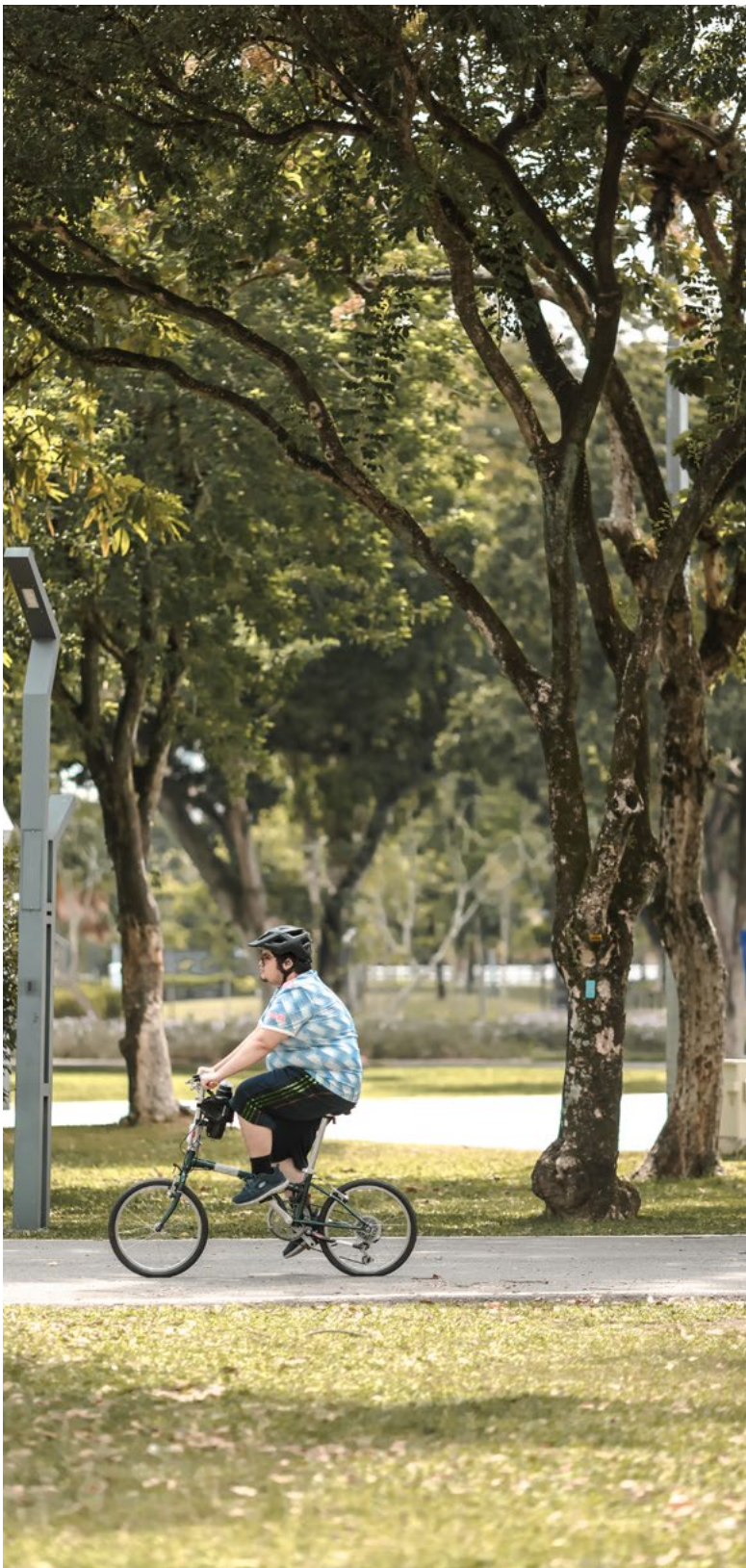


Figure 2.4: Kuala Lumpur City Plan (KLCP 2020)



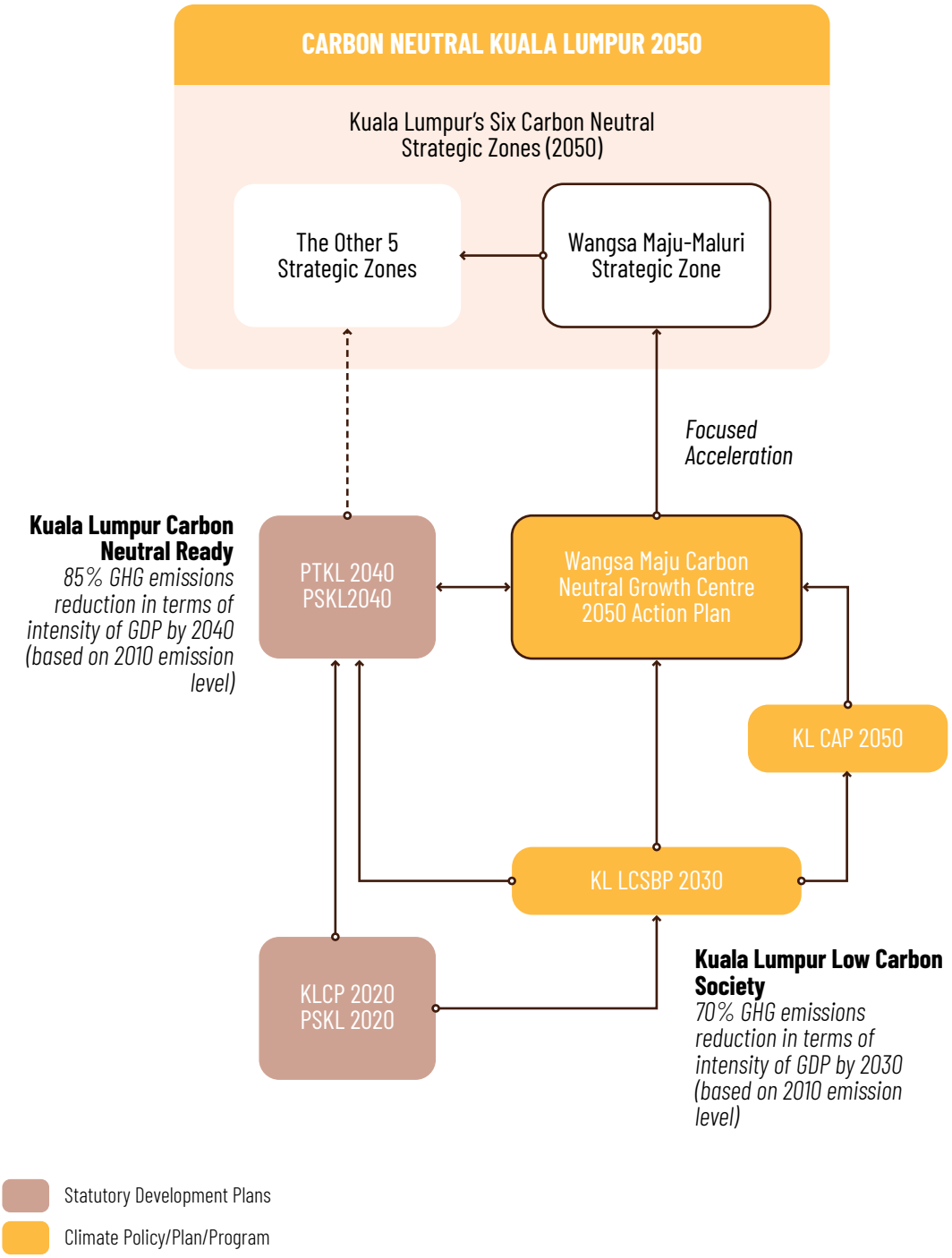


Figure 2.5: Positioning Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan

2.4

Aim and Objectives of Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan

In light of the above background, the Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan aims to:

Aim

Develop the Wangsa Maju Growth Centre into a thriving, prosperous, carbon neutral urban precinct, serving as a pioneer showcase that is up-scalable to other Kuala Lumpur Strategic Zones for a progressive transformation of Kuala Lumpur into a carbon neutral city by 2050.

Objective 1

To set out a carbon neutral project framework for the Wangsa Maju Carbon Neutral Growth Centre in relation to the Kuala Lumpur Carbon Neutral 2050 modelling and pathway

Objective 2

To identify suitable development concepts and projects for the Wangsa Maju Carbon Neutral Growth Centre that will serve as a best practice reference for upscaling to the other five strategic zones in Kuala Lumpur

2.5

Scope of Wangsa Maju Carbon Neutral Growth Centre 2050 Action Plan

The overall scopes of this project is:

1 Calculate GHG emission for both Kuala Lumpur and Wangsa Maju Strategic Zone with 2010 as the base year and 2050 as the target year

2 Propose a set of quick-win, game-changing and implementable carbon neutral projects in Wangsa Maju Carbon Neutral Growth Centre

The scopes for each strategic sector also has been outlined and will be use as a guide to identify the initiatives or projects that suitable, feasible and implementable in Wangsa Maju Growth Centre.

Energy

1. Reduce the **energy consumption** for selected building and KLCH assets
2. Identify existing sources for **EE and RE**
3. Identify potential location for **district cooling and RE generation**
4. Implementing **SARE** (Supply Agreement Renewable Energy), **NEDA** (New Enhanced Dispatch Arrangement),
5. **SELCO** (Self Consumption), **utility regulation, incentive packages and taxes**, encourage investments in efficient services

Waste

1. Planning **recycling facilities** for community neighbourhood
2. Propose **composting plant** for food court or wet market
3. Propose **anaerobic digester plant**

Mobility

1. Planning a **comprehensive network of bicycles route**
2. Proposed safe and convenience **cycling and pedestrian infrastructure**
3. Enhance the **feeder bus route** and promote **electric buses**
4. Improve the LRT station by introduce **Station Area Planning (SAP)**
5. Planning comprehensive and accessible **electric vehicles charging station infrastructure**

Community

1. Promoting **education and public awareness** campaigns (community and school) on the importance of low carbon lifestyles and the environment
2. Promoting **involvement of stakeholders** in the low carbon development and environmental conservation programs
3. Introducing **Eco Park** concept (hydroponic, urban farming, IoT, PV solar, composting and biogas)

Green

1. Organising **green infrastructure** such as forests, parks, and water bodies as part of an uninterrupted network of green corridors in the city as well as carbon sink
2. Carrying out measure for **increasing the greening of the city** (i.e., green roofs, vertical green)
3. Promoting **tree planting and replanting** to increase green cover and carbon sequestration

2.6

Pathways to Carbon Neutrality: Wangsa Maju-Maluri Strategic Zone

GHG emissions of the Wangsa Maju-Maluri Strategic Zone are projected to increase from 4,334 $ktCO_2eq$ in 2010 to 13,357 $ktCO_2eq$ under the 2050 BaU scenario. Preliminary analysis shows a potential for the GHG emission to decrease to 2,960 $ktCO_2eq$ under the 2050 CM scenario (refer *Figure 2.6*).

The GHG emissions from the commercial sector will be about four (4) times the total as compared with year 2010 in the 2050 BaU scenario and the share will be around 47% of total GHG emissions. GHG emissions from passenger transport in 2050 BaU are also found to be almost triple the amount in 2010 and the share will be 29% of the total GHG emissions. This points to huge potentials for reduction in Wangsa Maju's GHG emission by strategically focusing on carbon neutrality initiative in the commercial and transportation sectors.

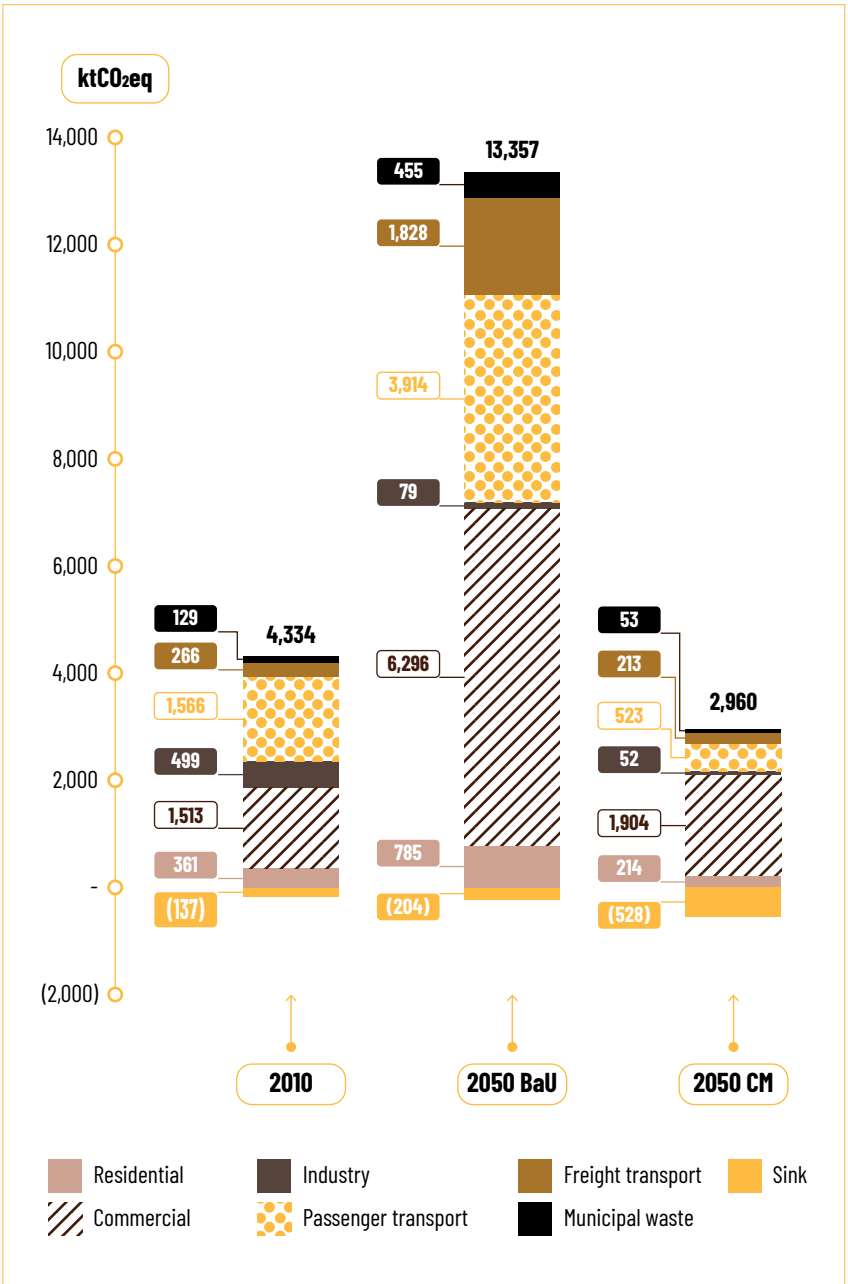


Figure 2.6: GHG Emission by End-Use Sector of Wangsa Maju-Maluri Strategic Zone
Source: UTM-LCARC Projections

CHAPTER 3

TOWARDS WANGSA MAJU CARBON NEUTRAL GROWTH CENTRE 2050 ACTION PLAN

3.1

Carbon Neutrality Opportunities in Wangsa Maju Growth Centre

With the resource, financial, technological and time constraints commonly faced especially by developing cities, strategic prioritisation of emission reduction countermeasures through a 'focused acceleration' approach is highly crucial. A focused acceleration approach gets cities to effectively focus on implementing a small number of projects that are high-value, impactful within the cities' available capacities with a potential to achieve up to 90% of the emission reduction target. These include projects within the power and energy; waste; mobility; green and community sectors.

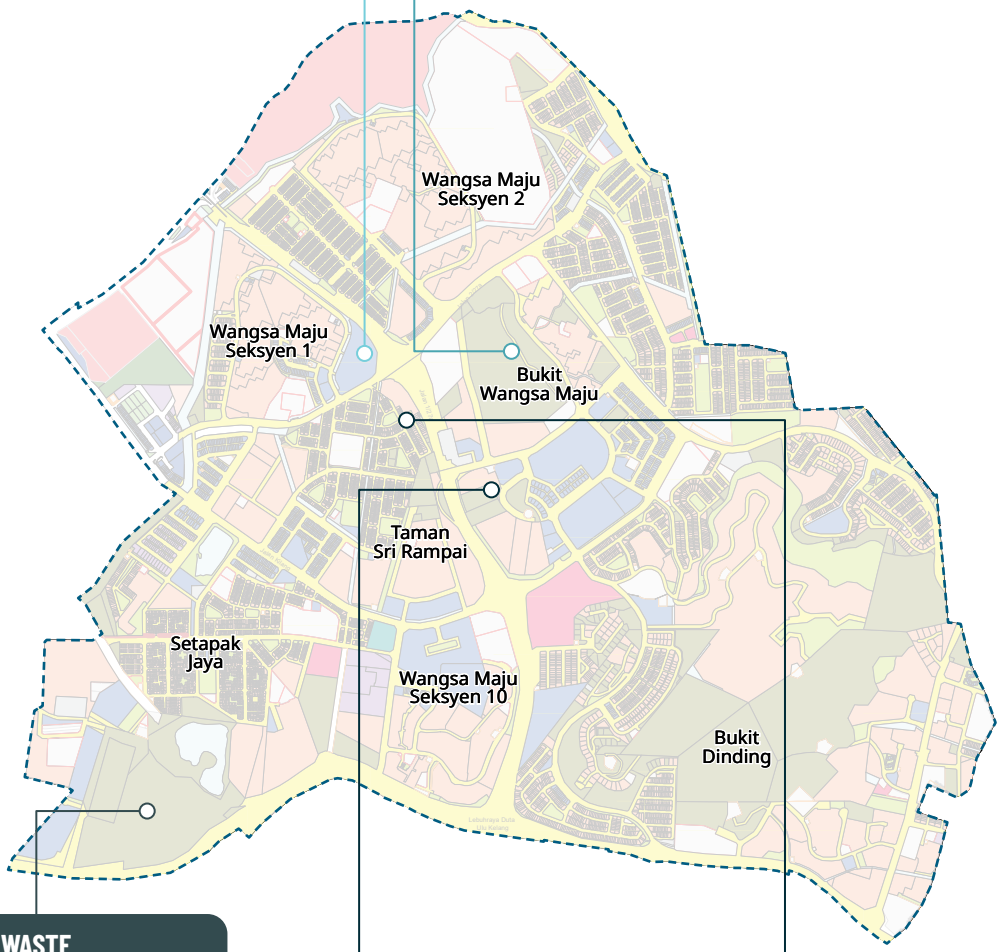
Through the Wangsa Maju Carbon Neutral Growth Centre Action Plan, 20 proposed initiatives leading the zone to carbon neutrality by 2050 are identified and defined *(refer to Figure 3.1)*. These carbon neutrality opportunities or actions have been identified based on the following considerations, namely emissions reduction potential, climate resiliency, equitable benefits, promotion of community inclusion, and most importantly, project feasibility taking into account KLCH's capacity in realising and sustaining them.

ENERGY

1. Solar on Infrastructure
2. Floating Solar PV
3. District Cooling System

GREEN & OPEN SPACE

1. Open Space and Forest Protection
2. Vertical/Roof Garden Urban Parks
3. Linear Urban Parks along River and Waterways Reserve
4. River Cleaning



WASTE

1. Anaerobic Digester
2. Waste Composting Plant
3. Waste Recycling Point

MOBILITY

1. Pedestrian Cycling Network
2. Public Transportation
3. Station Area Planning

COMMUNITY

1. Eco Park
2. Community Farming
3. Community Water and Energy Saving Program
4. Carbon Neutral Resident Association
5. Zero Waste Community
6. Strengthen School Community through Concentrated Efforts
7. Carbon Neutrality Challenge Programs in Schools

Figure 3.1: Five (5) Sectors and 20 Proposed Initiatives in Wangsa Maju CNGC 2050

The Three (3) Proposed Initiatives of Energy Sectors

- Solar on Infrastructure
- Floating Solar PV
- District Cooling System
- Potential Locations
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

3.2

The Five (5) Sectors towards Wangsa Maju Carbon Neutral Growth Centre

3.2.1 Energy

Decreasing energy demands through end-use savings and efficiency improvement measures alleviates the need to generate as much energy as would otherwise have been necessary. It also moderates the carbon footprint. Even with efficiency measures, demand for energy will always be present and a growing population and economic development will put further pressures on demand. In the context of carbon neutrality, it is therefore necessary to reduce the carbon intensity of the remaining energy supply through a significant transition into clean and renewable energy. The combination of renewable energy and energy efficiency improvement projects are essential to decouple Wangsa Maju's future growth from growing carbon emissions, by decreasing the share of fossil fuels in energy use. There are three (3) proposed initiatives as in energy sectors as follow:

PROPOSED INITIATIVES

1. **Install Solar on Infrastructure**
2. **Introduce Floating Solar PV**
3. **Introduce District Cooling System**

1 Install Solar on Infrastructure

(a) Installation of Rooftop Solar

A solar photovoltaic (PV) system, mounted on the roof or integrated into the facade of a building, is an electrical installation that converts solar energy into electricity. This can be used to meet the building's own energy consumption requirements or, in certain situations, fed back into the electrical grid. 91 kWp solar PV located at Alor Setar is an example of solar PV installed on building rooftop. There are several reasons that further accentuate the benefits of installing solar rooftop panels on buildings, such as cost savings, a secure investment, increase in access to energy, reduction in carbon footprints, green source of energy and elimination of the need for additional space for installation.

Rooftop solar PV systems are distributed electricity generation options, which help to meet a building's energy needs, or provide electricity within an existing distribution network. The size of the installation can vary dramatically, and is dependent on the size of the building, the amount of electricity required, the funding available for the project, and the grid operator's willingness to accept excess capacity. As a rule of thumb, 5 m^2 area is required for 1 kWp capacity of solar PV system. 1 kWp capacity of solar PV system can generate in a range from 1200 – 1500 kWh of electricity per year.

The average daily sunshine hours in Malaysia range from 4-6 hours a day. Core components of a solar PV system include PV modules, their mounting structure and an inverter. However, other components can also be incorporated into the system, depending on its size and complexity. These include string boxes, batteries, generators, transformers and meters. The layout and configuration of systems can differ, depending on the load type and the energy supply requirements. An indicative layout is shown in *Figure 3.2*.

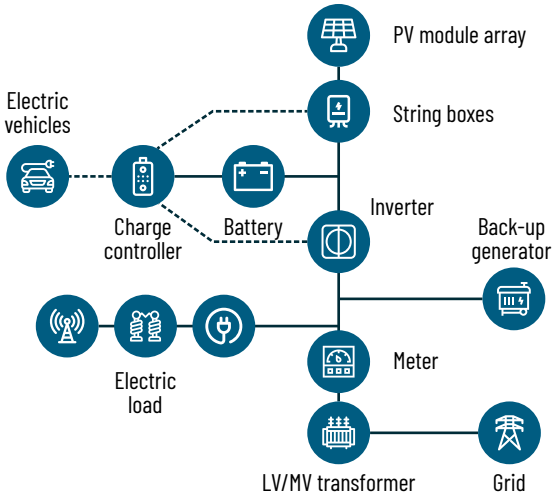


Figure 3.2: Solar PV Configuration Systems
Source: Solar Vest

PROJECT COMPONENTS

(a) Distributed energy systems
(b) PV modules
(c) Mounting structure
(d) Inverter
(e) Grid operators
(f) Building owners

BEST PRACTICES

1. **Kuala Lumpur International Airport solar power plant, Malaysia**

   - **Installed capacity:** 19 MWp
   - **Description:** combines ground-mount, parking canopy and roof-top systems
   - **Project component:** Distributed energy systems, PV modules, Mounting structure, Inverter, Grid operators , Building owners

2. **Top Glove, Klang, Selangor, Malaysia**

   - **Installed capacity:** 2.2 MW
   - **Description:** PPA between Shizen Malaysia and Top Glove in Nov 2021
   - **Project component:** Distributed energy systems, PV modules, Mounting structure, Inverter, Grid operators , Building owners

BASIS OF CALCULATION

(a) Carbon reduction: 0.741 kg CO_2/kWh of solar electricity consumed
(b) Potential savings: 36.5 cent/ kWh of solar electricity consumed (tariff C1)

Currently, there are several solar PV incentives in Malaysia as discussed below.

- NEM Rakyat Programme

Domestic Consumer(s) who has a solar PV installation on the roof-top of their premises will consume the energy produced first, and any excess will be exported to the TNB grid. The credit to be received for such excess energy will be used to offset part of the electricity bill on a "one-on-one" offset basis for a period of ten (10) years of operation.

- NEM GoMEn

The concept of NEM GoMEn is that the energy produced from the solar PV installation on Government premises will be consumed first, and any excess will be exported to the TNB grid. The credit to be received for such excess energy will be used to offset part of the electricity bill on a "one-on-one" offset basis for a period of ten (10) years of operation.

- NOVA NEM

The concept of Net Offset Virtual Aggregation (NOVA) Programme is that the energy produced from the solar PV installation on a NOVA consumer premises shall be consumed and designed primarily for self-consumption. Any excess energy which is not consumed at the premises where the PV Installation is located due to operational constraints or monthly or seasonal variation in load demands at the said premises may be exported through the supply system.

The details NEM Rakyat, NEM GoMEn and NOVA NEM info are attached in Appendix 4.

The details of project implementation status that involve estimated potential, area and building partnership for Rooftop Solar PV are explained in *Table 3.1* and *Table 3.2*.

Table 3.1: Estimated Potential and Area for Rooftop Solar PV

Location	Estimated Area (m^2)	PV Features	Estimated Potential (MWP)	Estimated Energy (MWh)
Wangsa Walk	10,000 (rooftop and carpark)	Efficiency= 20.8% Output= 4.85 m^2/kWp Model= Q.Peak Duo ML-GP	2	7.2
Aeon Big	30, 000		6	21.6
Wangsa Maju LRT Station	1,300		0.27	1
Giant hypermarket Setapak	10,000 (rooftop and carpark)		2	7.2
Puspakom	800		0.16	0.58
Hospital Angkatan Tentera Tuanku Mizan	5,000		1	3.6

Source: Estimation by UTM-LCARC based on Google Maps

Table 3.2: Building Partnership for Rooftop Solar PV

	Building Partnership
Implementation Approaches	Direct installation on buildings, carparks and walkways
Estimated Cost	RM 3000-4000/ kWp solar PV system
Timeline	◢ 2021-2025 ◢ 2026-2030
Implementers	"Building owners, Government agencies (NEM, GoMEn)
Agency	Sustainable Energy Development Authority (SEDA), Energy Commission (ST), Ministry of Science, Technology and Innovation (MOSTI) Malaysian Green Technology and Climate Change Centre (MGTC), Malaysian Green Building Council (MGBC), Malaysia Association of Energy Service Companies (MAESCO), Tenaga Nasional Berhad (TNB)
KLCH dept.	JKME, JKB, JKAWS, JPLR, JPPH, JPPPB

GUIDELINES/REFERENCES

Net Energy Metering (NEM)

POTENTIAL LOCATIONS

A few potential locations are identified and are divided into:

Short Term

- Installation on residential buildings and commercial buildings (Wangsa Walk and Aeon Big, Aeon Wangsa Maju, Giant hypermarket, Puspakom, Hospital Angkatan Tentera Tuanku Mizan) (refer to *Figure 3.3* and *Figure 3.4*) through NEM Rakyat, GoMen and NOVA.
- Open car park surrounding Wangsa Walk Mall can be installed with solar PV that provides shelter for cars.
- Wangsa Maju LRT Station

Mid Term

- Installation of rooftop PV on bus stop shelters for real time info displays, USB Charging point and night time lighting with support of a battery system. Battery technology will mature and installation costs are expected to reduce significantly in the next 5-10 years.
- Covered walkway (Wangsa Maju LRT Station and Taman Sri Rampai LRT Station)

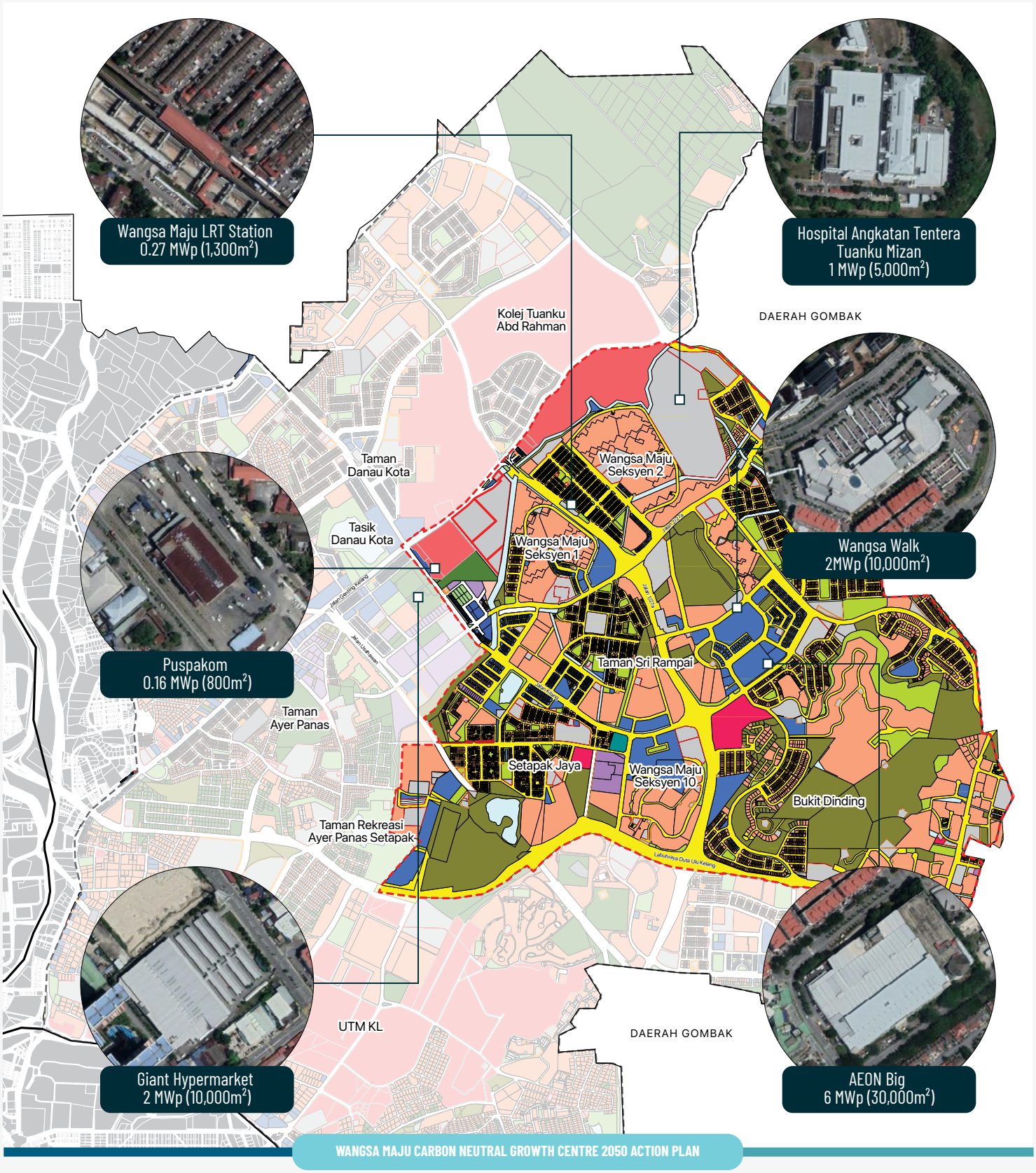


FIGURE 3.3

Potential Rooftop Solar PV Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

FIGURE 3.4

Potential Rooftop Solar PV Sites from the Aerial View

Solar PV

Potential Locations

Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

(b) Solar for Pedestrian Mist

Cooling mist has been widely applied to provide cooling and is suitable to be implemented for pedestrian walkway. As the water required by the mist system is only during day time, mostly from 9:00 am to 5:00 pm, the integration with solar PV system will be able to provide green and renewable energy with minimal reliance on power grid. The proposed site, which is from the LRT Wangsa Maju and along Jalan 3/27A, is 1 km in length. The cooling mist system can be installed along this site to provide cooling to pedestrian, in which solar PV can be installed on the roof or spatially along the walkway, as shown in *Figure 3.5*.

Based on the specification, the total energy required to operate the system for 8 hours a day is 27.4976 kWh. Solar PV can provide this energy for the system. However, in order to provide 100 % supply of solar energy throughout the day, a battery system is required as to not oversize the solar PV system. Alternatively, a mix of energy from solar PV and power grid can be applied as well. Based on the solar PV with an average solar irradiation of 3.5 kWh/kWp (Solargis, 2022), a solar PV capacity of 7.86 kWp is required to sustain the system for a day. Considering that the solar PV is spaced out along the pedestrian walkway, a solar PV panel of 300 kWp is required for every 30-40 m, with battery integrated. On the other hand, based on peak solar radiation of 1 kWh/kWp, a solar PV of 3.44 kWp can be installed. The solar PV can be installed in a spacing of 80-90 m. The details of project implementation status that involve building partnership for Pedestrian with Mist System are explained in *Table 3.3*.

Table 3.3: Building Partnership for Pedestrian with Mist System

	Building Partnership
Implementation Approaches	Direct installation
Estimated Cost	◢ RM 3000-4000/ kWp solar PV system, ◢ RM 6000-8000 for battery integrated
Timeline	2026-2030, >2030
Implementers	KLCH
Agency	Sustainable Energy Development Authority (SEDA), Energy Commission (ST), Ministry of Science, Technology and Innovation (MOSTI), Malaysian Green Technology and Climate Change Centre (MGTC), Malaysian Green Building Council (MGBC), Malaysia Association of Energy Service Companies (MAESCO), Tenaga Nasional Berhad (TNB)
Stakeholder	KLCH
KCLH dept.	JPPPB, JKB, JKAWS, JKME, JPPH, JPLR

PROJECT SPECIFICATIONS

(a) **Energy Consumption:** 0.454 kWh/m^3 (Narumi et al.)
(b) **Nozzle Spacing:** 0.5m
(c) **No. of Nozzle for 1km distance:** 2000 Nozzles
(d) **Water per nozzle per hour:** 0.003785 m^3

BEST PRACTICES

1. **Mist Walk at Marina Bay, Singapore**

   In Singapore, Mist Walk uses the water from the reservoir to provide evaporative cooling to pedestrian during day time whilst presenting attractive lighting during night time.

Source: linealight.com

Source: linealight.com

FIGURE 3.5

Pedestrian Walkway from LRT Wangsa Maju and Along Jalan 3/27A

Pedestrian Walkway

Bus Stop

Potential Locations

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

2 Floating Solar PV

Floating solar systems are an innovative, reliable and suitable solar solution for Wangsa Maju CNGC where land and physical spaces are limited resources. In combination in rooftop solar PV, the proposed floating solar system will potentially contribute to more significant use of renewable energy in Wangsa Maju CNGC.

Floating solar panels, also known as floating photovoltaic (FPV), are any kind of solar panels that float on water. Solar panels need to affix to a structure that will keep them above the surface. If you come across floating solar panel installations, it will most likely be located in a lake or a basin because the waters are generally calmer in the ocean.

It is also common that floating solar panel installations will be located on large man-made bodies of water, such as reservoirs in Japan and Kerala. Apart from common benefits of solar PV, the advantages of installing a floating solar system include:

- Increased efficiency and higher electricity yield of a solar panel, as water has a natural cooling effect on the solar panels
- Conserving valuable land
- Less water evaporation, the floating solar panel installation provides shade to the body of water and reduces the evaporation
- A reduction in algae growth and improvement in the quality of water

Figure 3.6 shows a conceptual diagram of floating solar. A typical floating solar energy (PV) system consists of the following components; (i) floating system (either a pontoon or separate Floats, (ii) mooring system, (iii) solar panels and (iv) cables.

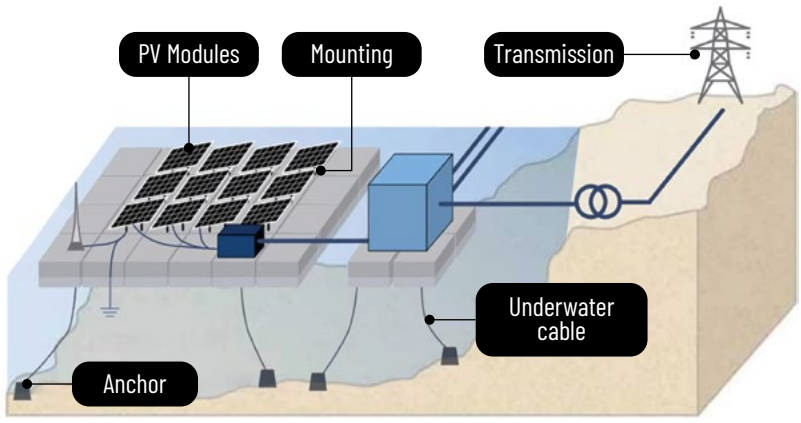


Figure 3.6: Conceptual Structure of Floating Solar
Source: www.azom.com

BEST PRACTICES

1. **Dengkil, Selangor, Malaysia**
   - **Installed capacity:** 13 MWp
   - **Area:** 53 ha of lake surfaces
   - **Partnership:** Solarvest, WD Solar Sdn Bhd
   - **Project component:** Floating system with either a pontoon or separate floats, Mooring system to secure the vessel, Solar panels, Electrical components such as cables, batteries and inverters for electricity connection

2. **Sg Labu Water Treatment Plant, Sepang, Selangor, Malaysia**
   - **Installed capacity:** 100 kWp
   - **Partnership:** Tenaga National Bhd (TNB), Malaysia Electricity Supply Industries Trust Account
   - **Area:** 1000 m^2
   - **Project component:** Floating system with either a pontoon or separate floats, Mooring system to secure the vessel, Solar panels, Electrical components such as cables, batteries and inverters for electricity connection

Currently there is no regulation for floating solar installation in Malaysia. However, the technology is gaining interest and several showcases have been done in Malaysia. The details of project implementation status that involve estimated area, solar energy potential and building partnership for Floating Solar PV are explained in *Table 3.4* and *Table 3.5*. Given the current interest, this technology will be viable in a long term scenario. Three (3) potential locations are identified as follows:

- Taman Tasik Danau Kota

Floating solar PV covering not more than 50% of the lake potentially generates approximately 3 MWp to supply to commercial shoplots around the lake. With a demand that is potentially higher than the estimated installed capacity of solar PV (refer to *Table 3.4*, *Figure 3.7* and *Figure 3.8*).

- Tasik Titiwangsa

Utilization of the smaller, less use section of Tasik Titiwangsa and the generation can be supplied to the nearby KLCH-owned buildings. This have a potential generation of 1MWp renewable energy (refer to *Table 3.4*, *Figure 3.7* and *Figure 3.8*).

- Kolam Air Leleh, Setapak

Utilization of the smaller and less use section of Kolam Air Leleh, Setapak potentially generates 1MWp of renewable energy (refer to *Table 3.4*, *Figure 3.7* and *Figure 3.8*).

Table 3.4: Estimated Area and Solar Energy Potential for Proposed Potential Location

Location	Estimated Potential	Estimated Area (m^2)	Notes
Taman Tasik Danau Kota	3 MWP	180 m x 80 m= 14,400	Coverage area= not more than 50% of lake
			Efficiency= 20.8 %
Tasik Titiwangsa	1 MWp	60 m x 80 m= 4,800	Output= 4.85 m^2/kWp
Kolam Air Leleh, Setapak	1 MWp	60 m x 80 m= 4,800	Model= Q.Peak Duo ML-GP

Source: Estimation by UTM-LCARC based on Google Maps

Table 3.5: Building Partnership for Floating Solar PV

	Building Partnership
Implementation Approaches	Direct installation, EPC, leasing
Estimated Cost	RM 3000-4000/ kWp solar PV system
Timeline	2026-2030, >2030
Implementers	Building owners, Government agencies (NEM, GoMEn)
Agency	Sustainable Energy Development Authority (SEDA), Energy Commission (ST), Ministry of Science, Technology and Innovation (MOSTI), Malaysian Green Technology and Climate Change Centre (MGTC), Malaysian Green Building Council (MGBC), Malaysia Association of Energy Service Companies (MAESCO), Tenaga Nasional Berhad (TNB)
Stakeholders	Building owners, government agencies, KLCH
KLCH dept.	JPPPB, JKB, JKAWS, JPLR, JPPH, JKME

PROJECT COMPONENTS

(a) Floating system with either a pontoon or separate floats
(b) Mooring system to secure the vessel
(c) Solar panels
(d) Electrical components such as cables, batteries and inverters for electricity connection

BASIS OF CALCULATION

(a) Carbon reduction: 0.741 kg CO_2/ kWh of solar electricity consumed
(b) Potential savings: 36.5 cent/ kWh of solar electricity consumed (tariff C1)

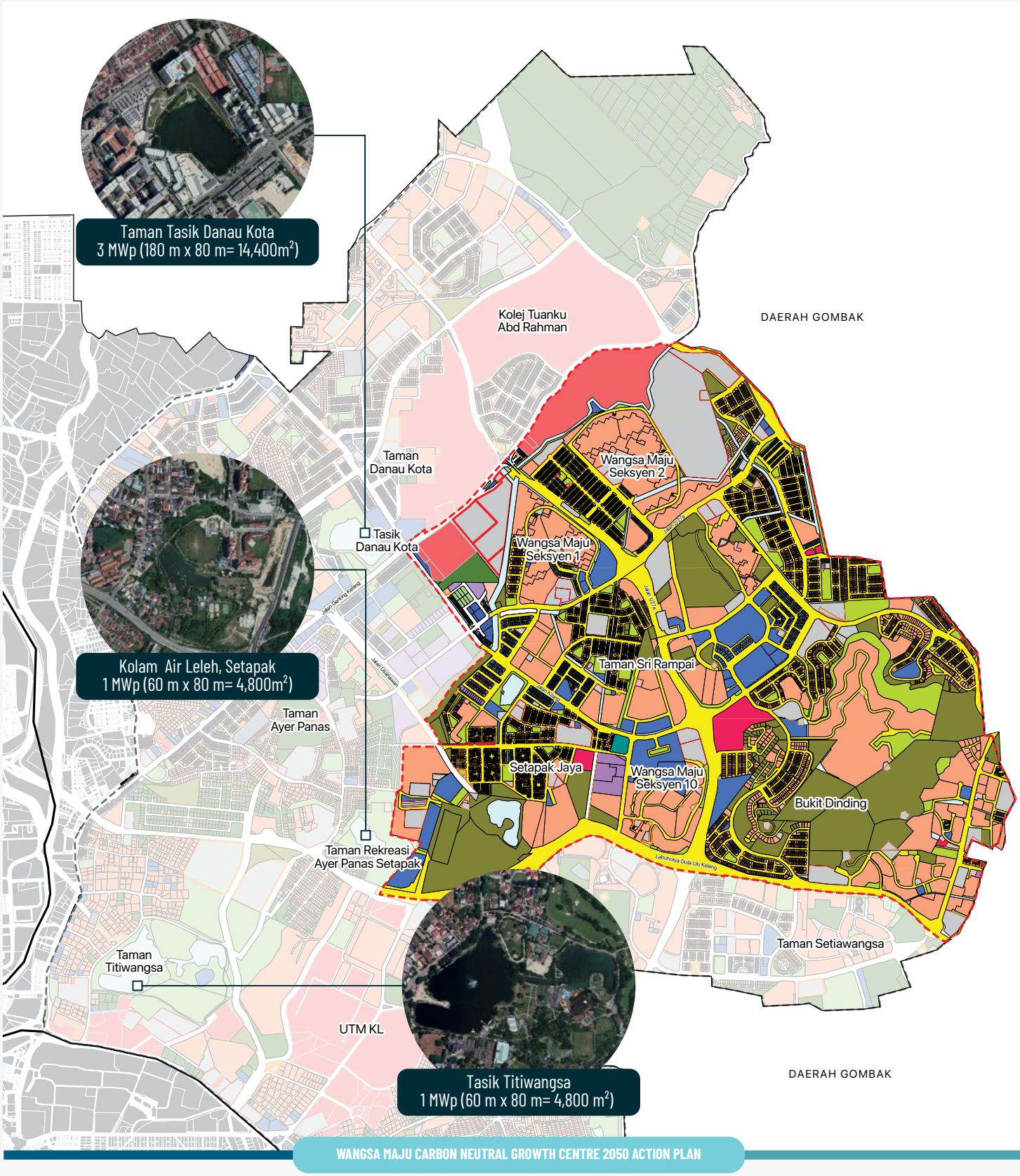


FIGURE 3.7

Potential Floating Solar Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

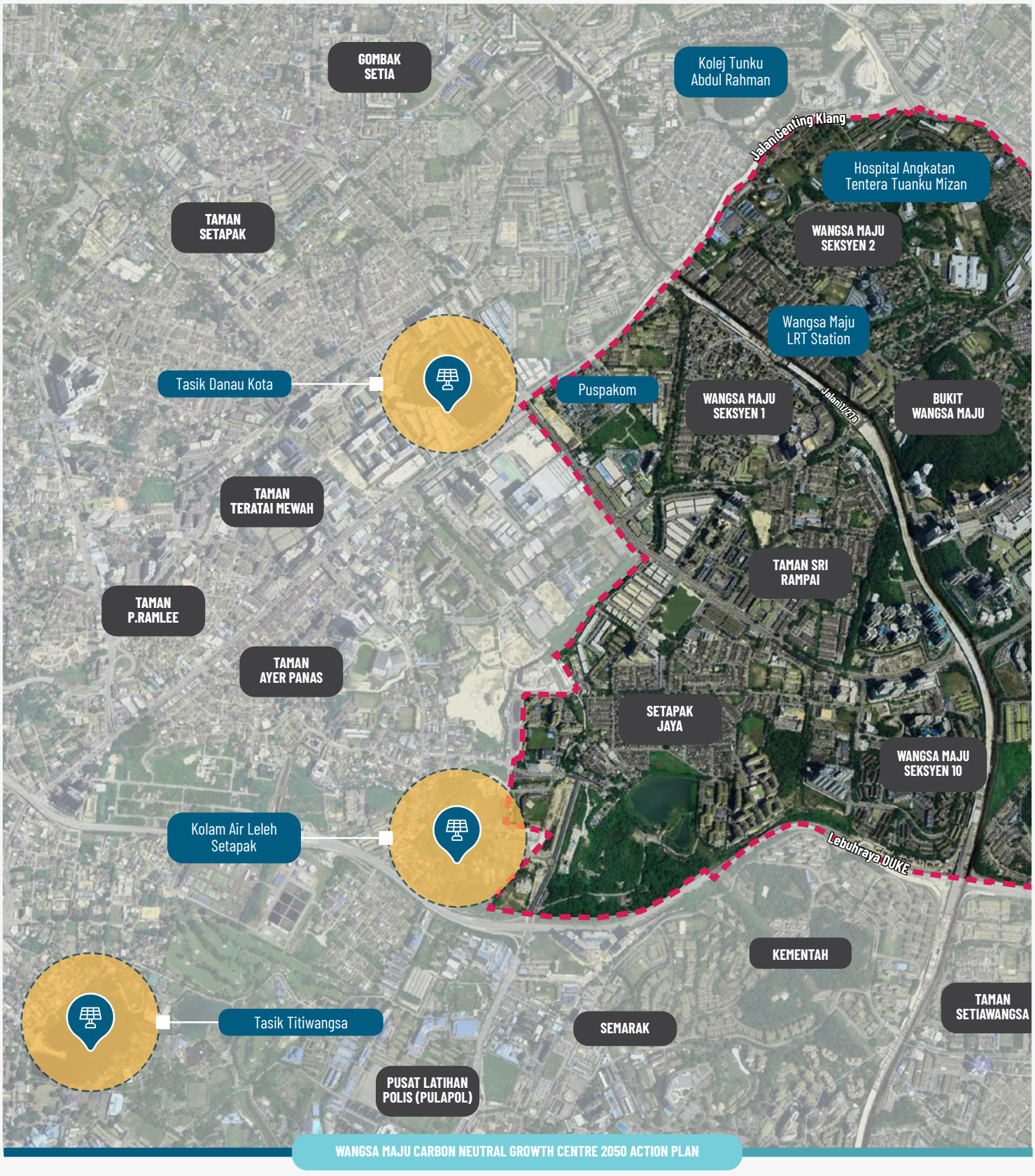


FIGURE 3.8

Potential Floating Solar PV Sites from the Aerial View

Floating Solar PV

Potential Locations

Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

3 District Cooling System

District cooling system (DCS) concept begins by chilling water at a centralised plant. There are (2) two categories DCS which are below ground DCS *(refer to Figure 3.9)* and above ground DCS *(refer to Figure 3.10)*. Chilled water is then pumped through a long piping network via underground to heat exchangers in different buildings. The heat exchangers are used to transfer the chilling energy from the water (often called Primary Loop) to customers' internal building chilled water loop (often call Secondary Loop). Cold air then is dissipated within the building via a typical Fan Coil unit and Air Handling Unit. Warm water returns to the heat exchangers for a continuous closed loop cooling process again.

The main benefits provided by DCS are:

- Multi-energy systems, using several energy sources (including energy from waste) and thus optimizing resource availability and reducing operating and environmental costs.
- Optimized capital expenses, as a result of variations in operating scale and in load demand
- Optimized operating expenses, through increased system efficiency
- Centralized system management, operation, and maintenance by capable and efficient professionals, optimizing the life-cycle cost
- High system efficiency, with low use of primary energy and reduced emissions
- DCS helps the environment by increasing energy efficiency and reducing environmental emissions including air pollution, the GHG and ozone destroying refrigerants. DCS can reduce annual CO_2 emissions by about 1 ton for every ton of district cooling refrigeration demand served.
- A DCS essentially delivers its benefits through economies of scale. Larger and more efficient chillers can be installed in places of the many scattered smaller and less efficient ones required in a conventional system.
- A higher efficiency system translates directly into both capital and running cost savings. Similar savings can be achieved for other plant equipment such as cooling towers and pumps. The DCS offers operating flexibility, since each building can use as much or as little cooling as needed, without worrying about chiller size or capacity – and the system produces no noise or vibrations.

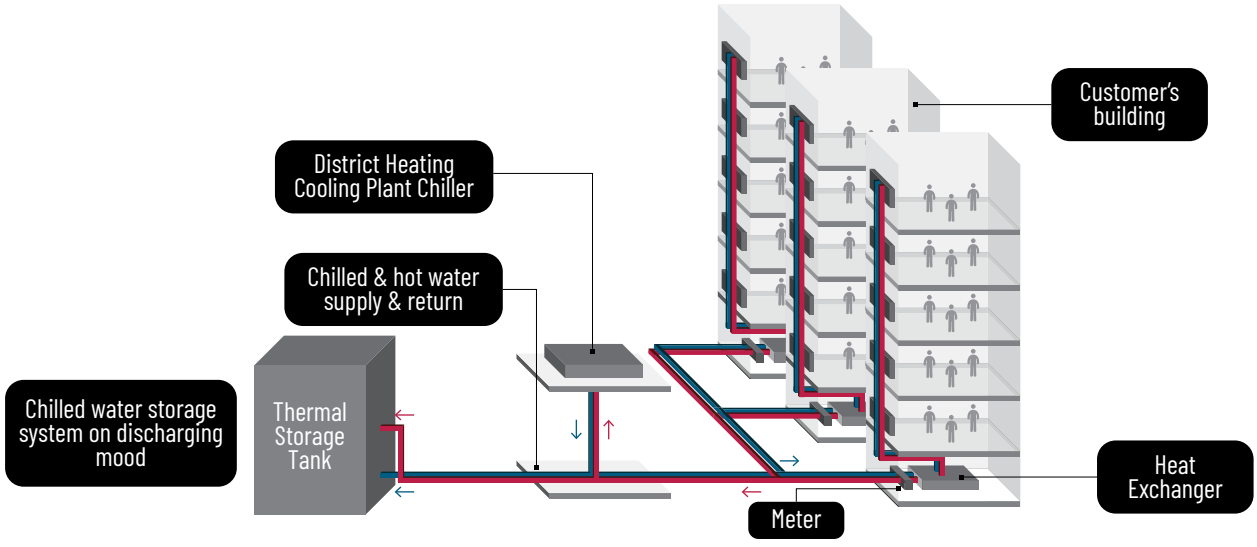


Figure 3.9: Below-ground District Cooling Concept System

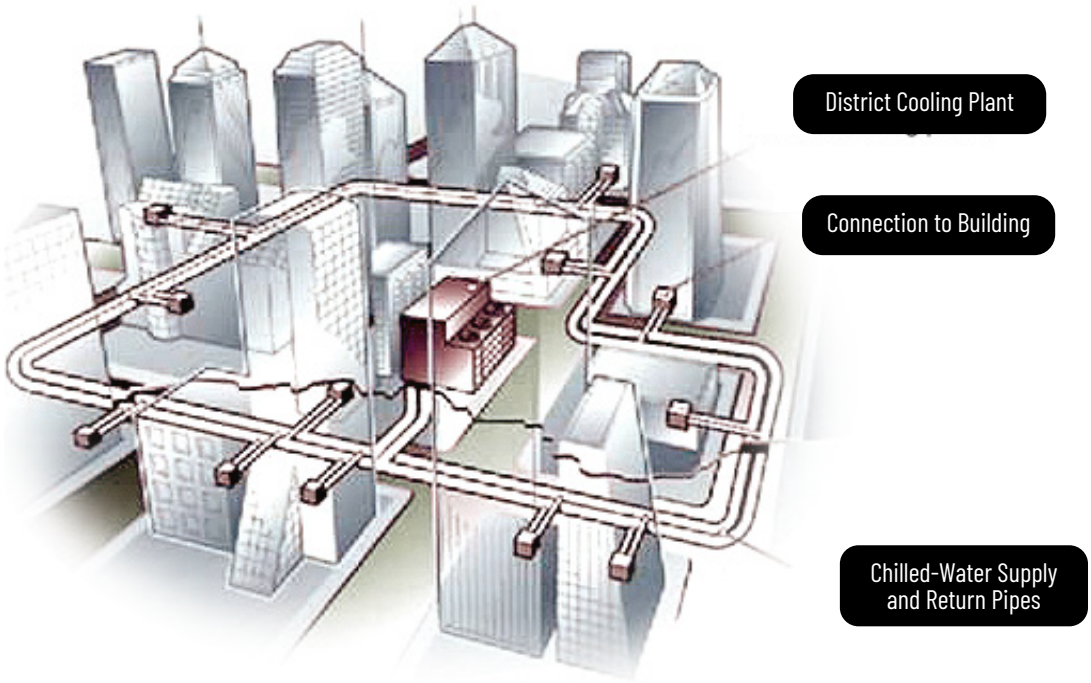


Figure 3.10: Above Ground District Cooling Concept System
Source: EMSD Energy Land

PROJECT COMPONENTS

A typical DCS comprises the following components:

(a) A Central Chiller Plant (to generate chilled water for cooling purposes)
(b) A Distribution Network (to distribute chilled water to buildings)
(c) A Consumer Substation (interface with building's own air-conditioning circuits)

BEST PRACTICES

1. Rooftop area on The Curve, Mutiara Damansara, Selangor

The DCS generates chilled water to fulfil the cooling demands to the nearby customers for the purpose of space cooling. The district cooling system plant consist of three closed loops running by different type of fluid which are the cooling water, the chilled water, and glycol. The system also includes ice tanks tank which consist a combination of chilled water and solid ice.

An underground system, as shown in *Figure 3.11*, is also a potential option. The advantage of the underground system is that it will not lead to aesthetic issues. It also requires less ground area compared to the above ground system, which is a good strategy for a compact location like Kuala Lumpur. However, the main challenges are that the underground system is difficult to retrofit and is expensive.

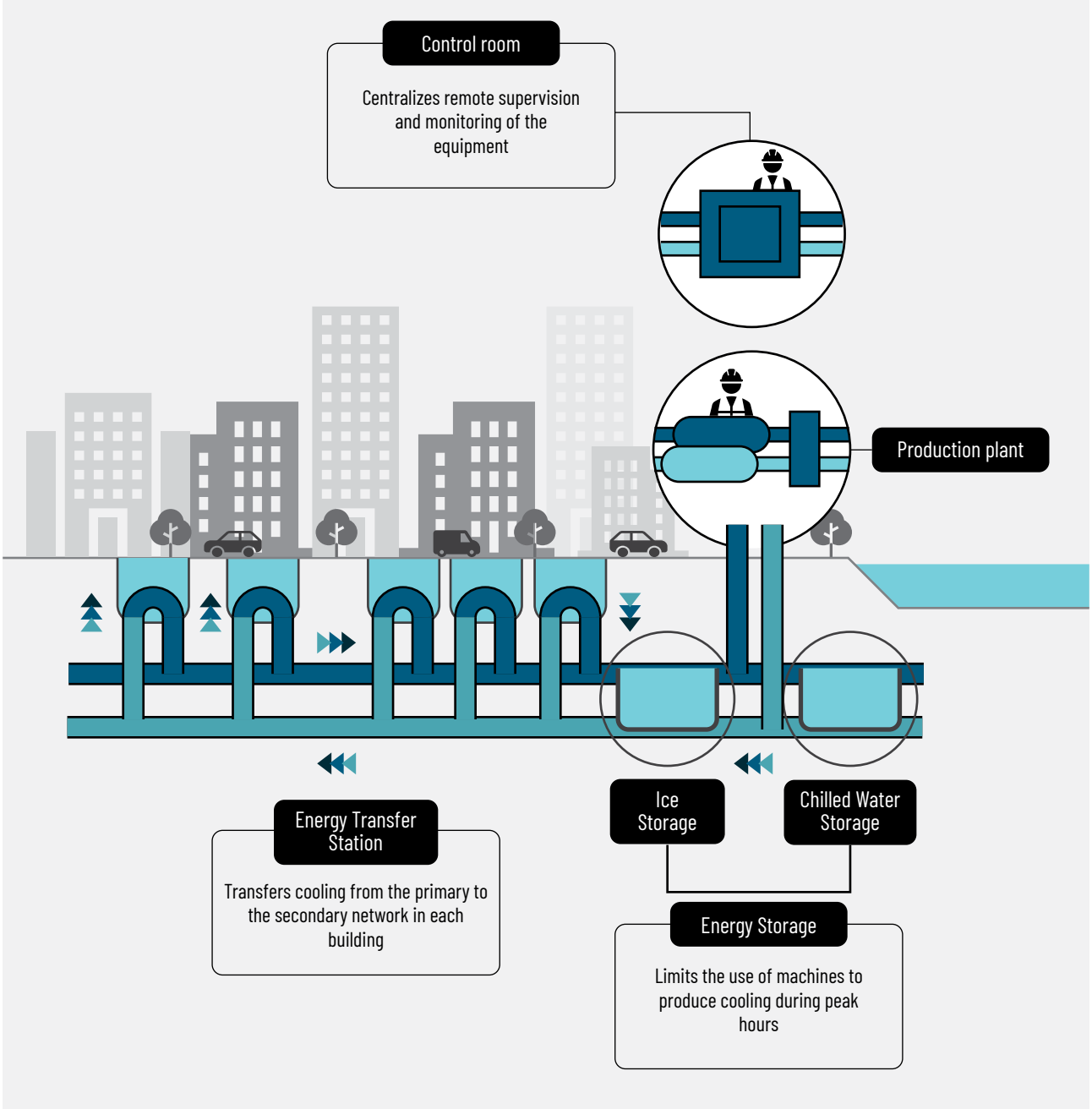


Figure 3.11: An Illustration Diagram of Underground DCS

POTENTIAL LOCATIONS

1. Jabatan Pengangkutan Jalan and Bazaria Genting (refer to *Figure 3.12* and *Figure 3.13*).
   - Shopping Mall and Jabatan Pengangkutan Jalan (JPJ) can be good locations for DCS
   - There is enough space to construct a new DCS Plant
2. Wangsa Maju LRT station including the vicinity of 400m walking distance as the pilot project
   - To integrate with Station Area Planning (SAP) in section 3.2.3 (page 81)
   - The location is selected for the project because of accessibility and active mobility
3. Wangsa Walk and AEON Big
   - Within Wangsa Walk and AEON Big, the shop lots that have multiple ownerships are not suitable, unless significant changes are undertaken

Given the current interest, this technology will be viable in a long term scenario. The details of project implementation status that involve building partnership for DCS are explained in *Table 3.6*.

Table 3.6: Building Partnership for District Cooling System (DCS)

	Building Partnership
Implementation Approaches	Private organisation; DCS can replace any existing chiller that requires replacement
Estimated Cost	N/A
Timeline	>2030
Implementers	Private organisation, building owners
Agency	Energy Commission (ST), Sustainable Energy Development Authority (SEDA), Petronas Sdn Bhd (District Cooling Section), Daikin Malaysia Sales Sdn Bhd
Stakeholders	Building owners, government agencies, KLCH
KLCH dept.	JPPPB, JKB, JKAWS, JPLR, JPPH

TARGET/OUTCOME

It is expected that DCS can contribute to a Carbon reduction of 30 % from conventional chiller

GUIDELINES/REFERENCES

MS 1525 for chiller performance

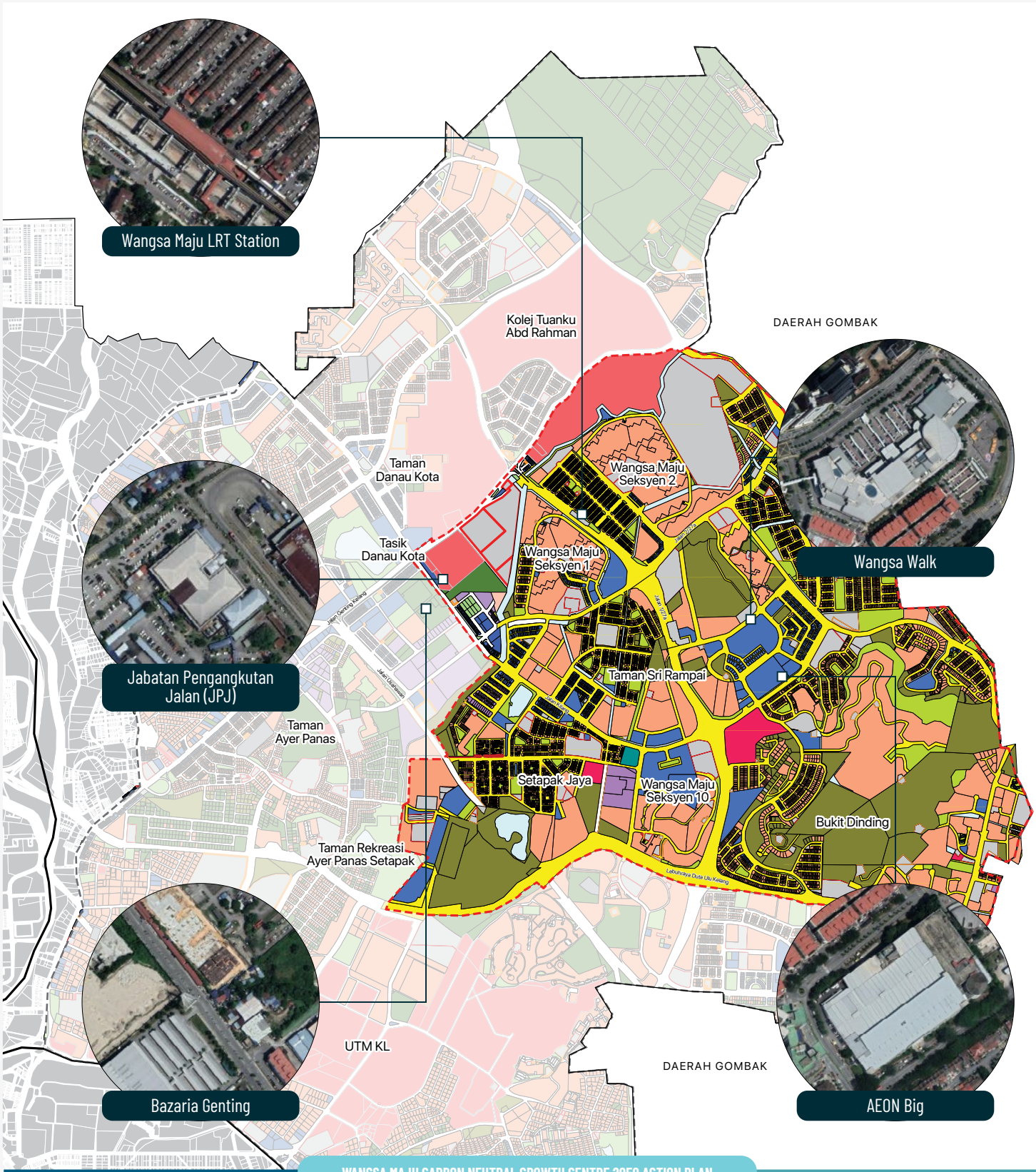


FIGURE 3.12

Potential Districts Cooling System Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

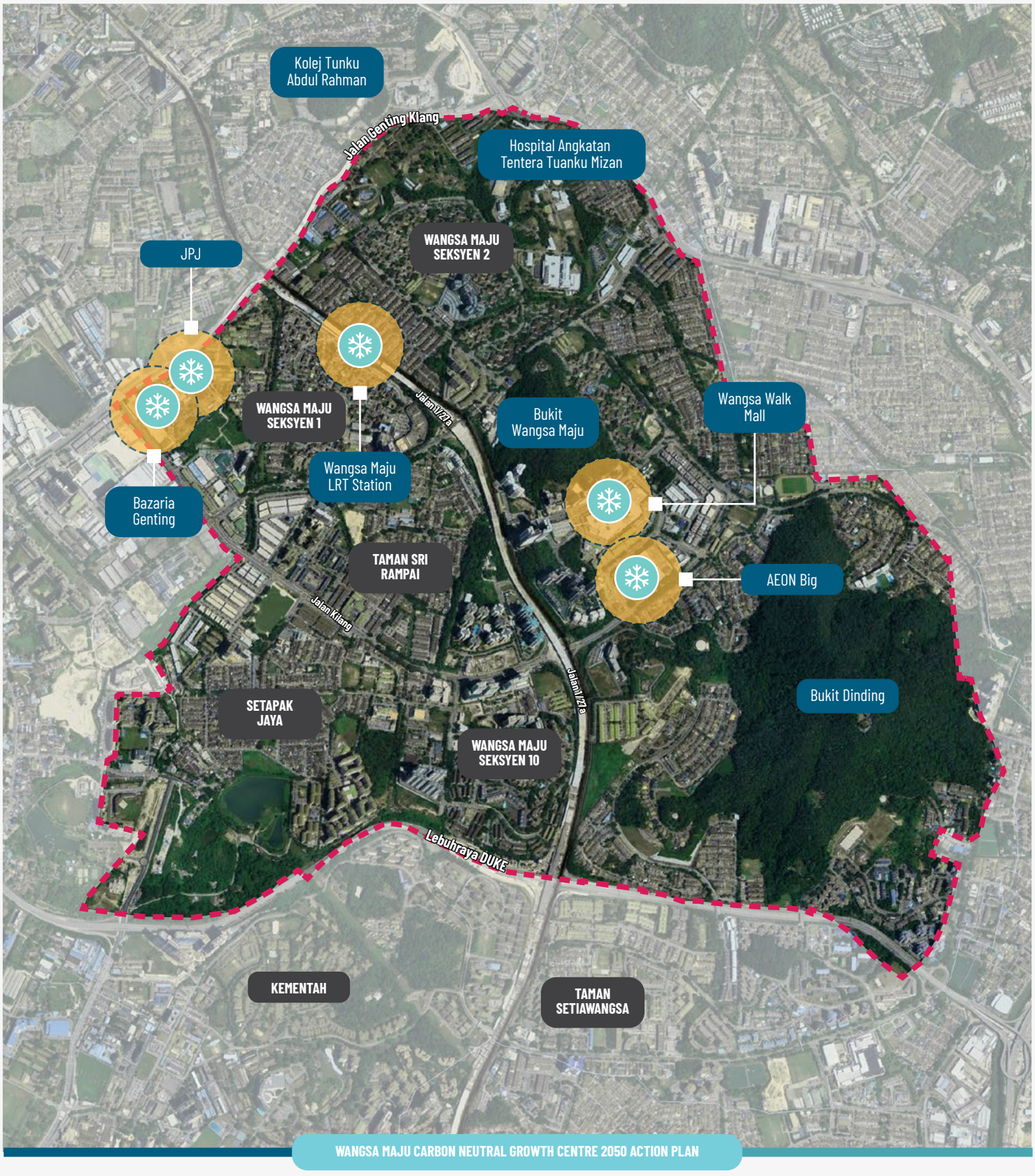


FIGURE 3.13

Potential District Cooling System Sites from the Aerial View

District Cooling System Sites

Potential Locations

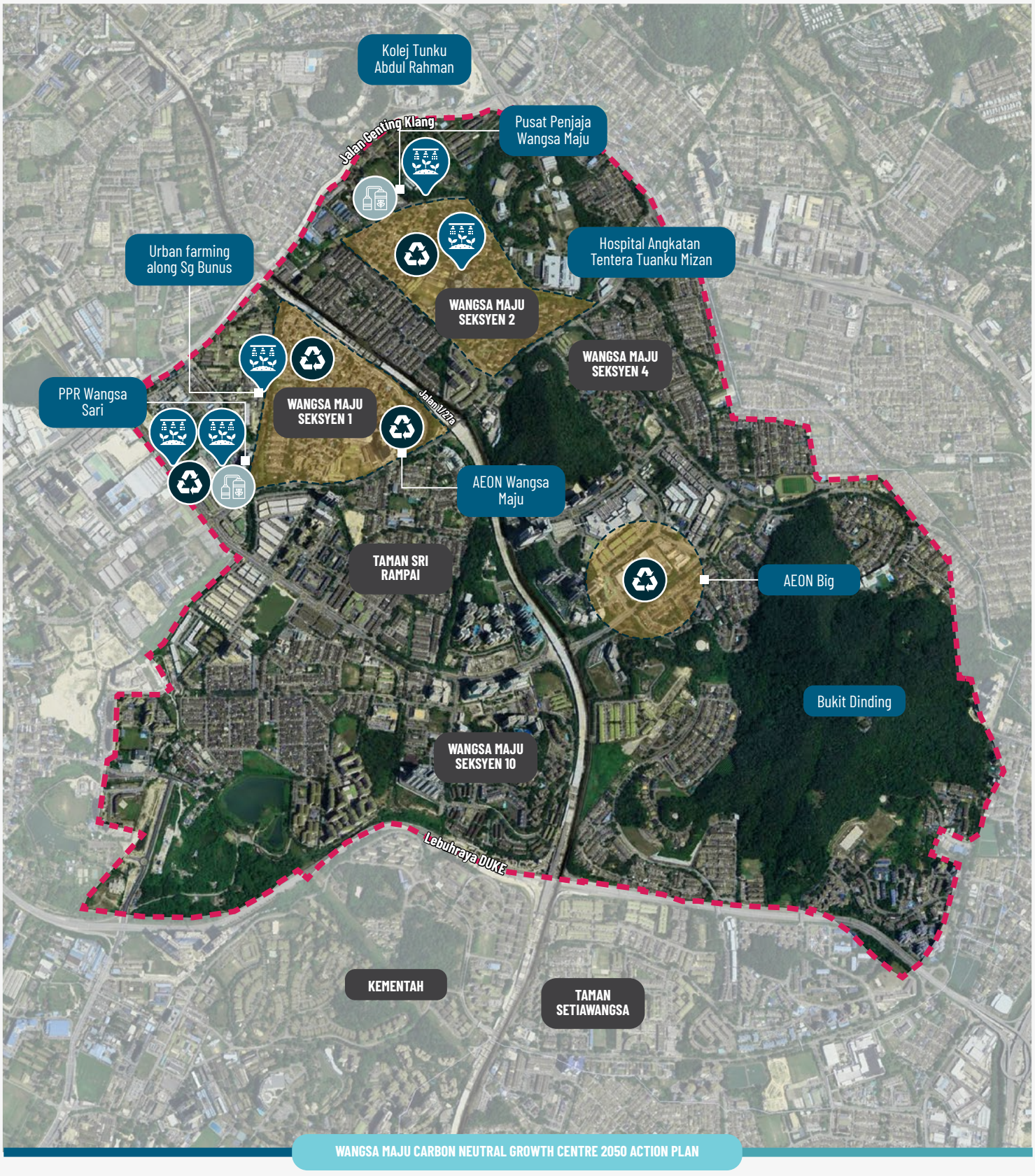
Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**



The Three (3) Proposed Initiatives of Waste Sectors

- Anaerobic Digester
- Waste Composting
- Waste Recycle Points
- Potential Locations
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

3.2.2 Waste

Waste is the residue at the end of a product's lifecycle. Waste generation necessitates its treatment, which consumes resources and energy. Waste landfills are also significant emitters of methane and, when burned, waste is also responsible for carbon emissions. Waste disposal places a heavy load on urban infrastructure and requires land and energy consumption to construct and operate waste disposal infrastructure. Waste can also amplify negative local climate impacts, e.g., by blocking drainage and causing flooding. As such, sustainable and holistic management of waste is a key dimension of the progression towards carbon neutrality.

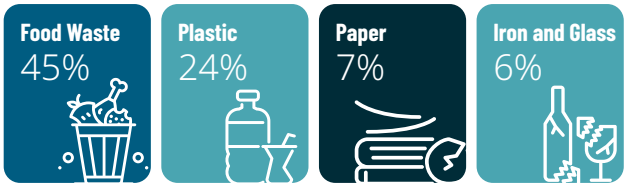
Malaysia produces nearly 1.14 million tonnes (Mt) of domestic waste per month. The government aims to achieve a 40 % recycling rate by 2025 under the 12th Malaysia Plan (12MP). Malaysia has 161 landfills, of which 14 are sanitary (SWCorp, 2021). The Bukit Tagar Sanitary landfill is designed with a 120 Mt of air space capacity and 150,000 t of aggregate volume, catering for solid waste management in the central region of Selangor and Kuala Lumpur. Some large centralised WtE parks have been in action. For example, the Ladang Tanah Merah Ecopark in Negeri Sembilan can handle up to 600 t/d of solid waste, an anaerobic digester with a processing capacity of 5 t/d and a sanitary landfill with a processing capacity of 80 t/d. The Taman Beringin Transfer Station is also equipped with a handling capacity of 2,100 t/d, with a WtE plant with a processing capacity of 1,000 t/d.

PROPOSED INITIATIVES

1. **Introduce Anaerobic Digester**
2. **Develop Waste Composting Plant**
3. **Provide Waste Recycling Points**

Currently, the solid waste in KL is managed by SW Corporation Sdn Bhd. The solid waste will be sent to the Taman Beringin Transfer Station before disposal to the Bukit Tagar Sanitary Landfill, Selangor. Based on Pelan Tindakan KL 2040 Report (KLCH, 2020), solid waste is still high in KL (1,800 t/d), including Wangsa Maju, and there are no localised treatment facilities in Wangsa Maju. Although a centralised system is in place, more decentralised and localised systems should be installed to support a clean environment and hygienic living conditions by reducing the quantity of waste at the source. Decentralised system also involves communities in segregating waste at the source and having various localised smaller waste facilities. Waste segregation at the source (shortened distance for waste transportation to landfill) is considered one of the most critical components for sustainable waste management. In Malaysia, the Separation at Source Initiative (SSI) under Solid Waste and Public Cleansing Management Act 2007 (Act 672) was enacted in September 2015 by the Solid Waste Management and Public Cleanliness Corporation (SWCorp) for several regions, including Kuala Lumpur, Putrajaya, Johor, Malacca, Negeri Sembilan, Pahang, Kedah and Perlis. The waste is separated into residual waste (food items, wet materials and soiled materials) and recyclable items (plastic, paper and others).

Solid Waste Composition in Malaysia



The solid waste composition of Malaysia is made up of 45% of food waste, 24% of plastic, 7% of paper, 6% of iron and glass (JPSPN), 2013). For the waste scenario in 2030 and short-medium waste management plan, the population of the WM is estimated to be 0.4 M (assuming 20 % of KL population of 1.98 M). The waste generation rate is estimated to be 1.62 kg/ppl/d (UNESCAP, 2020). For the waste scenario in 2050 and long term waste management plan, the population of the WM is estimated to be 0.5 M (assuming 20 % of KL population of 2.46 M). The waste generation rate is projected to increase up to 2 kg/ppl/d, based on the current generation rate in Malaysia and developed countries like US. Under these scenarios, the total waste generated in WM alone would be 1,000 t/d, which is close to the handling capacity of the Taman Beringin Waste Transfer Station (1,800 t/d). Sustainable waste management initiatives should be planned to reduce, reuse and recycle the waste volume. Three initiatives are proposed, which are anaerobic digestion and composting for the organic portion and recycling facilities for the recyclables.

These technologies are proposed based on their viabilities and successful case studies currently practised over various scales. Other technologies may be considered subjected to the changes of waste composition and technology viability. For the total organic waste generated (450 t/d), it is assumed that the 50 % (225 t/d) will be handled through a large and centralised treatment plant by the federal government (e.g. Bukit Tagar Sanitary landfill), 10 % (25 t/d) at a localised level by the local municipality, and 40 % (200 t/d) through decentralisation by leasing to investors and industries through private-public partnership (PPP) and built-operation-transfer (BOT). The targets proposed under the short-medium plan and long-term plan are based on the total waste diverted from landfill and the GHG emission (CO_2-eq) avoided from landfill emission. The emission factor (EF) used is 0.63 t CO_2-eq/t organic waste (Lim et al., 2019), which was derived from the IPCC model, with a global warming potential of CH4 of 21 over a time horizon of 100 years.

1 Anaerobic Digester (AD)

Anaerobic digestion (AD) is the biological process where microbes decompose organic matter without oxygen. The two main products are methane (CH4)-containing biogas and nutrient-rich digestate. The biogas can be used as cooking gas or generate energy through a boiler system and combined heat and power plant (CHP). Anaerobic digestion serves as a greener alternative for landfilling in handling organic waste. It reduces greenhouse gas emissions and acidic leachate runoff while generating renewable bioenergy and digestate as a soil conditioner or biofertiliser.

Source-segregated organic waste through separate collections could be an effective way to ensure the process quality, such as minimised pollutants and unwanted materials in the produced digestate that are to be used for soil application or fertiliser. Such a practice also offers opportunities for resource and material recycling. The AD site normally consists of a waste reception area for quantity recording. A storage area is needed if the collected waste exceeds the processing capacity of the digester. Easily biodegradable food waste cannot be stored long and thus can be diverted to composting *(refer to Figure 3.14)*.

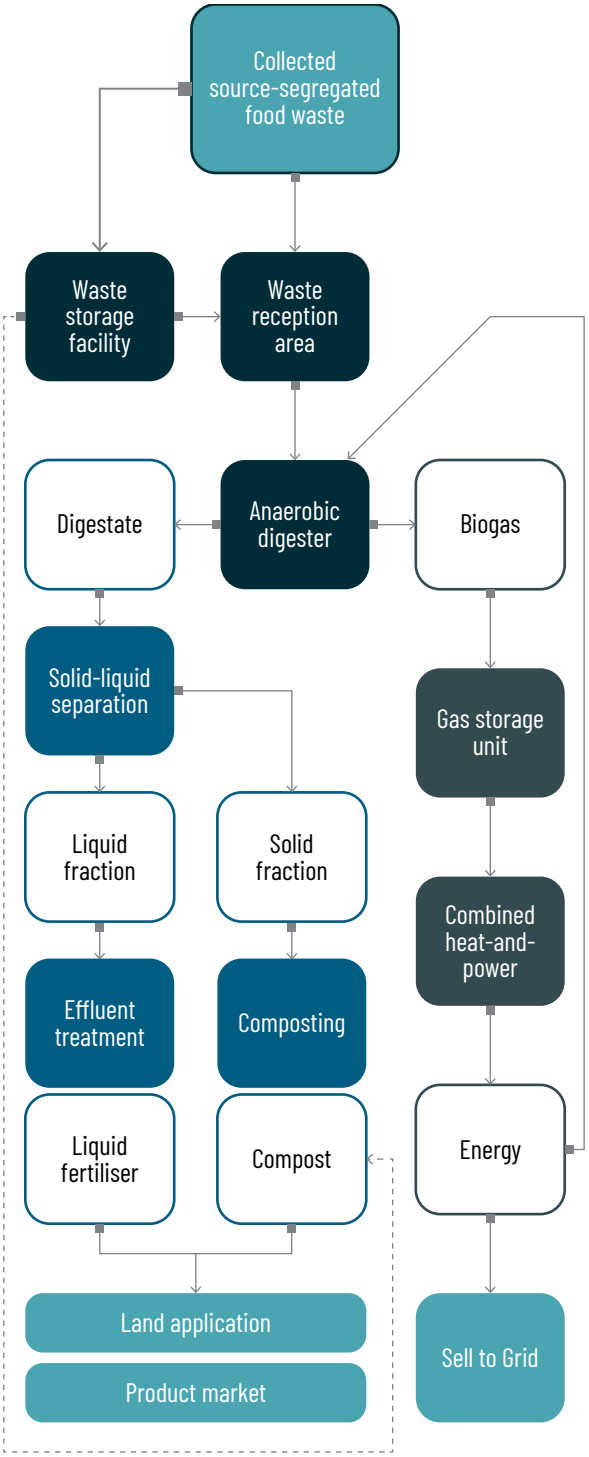


Figure 3.14: A Brief Overview for the AD Supply Chain Model

The following introduces two best practices for AD implementation, Model 1 for small scale (short-medium term) and Model 2 for large scale (long term).

BEST PRACTICES

1. Model 1: Kampung Permas Besar, Johor

Technology provider: I-TECH Farming Solution (ITFS)
Objective: The project aims to divert organic waste from landfill whilst generating biogas as cooking gas.
Processing capacity: 8 kg food waste
Production capacity: cooking gas up to 8 hrs usage

2. Model 2: The South Shropshire Biodigester, Ludlow, UK

Technology provider: Biogen Greenfinch,
Partnership: The project was funded by the Department of Food and Rural Affairs (Defra), and Advantage West Midlands to handle source separated household kitchen waste.
Objective: The project aims to divert organic wase from landfill whilst generating renewable energy and biofertiliser.
Processing capacity: 5,000 t per annum
Production capacity: 0.12 MW (1,500 MWh electric energy per annum). 90 % of the electricity produced is exported to grid and the remaining for on-site consumption.
Plant design: The plant has two anaerobic digestion with a size of 900 m^3 each, and a gas storage tank of 150 m^3.

For the short-medium term (2021-2030), a small-scale AD unit (Model 1) can be placed in the local community area, such as the community wet market. The small-scale AD can take up to 50 kg of food waste. This system can nurture behaviour change in food waste segregation at source for good system performance. Two initiatives can be proposed as the practice has matured over a longer term (2021-2030). Firstly, the small-scale unit can be dispatched to a wider audience around Wangsa Maju. Engaging with potential stakeholders to install such a unit at their premises could be done at an early stage after successfully installing the first AD unit.

On the other hand, large scale AD plants can be considered with higher public acceptance, waste segregation practices, post-digestate treatment and application, national grid and gas pipe connection. The biogas potential from food waste is 0.2-0.3 m^3/ kg food waste. With a 50-60 % methane (CH4) in biogas composition, 1 m^3 of biogas contains 6 kWh of calorific energy. This will generate 2 kWh of useable electricity, and the rest will turn into heat (Biogas World, 2021). With a processing capacity of up to 5 t/d of food waste, the renewable energy (RE) potential is estimated to be 550-700 MWh per annum. Based on a report from the US, AD of 100 t of food waste/d can generate enough energy to supply up to 1,400 homes each year (EESI, 2021).

SHORT-MEDIUM TERM PLAN (BY 2030)

- Establish small-scale AD plant (0.05 t/d) as pilot project (Model 1)
- Community engagement on waste segregation and AD application
- Replicate small-scale AD plant to more locations with a target of reaching processing capacity of 1 t/d through PPP and BOT
- Basis of Calculation for potential carbon avoidance : Organic waste production = 0.4 M population x 1.62 kg/person/d x 45 % (organic waste) x 50 % (decentralised)= 150 t/d equal to 94.5 t CO_2eq (20 % KL population of 1.98 M by 2030= 0.4 M, EF= 0.63 t CO_2-eq/t organic waste)

AD also produces a significant amount of digestate (slurry waste). So far, Malaysia does not regulate digestate for soil application or agricultural purposes. A high-quality digestate for fertilisation is defined by its nutrient content, pH, organic dry matter, free from physical impurities and pathogens. Post-treatment of the digestate usually involves solid-liquid separation. AD can be integrated with composting for post-treatment of the solid fraction.

The solid fraction can be used for direct land application but requires more insightful and detailed application guidelines. e.g. avoidance/segregation of toxic waste at source. The details of project implementation status that involve building partnership, implementation stage and project components for introduce Anaerobic Digester are explained in *Table 3.7*and *Table 3.8*.

Table 3.7: Building Partnership for Anaerobic Digester (AD)

	Building Partnership
Implementation Approaches	Private Public Partnership (PPP) / Built-Operation-Transfer (BOT)
Estimated Cost	RM 5-6 m for 5 t/d
Timeline	◢ Short term: 2021-2025 (small scale unit) ◢ Long term: >2026 (large scale unit)
Implementers	Consultant/Technology provider
Agency	National Solid Waste Management Department (JPSPN), Solid Waste Management and Public Cleansing Corporation (SW Corp), Alam Flora Sdn Bhd, Sustainable Energy Development Authority (SEDA), Indah Water Konsortium Sdn Bhd (IWK)
Stakeholders	KLCH agencies, Government agencies (JPSPN), SEDA, SWCorp etc), Waste/energy operators, Investors, Communities
KLCH dept.	JPRB (LA21 KL), JKAS, JPPPK, JPPP

POTENTIAL LOCATIONS

Justification of the site selection:

The location is selected for the project because of accessibility (near to the housing area), ownership and suitability (refer to *Figure 3.15* and *Figure 3.16*).

Locations:

1. Eco Park (2.67 acre)
2. Pusat Penjaja Wangsa Maju

LONG TERM PLAN (BY 2050)

- Establish large scale community AD plant with capacity of 5t/d (Model 2)
- Engage with investors and industries to manage remaining waste through leasing, PPP and BOT mechanisms (Model 2)
- Basis of Calculation for potential carbon avoidance: Organic waste production = 0.5 M population* 2 kg/person/d * 45 % (organic waste) * 50 % (decentralised)= 225 t/d equal to 141.8 t CO_2eq (20 % KL population of 2.46 M by 2050= 0.5 M, EF= 0.63 t CO_2-eq/t organic waste)

GUIDELINES/REFERENCES

1. RMK 12 (2021-2025)

- Chapter 6: Improving Regional Balance and Inclusion: Strategy B3: Prioritising Green and Resilient Urban Management: Strengthening Waste Management (pp. 6-20)
- Chapter 8: Advancing Green Growth for Sustainability and Resilience: Strategy A2: Accelerating Transition to the Circular Economy: Creating an Enabling Ecosystem for the Circular Economy (pp. 8-15)

2. Act 672 for Waste segregation at source
3. Renewable Energy Act 2011 (SEDA)
4. Kuala Lumpur Low Carbon Society Blueprint 2030 on Sustainable Waste Management (Action 8)
5. Sustainable Development Goals (SDG)
6. Guidelines on Biogas Power Plant AT&PA for FIT Projects (SEDA)

IMPLEMENTATION GUIDE FOR AD

- Feedstock availability: A stable and secured feedstock of 10 kg/d
- Demand availability: The biogas produced can be used for either cooking gas or electricity generation.
- Biogas application: Specifically designed biogas burners or modified consumer appliances.
- Safety measures: Periodic checking and maintenance to minimise the risk of leakages and explosions.
- Post-treatment: Storage tanks for digestate and transportation to other facilities (e.g. composting)
- Legal and inventory: registration/licensing of small AD units and data inventory by authorities

Table 3.8: Major Project Components for Establishing and Implementing AD Plant

No	Project Component	Component Project	Key Partners
1	Community engagement	◢ On-going green campaigns and workshop to reach wider audience, e.g. waste segregation, renewable energy, biofertiliser and biofertiliser-applied crops/other products, small-scale showcasing etc.	**Lead and coordinator:** Subject expert/consultant, KLCH agencies. **Stakeholders:** Local community, Government agencies (JPSPN, SEDA, SWCorp etc) Waste/energy operators, Technology/service providers, Investors, NGOs, schools and universities.
2	Feasibility study	◢ Waste component and characteristic analysis, quantity of waste. ◢ Identification of best practices, stakeholder mapping and regulation framework. ◢ Availability of infrastructure, e.g. grid connectivity or piping to national gas network.	
3	Multistakeholder partnership	◢ Consensus building on partnership and business model covering supply chain management, investment opportunity, public acceptance on siting location ◢ Enabling policy and market initiative, e.g. feed-in-tariff, waste buy-in and product buy-back mechanism, product labelling and marketing, certification schemes, green credits. ◢ Guidelines and best practices mapping.	**Lead and coordinator:** Subject expert/consultant, KLCH agencies. **Stakeholders:** Local community, Government agencies (JPSPN), SEDA, SWCorp etc) Waste/energy operators, Technology/service providers, Investors, NGOs, schools and universities.
4	AD plant design	◢ Waste reception area and feedstock quality checking. ◢ AD digester and operating parameters. ◢ Permit application procedure (if needed), e.g. feedstock and product declaration, health and safety check on gas leakage.	**Lead and coordinator:** Technology/service provider, subject expert/ consultant **Stakeholders:** KLCH agencies, Government agencies (JPSPN), SEDA, SWCorp etc), Waste/energy operators, Investors.
5	Implementation and monitoring	◢ Monitoring quality of biogas, digestate and digestate-derived biofertiliser produced. ◢ To have clear guidelines on which feedstock can be used and based on their final application (crops, soil, landscape). ◢ Availability of infrastructure, e.g. grid connectivity or piping to national gas network. ◢ Inventory data collection on the waste collected and diverted from landfill to anaerobic digestion unit	**Lead and coordinator:** Technology/service provider, Subject expert/ consultant **Stakeholders:** Local community and NGOs, KLCH agencies, Enterprises, Government agencies (SEDA etc).

FIGURE 3.15

Potential Anaerobic Digester Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KLCH2050 KUALA LUMPUR CARBON NEUTRAL

Source: **KLCH, 2021**

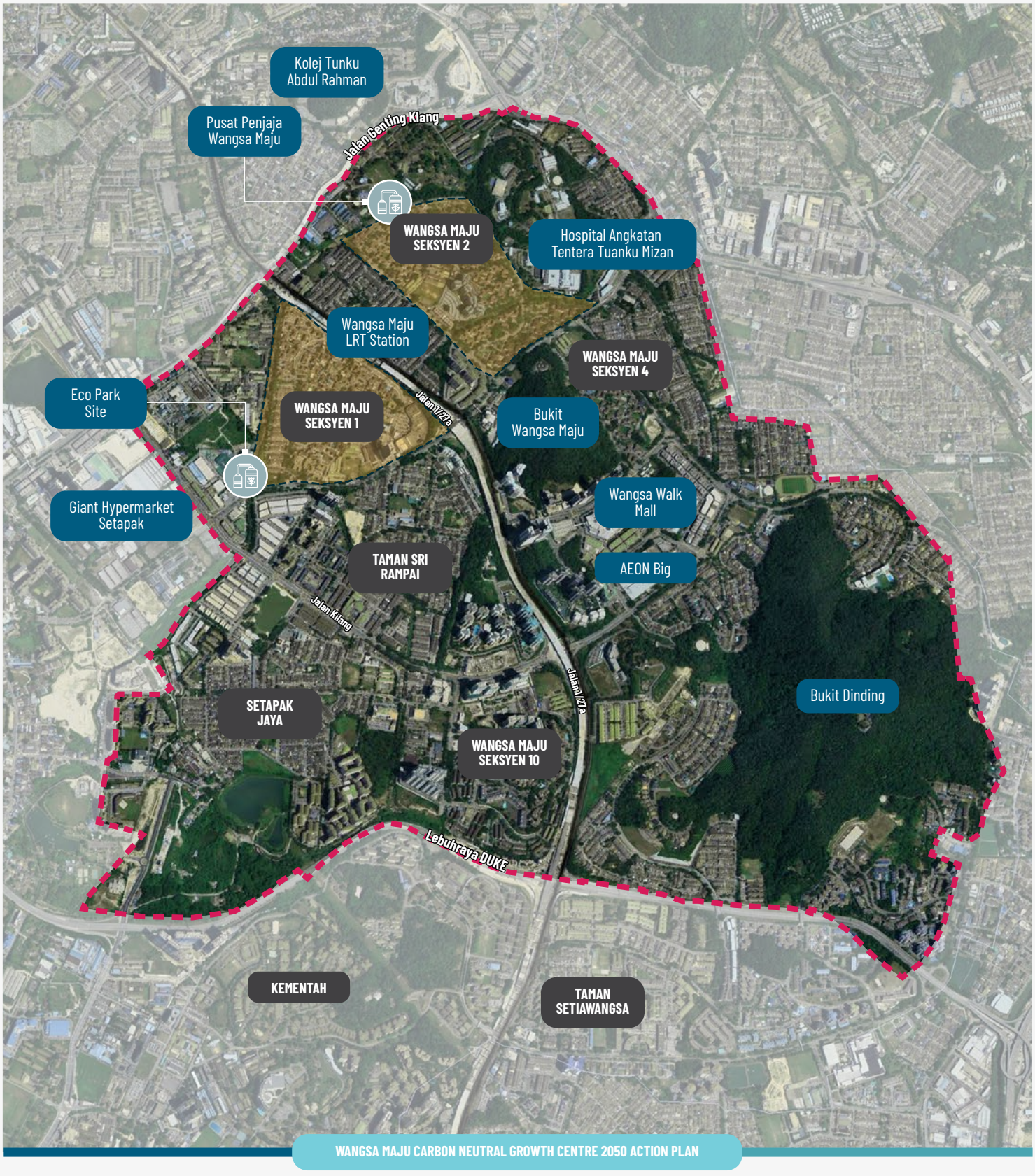


FIGURE 3.16

Potential Anaerobic Digester Sites from the Aerial View

Anaerobic Digester

Potential Locations

Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

2 Develop Waste Composting Plant

Composting is a biological process where organic waste, such as food waste and green waste, is decomposed into humus-like material used as a soil conditioner or biofertiliser. The composting process offers a greener alternative than landfill in handling organic waste such as food waste. The diversion of organic waste from landfill contributes to GHG reduction. The product, compost, can be used as an alternative for fertiliser and soil amendment, thus improving resource conservation by recycling nutrients from organic waste and reducing fertiliser consumption. The composting process comes in several process designs. This chapter presents three composting models, namely in-vessel bin composting, open windrow composting, and turner composting. Source-segregated organic waste through separate collections plays an important role in producing high-quality compost as a soil amendment or biofertiliser. Such a practice also offers opportunities for resource and material recycling.

BEST PRACTICES

1. Model 1: Mini-RTC Layang-Layang, Johor, Malaysia

Technology provider: Universiti Teknologi Malaysia (UTM), Johor
Partnership: Local community, University Community Transformation Centre (UCTC), National Blue Ocean Strategy (NBOS), schools.
Objective: to bio-transform food waste and green waste to produce value-added compost and bio-liquid (leachate) through composting, which reduces waste to landfill and promote sustainable agriculture
Processing capacity: up to 200 kg waste/d
Production capacity: up to 80 kg compost/d
Plant design: The site has an area of 200 m^2, with waste reception area, composting bin area, bio-liquid collection and fermentation area, compost maturation area and product storage area. The project was executed in 6 months, including consensus building, knowledge transfer, workshop and site preparation (location siting, equipment and materials purchase, and site construction) *(refer to Figure 3.17)*.

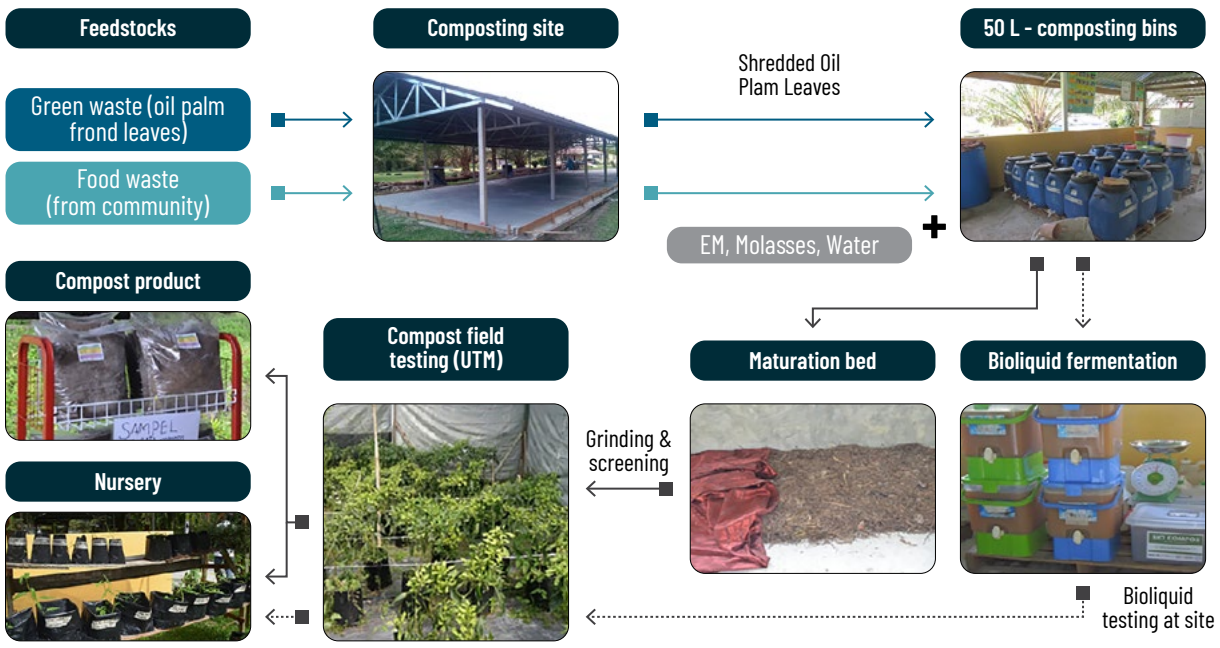


Figure 3.17: Community Scale Composting Plant at Mini-RTC Layang-Layang Johor, Malaysia

BEST PRACTICES

2. Model 2: Green waste composting by Madrid City Hall, Spain

Objective: to receive green waste or landscape waste around the city, composted then used as soil amendment for landscaping
Processing capacity: 60,000 m^3 waste/yr
Production capacity: 9,000 m^3 compost/yr
Plant design: The composting site takes up an area of 15,000 m^2, which is divided into waste reception area, waste pre-treatment area, composting, maturation bay and product storage area. The composting process can take up to 4 months *(refer to Figure 3.18)*.

Figure 3.18: Composting Flowchart for Windrow Composting by Madrid City Hall, Spain

BEST PRACTICES

3. Composting plant in Sandakan and Kota Bahru

Technology provider: SS Microbial Sdn Bhd
Objective: to reduce waste entering landfill and to produce biofertiliser
Processing capacity: up to 80,000 t MSW/ yr (currently 120 t/d)
Production capacity: 25,000 t/yr
Plant design: The plant has an area of 2500-3000 m^2. The plant utilises two stage processes, stage 1 for in-vessel and stage 2 for windrow turner. The company utilises PLG Micro-organism Technology to achieve higher process efficiency, which can be completed in 14-15 d and up to 98 % waste reduction. The composting site has a waste reception area and weigh bridge, breaker/crusher, primary and secondary composting system, anti-odour system, automatic fertiliser packaging system and other equipment *(refer to Figure 3.19)*.

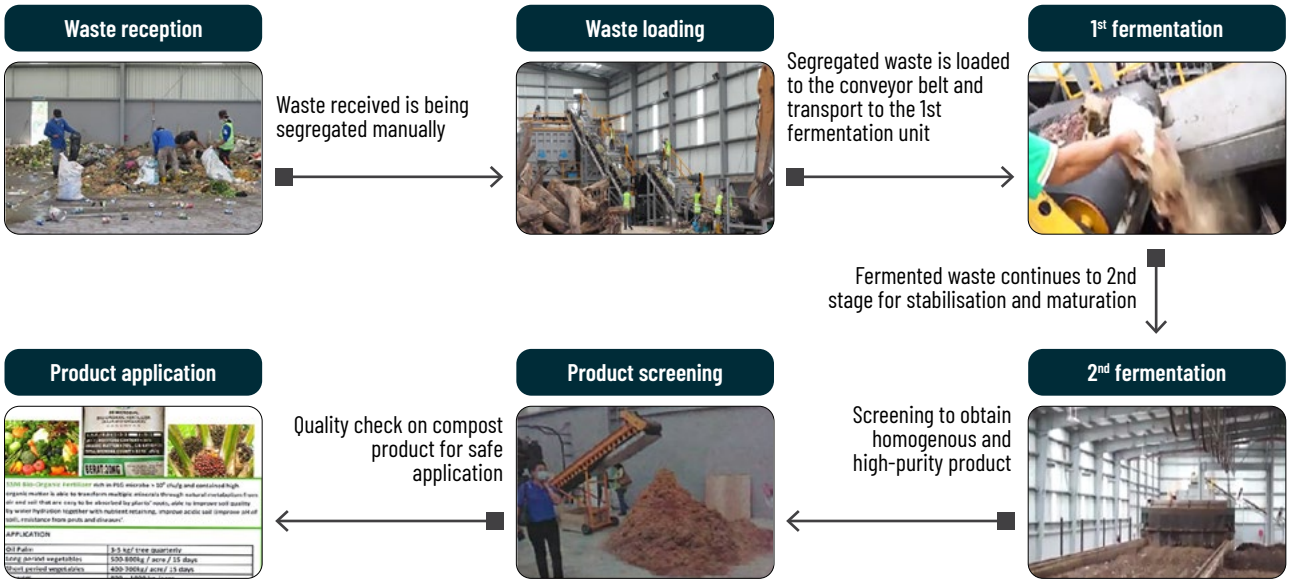


Figure 3.19: Composting Flowchart for Turner Composting by SS Microbial

In the short term, composting bins (50 L) are proposed for rapid execution and implementation. This system has been successfully implemented in Mini-RTC Layang-Layang and SJK (C) Pulai, Johor. Another open system composting was also done on UTM campus. In RTC Layang-Layang, one blue bin (50 L) can cater up to 60 kg of food waste, layered with an equal amount of shredded oil palm leaves and sprayed with effective microbes. This model can be executed by engaging vendors in the wet markets and volunteers from the community. This project is proposed for short-to-medium term implementation (2021-2030).

This system can be run at a small scale (1-10 households) initially (up to 50 kg/d), then gradually expanded (> 10 households) (up to 100 kg/d). The small-scale unit (50 L bin) is recommended to minimise community concern over odour and aesthetic purposes. This system can nurture behaviour change in food waste segregation at the source using the compost bin. As the practice has matured over the longer term, large-scale composting can be considered with higher public acceptance and facilitate large scale compost bin collection. The details of implementation stages and project components short term are explained in *Table 3.9*.

For the long term execution, several options could be considered. One is the expansion of the composting bins (Model 1) to involve a higher number of participants. As there is a high capacity (e.g.>50 bins), a smart App can be developed, whereas the bin owners (e.g. wet market operators, wet market vendors, families, schools etc.) can report to contract companies or the local agencies via the App for bin collection. Another option is large-scale open windrow composting or turner composting, with a processing capacity of up to 5 t/d. This plant can take in waste from the compost bins (for further composting or maturation) or from waste collectors (for composting).

SHORT-MEDIUM TERM PLAN (BY 2030)

- Establish small-scale AD plant (0.05 t/d) as pilot project (Model 1)
- Community engagement on waste segregation and AD application
- Replicate small-scale AD plant to more locations with a target of reaching processing capacity of 1 t/d through PPP and BOT
- Basic of Calculation for potential carbon avoidance: Organic waste production = 0.4 M population* 1.62 kg/person/d * 45 % (organic waste) * 50 % (decentralised)= 150 t/d equal to 94.5 t CO_2eq (20 % KL population of 1.98 M by 2030= 0.4 M, EF= 0.63 t CO_2-eq/t organic waste)

Table 3.9: Short-term Implementation Stages and Project Components for Establishing Small Scale Community Composting

No	Project Component	Component Project	Key Partners
1	Community engagement	◢ Engagement with local community, authority and stakeholders for consensus building, identification of potential conflict interest and collaboration ◢ Knowledge sharing workshops on household food waste segregation at source and composting know-how ◢ Food waste collection logistic- partners and responsibility ◢ Active green workshop and hands on composting workshop to translate science to public-friendly topic ◢ Establishing composting council/ steering committee	**Lead and coordinator:** Subject expert/ consultant, KLCH agencies. **Stakeholders:** Local community, Government agencies (JPSPN, SWCorp etc), Waste operators, Technology/ service providers, Investors, NGOs, schools and universities.
2	Feasibility study	◢ Waste component and characteristic analysis, Quantity of waste ◢ Identification of best practices, stakeholder mapping and regulation framework	
3	Composting site	◢ Construction of composting site, preparation of composting bins and other materials, guiding community on the composting process ◢ Frequent green workshop to spread the green awareness to larger community such as commercial, schools and enterprise/entrepreneurs	
4	Implementation and monitoring	◢ Composting process and quality monitoring, field application testing ◢ Establishing product market, e.g. compost buy-back by local community for own use or local authority for landscape, partnership with entrepreneur for product marketing. ◢ Inventory data collection on the waste collected and diverted from landfill to composting unit	**Lead and coordinator:** Technology/ service provider, Subject expert/ consultant. **Stakeholders:** Local community and NGOs, KLCH agencies, Enterprises, Government agencies.

LONG-TERM PLAN (BY 2050)

- Establish large scale community composting plant with capacity of 5t/d (e.g. Model 2 & 3)
- Engage with investors and industries to manage remaining waste through leasing, PPP and BOT mechanisms
- Basis of Calculation for potential carbon avoidance: Organic waste production = 0.5 M population* 2 kg/person/d * 45 % (organic waste) * 50 % (decentralised)= 225 t/d equal to equal to 141.8 t CO_2eq (20 % KL population of 2.46 M by 2050= 0.5 M, EF= 0.63 t CO_2-eq/t organic waste)

GUIDELINES/REFERENCES

1. RMK 12 (2021-2025)

- Chapter 6: Improving Regional Balance and Inclusion: Strategy B3: Prioritising Green and Resilient Urban Management: Strengthening Waste Management (pp. 6-20)
- Chapter 8: Advancing Green Growth for Sustainability and Resilience: Strategy A2: Accelerating Transition to the Circular Economy: Creating an Enabling Ecosystem for the Circular Economy (pp. 8-15)

2. Act 672 for Waste segregation at source
3. Malaysia Organic/ Biofertiliser Certification Schemes
4. Kuala Lumpur Low Carbon Society Blueprint 2030 on Sustainable Waste Management (Action 8)

The business model for composting bins collection can be designed through PPP with enterprise to collect up to 5 t/d of food waste from households and commercials. Small bins can be provided to the community for collecting food scraps and food waste. The collected waste is then transported to the composting site for open windrow or turner composting. As a larger area is required for waste reception, composting, maturation, and product storage, the KLCH landscape waste site could be a potential location. This also helps to secure the green waste source as co-feedstock for composting. This model can also be coupled with the management of AD digestate (Part 1: Energy). Similarly, through continuous culturing of green practices among the community, large scale composting plants can be considered with higher public acceptance, waste segregation practices, and an expanded compost market. The details of project components for long term and summary of composting project are explained in *Table 3.10* and *Table 3.11*.

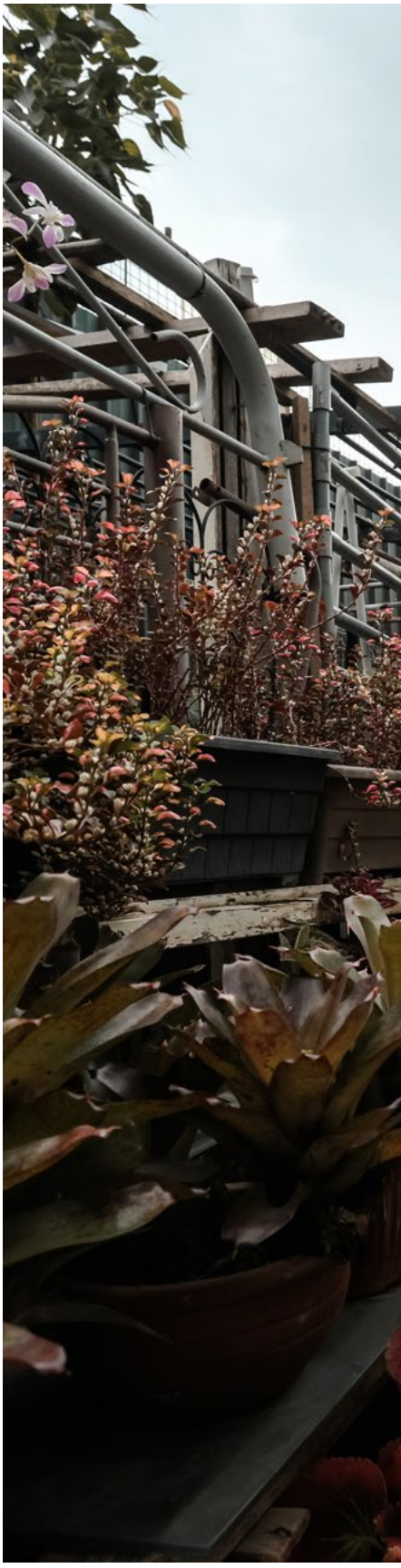


Table 3.10: Long-Term Implementation Stages and Project Components for Large Scale Composting

No	Project Component	Component Project	Key Partners
1	Community engagement	◢ On-going green campaigns and workshop to reach wider audience, e.g. waste segregation, composting know-how and compost usage. ◢ Home composting can be implemented as community has been familiarised with composting through green campaigns and the operation of the composting site.	**Lead and coordinator:** Subject expert/ consultant, KLCH agencies. **Stakeholders:** Local community, Government agencies (JPSPN, SWCorp etc) Waste operators, Technology/ service providers, Investors, NGOs, schools and universities.
2	Feasibility study	◢ Waste component and characteristic analysis, Quantity of waste ◢ Identification of best practices, stakeholder mapping and regulation framework	
3	Multistakeholder partnership	◢ Consensus building on partnership and business model ◢ E.g. business model covering supply chain management (feedstock logistics, process, product selling and consumption (e.g. buy-in (feedstock) and buy-back (compost) mechanisms)). ◢ Marketing initiative to promote sustainable business, e.g. product labelling and marketing, certification schemes, green credits.	
4	Compost plant design	◢ Public acceptance on siting location ◢ Area needed for waste receiving facility, waste storage, buffering zone, composting, compost maturation, compost packing; ◢ Selection of Composting Technology based on waste volume and size of composting site ◢ Permit application procedure and operating guidelines for larger –scale operation	
5	Implementation and Monitoring	◢ Monitoring quality of compost produced ◢ To have clear guidelines on which feedstock can be used and based on their final application (crops, soil, landscape) ◢ Inventory data collection on the waste collected and diverted from landfill to composting unit	

Table 3.11: Building Partnership for Waste Composting Plant

Building Partnership	
Implementation Approaches	◢ Private Public Partnership (PPP) ◢ Built-Operation-Transfer (BOT)
Estimated Cost	◢ Phase 1: RM 10 k/ urban site, ◢ Phase 2: RM 4-5 m
Timeline	◢ For short term- community farming area or wet market ◢ For long term- landscape waste area, waste transfer station
Implementers	Consultant/Technology provider
Agency	Department of Environment (DOE), National Solid Waste Management Department (JPSPN), Solid Waste Management and Public Cleansing Corporation (SW Corp), Alam Flora Sdn. Bhd
Stakeholders	Local community, Government agencies (JPSPN, SEDA, SWCorp etc), Waste operators, Technology/ service providers, Investors, NGOs (e.g. Tzu Chi Foundation), schools and universities.
KLCH dept.	JPRB (LA21 KL) , JKAS, JPPP, JPPPK

POTENTIAL LOCATIONS

Justification of the site selection:

The location is selected for the project because of accessibility (near to the housing area), ownership and suitability.

Locations:

1. Commercial area (Pusat Penjaja Wangsa Maju)
2. Community farming and Eco Park
3. Public housing (PPR Wangsa Sari, Flat Wangsa Maju Seksyen 1, Flat Wangsa Maju Seksyen 2) (refer to *Figure 3.20* and *Figure 3.21*).

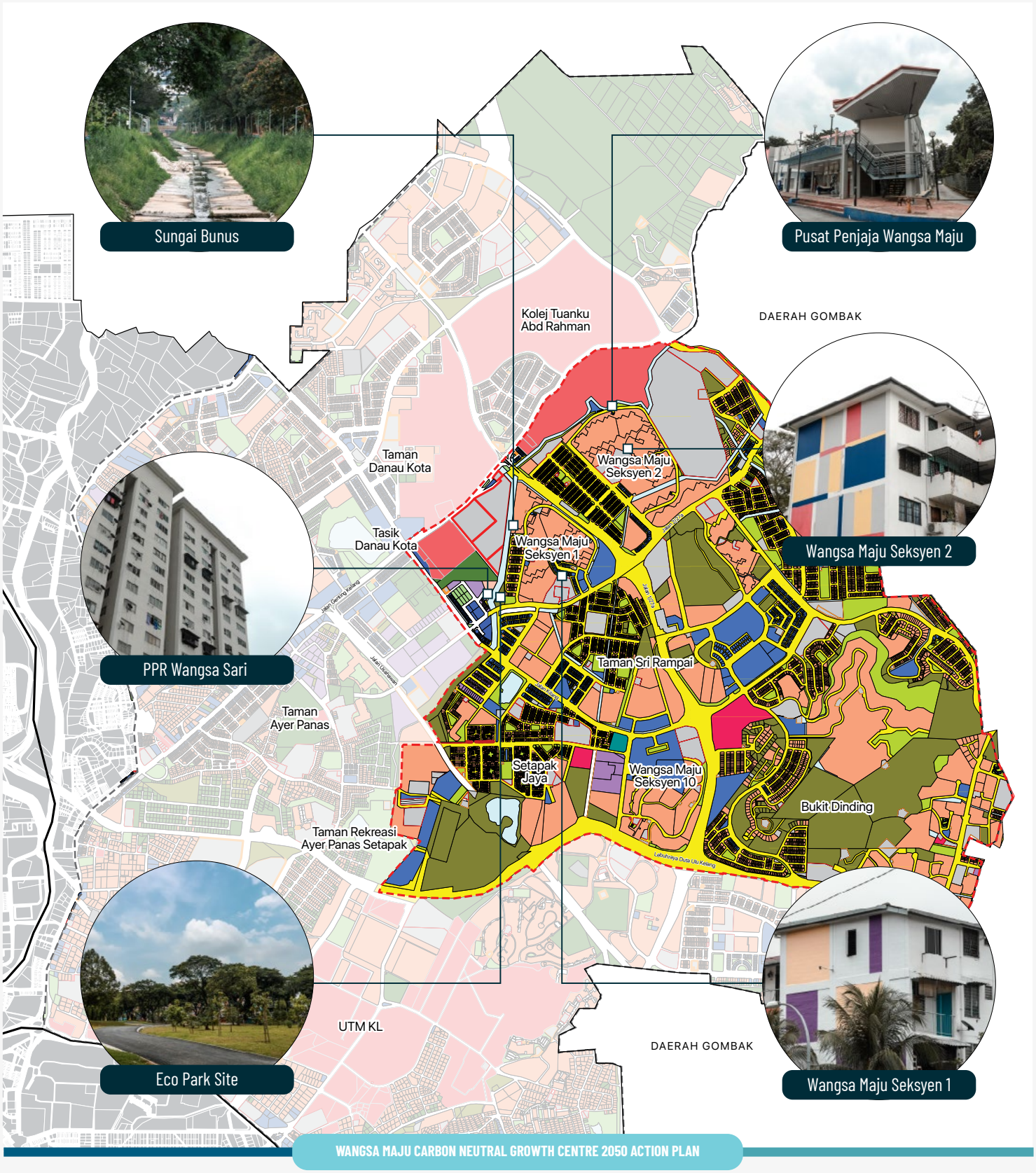


FIGURE 3.20

Potential Waste Composting Plant Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KLCH2050 KUALA LUMPUR CARBON NEUTRAL

Source: **KLCH, 2021**

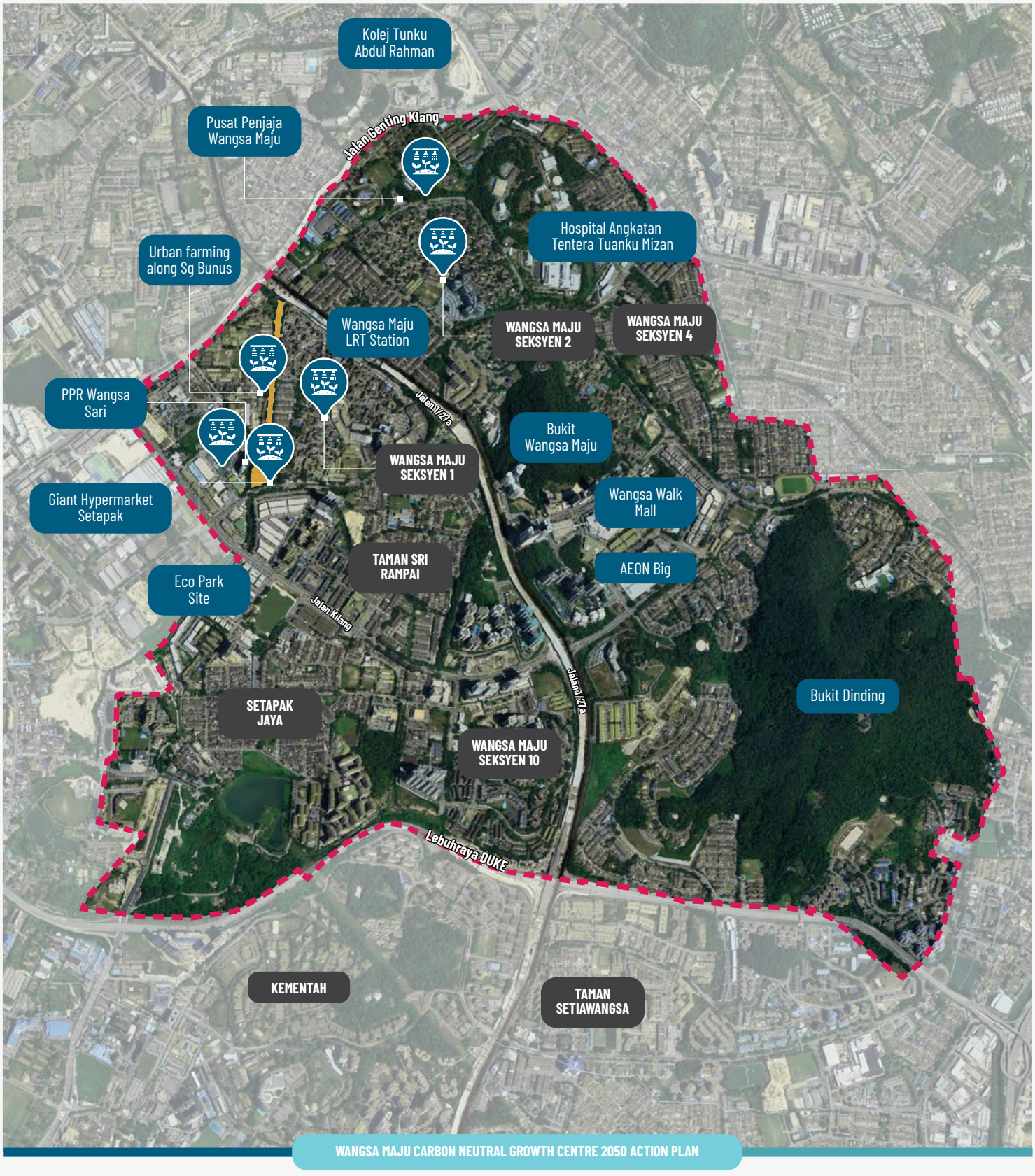


FIGURE 3.21

Potential Waste Composting Sites from the Aerial View

- Waste Composting Sites
- Location community farming and Eco Park
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

The following *Figure 3.22* provides an illustrated summary on the overall waste management scenario for organic waste treatment, as well as the short-term and long-term targets to reach carbon neutrality by 2050 through the landfill diversion of organic waste.

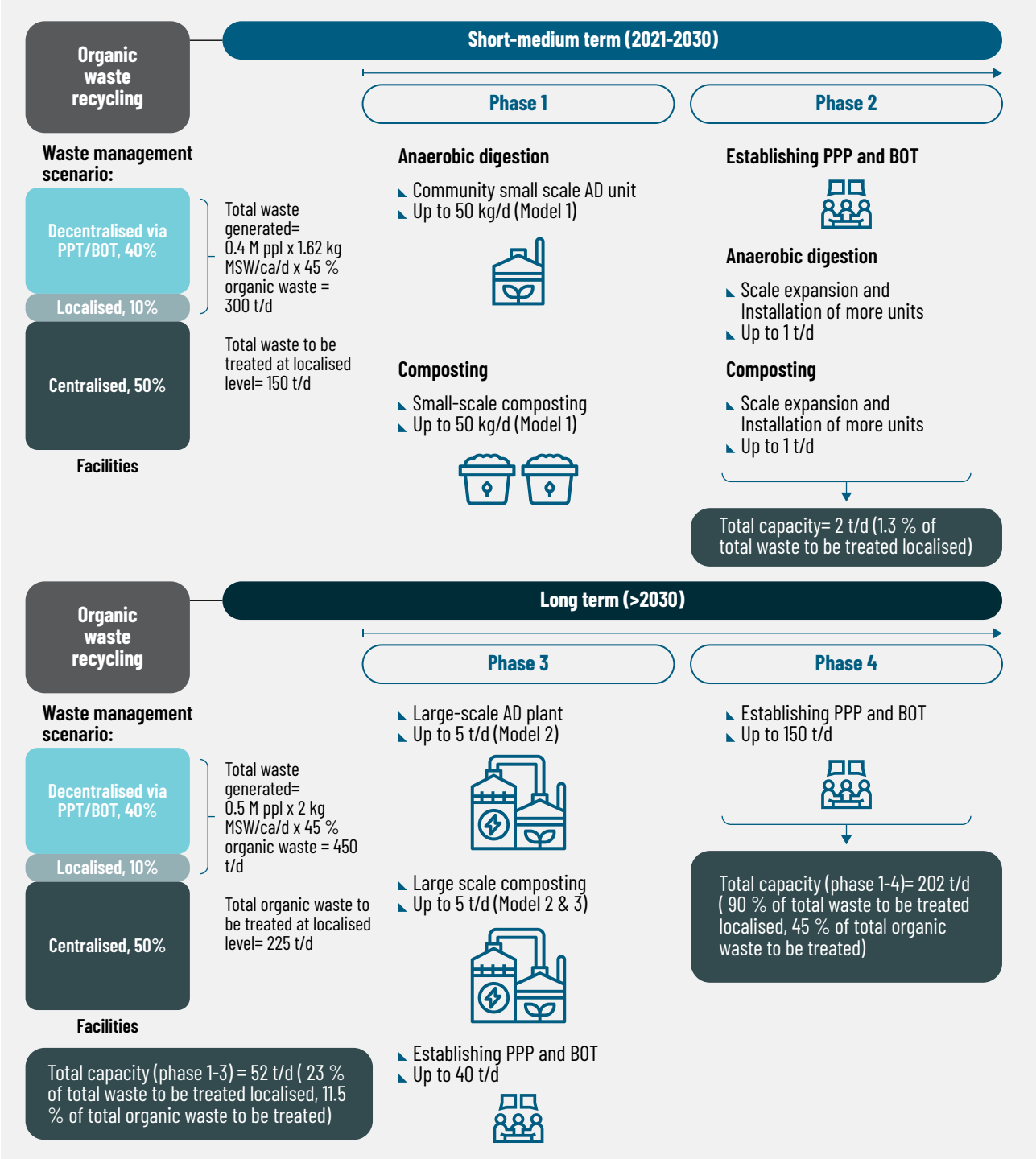


Figure 3.22: Summary of AD and Composting Program

3 Provide Waste Recycling Points

Recycling is another approach to recover valuable materials for reuse and reutilisation, which reduces waste production and raw material consumption. Recycling points come in a smaller scale and has smaller number of bins as compared to recycling centre, but they offer easier management. The main type of recyclables that can be disposed of varies. The following showed a few examples of recycling points or kiosks that could facilitate the recycling programs.

The waste recycling centre's project component can be divided into the soft (community engagement and education) and the hard part (technical). The community engagement part is discussed in Sector Community section 3.2.4 (page 101). In terms of technical, the implementation phases can be divided into short term (phase 1) and middle/long term (phase 2). For the short term, recycling points that cater to materials such as glass, used clothes, and papers can be placed in the shopping centre's carpark. Proper guidelines and community outreach are needed to maintain the cleanliness of the recycling area and ensure acceptable quality to be processed by the recycling contractor and facilities.

TARGET/OUTCOME

(a) Short-medium term: 25-40 % recycling rate
(b) Long term: 50 % recycling rate

BEST PRACTICES

1. UK

- UK is having small roadside recycling centre or points around their neighbourhoods, which is commonly located near public services, local car park and supermarket.
- These recycling areas can accept recyclables like paper, plastic, glass, metal, clothes, e-waste, based on their capacities. There is also Household Waste and Recycling Centre around the neighbourhood that cater for garbage and recycling services.
- Local authorities also provides small containers to household for food scraps as part of their household recycling collections. This can also promote home composting.

2. Singapore

- The National Environmental Agency (NEA) Singapore and ALBA company dispatched 300 units of e-waste collection and recycling kiosk, including laptops, mobile phones, and portable batteries.
- The public can earn points that can be redeemed for shopping vouchers.

3. Malaysia

- The start-up company in Malaysia, KLEAN, Janz Technologies, developed a plastic bottle recycling kiosk. Such machine has been dispatched into popular tourist sites like Resort World Genting and high density area like Shell petrol station and Lotus shopping mall.
- The kiosk is integrated with e-wallet services such as Boost , Touch n Go and Grab. Points can be collected in exchange for tax vouchers and gifts upon depositing bottle cans through their KLEAN App. The company also offers real-time tracking of data and reporting via the KLEAN dashboard.

4. Nanjing, China

- Smart recycling bins by JW Vending Technology presents a smart waste sorting and recycling machine in Nanjing, China.
- Citizens could sort and segregate their waste, weigh them and collect money through their mobile phones. The unit has seven boxes, one is the electronic operation display screen, and the other six being collection bins for metal, plastic, textile, paper, glass, hazardous and e-waste.
- Different items have a specific selling rate. The public can withdraw the cash through a bounded bank when their credits reach a certain amount.

5. New York City

- New York City has teamed up with Bigbelly waste management company to deploy smart waste bins to tackle its overflowing waste issue.
- 170 solar-powered smart bins have been installed. Each container is equipped with a chip. The installation of sensors provides real-time data and fill alerts that can streamline waste collection, allowing thrash to be picked up when needed the most. This can also help to optimise the waste collection logistic.
- The company has formed a partnership with New York's Downtown Alliance for a pilot-scale project. Wi-Fi units were installed in two containers and turned into Wi-Fi hotspots. The bins may also help the government collect data about waste management or display public service. The trash and recycling bins can serve as wireless hotspots throughout the city.

Additionally, in the shopping centre, individual recycling kiosks, such as plastic bottles, e-waste and plastic, can also be installed respectively for the convenience of customers to recycle these materials immediately after consumption. For the longer term, a smart recycling kiosk can be installed in the neighbourhood when the recycling practices are nurtured into daily activities and with high public participation. Such community-based recycling kiosks can come with a complete recycling package, with respective bins catering for different recyclables. A tracking app is useful to help consumers quantify their recycling activities and for local authorities to estimate the recycling rate of the area/city.

Some features to be included could be waste generated (waste composition), waste recycling, point reward system, assessment as waste producer and recycler (high, middle, low). This can also be integrated with home and community composting systems *(refer to Figure 3.21)*. The tracking app is useful for developing waste recycling inventory. This can also be integrated with the waste sent to anaerobic digestion and composting and utilising the respective product. The smart waste management system has been helping the local council to manage waste and reduce cost-effectively.

The material recycling facilities (MRF) is a large scale system where the collected recyclable materials are sorted into different waste streams. It aims to achieve maximum material recovery while producing materials that are of high possible revenues. Based on the National Strategic Plan for Solid Waste Management by National Solid Waste Management Department (JPSPN), there a few MRF facilities planned, including Gombak MRF (1,600 t/d), Kajang/ PutraJaya MRF (1,540 t/d), Petaling Jaya (2,390 t/d), and Klang MRF (1,220 t/d).

It is assumed that the large scale MRF system by the Federal government can take up to 50 % of the recyclable waste produced for the area. For the remaining 50 %, it is targeted that 20 % can be treated locally by the local municipality, taking into account of readily available recyclable materials such as old newspapers, whereas another 30 % shall be collected and processed through PPP and BOT with investors and industries. The details of project implementation status that involve building partnership for Waste Recycling Points are explained in *Table 3.12*.

GUIDELINES/REFERENCES

1. 40 % recycling rate by 2025 under RMK 12
2. RMK 12 (2021-2025)

- Chapter 6: Improving Regional Balance and Inclusion: Strategy B3: Prioritising Green and Resilient Urban Management: Strengthening Waste Management (pp. 6-20)
- Chapter 8: Advancing Green Growth for Sustainability and Resilience: Strategy A2: Accelerating Transition to the Circular Economy: Creating an Enabling Ecosystem for the Circular Economy (page 8-15)

3. Act 672 – Solid Waste Management and Public Cleansing Act 1972 (Waste Segregation at Source)

POTENTIAL LOCATIONS

Justification of the site selection:

The location is selected for the project because of accessibility (near to the housing area), ownership and suitability.

Locations:

1. Public housing (e.g. PPR Wangsa Sari (refer to *Figure 3.24* and *Figure 3.25*).
2. Commercial area (Wangsa Walk and Aeon Big, petrol station)

Table 3.12: Building Partnership for Waste Recycling Points

	Building Partnership
Implementation Approaches	◢ Public-Private Partnership (PPP) ◢ Built-Operation-Transfer (BOT)
Estimated Cost	N/A
Timeline	◢ Phase 1: 2021-2025- Public housing (PPR Wangsa Sari, Flat Wangsa Maju Seksyen 1, Flat Wangsa Maju Seksyen 2) ◢ Phase 2: 2026-2030- Commercial area (Wangsa Walk and Aeon Big, petrol station)
Implementers	Consultant/Technology provider
Agency	Department of Environment (DOE), National Solid Waste Management Department (JPSPN), Solid Waste Management and Public Cleansing Corporation (SW Corp), Alam Flora Sdn. Bhd
Stakeholders	Local community, Government agencies (JPSPN, SEDA, SWCorp etc), Waste operators, Technology/service providers, Investors, NGOs, schools and universities.
KLCH dept.	JPRB (LA21 KL), JKAS, JPPP

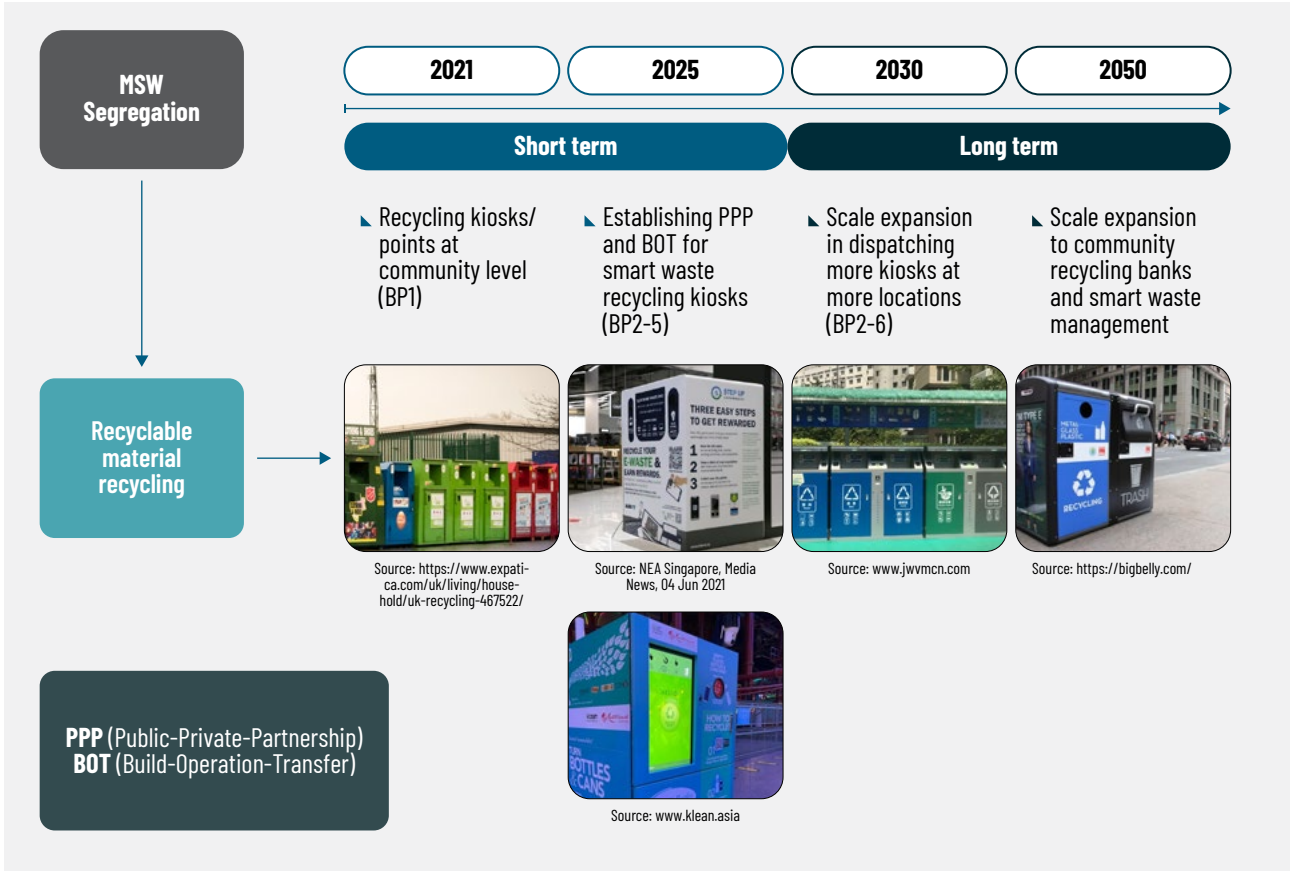


Figure 3.23: Summary of Recycle Program

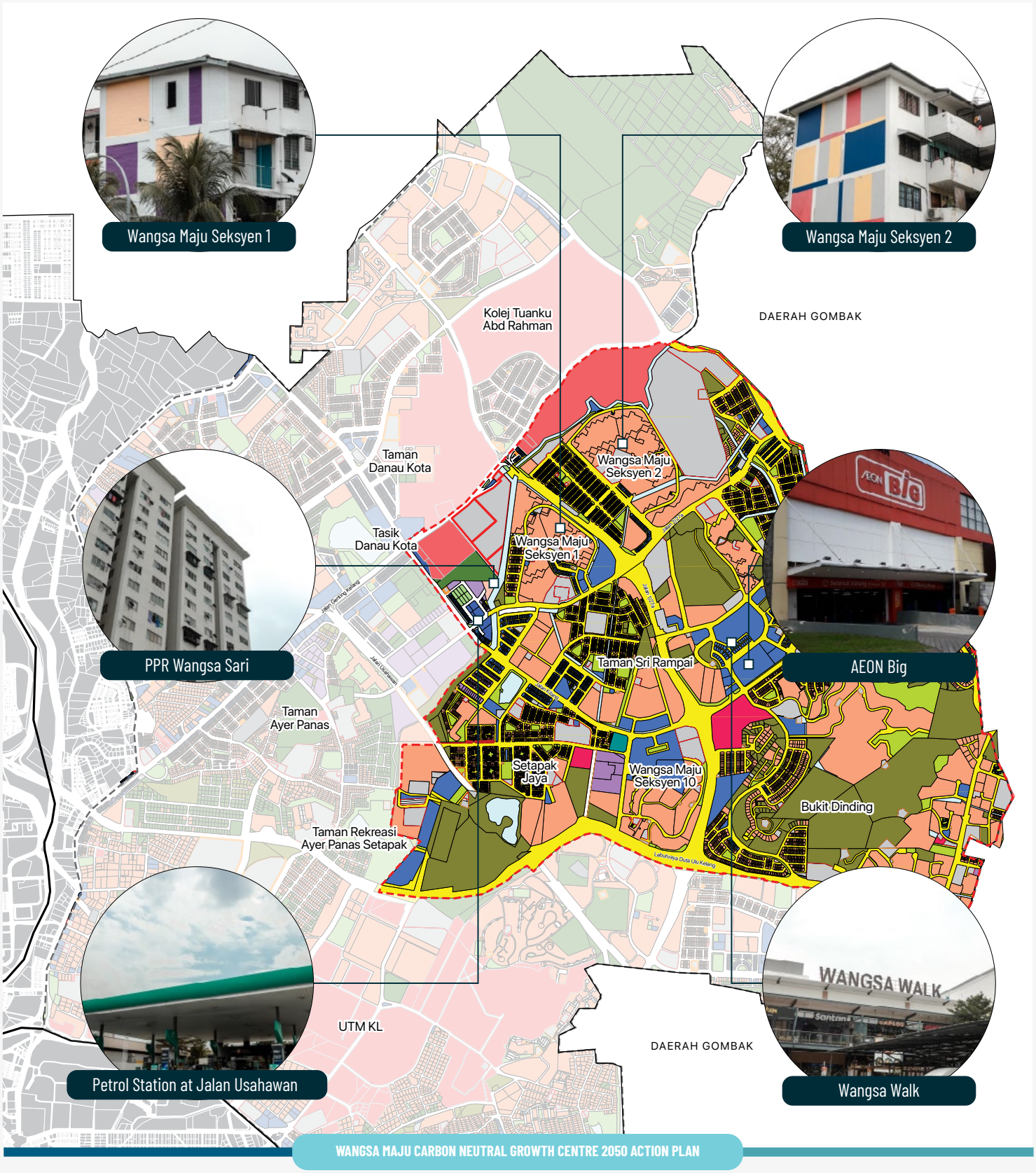


FIGURE 3.24

Potential Location of Waste Recycle Points Site

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KLCH2050 KUALA LUMPUR CARBON NEUTRAL

Source: **KLCH, 2021**

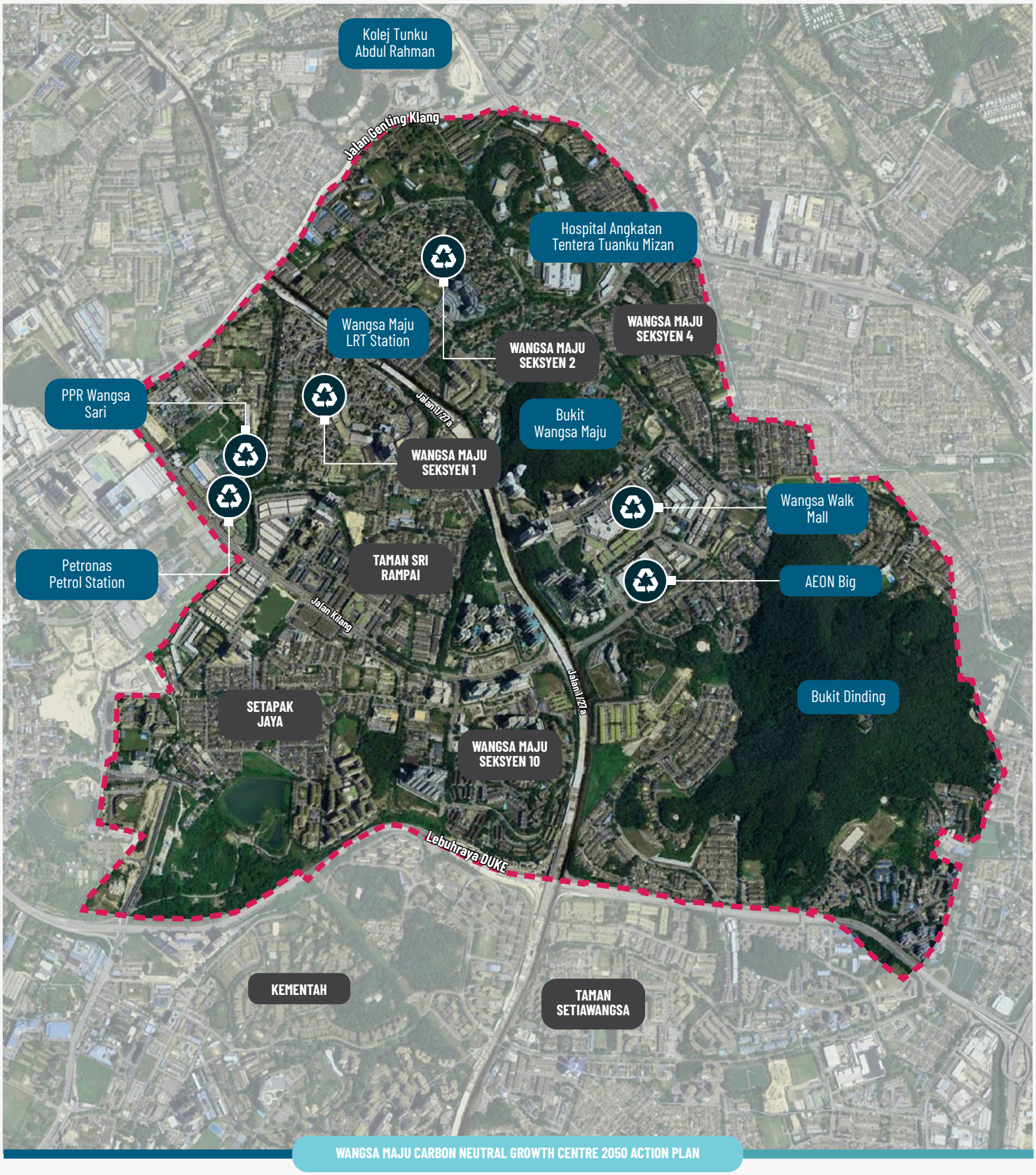


FIGURE 3.25

Potential Waste Recycle Points from the Aerial View

Waste Recycle Points

Wangsa Maju CNGC Boundary

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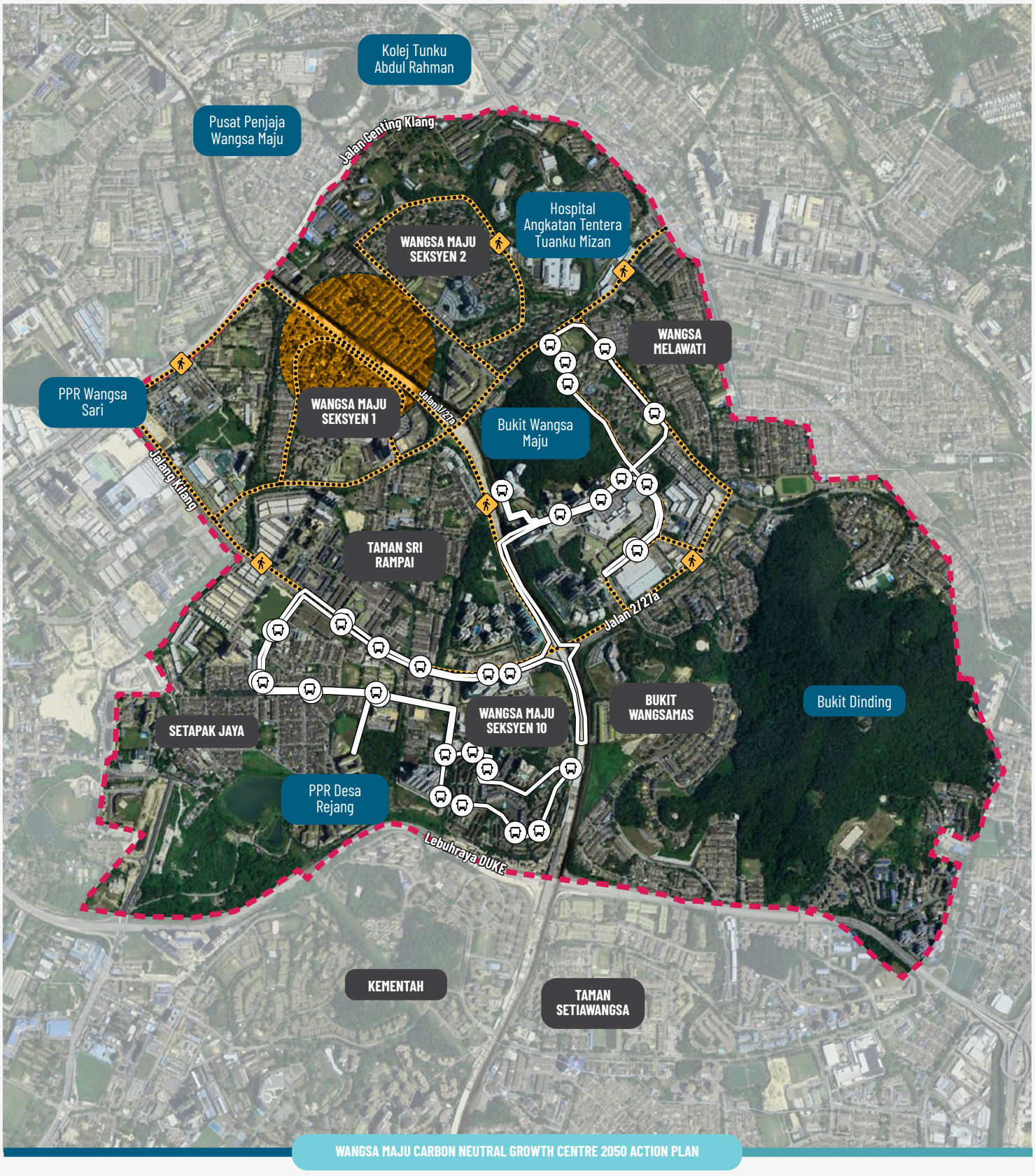
KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**



The Three (3) Proposed Initiatives of Mobility Sectors

- Bus Station
- EV Bus Route
- Pedestrian & Cycling Network
- Station Area Planning (400 m)
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

3.2.3 Mobility

Mobility of people and conveyance of goods are the most fundamental activities in cities. Transportation is estimated to account for over a third of Kuala Lumpur's GHG emissions in 2010 and thus plays a key role in the city's transition towards carbon neutrality by 2050.

Spatial planning projects that reduce the population's needs for travel and at the same time encourage active mobility, as well as widespread use of non-fossil fuel modes of transportation for necessary travel in the city are a key way forward to eliminate about 40% of Kuala Lumpur's GHG emissions towards 2050. The Wangsa Maju Growth Centre provides a good opportunity for pioneering such carbon neutrality mobility projects that will be upscale-able to other strategic zones in Kuala Lumpur as well as other Malaysian cities. There are three (3) proposed initiatives as follow:

PROPOSED INITIATIVES

1. **Improve Pedestrian & Cycling Network**
2. **Improve Public Transportation**
3. **Adopt Station Area Planning (SAP)**

Kuala Lumpur Structure Plan 2040 has classified public transportation (PT) mode share as the combination of rail based PT, e-hailing and other road based PT as well as walking/active mobility trips. The strategic direction of active mobility to improve accessibility are mainly targeted to provide safe, quality and connected pedestrian network, provide micro-mobility facilities and carry out awareness and safety campaigns.

Current and Targeted Modal Split in Kuala Lumpur

Kuala Lumpur Structure Plan 2040 (PSKL2040) and Draft Kuala Lumpur Local Plan 2040 (PTKL2040) indicates that the year 2018 mode share pattern is 25:75 with 20% being a public transport user. The Ministry of Transport (MOT) has also published that the current mode split for the same year is between 20% - 25%.

By year 2025, the public transportation mode share targeted for Kuala Lumpur is set at 50%. It is expected that by year 2030, both the LRT3 and MRT2 will be under operational phase. Therefore, the mode share is expected to increase to 60% of PT users. With the Kuala Lumpur Pedestrian and Bicycle Master Plan is set to implement fully by the year 2028, the active mobility pattern will be improved.

MRT3 is expected to be fully operated by 2035, mode share for Kuala Lumpur PT is expected to grow to 65%. It is recommended that MRT3 station accessibility coverage is extended up to 600m radius to attract walking and cycling. By the year 2040, the PT mode share targeted for Kuala Lumpur is set at 70%. This is set based on the expectation with no new road corridors are expected to be built until 2040.

1 Improve Pedestrian & Cycling Network

In the long term branding Kuala Lumpur as Malaysia's premier walking and cycling, city has to be part of national initiative to become the best practice for other cities to benchmark. As Kuala Lumpur expected to achieve 70% modal split of public transportation in 2040, active mobility plays the important roles in order to enhance first mile-last mile experiences. Development of physical infrastructures need to be given priority in order to improve active mobility and contribute to carbon reduction. Details of project implementation status for improve pedestrian and cycling network are explained in *Table 3.12*.

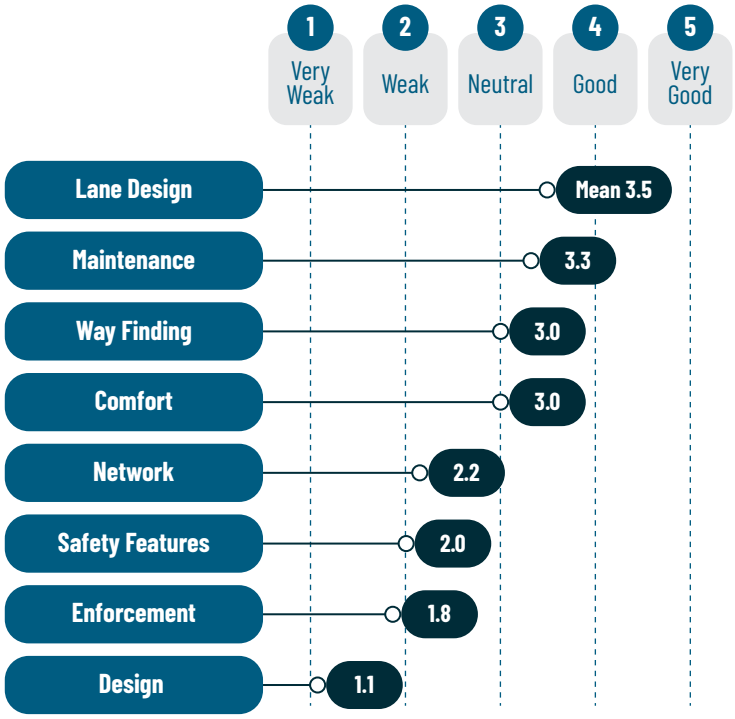
BEST PRACTICES

1. Orchard Road, Singapore

- The initiative aims to inject street vibrancy into precinct by creating good pedestrian with community space and accessible lifestyle experiences
- Street activities actively occurs during night time to attract more people to walk along the pedestrian path
- Planned to improve connectivity in the stretch towards the Singapore River to form a 6km green connection

2. Amsterdam, The Netherlands

- Clear hierarchy of road users and higher priority are given to pedestrians, followed by cyclists. Motorists have the lowest priority
- Ample bicycle parking are available to avoid inconveniences to the users
- Ample resting places for pedestrians and cyclist to rest



Study carried out in Wangsa Maju for Pedestrian and Bicycle Master Plan (April, 2021) explains the importance of lane design as the highest importance priority given by respondents. This is follows by maintenance issues as well as way finding and comfort expected to be improved and given priority in order to develop Wangsa Maju as one of the active mobility zone in Kuala Lumpur.

PROJECT COMPONENTS

(a) Enhance First-Mile and Last-Mile Walking and Cycling Experiences

- Walking and cycling experience within 400m to 800m radius from transit stations to high demand points must be enhanced to guarantee seamless active mobility, increase safety, security and comfort. The facilities of walking and cycling will be improve are signage, road barriers, lighting and the route.

(b) Improve Existing Pedestrian Walkway

- Existing at grade walkways must be improved to guarantee pedestrian continuous, unobstructed, safe, secure and comfortable walking experience. Include enhancement of cross junctions to protect Pedestrians from possible conflicts with motorised vehicles. Pedestrian must feel safe walking along the sidewalk.

(c) Develop Walkway and Bicycle Lane Infrastructure at High Potential Demand (HPD) Spots

- Connect HPD spots to transit nodes with walkway and bicycle lane. Improve quality–safety and comfort– of existing walkway and bicycle lane. Upgrade junctions around the HPD spots to provide total protection for pedestrians and cyclists

GUIDELINES/REFERENCES

1. Kuala Lumpur Pedestrian and Cycling Masterplan 2019-2028
2. Kuala Lumpur Walkway and Cycle Lane Design Guideline
3. Arahan Teknik (Jalan) 2E/87– Guide Signs Design and Application

Table 3.13: Building Partnership for Improve Pedestrian and Cycling Network

Building Partnership	
Implementation Approaches	ROW redesigned, Private Public Partnership, upgrading, maintenance)
Estimated Cost	RM 15 mil
Timeline	◢ 2021-2025 ◢ 2026-2030
Implementers	Private Contractor
Agencies	Ministry of Transport (MOT), Malaysian Institute of Road Safety Research (MIROS), Public Works Department Malaysia (JKR)
Stakeholder	Bike clubs
DBKL dept.	JPIF, JPB, JPLR, JKME, JPRB, JPPH, JPPPB, JPEPP, JPPP, JKAWS

In this study, PIQOS Audit have been used to evaluate pedestrian infrastructure such as the pedestrian level of service (PLOS) and quality of service (QoS). There are six (6) categories of quality namely Complete Street, Pedestrian-friendly, Exercise Caution, Risk, Dangerous, Hot-spot. This audit will be evaluated by site visit to the site. There are 10 roads are involved in Wangsa Maju (refer to *Figure 3.26* and *Figure 3.27*). Based on the result in *Figure 3.28*, there are six (6) roads in Wangsa Maju have exercise caution quality, three (3) roads have pedestrian friendly quality and one (1) road has risk quality.

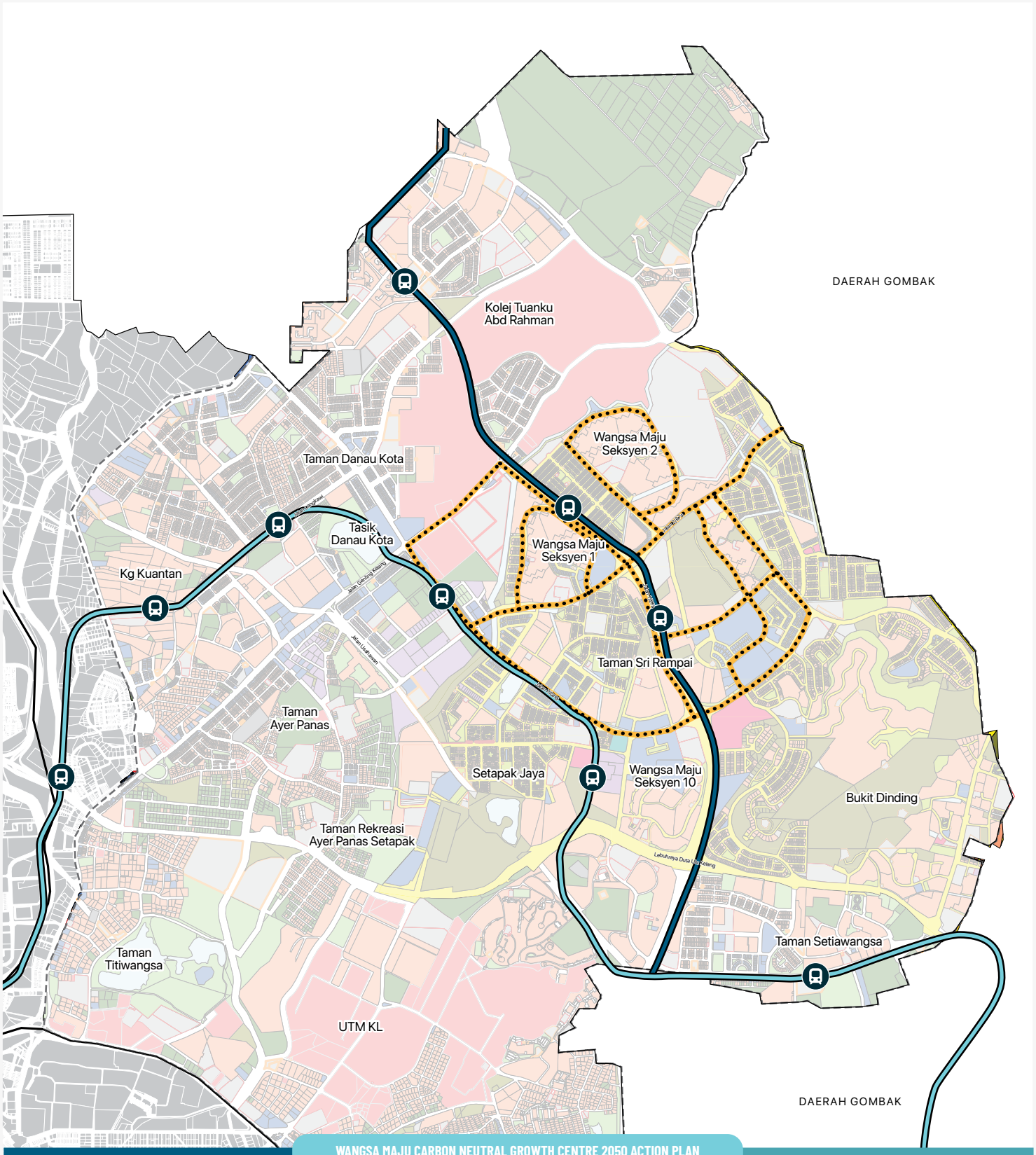


FIGURE 3.26

Wangsa Maju PIQOS™ Audit Area

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Audit Area
- LRT Line
- MRT 3 Line
- LRT/MRT Station

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NOT TO SCALE

Source: **KLCH, 2021**

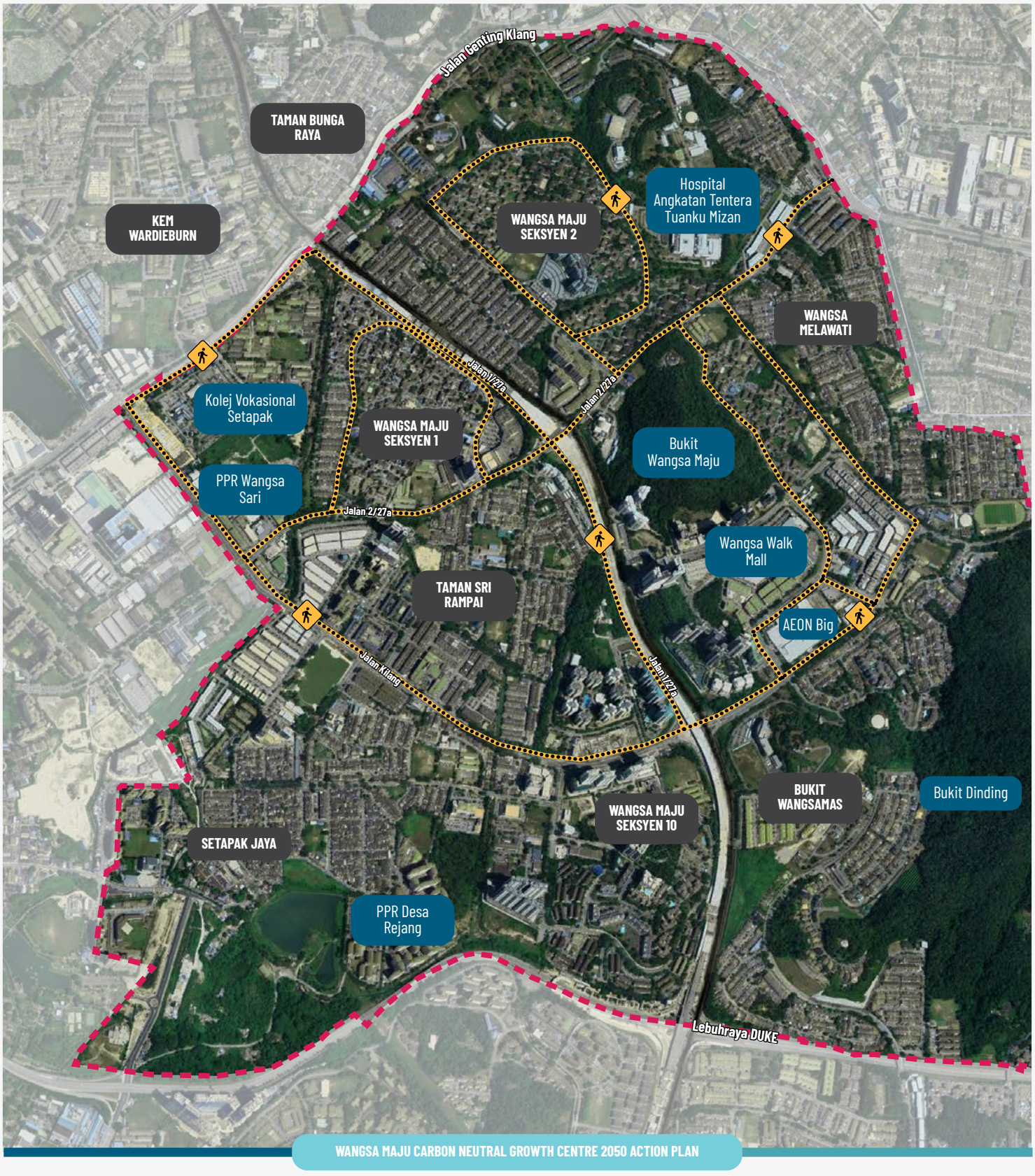

FIGURE 3.27

Pedestrian & Cycling Network from the Aerial View

Pedestrian & Cycling Network

Wangsa Maju CNGC Boundary

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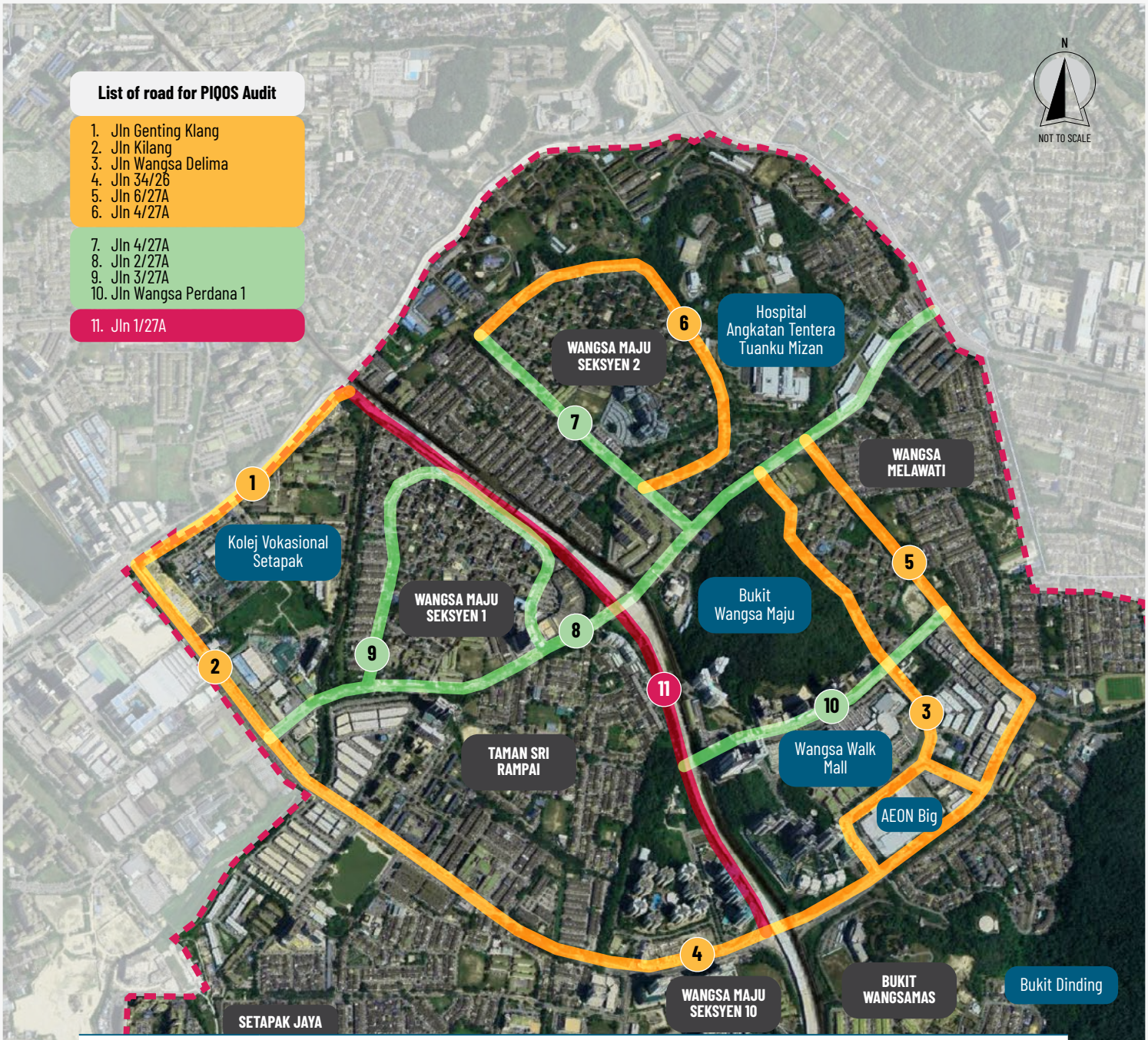
NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**



Grade	Marks	Cut-off/50	Code	Meaning	Quality
A	9.50 – 10.0	47.5	A+	Relaxed! Pleasant and enjoyable for pedestrian to walk.	Complete Street
A-	8.50 – 9.49	42.5	A9	Comfortable and easy for pedestrian to walk	
B	7.50 – 8.49	37.5	B8	Safe and secure for pedestrian to walk	Pedestrian-friendly
B-	6.50 – 7.49	32.5	B7	Ample evidence of efforts to protect pedestrians	
C	5.50 – 6.49	27.5	C6	Good attempt to protect pedestrians	Exercise Caution
C-	4.50 – 5.49	22.5	C5	Meeting minimum requirements to protect pedestrians	
D	3.50 – 4.49	17.5	D4	Minor evidence of attempts to protect pedestrians	Risky
D-	2.50 – 3.49	12.5	D3	Marginal attempts to protect pedestrians	
E	1.50 – 2.49	7.5	E2	Inadequate pedestrian protection in most segments of the streets	Dangerous
E-	0.50 – 1.49	2.5	E1	Scarcely any evidence of pedestrian protection	
F	0 – 0.49	0	F0	Complete failure to protect pedestrians. Unacceptable condition.	HOT-SPOT

Figure 3.28: Result of Wangsa Maju PIQOS™ Audit Area

Figure 3.29: Pedestrian Walkways in Jalan 2/27A Wangsa Maju (March 2019)

Figure 3.29 and *Figure 3.30* shows that the situation before and after pedestrian walkways in Jalan 2/27A in Wangsa Maju.

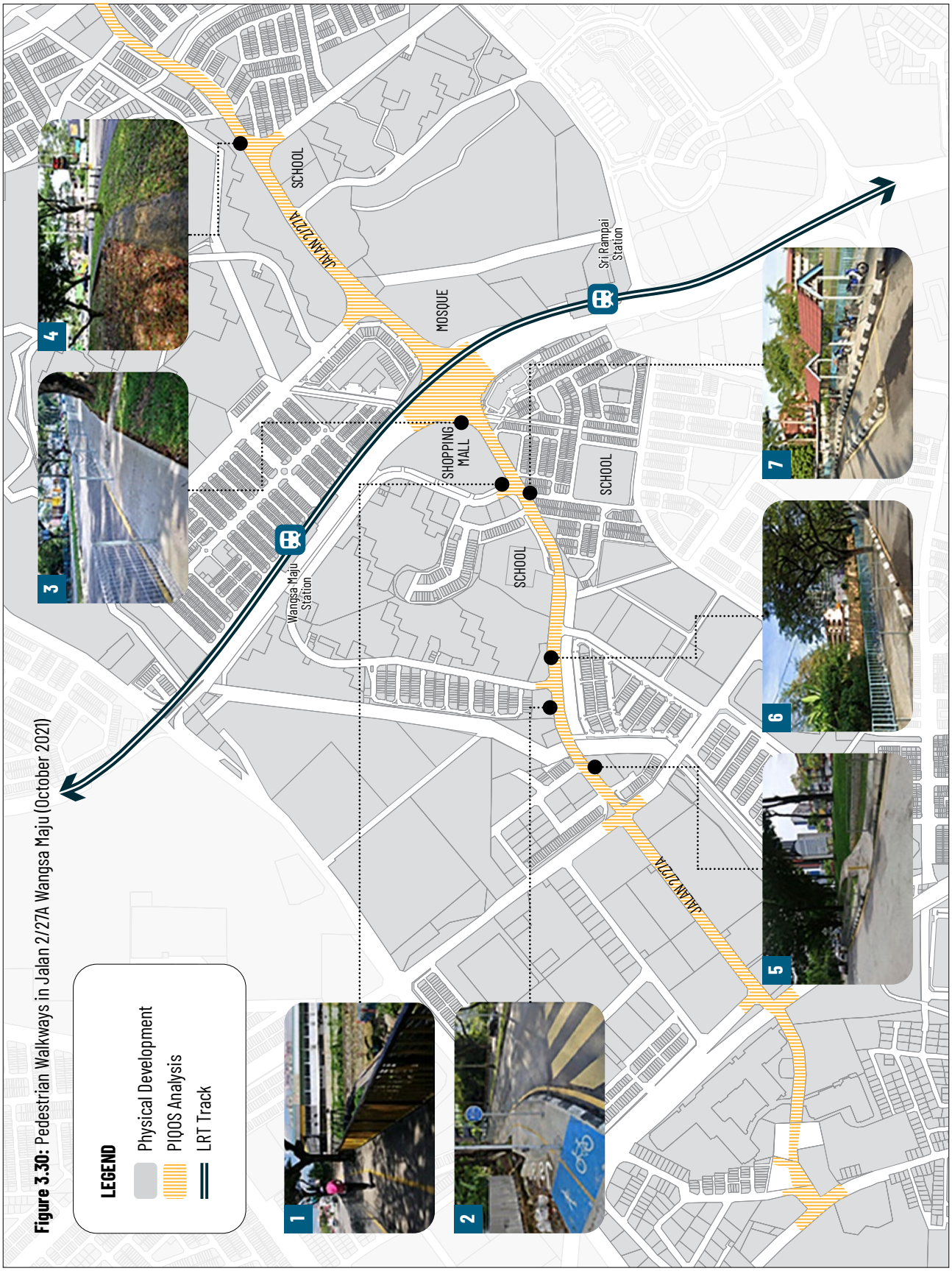


Figure 3.30: Pedestrian Walkways in Jalan 2/27A Wangsa Maju (October 2021)

Priority Level of Road Users

In a civil society, the higher the level of vulnerability of a road user to injuries, the higher the level of priority is assigned to that user category. Based on this, pedestrians has the highest priority level as they are the most vulnerable among all road users, and followed by cyclists. Trucks and other commercial vehicles has the lowest priority. This categorisation of priority levels has been endorsed in Kuala Lumpur Urban Design Guidelines.

Physical Separation

The protection of pedestrians and cyclists from potential danger is maximized by erecting a non-climbable fence along the non-motorized zone as a form of physical separator between motorized and non-motorized traffics.

The physical separator also acts as a barrier to prevent jaywalking among the unscrupulous pedestrians. However, where there are mid-block crossings, the physical separator may be disconnected to allow crossings of pedestrians *(refer to Figure 3.31)*

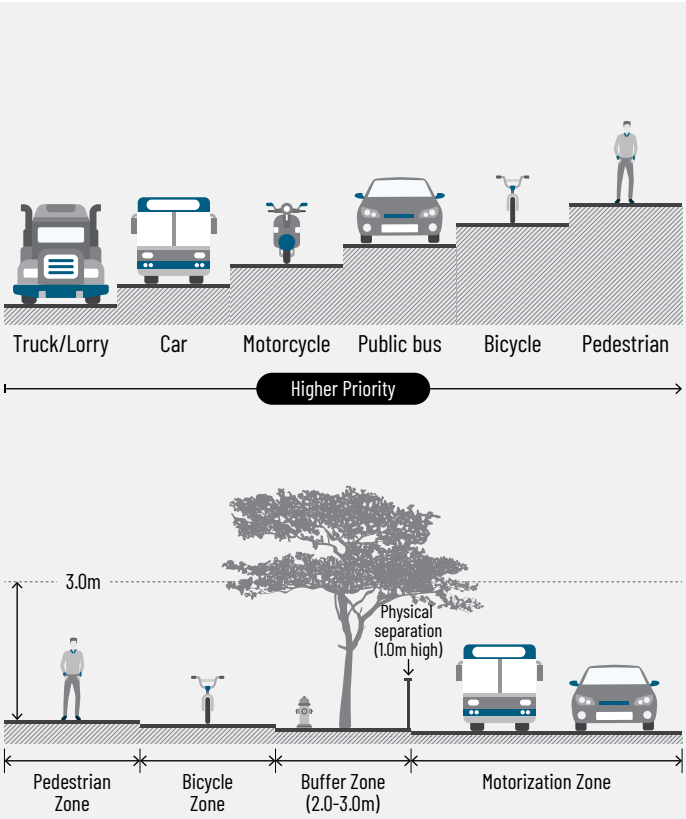
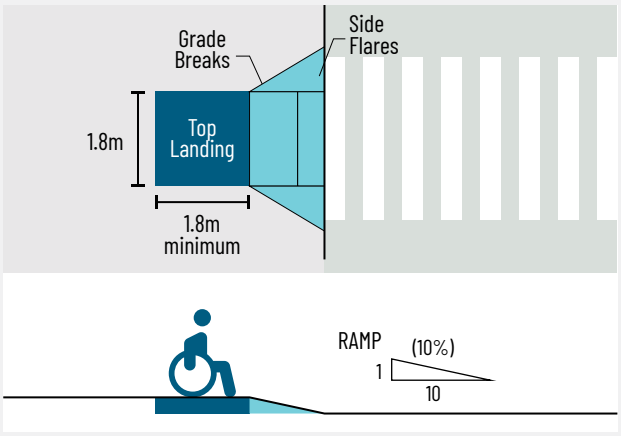


Figure 3.31: Cross Section of Physical Separator

GENERAL GUIDELINES

- Develop pedestrian walkways design guidelines that meet world-class standard ensuring equality, safety, security, friendliness (including PWD) and comfort
- Develop detailed maintenance and retrofitting plan for existing walkways based on pedestrian walkways design guidelines
- Ensure seamless first-mile and last-mile connectivity within 400m to 800m of existing transit stations
- Increase aesthetic value while providing natural shadings of walkways through effective soft- and hard-landscaping
- Improve way-finding to major land uses/ attractions from transit stations and vice versa
- Reduce urban heat island effect along the existing walkways



2 Public Transportation Improvement

For more effective implementation, policies which support and encourage Kuala Lumpur City Hall to pioneering the usage of Electric Bus *(refer to Figure 3.32)* Switching from fuel to renewable energy source is one of the effective action in green transportation. Electric bus is highly adapted to the environment and can be a good alternative to diesel transportation buses to reduce environmental pollutants. Details of project implementation status for public transportation improvement are explained in *Table 3.13*.

BEST PRACTICES

1. Nottingham, England

- The objective is to reduced carbon emissions
- The project component including Operation plans a single through-the-day 50kW rapid charge, usually timetabled during lunch break. Charge approximately 1% of battery capacity every 2 minutes.
- Range of electric bus station are 70 miles and consists 45 Optare Solo EV busses with overnight trickle charging that takes 8 hours

PROJECT COMPONENTS

(a) Identify suitable EV bus routes in Wangsa Maju especially on connecting high-demand routes (refer to *Figure 3.33* and *Figure 3.34*)
(b) Identify Suitable location for EV Charging station
(c) Reliable first mile and last mile buses, easily accessible, good connectivity, safe and comfortable to increase the use of public transport and reduce road congestion in Kuala Lumpur.

TARGET/OUTCOME

(a) Carbon reduction contribution from public transportation
(b) Reliable first mile and last mile buses, easily accessible, good connectivity, safe and comfortable to increase the use of public transport and reduce road congestion in Kuala Lumpur.

GUIDELINES/REFERENCES

1. Draft KL Structure Plan 2040
2. Draft KL Local Plan 2040

Table 3.14: Building Partnership for Public Transportation Improvement

Building Partnership	
Implementation Approaches	Land Acquisition and One EV measuring 9.5meters will be used as a pilot project around Wangsa Maju Area)
Estimated Cost	RM 150 mil
Timeline	◢ Aug-21 ◢ Feb-22 ◢ January 2023—end of project
Implementers	Rapid, GOKL, MRT Feeder Bus
Agency	Mass Rapid Transit Corporation Sdn Bhd (MRT Corp.), Ministry of Transport Malaysia (MOT), Prasarana Malaysia Berhad
DBKL dept.	JPIF, JPB, JKME, JPRB, JPPPB, JPEPP, JPPP, JKAWS

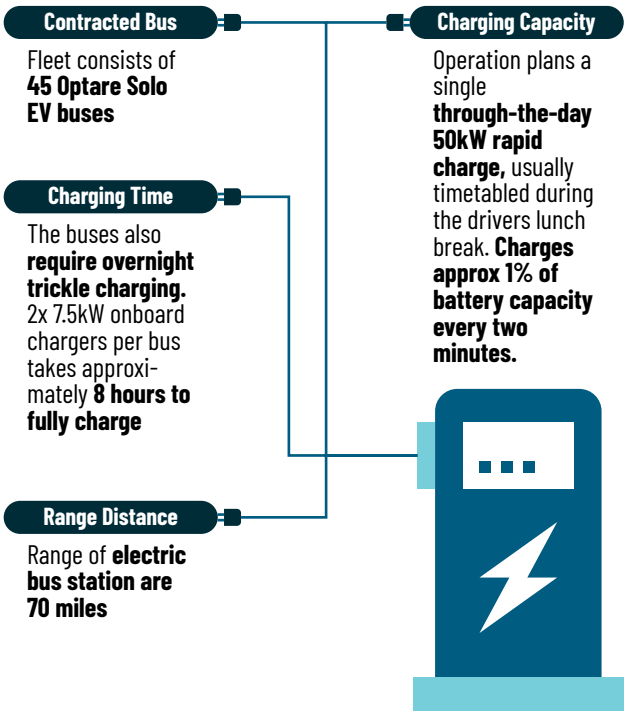
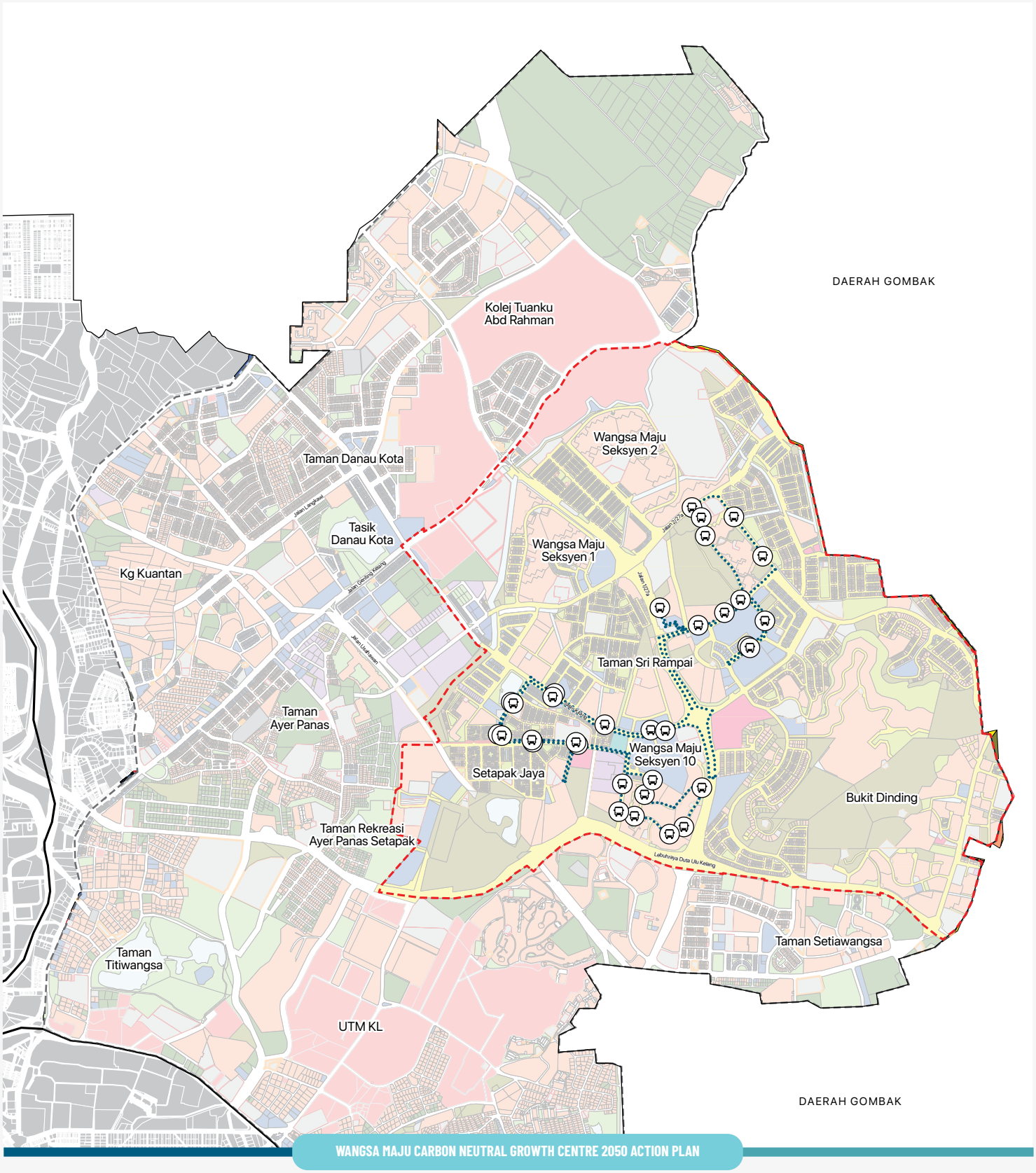


Figure 3.32: Criteria EV Charging Station



WANGSA MAJU CARBON NEUTRAL GROWTH CENTRE 2050 ACTION PLAN

FIGURE 3.33

Wangsa Maju EV Bus Proposed Lane and Bus Station

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Proposed EV Lane Bus
- Bus Station

N

NOT TO SCALE

KLCH2050 KUALA LUMPUR CARBON NEUTRAL

Source: **KLCH, 2021**

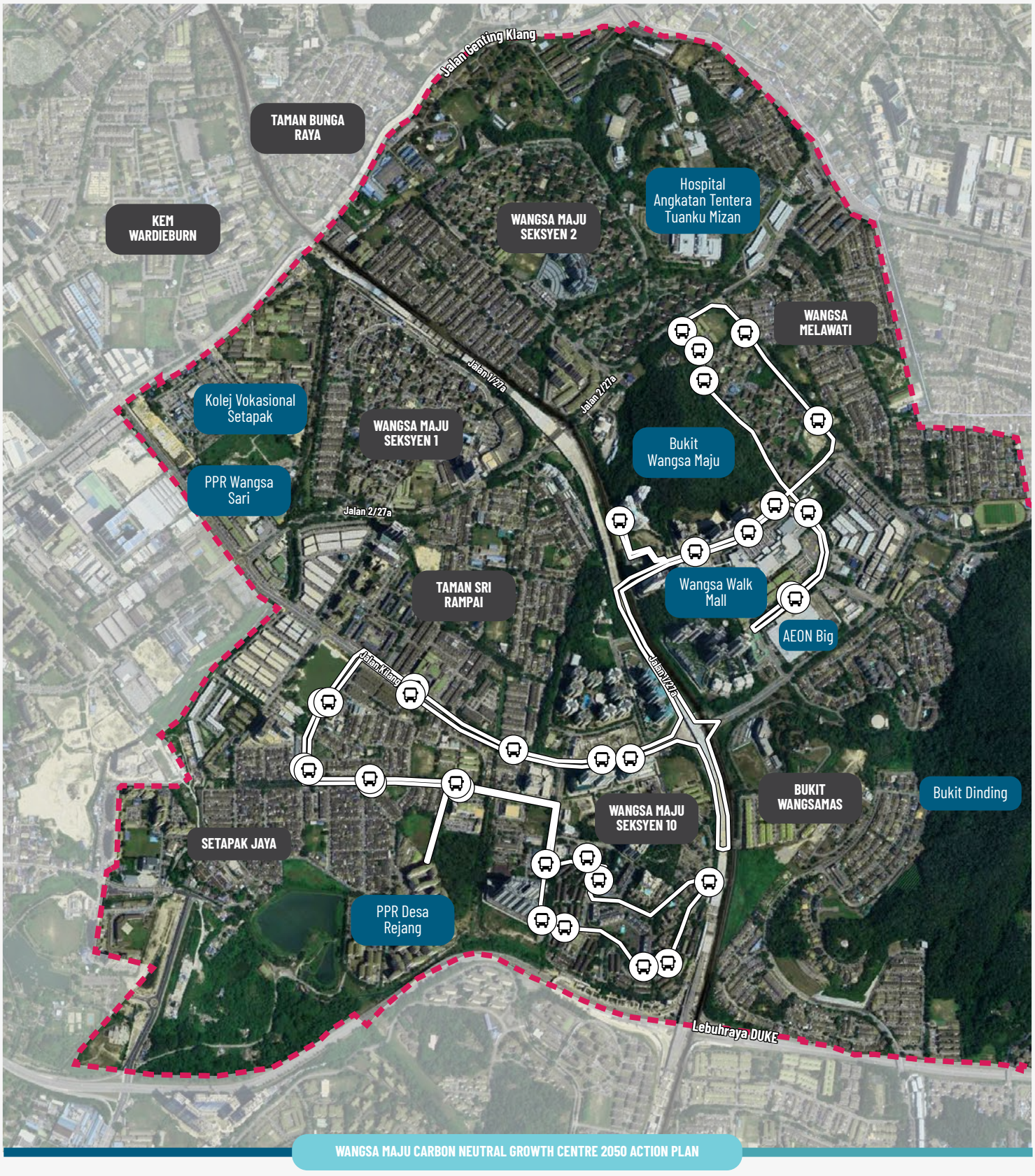


FIGURE 3.34

EV Bus Route and Bus Station from the Aerial View

Bus Station

EV Bus Route

Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

3 Station Area Planning

Wangsa Maju has benefited from road and infrastructure improvements in recent years, and has been transformed from an underdeveloped area to a mature mid-end residential neighbourhood created an area that is benefited location wise. Despite, Wangsa Maju is located near to the city centre, it also has two existing LRT station (Sri Rampai Station and Wangsa Maju Station).

The station area planning proposal for the Wangsa Maju Carbon Neutral Growth Centre is main focusing on the Wangsa Maju LRT station including the vicinity of 400m walking distance as the pilot project. Wangsa Maju LRT station is an elevated rapid transit station in Wangsa Maju *(refer to Figure 3.35)*, forming part of the Kelana Jaya Line (formerly known as PUTRA). It is situated directly within the northern Kuala Lumpur suburb of Wangsa Maju. The station was opened on June 1, 1999, as part of the line's second segment encompassing 12 stations between Kelana Jaya station and Terminal PUTRA and an underground line. The proposal of Wangsa Maju station area plan could bring new values with respect to improved public amenities and accessibility for the communities. Further, it provides an opportunity for more businesses by the increased quality of public space and employment floor space.

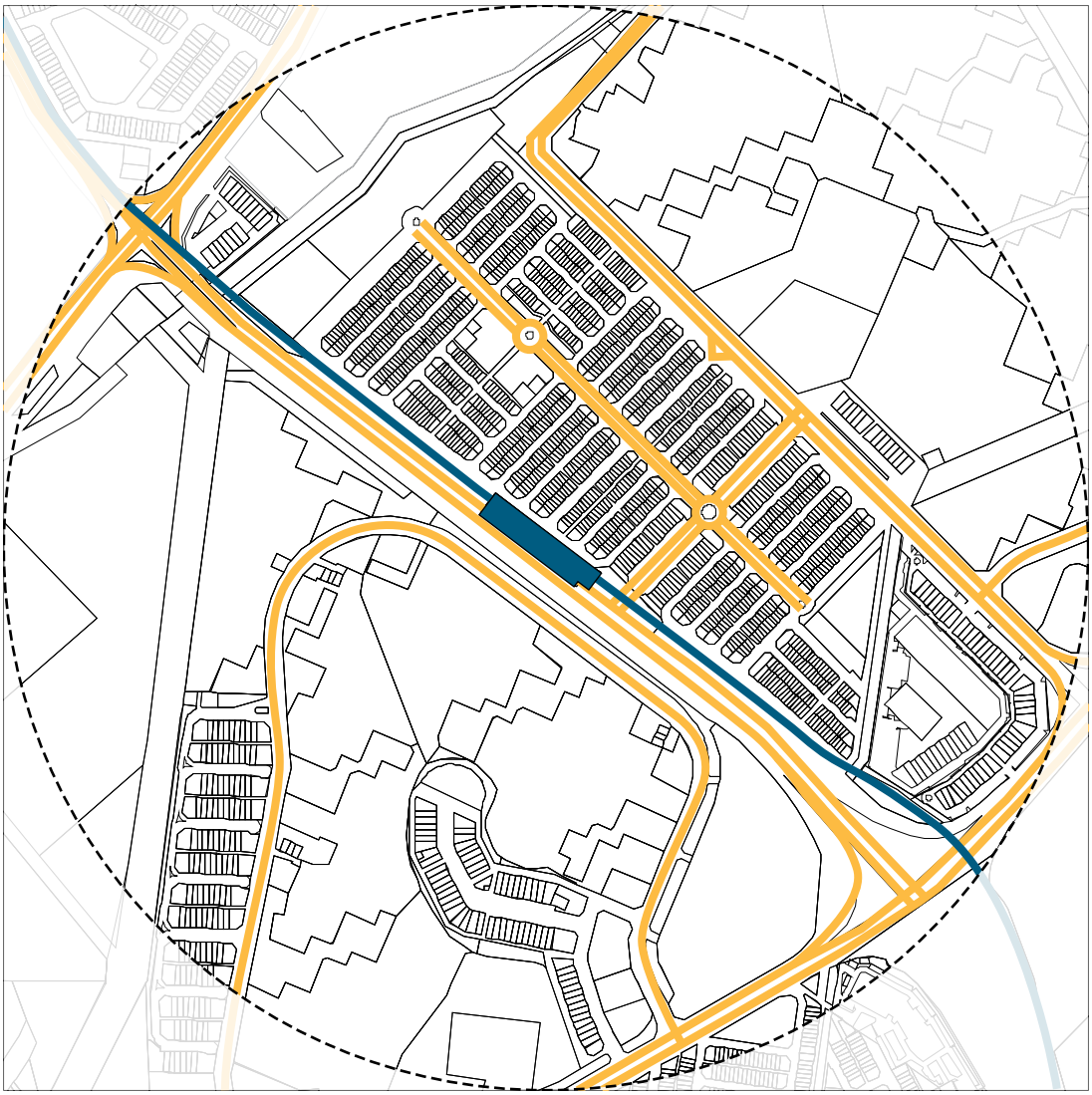


Figure 3.35: Vicinity of 400m Radius from Wangsa LRT Station

ISSUE OF WANGSA MAJU STATION AREA

Poorly Connected Pathway

- Existing pathway in the area is not well connected particularly the linkages from/to the Wangsa Maju station. A seamless connection of pathway can promote more people to walk and use public transport.

Lack of Public Space

- There is an insufficient public space in the surrounding area for the communities to socialize and interact with each other. Existence of public space can enhance the sense of welcoming toward the place.

Weak Identity

- Although Wangsa Maju LRT station and its surrounding neighbourhood has been well-established for a period of time. However, with little or no unique feature that distinguish its image from other nearby LRT station area.

Insufficient Parking Spaces

- The rising demand of the parking space for rider of the LRT is observed. Consequently, too much of vehicles are presence on the street leading to the traffic congestion and discomfort to the pedestrian (especially during the peak hour in the working days.

Limited Vegetation

- Existing vegetation in the area is inadequate for shading, cooling and it is not aesthetically pleasing. Shaded area will enhance comfortable walking experiences and reduce the temperature of surface that has been covered.

AIM AND OBJECTIVES

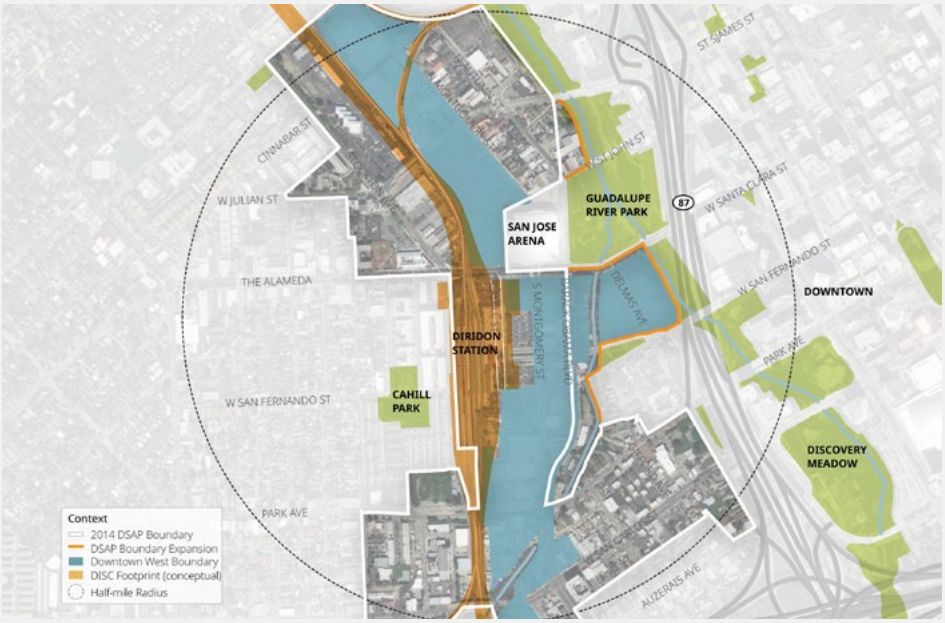
This pilot project aims to transform Wangsa Maju LRT station area from being a station to a destination, creating a well-integrated transit station that is functional, generates new job opportunities and enhance the accessibility. To that end, the objectives of Wangsa Maju station area planning are as follow:

(a) To improve and increase the ridership of public transport system
(b) To leverage and maximize the benefits and use of the surrounding lands
(c) To accelerate and enhance the connectivity and activity of the area
(d) To create a liveable surrounding areas for the communities
(e) To provide an interactive and sustainable urban design that can be used by all type of users

BEST PRACTICES

1. Diridon Station Area (California, United States)

- Diridon Station Area generates significant ongoing annual revenues that support the provision of city-wide public services including public safety, transportation improvements and other critical city services.
- It contains similar characteristics with Wangsa Maju Station and they possessed a strong and doable concept of Station Area Planning and Transit Oriented Development. The Plan of Diridon integrates open space, transportation and land uses to create an expansion of Downtown San José, while respecting existing environments.



Source: San Jose CA Web (2021)

STRATEGIES

- Intensification new primary public plaza. The space will have a civic as well as a commercial focus.
- A focal point of the central core area that provides sufficient.
- open space for a wide variety of activities

- Facilitate pedestrian access and safety through pedestrian enhancements,
- Encourage improved bicycle and trail connectivity and provide enhanced bicycle parking opportunities within the Station Area

- Facilitate pedestrian access and safety through pedestrian enhancements,
- Encourage improved bicycle and trail connectivity and provide enhanced bicycle parking opportunities within the Station Area

BEST PRACTICES

2. Fruitvale Village I (California, United States)

- Fruitvale Village I is a 4-acre mixed-use, mixed-income, transit-oriented development located near to the Fruitvale Bay Area Rapid Transit (BART) station in the Fruitvale neighbourhood, about 7.2 km south of downtown Oakland, California.
- The 100 million USD project has constructed almost 3,716 sqm of ground-floor retail space structured around a plaza that guides pedestrians from the BART station to the businesses, while space above the village's retail uses is reserved to offices. Fruitvale Village's residential component consists of 47 units, 10 of which are allocated for low-income people.
- The project was established by the Unity Council, a local non-profit community development corporation, and integrates 37 market-rate loft-style units embracing the mixed-use development approach.

Source: BART Transit-Oriented Development Program

STRATEGIES

Source: BART Transit-Oriented Development Program

Be a catalyst for economic development in the neighborhood by creating a pedestrian plaza that link to the BART station and main commercial area.

Source: ULI Development Case Studies - Fruitvale Village 1

The project comprises 107,570 square feet of office space and 47 apartments located over of ground-level retail uses

Source: ULI Development Case Studies - Fruitvale Village 1

Two building, mixed use, transit oriented development that gives train passengers to the Fruitvale neighborhood.

Source: ULI Development Case Studies - Fruitvale Village 1

Second levels has covered 150 parking garages. The building's features a play area for children enrolled.

Source: ULI Development Case Studies - Fruitvale Village 1

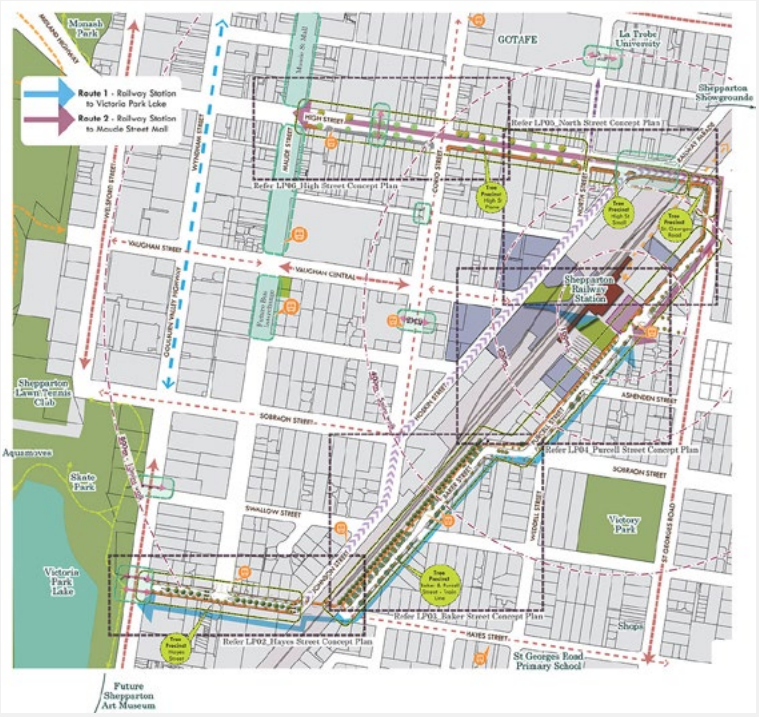
Commercial vacancy rates upwards of 40 %. The Fruitvale neighborhood has the highest level of sales tax revenue in the city.

Source: ULI Development Case Studies - Fruitvale Village 1

BEST PRACTICES

3. Shepparton Station Area (Victoria, Australia)

- The Railway Station in Shepparton is envisioned as a gateway into the heart of the Goulburn Valley, serving as both a physical and metaphorical point of entrance into the Shepparton CBD. It welcomes visitors to the area and connects them to the city's infrastructure and facilities.
- Future planning for the station and its precinct integrates with the local city, improves land uses compatibility and accommodates the transportation infrastructure future operating needs. The station area suffers from weak pedestrian links to surrounding destinations due to physical barriers including buildings and the railway line.



Source: LM LA Web– Shepparton Railway Precinct Linkages

Source: Greater Shepparton Web

STRATEGIES

1. Landscape

- Work with landowners/shop owners in the area to provide appealing, safe amenity and interfaces along the key pedestrian routes, tidy

2. Parking

- Create additional car parking area
- Provide covered walkway to station.
- Ensure car park has secure area for long term parking.

3. Activate Public Space

- Improve station forecourt through place making initiatives
- Encourage pop up kiosks/food outlets at the station

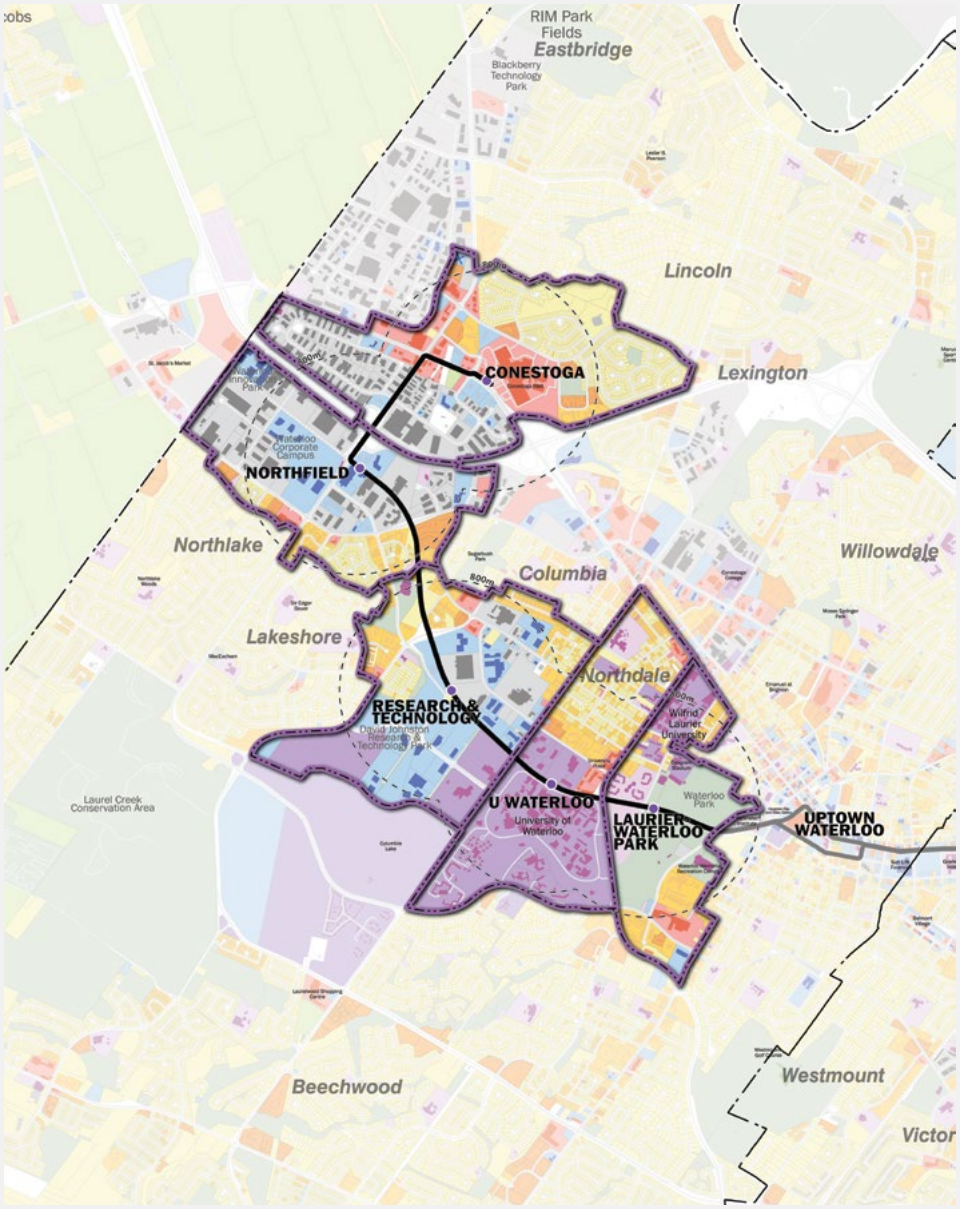
4. Mixed Use Development

- Encourage appropriate land use mix and better utilization of the Railway Precinct
- Develop a contemporary mixed-use precinct with residential and commercial elements

BEST PRACTICES

4. Waterloo Station Area (Ontario, Canada)

- In June 2017, the City of Waterloo Council overwhelmingly approved the Station Area Plans in which according to one, they were the most significant planning documents since the City's choice to expand up rather than out through its nodes and corridors approach.
- The Waterloo Station Area serves to encourage employment growth and densification surrounding the stations, as well as guiding open spaces and infrastructural developments and support the downtown area around station. The plans are also described a set of policy orientations and regulatory measures to aid in the implementation of change and to govern long-term decision-making.



Source: Urban Strategies - Waterloo Station Area Planning

STRATEGIES

1. Local Mobility

- A finer grained and interconnected street grid pattern
- Establish a Pedestrian Transfer Zone at the station
- Enhance the cycling network
- Reconfigure bus routes and ensure frequent services
- Encouraging a shift towards structured parking

2. Built Form and Land Use

- Create a higher-density and more transit-oriented place by the intensification of Conestoga Mall
- Greater mix of uses around the station
- Encourage buildings that actively address the street
- Encourage employment growth within the station area

3. Public Realm

- Establish a signature open space
- Public realm improvements and wayfinding along King Street
- Enhance the setting for workers and businesses with urban tree canopy

Source: urbanstrategies.com

Source: urbanstrategies.com

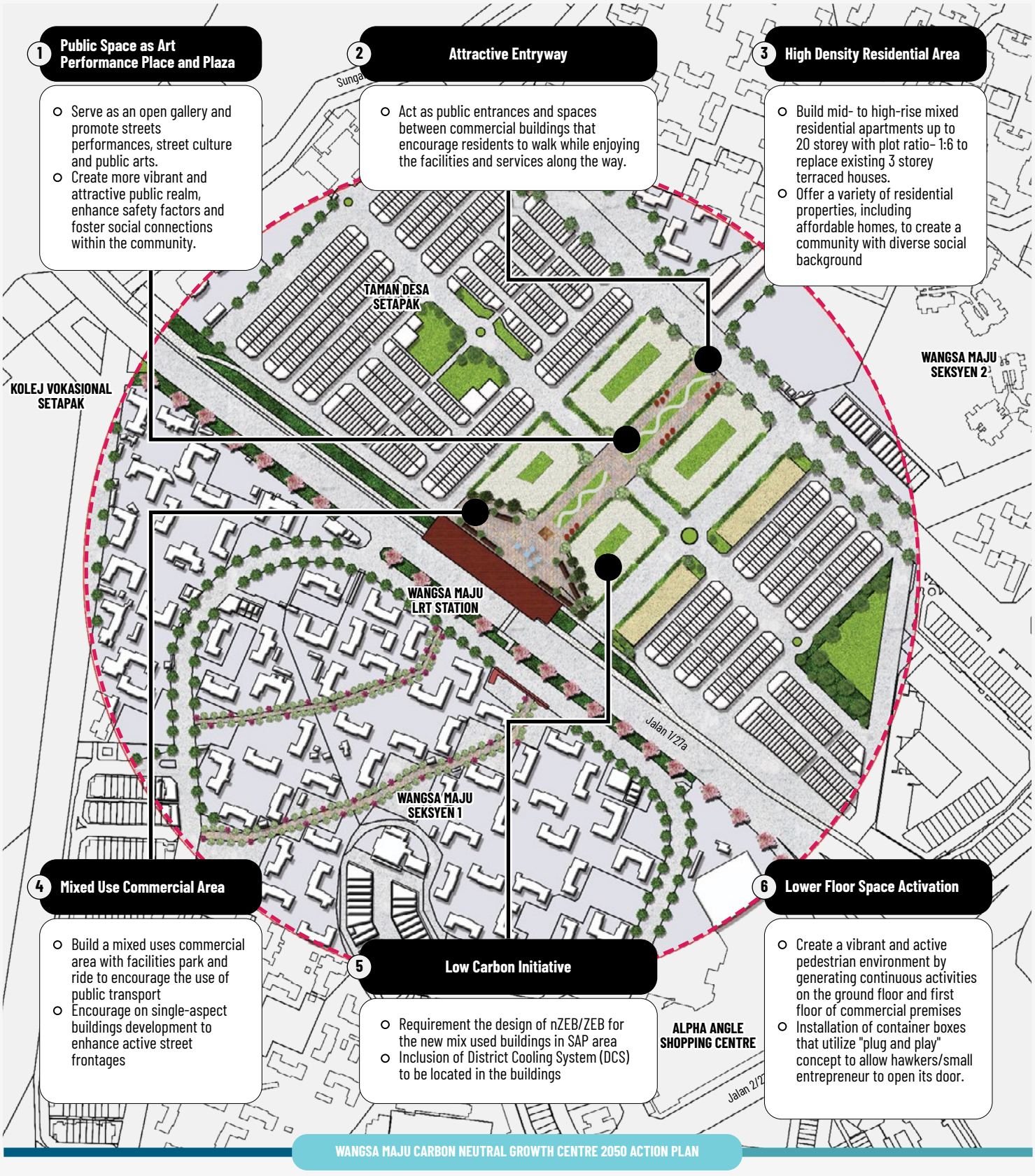


FIGURE 3.36

Key Strategies of Station Area Planning

Building
Open Spaces
LRT Station Wangsa Maju
SAP within 400 m

N
NOT TO SCALE

Source: **Google Earth, 2021**

What is Zero Energy Building (ZEB)?

Zero Energy Building means a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby. In Wangsa Maju Station Area Planning,

ZEB should be taken in account in the redevelopment process as this approach will assist the measures in reducing overall energy demand or consumption. In fact, this approach will enhance new development in Wangsa Maju in adopting low carbon green building that focus purely on sustainable energy practices.

ZEB = (EE + RE) x Sustainable Practice
*EE = Energy Efficiency, RE = Renewable Energy

GUIDELINES/REFERENCES

1. MS1525 - Code of Practice Use of Energy Efficiency & Renewable Energy for Non-residential Buildings (2007)
2. MS2680 - Code of Practice Energy Efficient and use of renewable energy of residential buildings (2017)

Some of the ways to achieve net zero energy that shows in the guidelines are covered in the sections:

LOCATION

Several factors, including the building location, the environment, and the building's exposure, should be evaluated. Climate, wind patterns, and rain patterns are examples of these.

ORIENTATION

The building's orientation is determined by the achievement of obtaining zero energy, since renewable energy generating devices operate best when the structure is facing a specific orientation. It is also vital to save energy by positioning the structure to take advantage of the shade.

DESIGN AND PASSIVE STRATEGIES

It is possible to pick the best-insulating materials so that the building conserves as much energy as feasible. Windows may play an important role in energy conservation. Passive approaches and strategies help in reducing energy consumption while maximizing energy performance of the building.

RENEWABLE AND ACTIVE STRATEGIES

The most crucial component of designing high-performance buildings is selecting the most efficient renewable energy sources depend on the building. Solar panels may be the approach to go for new development.

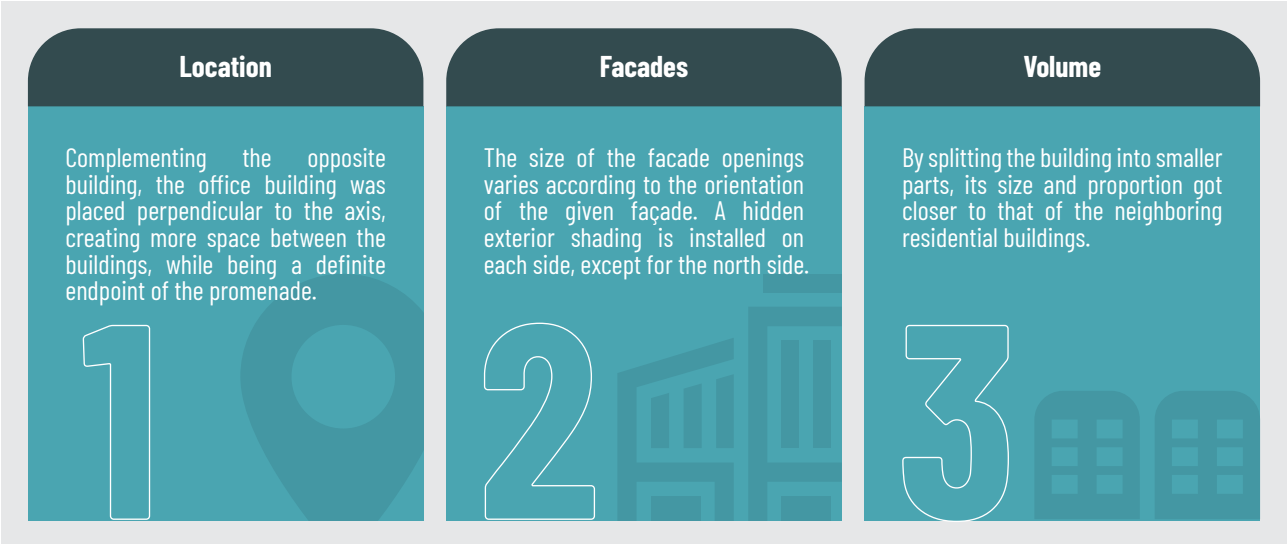
Green Energy Office (GEO) GreenTech Malaysia
Source: New Straits Times

KeTTHA Low Energy Office (LEO) Building
Source: New Straits Times

What is Single Aspect Development ?

Single aspect development features apartments are positioned above ground-floor businesses along a renovated pedestrian-only walkway, with urban amenities nearby.

In the development, the premises will be devoted to all ground floors of the development that front to the pedestrian walkway and public realm. This design of single-aspect will activate the vibrant floor space and it will increase the comfort for the pedestrian while walking along the premises. The most crucial things that should be considered in the development are as below:



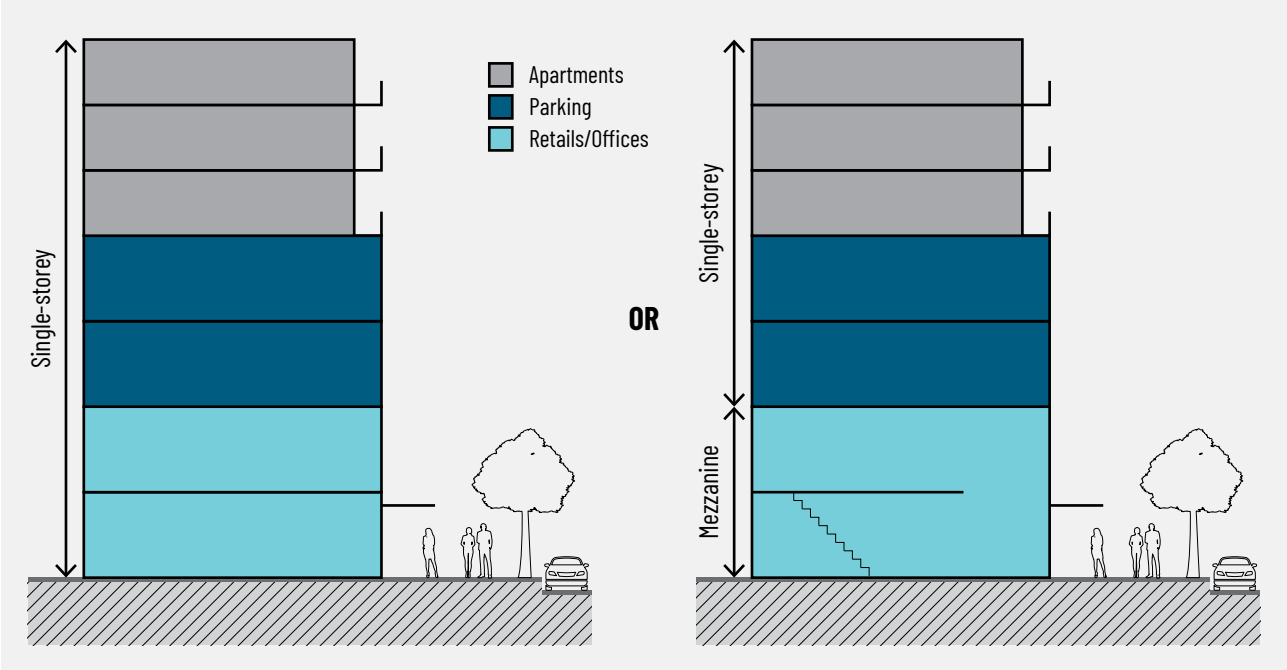
General Design Brief

(a) Facades

Facade design considerably contributes to the visual attraction of the structure as well as the character of the surrounding area. The public domain is influenced by street facades, whereas side and rear facades frequently influence the amenity of neighboring buildings and communal and private open spaces. Facades that are well-designed also reflect the function, interior layout, and construction of an apartment complex. The façade's pattern and repeats, the proportions and articulation of exterior walls, and the particular design of facade components are all crucial attributes.

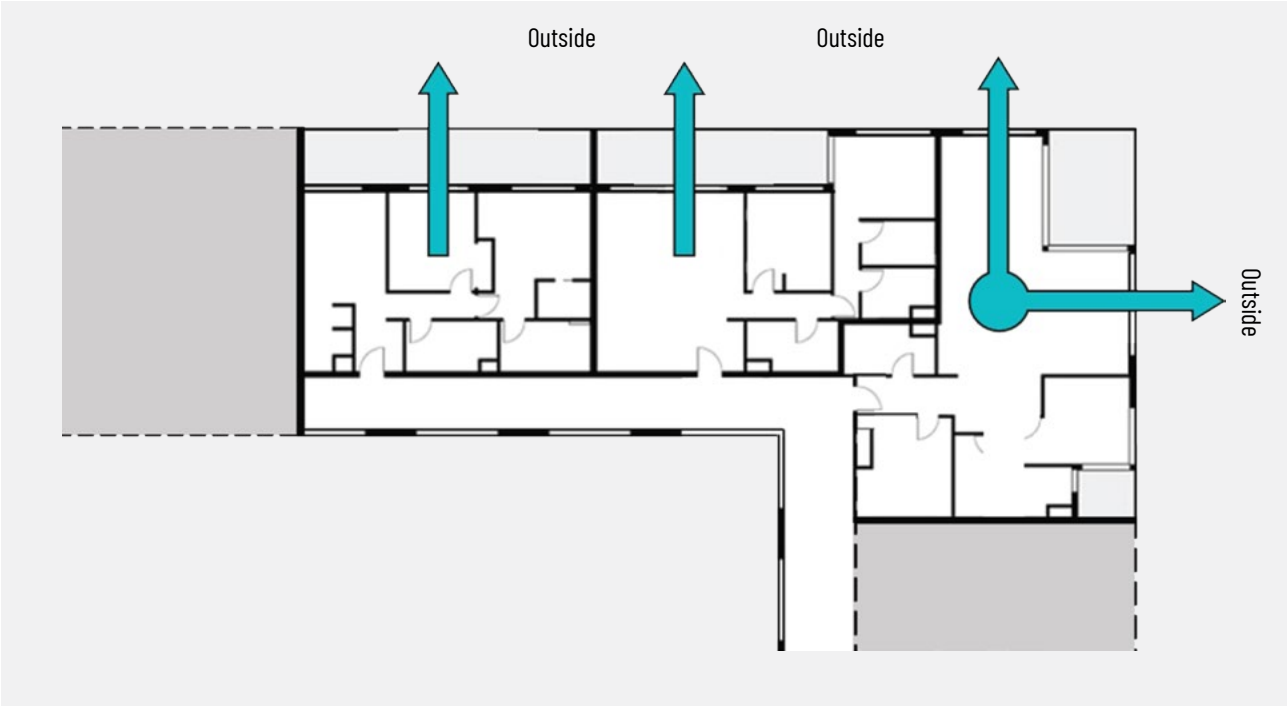
Source: Blackstock Street, Liverpool L3

Number of storeys of single aspect development can be either single storey or mezzanine:



Source: UTM-LCARC, 2022

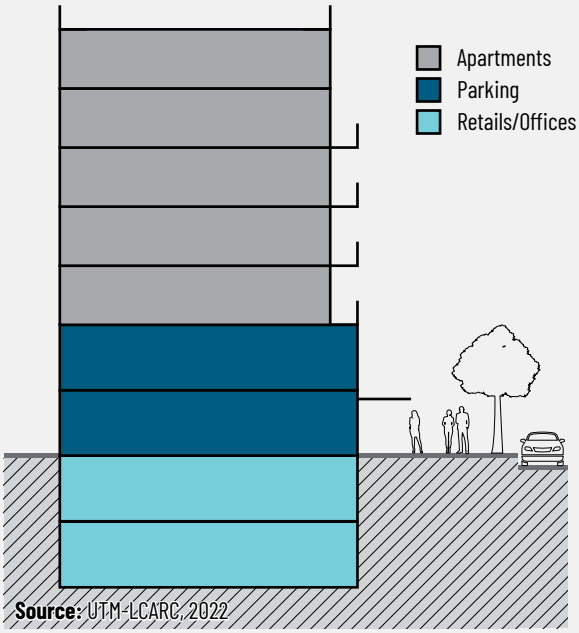
Number of external walls that have views to the outside in single aspect development:



Source: UTM-LCARC, 2 022

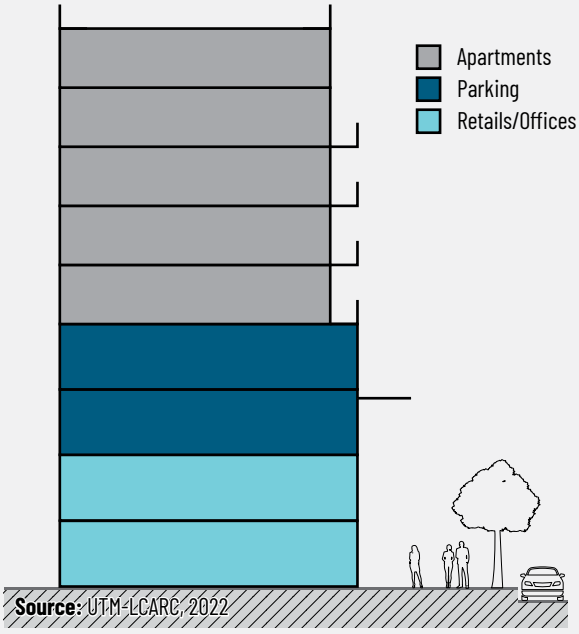
(b) Mixed use

A mixed-use development incorporates numerous applications into a single structure. This is typically performed vertically in mixed-use construction, with diverse uses piled on top of one another. A vertical mix of uses is more likely to enhance activity during the day and night, improving passive observation of the public realm. Buildings in mixed-use zones should be designed to accommodate a variety of non-residential purposes. Non-residential uses should be positioned on lower floors of buildings in regions where residential use is neither acceptable or desired, such as along major highways or railway lines.



Source: UTM-LCARC, 2022

OR



Source: UTM-LCARC, 2022

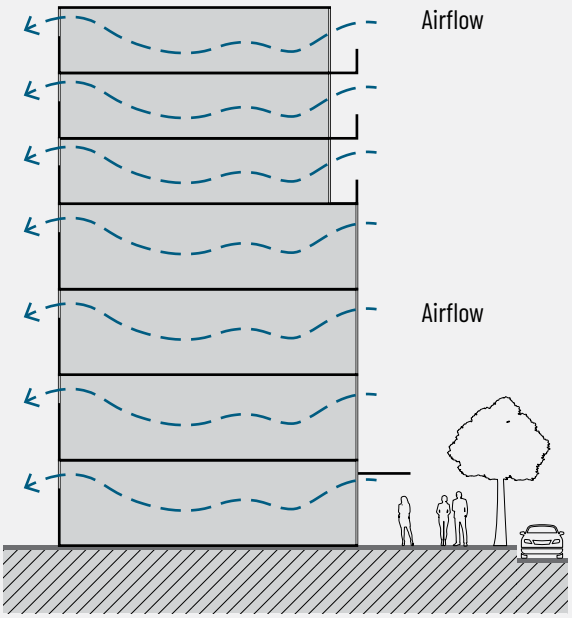
Source: Blackstock Street, Liverpool L3

Source: Auckland Design Manual

(c) Ventilation

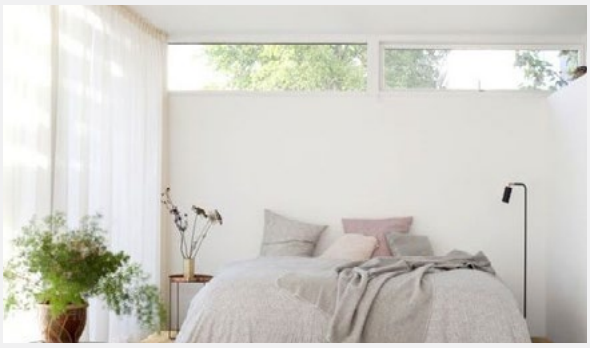
Natural ventilation refers to the circulation of sufficient amount of fresh air through a unit to provide a pleasant and comfortable environment. Natural ventilation is included into sustainable design approach in which adapts to the local environment, reducing the demand for artificial ventilation and air conditioning. Building orientation, level arrangements, and the exterior building envelope must all be carefully considered to enable natural ventilation.

The ability of a unit to be naturally ventilated is closely related to unit layout and building depth. In general, effective airflow decreases as the building depth increases. In a single aspect development, the ideal way to provide natural ventilation depends on types of windows that been used in the units such as high casement or sash windows, clerestory windows, and windows above interior doorways *(refer to Figure 3.37)*.



High casement windows
Source: Window Elements

Sash windows
Source: Lomax x Wood



Clerestory windows
Source: Digs Digs

Windows above interior doorways
Source: Helter Shelter DC Wordpress

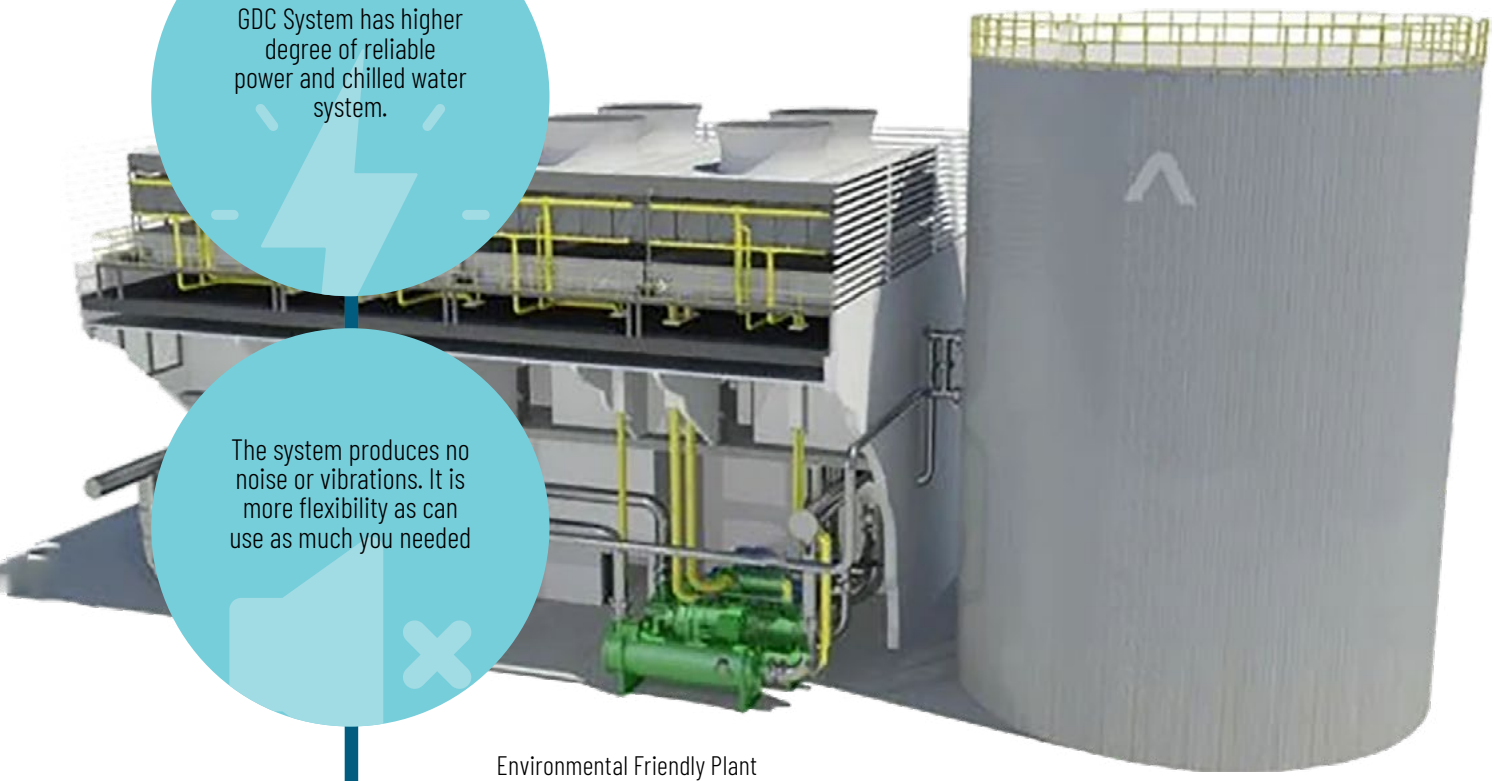
Figure 3.37: Types of windows

District Cooling System (DCS)

District cooling concept begins by chilling water at a centralized plant. Chilled water is then pumped through a long piping network via underground to heat exchangers in different buildings. The heat exchangers are used to transfer the chilling energy from the water (often called Primary Loop) to customers' internal building chilled water loop (often call Secondary Loop).

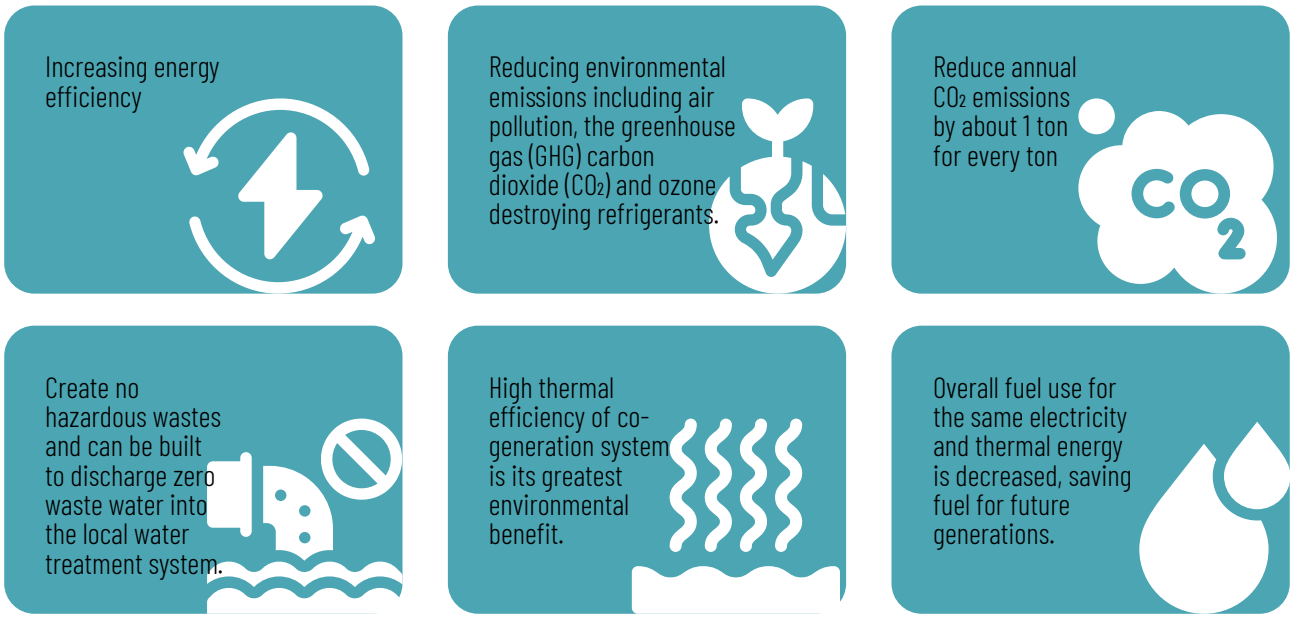
Advantages of DCS System:

- Optimize Building Space since the combined chiller plant is located away from consumer
- GDC system is higher efficiency enables achieving up to 35% compared to conventional electrical driven system.
- GDC System has higher degree of reliable power and chilled water system.
- The system produces no noise or vibrations. It is more flexibility as can use as much you needed



Environmental Friendly Plant

District cooling helps the environment by:



Malaysia's largest district cooling provider serving Putrajaya, Kuala Lumpur City Centre (KLCC) and Kuala Lumpur International Airport (KLIA). Our assets encompass of 8 co-generation / district cooling plants with total combined capacity of **59 MW electric, 442 ton/hr steam, 147,000 RT & 238,000 RTh chilled water.** We aspire to be the Chilled Water and Electricity Provider of Choice in Malaysia.

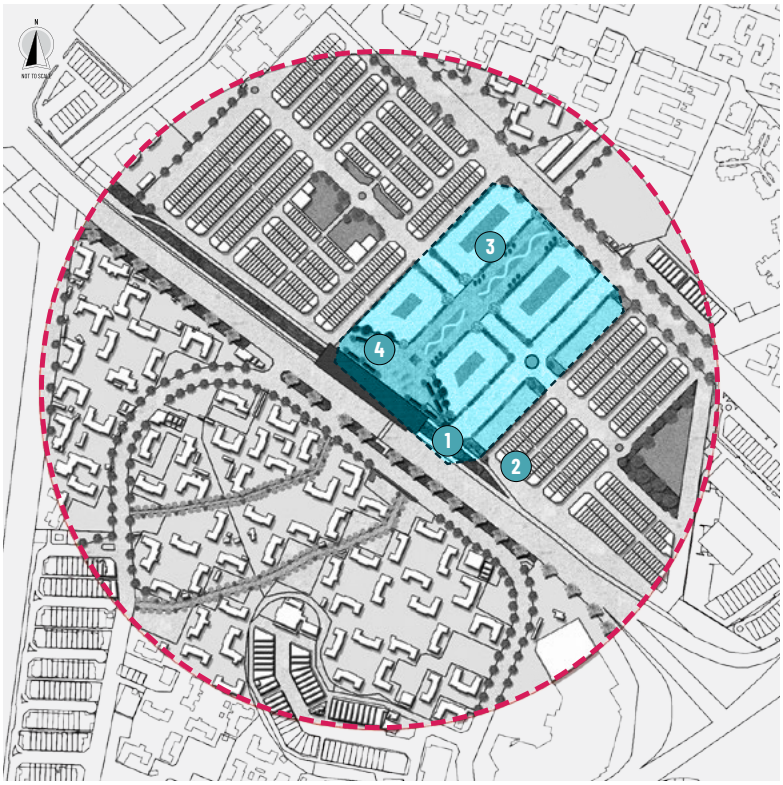
Gas District Cooling (GDC) Plant 1, Putrajaya

Source: Sunway Construction Web

Design Approaches in Wangsa Maju SAP

The Diversity of Uses

- The precinct is designed to feature a range of uses, providing businesses and households with the choice of commuting with facilities and services available within close reach which is 400 metres *(refer to Figure 3.38)*
- The SAP will concentrating on jobs and social contact near station area and major neighbourhood places promotes people to interact with and occupy the public realm, allowing people to live without relying on automobiles *(refer to Figure 3.39)*.
- The developments will comply plot ratio up to 1:6 in order to increase the density of the area however with adaptable ground floors to activate active frontages.



Source: UTM-LCARC, 2021

The entrance of the SAP Phase 1 with new landmarks.

Variety types of built form with well-proportioned and not overcrowded to guarantee natural sunlight on adjacent streets throughout the area.

Provision of many types of housing to create a diversity in the neighbourhood's background and land use.

A mix of employment and retail opportunity near the station area creating a new economic opportunities for people.

Figure 3.38: Illustration of Aerial View of Wangsa Maju SAP Phase 1
Source: UTM-LCARC 2021

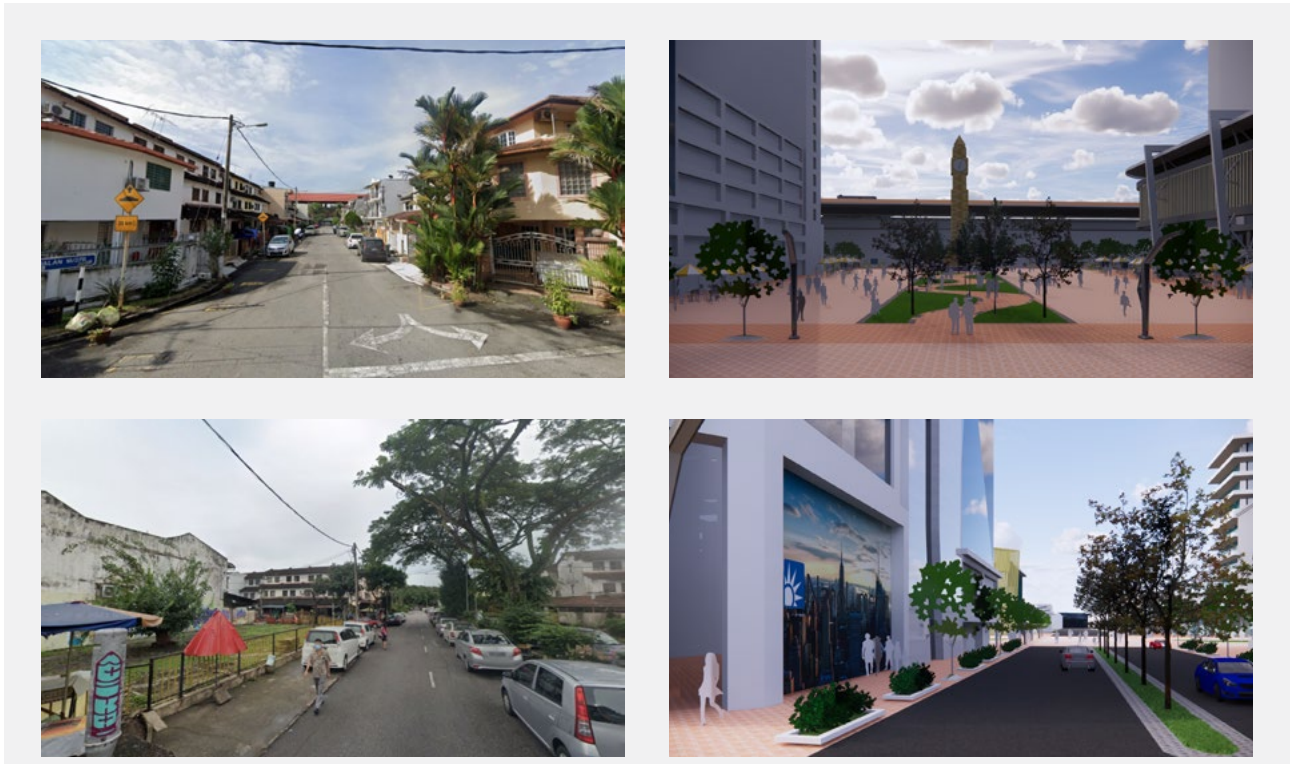
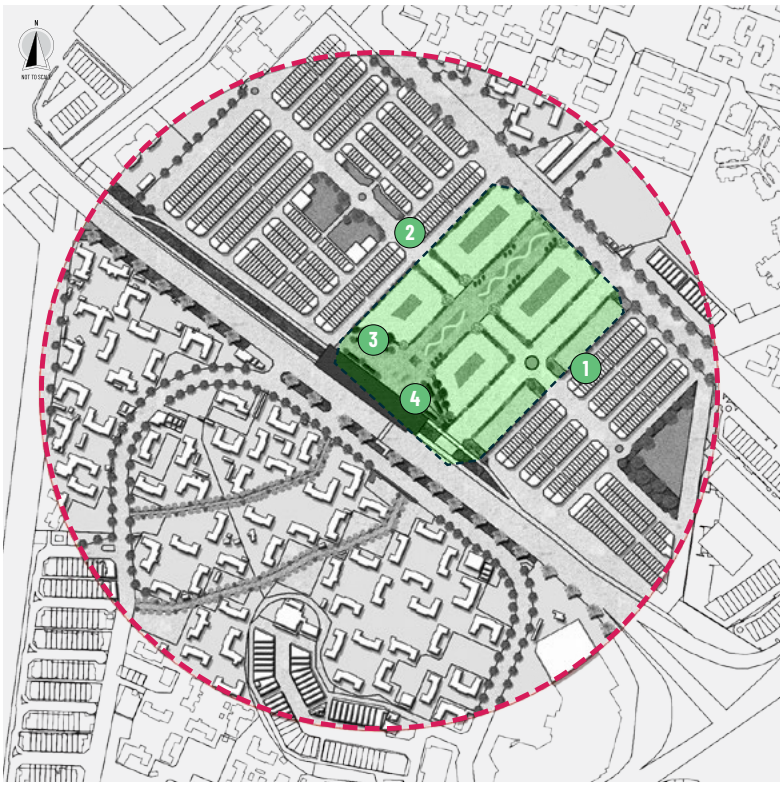


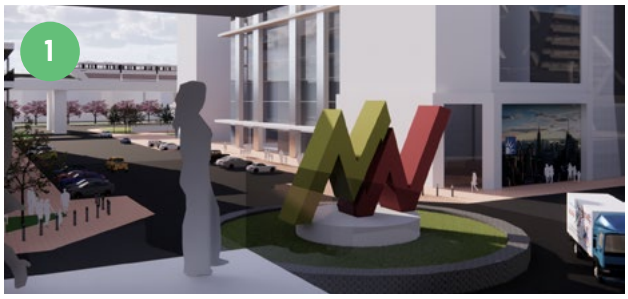
Figure 3.39: Current Situation at Jalan 39/27b and Illustration of Wangsa Maju SAP
Source: UTM-LCARC 2021

The Materiality of Commercial

- The proposed commercial will use more transparent continuous shop front glassing system to ensure the maximum amount of natural lighting.
- The street's width has been purposefully maintained to a bare minimum in order to offer the greatest impression of enclosure. Instead, vehicle parking is primarily condensed on the surrounding streets, lower planting, and public sitting options are included into the tenancy frontages.
- The pedestrian walkway is designed 6 to 10 meter from the shop fronts to allow active street frontage.



Source: UTM-LCARC, 2021



The view from the upper floor of the retails in Wangsa Maju SAP.

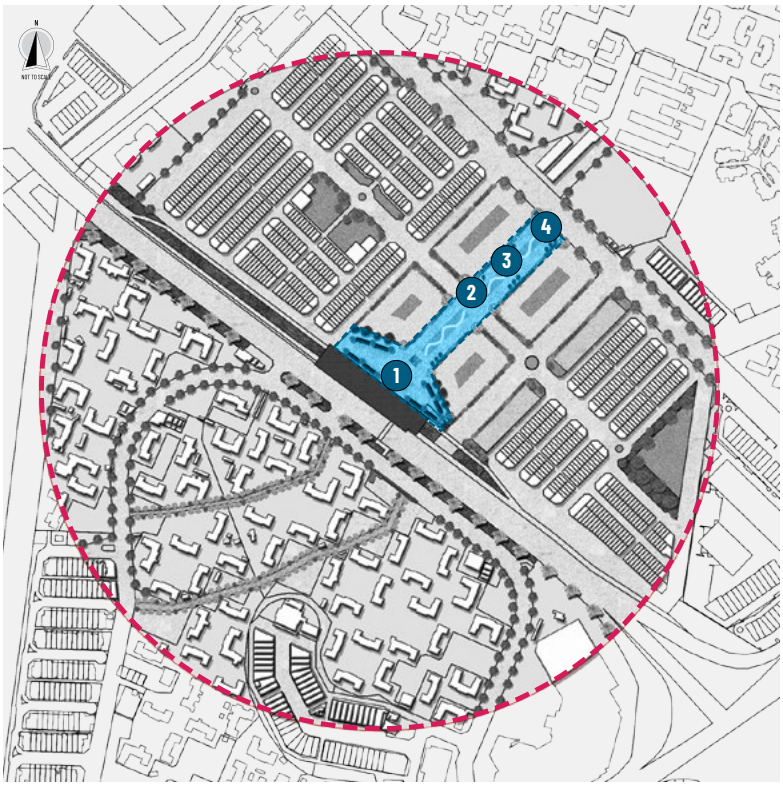
The street should be redesigned as a multi-modal passageway for secure and convenient movement for all types of user.

The installation of pop-up shops that utilise "plug and play" concept to allow hawkers to open its door.

The 10-minutes parking in front of the shop lots for the users that in rush to use the services there.

Public Realm

- The design of public realm is integrated with transportation services and experiences that emphasize walking, biking, and taking public transportation *(refer to Figure 3.40)*.
- The space provides a range of amenities to residents and users, are comfortable, serve to a pleasant pedestrian-oriented public environment, and have convenient access to public transportation.
- Restaurants, cafés, public art and cultural institutions that front open public spaces offer an environment that promotes health and well-being *(refer to Figure 3.41)*



Source: UTM-LCARC, 2021

The imagination of the illustrator when arriving at the station area

Public realm acts as an open gallery to encourage users creating performances in collaboration with street culture and contemporary art.

Lower floor activation space helps in creating a vibrant environment throughout pedestrian walkway.

Sculpture of Wangsa Maju acts as public entrance and spaces between mixed use buildings to announce the arrival at station area.

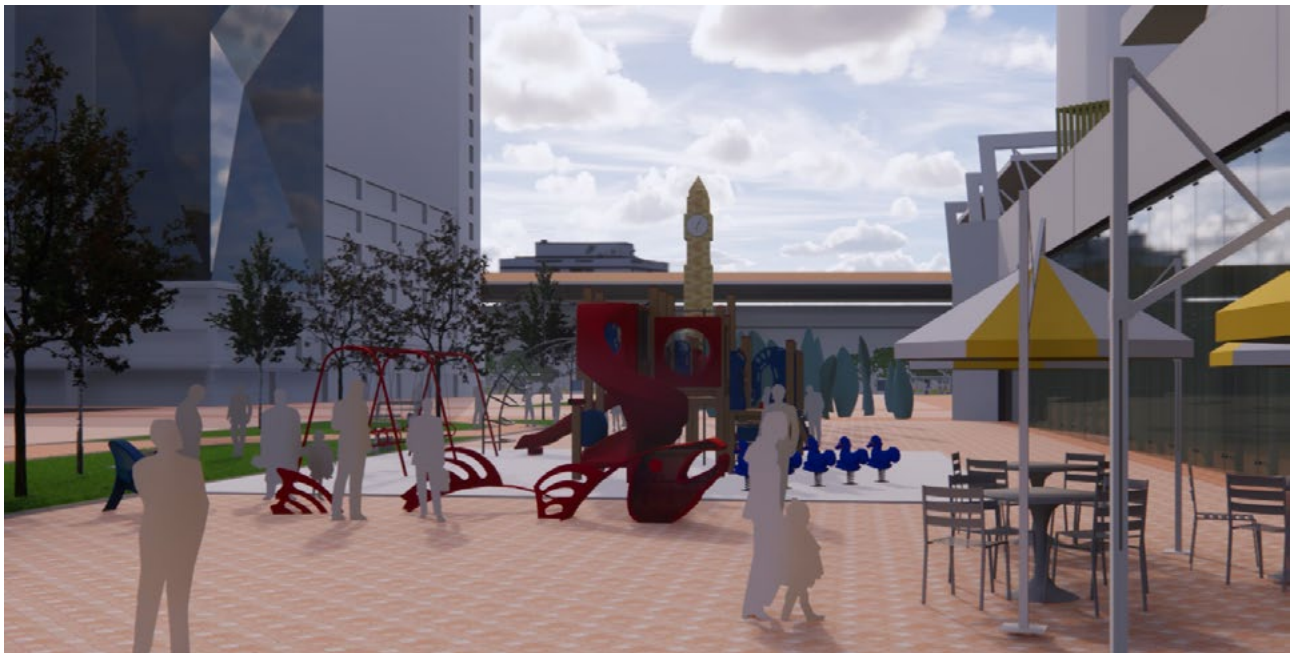


Figure 3.40: Illustration of Public Space in Wangsa Maju SAP
Source: UTM-LCARC 2021

Figure 3.41: Current Situation and Illustration of Pedestrian Connecting Link to Wangsa Maju Station Area in Seksyen 2
Source: UTM-LCARC 2021

The details of project implementation status that involve phase and building partnership for Station Area Planning are explained in *Figure 3.42* and *Table 3.15*.

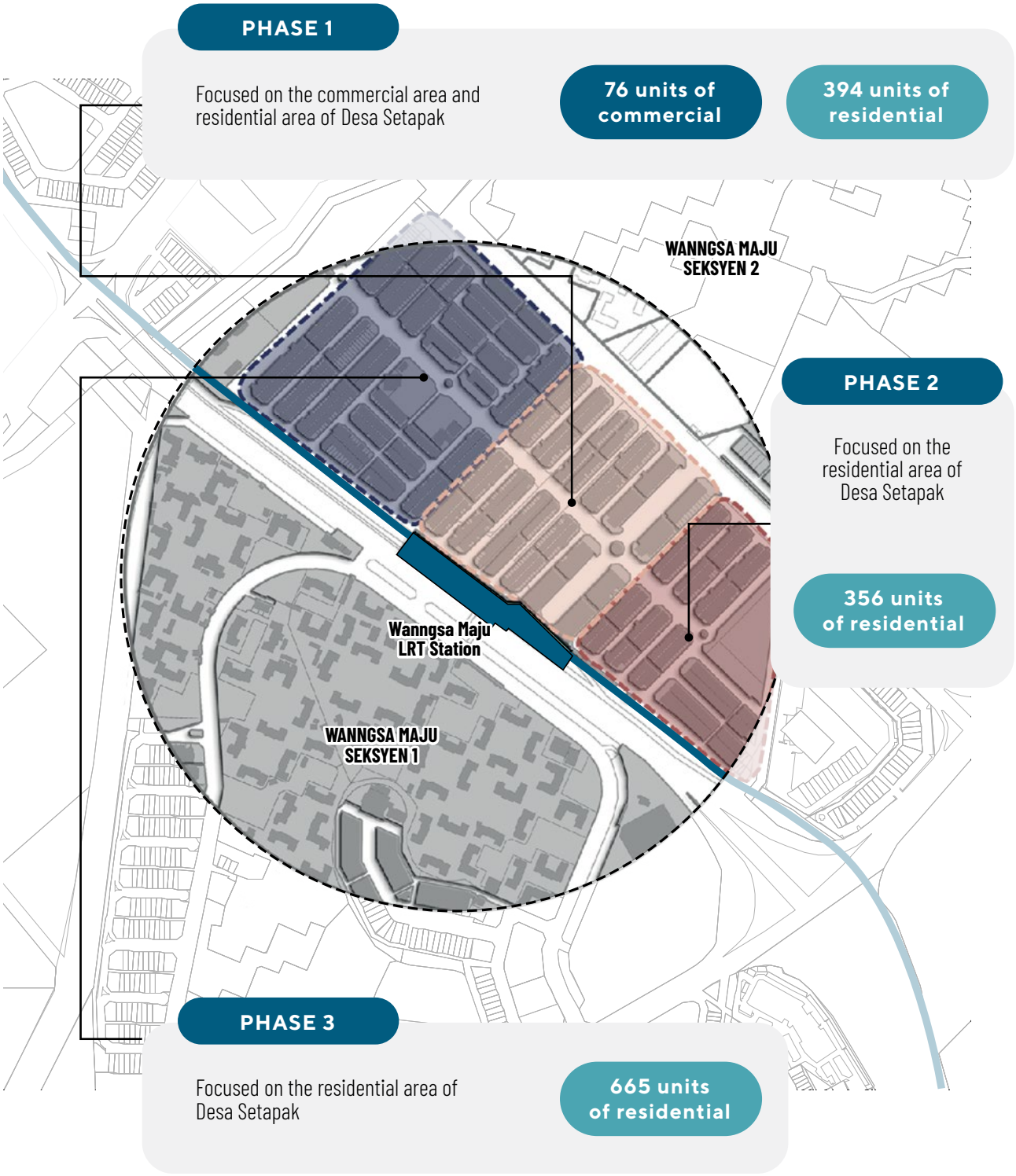


Figure 3.42: The Phase and Unit of Residential and Commercial Will Be Involved

Table 3.15: Building Partnership for Station Area Planning

	Building Partnership
Implementation Approaches	Top-down Approach, Land acquisition, Private Public Partnership (PPP)
Estimated Cost	RM1.5 billion (Phase 1)
Timeline	◢ Phase 1: 2022—2029 ◢ Phase 2: 2027—2034 ◢ Phase 3: 2031—onwards
Implementers	Building experts (Architects, QS, ID, Energy, etc.)
Agency	Federal Territories Directors of Lands and Mines Office (PPTGWPKL), Public Works Department Malaysia (JKR), Tenaga Nasional Berhad (TNB) Energy Commission (ST), Sustainable Energy Development Authority (SEDA), Petroliam Nasional Berhad (PETRONAS)
Stakeholder	Real Estate and Housing Developers' Association Malaysia (REHDA), Prasarana Malaysia Berhad
KLCH dept.	JPRB, JPPPB, JKAWS, JKME, JPPH, JPLR, JPPP, JPIF, JPEP

Source: Estimation by UTM-LCARC Based on Google Maps

GUIDELINES/REFERENCES

1. KL City Plan 2020
2. Draft KL Structure Plan 2040
3. Garis Panduan Perancangan
4. Building Energy Standard
5. AEMAS
6. LCCF

POTENTIAL LOCATIONS

- Wangsa Maju LRT Station (refer to *Figure 3.43* and *Figure 3.44*).

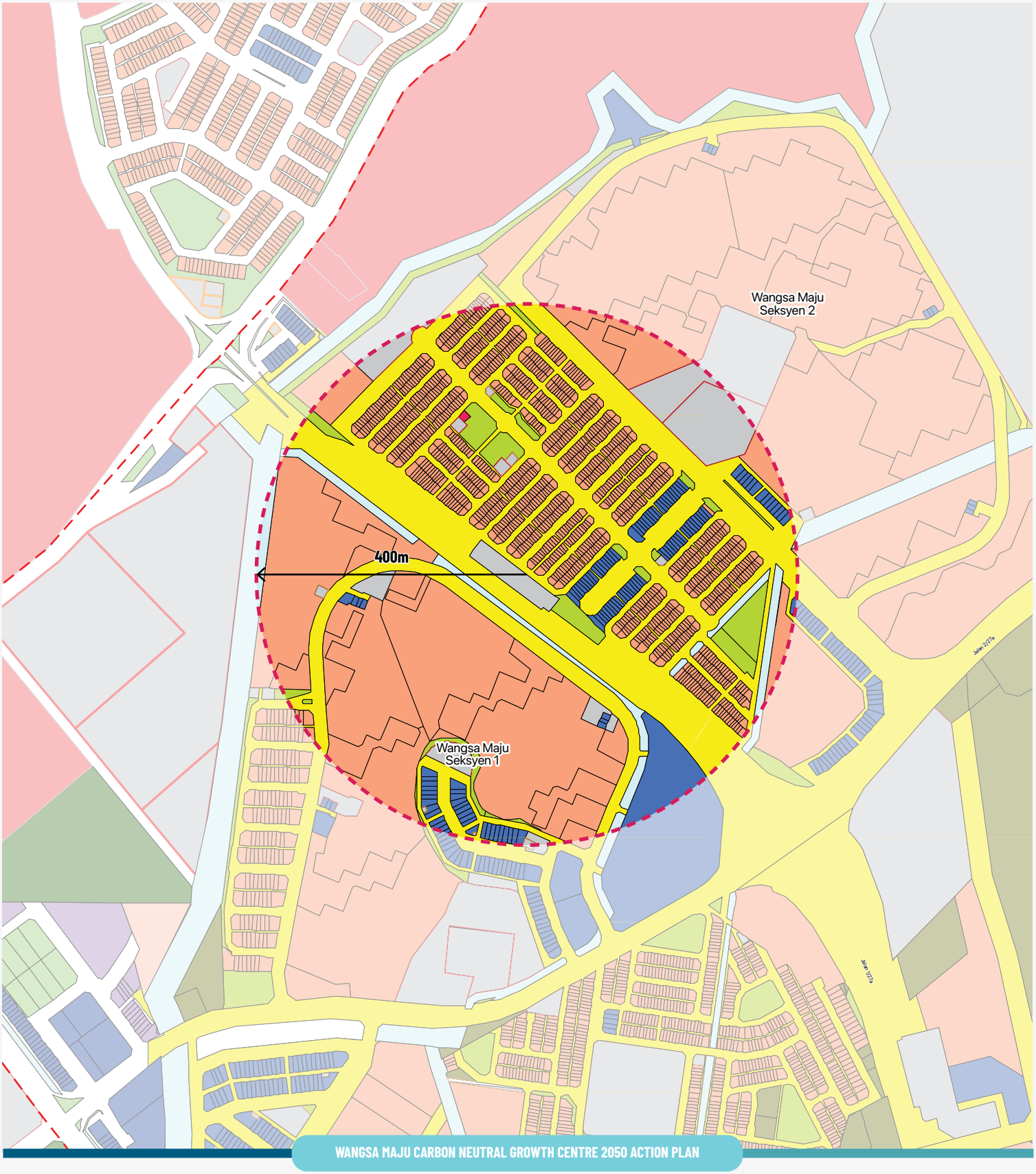


FIGURE 3.43

Land Use Map of Wangsa Maju SAP within 400m Vicinity

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Proposed SAP

N

NOT TO SCALE

Source: **KLCH, 2021**

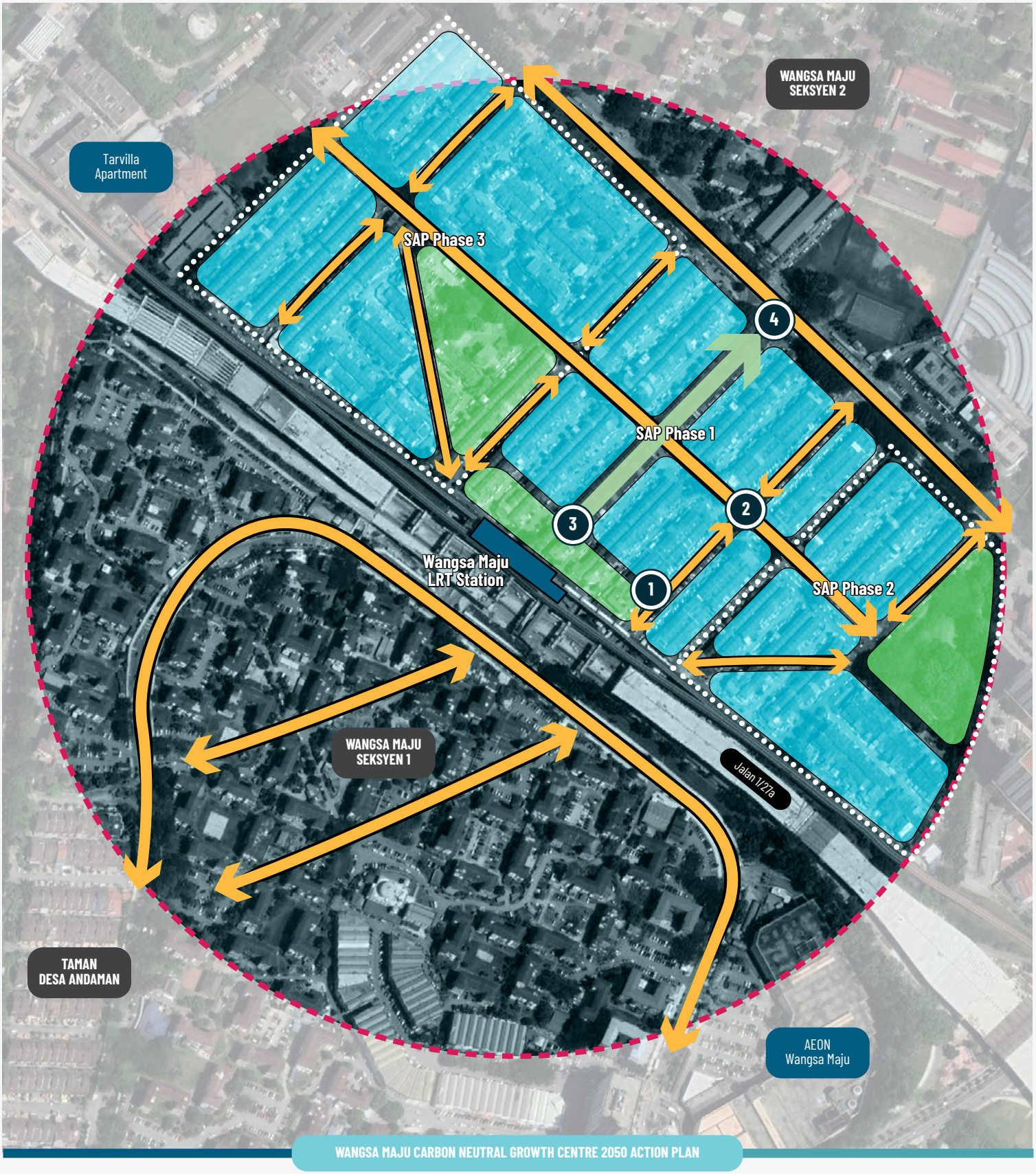


FIGURE 3.44

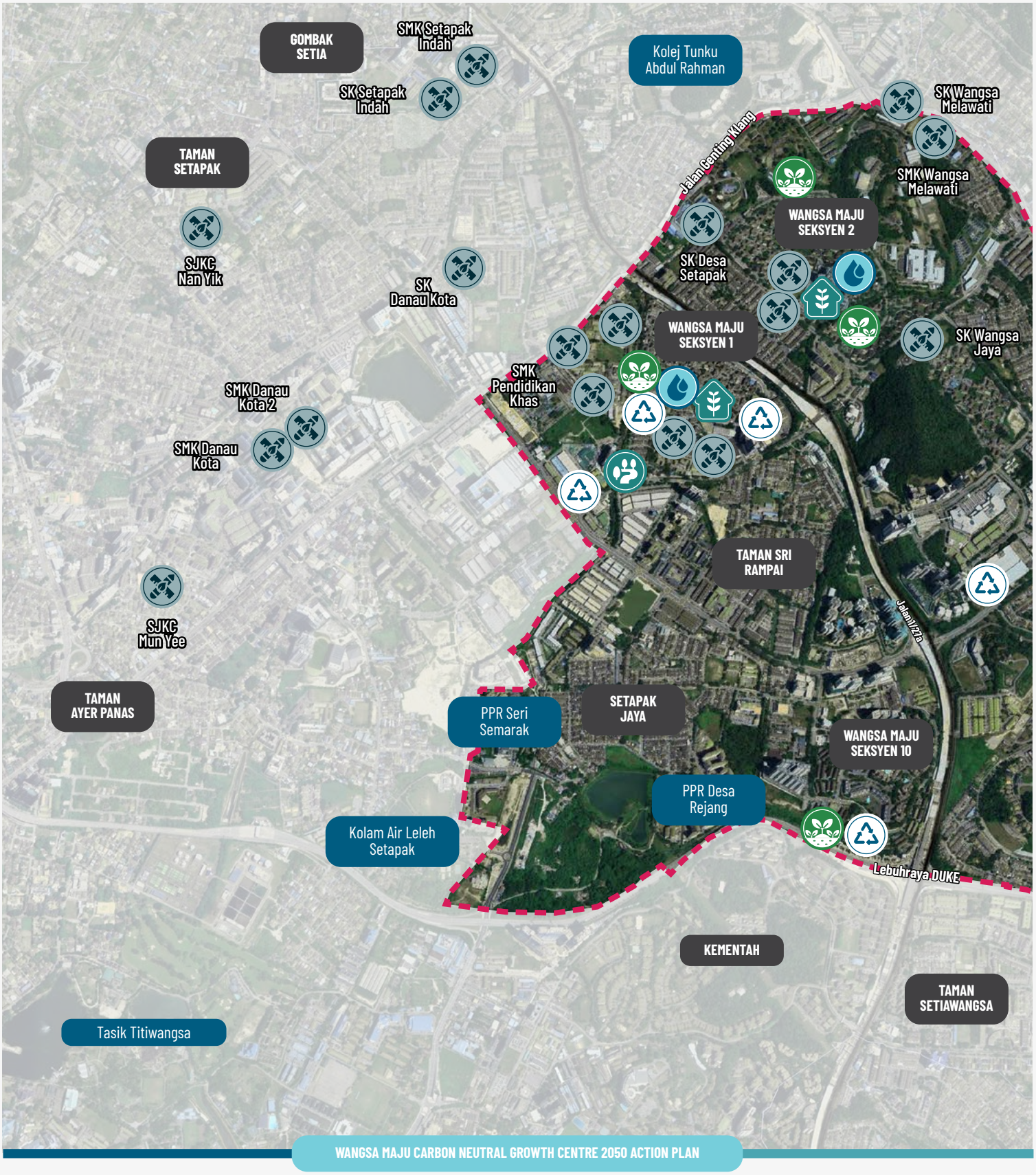
Station Area Planning Sites from the Aerial View

- Redevelopment
- Public Realm
- 1 Building Tower
- 2 Sculpture
- 3 Clock Tower
- 4 Sculpture
- Road
- Boundary 400m

N

NOT TO SCALE

Source: **Google Earth, 2021**



The Seven (7) Proposed Initiatives of Community Sectors

- Eco Park
- Community Farming
- Community Water and Energy Saving Program
- Transform the Existing RA into Carbon Neutrality Community
- Zero Waste Community
- Strengthen School Community through Concentrated Efforts
- Carbon Neutrality Challenge Programs in Schools
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

3.2.4 Community

Citizens can have a huge impact on the environment, but it is also the citizens who can take an active role in their neighbourhoods, in resident associations and their own homes, to drive a climate transition into carbon neutrality thereby improving the economy and the environment. For this mission to be successful, citizens and the civil society must have a primary role and be able to use appropriate resources to drive this systematic and continuous socio-ecological transition. As a national capital and leading city in Malaysia in terms of economy and infrastructure development, it is essential that Kuala Lumpur puts in place and implements concrete sustainable city planning towards becoming a prosperous, inclusive, and environmentally friendly city towards 2050, and carbon neutrality becomes a key approach towards the realisation. There are seven (7) proposed initiatives as follow:

PROPOSED INITIATIVES

1. **Develop an Eco Park**
2. **Promote Community Farming**
3. **Introduce Community Water and Energy Saving Program**
4. **Transform the Existing Resident Association into Carbon Neutrality Community**
5. **Zero Waste Community**
6. **Strengthen School Community through Concentrated Efforts**
7. **Introduce Carbon Neutrality Challenge Programs in Schools**

1 Develop an Eco Park

Various efforts have been carried out by Universiti Teknologi Malaysia in pursuing her aspiration of being environmentally sustainable campus. Living lab is an effort to showcase some of the selected sustainability projects at UTM. UTM Ecopark implemented several resource conservation and green projects as living lab which include solar energy system for fertigation, rainwater harvesting, food waste to compost, aquaphonics system etc. In this context, an Eco Park refers to a self-sustaining farm that generates its own energy, uses harvested rain water and produces agriculture products for communities. Eco Park can be categorised as a community based Ecopark (small scale, grown for self-consumption) and a larger commercial based Ecopark (large scale, grown for market and profit oriented). The concept of Eco Park developed in UTM can be duplicated for other communities in DBKL such as Wangsa Sari to nourish communities with new urban-farming strategies aided with technologies and create economic opportunities to further enhance environmental sustainability practices

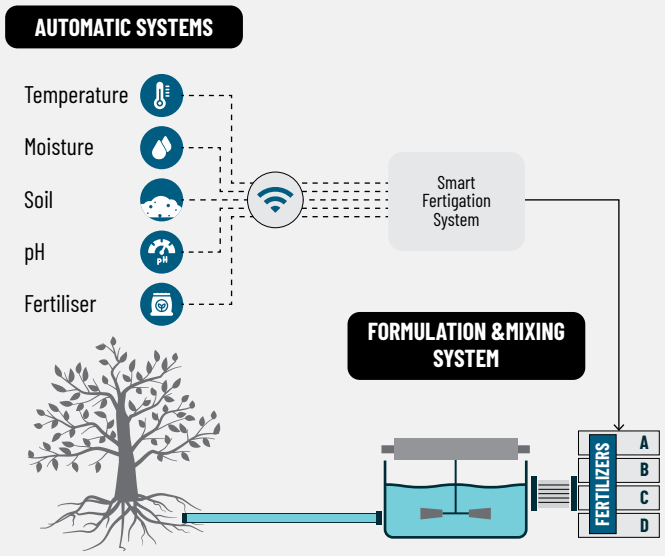
Different technologies have been applied in agriculture with the aim of increasing the production and diminishing the environmental impact in edaphic waters produced by excessive fertilizer contribution. Fertigation is one of the technology which delivering plant nutrients and water to produce a quality crop with higher yields. The rationale of conducting this program by employing an automated fertigation system can help farmers make informed decisions that can significantly impact water and nutrient usage as well as contribute to reducing disease. Recent advancement in ICT technology in agriculture can provide a low maintenance and affordable automatic mixing system and irrigation scheduling, and easy monitoring and control system for an efficient crop management.

The proposed system is expected to have a tri impact towards the farming/agriculture practices i.e. increasing productivity, minimise emission as well as enhancing sustainable agriculture activities. Fertilizer formulation and automated mixing systems that will be developed enable the identification of the exact need of plants in the terms of its nutritional composition as well as the right fertilizing and watering timing, thus controlling and optimizing the input resources consumption. Whilst the the solar system enable automated irrigation system, reduce the number of labor for monitoring the planting/farming activities. The rain water harvesting will enable farmers to use rain water to replace fresh water consumption for aquaculture system operation. The details of community based Ecopark as a showcase project are explained in *Table 3.16*.This project consists of five (5) components *(refer to Figure 3.45)*.

PROJECT COMPONENTS

(a) Fertigation system

- To fully automate a self-sustaining aquaponic farming system with wireless sensors and motorised fertigation system.
- A scheduled fertigation system is implemented in this area so that the fertilizer watered is sufficient to fertilize the crop and avoid wastage of fertilizer. The pump runs using a solar system to flow fertilizer to this crop area.



Smart Fertigation System

Mini composter and smart fertifgation system

Source: UTM-LCARC, 2021

(b) Mini composter

- **Capacity:** 160 L (40kg food waste +10 kg green waste (leaves/plant waste/grass)
- **Weight:** 9.5 kg
- **Size:** L70 x W60 x H93cm

(c) Solar Systems for Fertigation Pumps and Vertical Farming

Project Description

- Providence of Green Energy for Eco Park Damai Sari using Solar PV System
- System is connected to a DC Pump to operate fertigation system in Eco Park Damai Sari
- Using of DC-DC will lead to higher energy efficiency
- System is installed with battery system to ensure smooth operation even during rainy

Project Specification

- Solar PV 320 W
- Solar Charge Controller 60 A
- 12 VDC Lead Acid Battery – 80 Ah
- 260 W DC Pump
- Scheduled Operation based on Fertigation System

Solar system and vertical farming

Source: UTM-LCARC, 2021

PROJECT COMPONENTS

(a) Biological and mechanical filters for aquaculture systems

- This filter aims to filter water from fish tanks that have been contaminated by fish droppings to be recycled so that water wastage can be avoided.
- Ensuring sustainable supply of waste with controlled composition of input waste to the AD as well as improving the performance of the system through ensilation

(b) Fertilizer Injection System

- The A & B fertilizer concentration ratio was determined using a fertilizer injection system using the principle of gravity. Therefore the use of electricity can be avoided

(c) Rainwater Harvesting System

- Gutters are installed at a distance of about 3-4 meters to retain rainwater to flow to the rainwater harvesting system. This rainwater is fed into the tank of the aquaculture system. This can save the use of clean water

Fertilizer injection system

Source: UTM-LCARC, 2021

Rainwater harvesting system

Source: UTM-LCARC, 2021

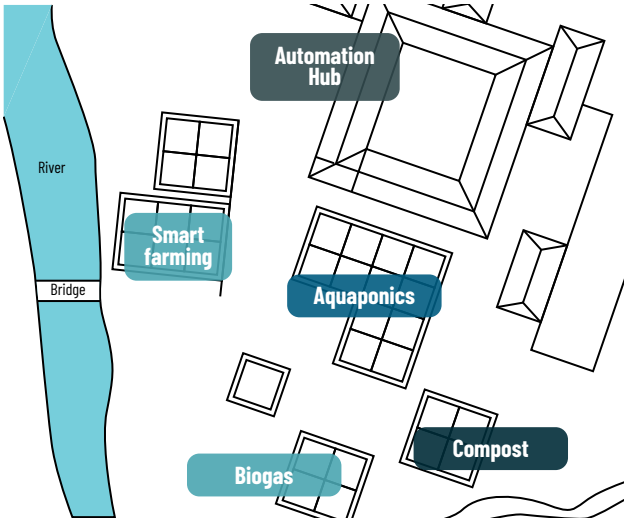


Figure 3.45: Conceptual of Eco Park

Table 3.16: Building Partnership for Eco Park

Building Partnership	
Implementation Approaches	Private Public Partnership
Estimated Cost	RM 25,000 (costing based on size of equipment in project components)
Timeline	◢ 2021-2025 ◢ 2026-2030
Implementers	Residents Assoc/ Management Corporation
Agency	UTM, Jabatan Pertanian Malaysia (DOA)
KLCH dept.	JPRB (LA21 KL), JPLR, JKAS, JPPPK

GUIDELINES/REFERENCES

1. Green Neighborhood Planning Guidelines
2. SPAH Implementation Guide

POTENTIAL LOCATIONS

Justification of the site selection:

- The location is selected for the project because of accessibility (near to the housing area), ownership and suitability.
- This location as pilot project for Wangsa Maju CNGC and other location can be considered in the future.
- Location: Lot 26422, 26423, 23500 in Wangsa Maju Seksyen 1 (refer to *Figure 3.46* and *Figure 3.47*).
- Area: 2.67 acre (Eco Park)

FIGURE 3.46

Potential Eco Park Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

FIGURE 3.47

Propose Eco Park Sites from the Aerial View

Potential Location

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

2 Promote Community Farming

This project involves communities of Wangsa Maju to carry out agricultural activities through community farming, while encouraging the use of sustainable agricultural practices. Apart from creating unity in society and providing fresh local food, community farming can potentially reduce carbon footprint as urban green spaces are one of the solutions to reduce CO_2 emissions (Azaria et al., 2018).

A community farming is a shared space where people gather together to grow vegetables, herbs, fruits and/or flowers collectively. It is managed publicly by a coalition of community members and organisations or government agencies. These farms can occupy both public and privately-owned land, and they are publicly accessible. Community farming vary widely in their structure, purpose and format. They can consist of collective plots, individual plots, or a combination of the two. Food may be grown for the farm's members, for a local organization such as a community kitchen or bulk buying club, or for the community at large. The most common type of community farming is one in which farms plots are rented to community members on an annual basis to plant vegetables for their own consumption.

Community farming is important to be considered in achieving carbon neutrality as self-cultivation of crops from urban community farming reduces food mileage (distance required to transport agricultural products from producer to consumer), which in turn reduces CO_2 emission due to absence of transportation vehicle. Community farming also uses less energy compared to crops that are conventionally grown in energy intensive greenhouses. The process of evapotranspiration (water surface evaporation, soil moisture evaporation, and plant transpiration) from community farming can also mitigate the effect of urban heat island.

BEST PRACTICES

1. Taman Herba LA21KL

The objective of Taman Herba LA21KL is to create a sense of ownership and sense of belonging to the local community and green activities based on a healthy lifestyle. The working committee for LA21KL Herbal Garden Project were established through the signing of MoU between partners, and the meeting among the comittees are organized at least 4 times in a year. The role of the working committee is to report on the progress of project implementation and monitoring.

2. Happy Farm Flora Heights, MBPG

Happy Farm community garden has previously received a consolation prize for green neighborhood gardens award organized by PLANMalaysia in 2020. Therefore it has often been used as the benchmark for other upcoming community garden projects. Since the site for the garden is an open reserve space provided by Majlis Bandaraya Pasir Gudang (MBPG), no fees were charged to the participants. The initial preparation cost of RM20,000 were also provided for the needed process of starting the garden, tools and seeds.

3. Community in Bloom (CIB), Singapore

The CIB programme launched by National Parks Board (NParks) in 2005 and aims to promote a gardening culture among Singapore's residents by encouraging and facilitating gardening efforts by the community. NParks provides guidance and advice to community groups as part of this island-wide community gardening initiative. In 2020, CIB has over 1,600 community gardens across Singapore that have engaged more than 40,000 gardening enthusiasts.

Taman Herba LA21

The details of project components and implementation status that involve building partnership for Community Farming are explained in *Figure 3.48* and *Table 3.17*.

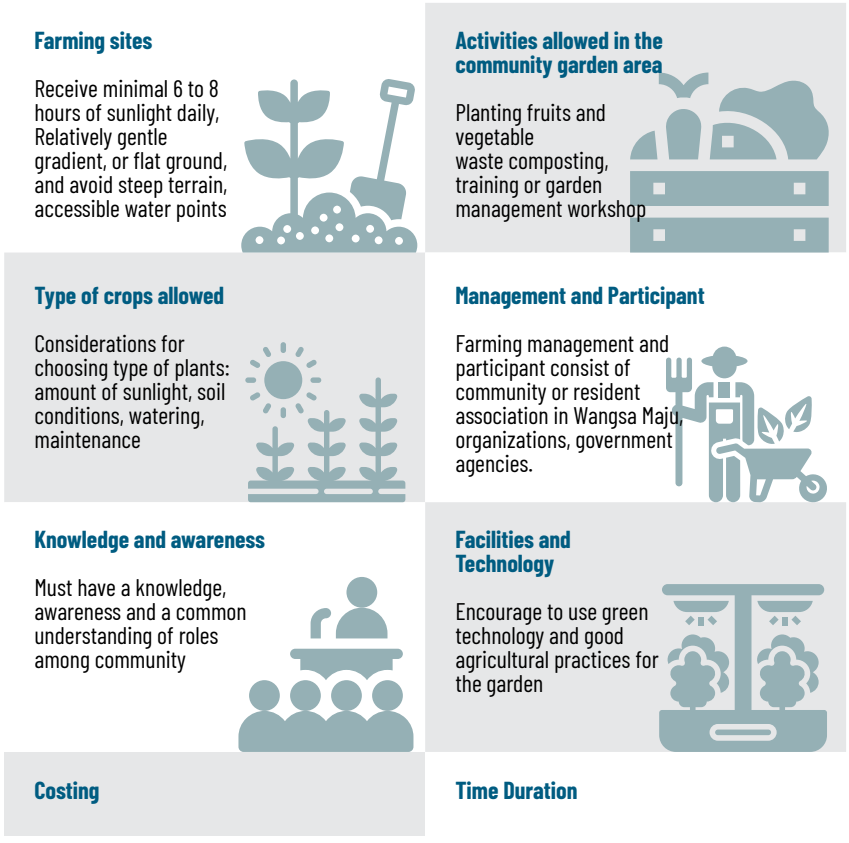


Figure 3.48: The Eight (8) Component of Community Farming

TARGET/OUTCOME

(a) Short Term - 2021-2025

- Target 5-10% community/RA involvement

(b) Medium Term - 2026-2040

- Target 40-50% community/RA involvement

(c) Long Term - 2040-2050

- Target 80-100% community/RA involvement

(d) Community Garden Implementation Framework

Table 3.17: Building Partnership for Community Farming

	Building Partnership
Implementation Approaches	◢ Bottom-down Approach ◢ Corporate Social Responsibility (CSR) ◢ Private Public Partnership ◢ Six implementation stages (Refer to Table 3.18)
Estimated Cost	Cost breakdown: ◢ Hand Tools (e.g shovels, rakes, forks) - RM300 ◢ Water (e.g storage tank, pipe, water sprinkle) – from RM600 ◢ Crops/Seeds - RM100 ◢ Fertilizer and herbicides – RM500 ◢ Planter box/mini greenhouse/topsoil – from RM1,000 ◢ Maintenance and Cleaning (e.g garbage cleaning, safety and implementation of activities) – from RM1,000 ◢ Total – from RM3,500 Financial resources / in-kind contributions can be obtained through the one-off or continue annual allocation from the local authority, related agencies or from the initiative of the Residents Association, Management Corporation and NGOs
Timeline	◢ 2021-2025 ◢ 2026-2030 ◢ >2030
Implementers	Community, Resident Association, Management Corporation, government agencies – e.g school, NGOs, Private Company (CSR)
Agency	Department of Agriculture (DOA), Department of Irrigation and Drainage Malaysia (JPS), Federal Territories Directors of Lands and Mines Office (PPTGWPKL), Federal Territory of Kuala Lumpur Education Department (JPWPKL)
KLCH dept.	JPRB (LA21), JPLR, JKAS, JPPPK

Table 3.18: The Six (6) Stages of Project Implementation

Project Stage	Details
Stage 1: **Form farming group**	Identify total number of resident association (RA) involved in Wangsa Maju and how many RA already have community farming project. Plan allocation target for community RA involvement for short, medium and long term plan. Assign roles for the community farming committee: ◢ **Framing leader** To guide and direct the gardening group over a set term, act as liaison between gardening group and stakeholders ◢ **Treasurer** Secure and handle funds and financial matters for farming group ◢ **Programme head** To coordinate and organise events to engage other members of the group, communicate with the rest of the group on activities and events
Stage 2: **Identify suitable site**	Criteria of suitable site ◢ Must comply to the related community farming guidelines ◢ Within neighbourhood compound or nearby available reserve ◢ Receive minimal 6 to 8 hours of sunlight daily ◢ Relatively gentle gradient, or flat ground, and avoid steep terrain ◢ Accessible water points

Project Stage	Details
Stage 3: Organize sharing session and community engagement	Brainstorming and Sharing Sessions ◢ Evaluate all of the ideas shared by the members to identify mutual goals and explore solutions to any potential problems ◢ Encourage the members to use good agricultural practices
Stage 4: Plan the garden	◢ Plan allocation target for community RA involvement for short, medium and long term plan. The existing number of community farming project can be included in short term plan. ◢ Community farming design - design theme, active and passive zones, types of planter beds, focal points, storage (Refer to Figure 3.45)
Stage 5: Plant the garden	Consider choosing the type of plants and technologies suitable for the farming project and may varies or change following different terms - planting vegetable, herbs and fruit, waste composting, training or farming management workshop Considerations for choosing type of plants: ◢ Amount of sunlight (sunniest planting beds recommended for sun loving plants such as edibles, other areas with less sunlight – recommended to grow foliage plants or other ornamental plants) ◢ Soil conditions (fertile and well-draining soil can take up nutrients rapidly) ◢ Watering (installing drip irrigation can sustain and ensure watering for plants that need it frequently) ◢ Air circulation to space out the plants (good airflow between plants help reduce pests in garden) ◢ Available space to proper plan efficient use of space to maximise the garden's yield ◢ Amount of time required to maintain (including watering, fertilising, and weeding) ◢ List of plants suitable for urban community garden: (Urban Community Garden Implementation Guideline, 2020) Vegetables and Food crop: Kacang Bendi *(Abelmoschus esculentus)*, Daun Bawang *(Allium fistulotum)*, Kucai *(Allium tuberosum)*, Lengkuas *(Alpinia galanga)*, Bayam *(Amaranthus)*, Sawi *(Brassica juncea)*, Cili Padi *(Capsicum frustecens)*, Cili Merah *(Capsicum annuum var. Grassum)*, Limau Nipis *(Citrus aurantifolia)*, Limau Kasturi *(Citrus microcarpa)*, Ketumbar *(Coriandrum sativum L)*, Ulam Raja *(Cosmos caudatus)*, Timun *(Cucumis sativus)*, Kunyit *(Curcuma domestica)*, Serai Makan *(Cymbopogon citratus)*, Serai Wangi *(Cymbopogon nardus)*
Stage 6: Collect harvest	Collect harvest from edible food crop and include suitable activities during the season to sustain and support the project with collaboration with different parties.

GUIDELINES/REFERENCES

To be integrated with existing guideline or modification subject to the local context

- Green Neighbourhood Development Initiative Implementation Guide (Neighbourhood Garden Development)
- Urban Community Garden Implementation Guideline (KPKT)

POTENTIAL LOCATIONS

Justification of the site selection:

- The location is selected for the project because of accessibility (near to the housing area), ownership, existing community farming and suitability.
- Location: along Sungai Bunus in Wangsa Maju Seksyen 1 (JPS reserved area) *(refer to Figure 3.51)*. This location as pilot project for Wangsa Maju CNGC and other locations (1. SMK Wangsa Melawati, 2. Surau Al Amin, Setapak Indah, 3. PPR Gombak Setia 41, 4. Wangsa Maju Seksyen 2 and 5. Wangsa Maju Seksyen 10) (refer to *Figure 3.49* and *Figure 3.50*) can be considered in the future.

FIGURE 3.49

Potential Community Farming Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

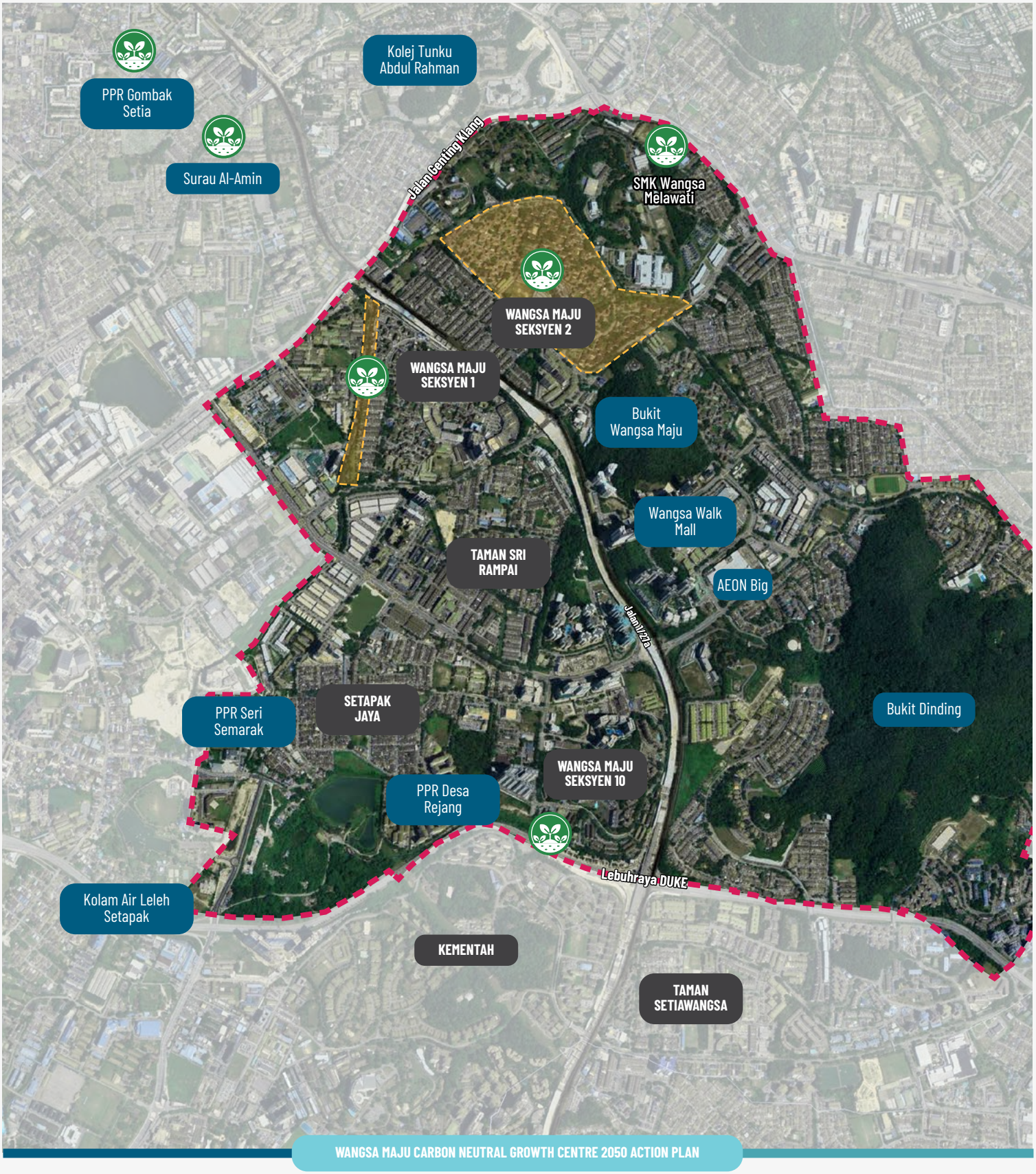


FIGURE 3.50

Potential Community Farming Sites from the Aerial View

Community Farming

Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

FIGURE 3.51

Potential community Farming Sites in Wangsa Maju Seksyen 1 from the Aerial View

- Community Farming Lot
- Straits
- Sungai Bunus
- Gazebo
- Bridge
- Pedestrian and Cycling Walkways
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

Source: **Google Earth, 2021**

3 Introduce Community Water and Energy Saving Program

Community of Wangsa Maju should be aware of the impact of their daily life activities to the environment, especially in terms of water and electrical usage. Saving water and electric usage not only save their money, but it also positively contributes to the carbon neutrality movement by reducing the carbon emission from water and electricity generation process. To motivate and obtain their active participation after the awareness campaigns above, competitions will be designed for the community to participate in individual category and other collective categories.

A calendar will be used to remind and monitor the community to be aware of the utility usage and other pocket awareness events at designated time and location. A database of the usage will be developed to further improve the behaviour. The details of project implementation status that involve building partnership for Community Water and Energy Saving program are explained in *Table 3.19*.

BEST PRACTICES

1. **Iskandar Puteri Low Carbon Society Calendar Competition 2020 (April – November 2020)**

   - Aims of the project: Encourage and motivate community to adopt a low carbon lifestyle by reducing the use of water, electricity and also increasing the amount of recycling.
   - The competition were run for about 9 month where the community were challenged to lead sustainable life through water, electric saving as well as to do recycling. The data collected from the community is about 6 month to monitor the carbon reduction through all participating activities. Budget RM80,000 (prize and operation). From the competition, two distinguish community were developed .

POTENTIAL LOCATIONS

Justification of the site selection:

- Housing area in Wangsa Maju Seksyen 1 and Wangsa Maju Seksyen 2 are selected as pilot cases due to the active existence residents association where easily to coordinate in the program (refer to *Figure 3.53* and *Figure 3.54*).

PROJECT COMPONENTS

(a) Awareness on carbon neutrality, water and electricity saving
(b) Competition on water and electricity saving
(c) Monitoring using calendar
(d) Development of database of residential usage and saving of water and electricity

TARGET/OUTCOME

(a) Implement (5) five program per year.
(b) Community involvement: 200-250 person per program

Table 3.19: Building Partnership for Community Water and Energy Saving

	Building Partnership
Implementation Approaches	Private Public Partnership
Estimated Cost	RM 80,000 (promotion, coordination, prize and operation).
Timeline	**2021-2025** The competition were run for about 9 months ◢ 7 Months – competition, coordination and promotion ◢ 1-2 Months evaluation and judging based on carbon reduction
Implementers	KLCH, Air Selangor, Tenaga Nasional Berhad (TNB)
Agency	Sustainable Energy Development Authority (SEDA), Suruhanjaya Perkhidmatan Air Negara (SPAN), Kementerian Ministry of Housing and Local Governance (KPKT), Federal Territory of Kuala Lumpur Education Department (JPWPKL)
KLCH dept.	JPRB (LA21 KL), JPLR, JKAS, JPPPK, JPKKB, Wangsa Maju Branch Offices

4 Transform the Existing Resident Association into Carbon Neutrality Community

One of the best methods to engage with community is through their resident association. Instead of creating a new community specifically for carbon neutrality agenda, transforming the existing resident association into carbon neutral community is more efficient. Creating a carbon neutral community is important to ensure sustainable implementation of carbon neutrality programs. With the cooperation from the resident association, it is easier to influence the community to participate in planned activities, and develop community of practice.

BEST PRACTICES

1. Iskandar Puteri Low Carbon Community

- Johor already has an established model community that not only practices low carbon initiatives but has successfully established three types of Low Carbon Advocates in Iskandar Puteri from Low Carbon Champion, Low Carbon Leader and Low Carbon Supporter *(refer to Figure 3.52)*.
- The Low carbon community was first developed through a designated integration of low carbon education with extrinsic and intrinsic motivation in terms of funding and moral support- the motivation varies based on the community. Ultimately, the community needs to translate the input they have attained into actions. In doing so, the community needs to understand the problem that they are facing that later will drive them. The designated Iskandar Puteri Low Carbon must be coupled with research as the data collected will drive them to do more innovations.

PROJECT COMPONENTS

(a) Engage with existing resident association in Wangsa Maju.
(b) Brief the community on the benefits of joining carbon neutrality projects.
(c) Assist resident association in designing carbon neutrality programs

TARGET/OUTCOME

(a) Implement (5) five program per year.
(b) Community involvement: 200-250 person per program

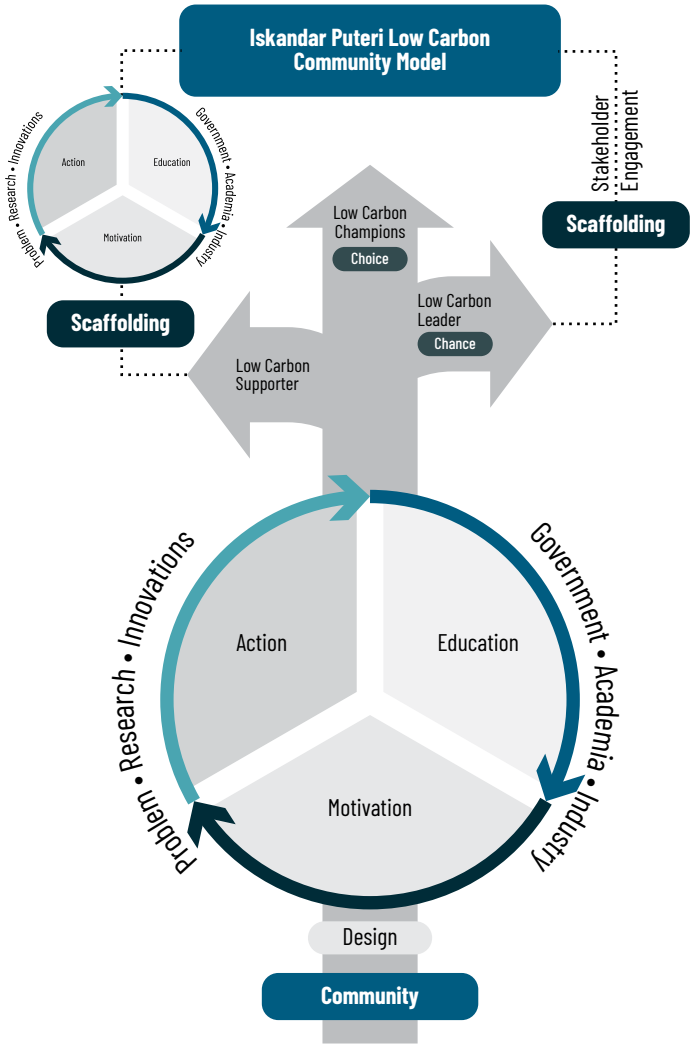


Figure 3.52: Iskandar Puteri Low Carbon Community Model

Communities play significant roles in realizing carbon neutrality. Since carbon emission in the world is highly contributed by electric usage, empowering the community from the roots is needed.

In order to realize the Wangsa Maju Carbon Neutrality model, a strategic action for WPKL is needed. The details of project implementation status that involve building partnership for Transform the Existing Resident Association into Carbon Neutrality Community are explained in *Table 3.20*.

Table 3.20: Building Partnership for Transform the Existing Resident Association into Carbon Neutrality Community

	Building Partnership
Implementation Approaches	The top bottom approach from all communities and the stakeholders
Estimated Cost	N/A
Timeline	2021-2025
Implementers	KLCH, Residents Assoc/ Management Corporation
Agency	Ministry of Housing and Local Governance (KPKT)
KLCH dept.	JPRB-LA21 KL, JPLR, JKAS, JPPPK, Wangsa Maju Branch Offices

POTENTIAL LOCATIONS

Justification of the site selection:

- Housing area in Wangsa Maju Seksyen 1 and Wangsa Maju Seksyen 2 are selected as pilot cases due to the active existence residents association where easily to coordinate in the program. (refer to *Figure 3.53* and *Figure 3.54*)

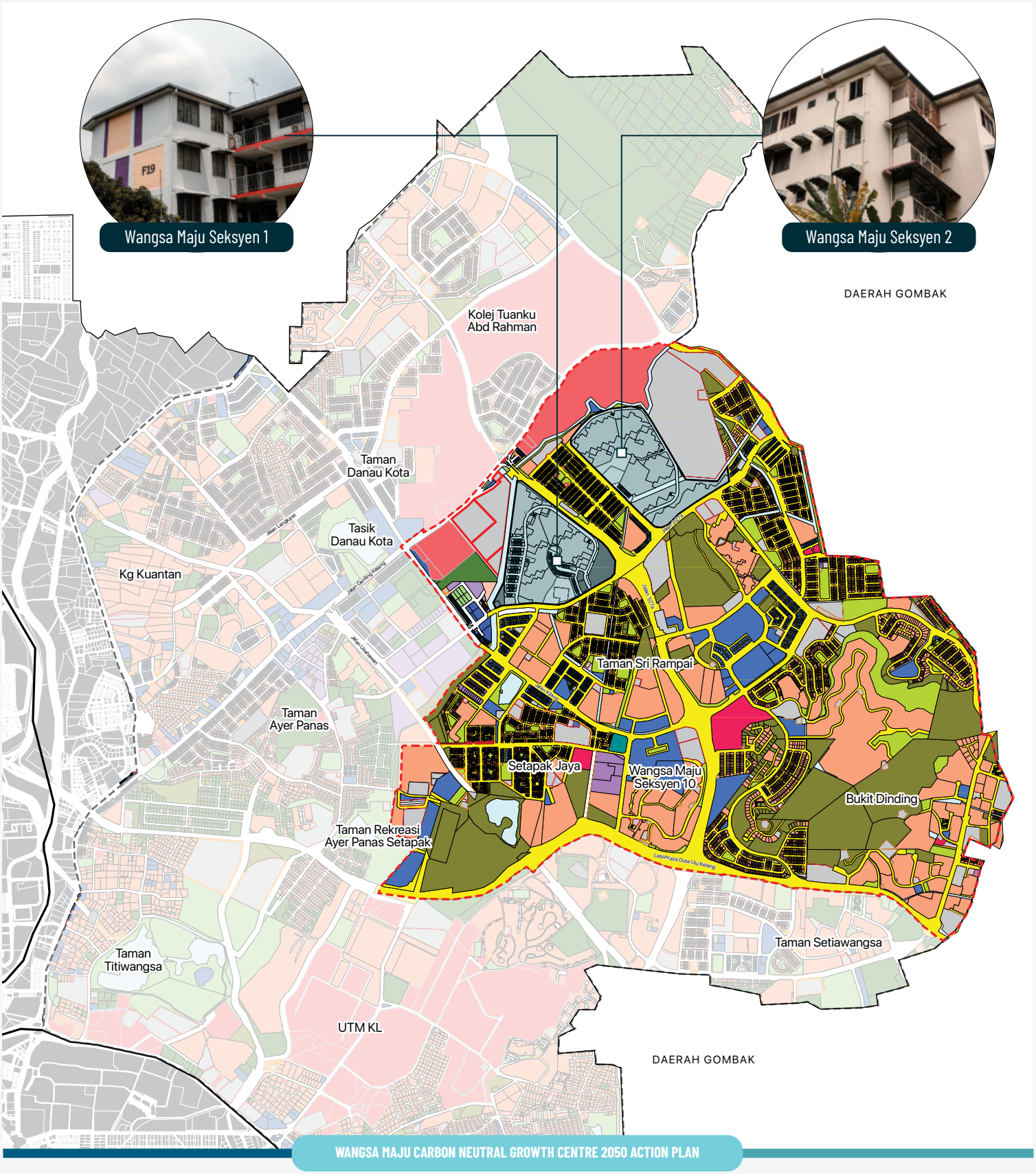


FIGURE 3.53

Transform the Existing Resident Association into Carbon Neutrality Community Potential Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary
- Wangsa Maju Seksyen 1 and 2 Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

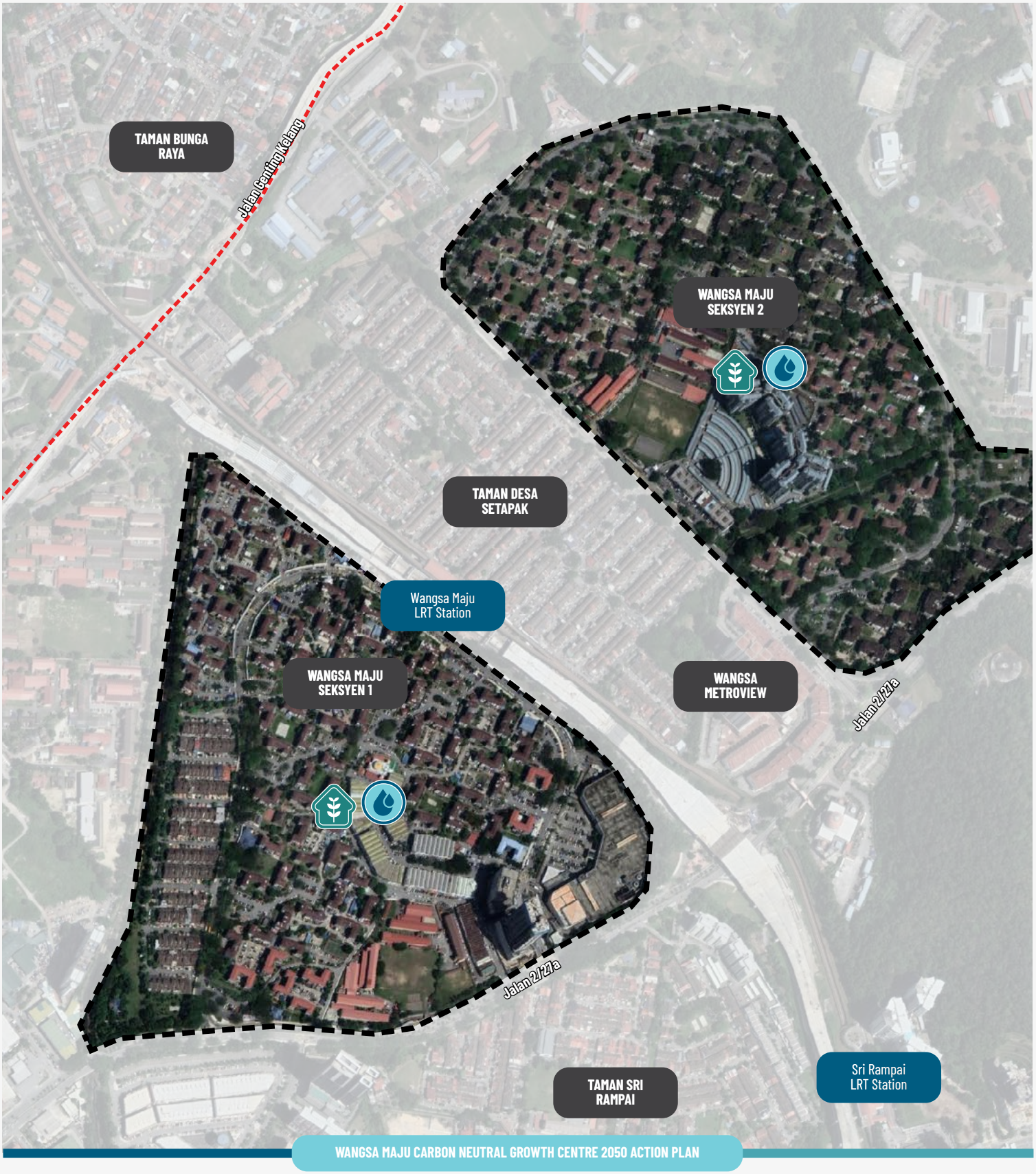


FIGURE 3.54

Transform the Existing Resident Association into Carbon Neutrality Community Potential Sites from the Aerial View

- Community Water and Energy Saving Program
- Transform the Existing Resident Association into Carbon Neutrality Community
- Wangsa Maju CNGC Boundary
- Wangsa Maju Seksyen 1 and 2 Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

5 Zero Waste Community

More than 40% of municipal wastes from residents can be recycled Dumping large amounts of solid wastes to disposal sites (landfills) for a long period of time not only creates environmental problems, but it also leads to unsustainable resource/material consumption where energy is inevitably required to produce similar products/ goods which have been disposed of. Implicationally, both phenomena above increase GHG emissions. In the context of Kuala Lumpur, per capita waste generation due to high urban density and growing consumption, around 1.62 kg per person per day, almost double the national average (UNESCAP, 2020). This is expected to continue to increase, reaching 2.23kg/capita by 2024 (Saeed et al., 2009).

Reduce, reuse and recycle (3R) is deemed as one of the best practices to abate the above waste management issues and eventually help cut down carbon emissions. With the low recycling rate of Kuala Lumpur (i.e., 4 to 5%) (Jereme et al., 2015), relative to the national recycling rate of 28.1% (DOSM, 2020), this hierarchical 3R concept is critical to be promoted and realised by Kuala Lumpur and Wangsa Maju communities (especially residents living in low-cost flats) where they need to become more prudent in managing (i.e., reusing and recycling) their domestic wastes before directly disposing of them (see The Star, 2021). Based on the FGD (22 Dec 2021), limited facilities for waste recycling and low awareness and knowledge among community in Wangsa Maju are the issues that should be tackled. However, promoting and instilling recycling behaviour in local communities can be challenging; a question on how to make communities in Wangsa Maju more ready and motivated for adopting a recycling program is posed.

Thus, enabling environments (as critical success factors), key stakeholders and potential locations, as well as a step-by-step process in guiding KLCH to organise a waste recycling programme, are to be identified to ensure effective implementation of community recycling. According to Rhonda Sherman, a solid waste specialist from the NC State University, primarily, there are three (3) steps with respective details involved in organising a community recycling program (NC State Extension, 2021): (i) Preliminary planning; (ii) Designing your program; and (iii) Operating your program, which can be appropriately adopted in the case of Wangsa Maju.

BEST PRACTICES

1. Green Exchange Program in Curitiba

- The Green Exchange Program is a city-wide initiative where residents trade recyclable materials for fresh produce. Every four kilograms of recyclables can be traded for one kilogram of fresh fruits and vegetables.
- The program guarantees the sale of surplus crop production and encourage and incentivize recycling and environmental preservation among Curitiba residents.

Source: knowledge-hub.circle-lab.com

Composition of waste in Kuala Lumpur

1. Organic
2. Inorganic (glass, aluminium cans, dust and metal)

PROJECT COMPONENTS

The details of project implementation status that involve building partnership for Zero Waste Community are explained in Table 3.21. In this project, there are two (2) project components are identified:

(a) Key enabling environments and stakeholders involvement in promoting recycling behaviour of residents:

Promotion of knowledge and awareness (via activities/events)

- Awareness on carbon neutrality and 3R– via local arts (a gallery of paintings and sculptures using e-waste, plastics and so on)
- Share metrics of recycling success (diversion of landfills) and benefits of recycling
- Competitions on 3R monthly
- Online recycling campaigns: fabric, E-waste, and used cooking oil recycling initiatives

Provision of facilities (e.g. recycling bins) and technological assistance

- Development of a database for storing, tracking, organising and managing data/records related to community recycling
- Using mobile recycling apps (e.g. Sharewaste)

Incentives/rewards and enforcement for waste recycling

- Trash to cash/voucher/household goods
- Waste separation enforcement under the Solid Waste and Public Cleansing Management Act 2007 by RA empowered by KLCH for more effective waste recycling
- Monitoring recycling participation, activities and performance of the community via RA (in collaboration with KLCH LA21)

(b) A Step by step of Implementation Process

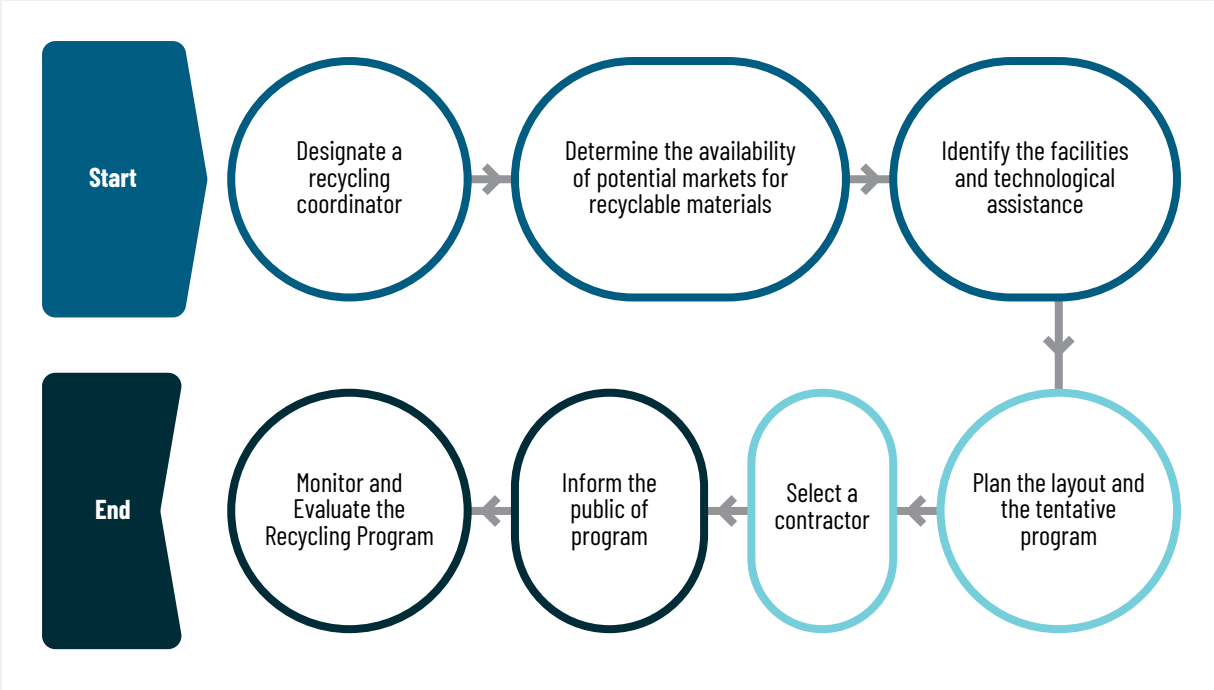


Figure 3.55: A Step-By-Step Implementation Process

TARGET/OUTCOME

(a) Estimation of waste can be recycle per year by community in Wangsa Maju CNGC:

- Short term: 1,500 tonnes
- Medium term: 3,000 tonnes
- Long term: >3,000 tonnes

(b) 100% of RA in Wangsa Maju are involve (short term, medium term, and long term)

(c) Outcome: Process Implementation of Community Recycling Program *(refer to Figure 3.55)*

GUIDELINES/REFERENCES

To be integrated with existing guidelines or modification subject to the local context:

1. Solid Waste and Public Cleansing Management Act 2007
2. Draft KL Local Plan 2040

POTENTIAL LOCATIONS

Justifications of the site selection:

- Communities in Wangsa Maju Seksyen 1 and Wangsa Maju Seksyen 10 are selected as pilot cases due to the existence of community halls which feasibly allow a large number of residents to participate in the program. (refer to *Figure 3.56* and *Figure 3.57*)
- Commercial area (petrol station) as a collecting point

Table 3.21: Building Partnership for Zero Waste Community

	Building Partnership
Implementation Approaches	◢ Private Public Partnership ◢ Corporate Social Responsibility (CSR) ◢ Provide Community Recycling Framework (refer to Table 3.22)
Estimated Cost	RM 50,000 (awareness, technology, facilities)
Timeline	◢ 2021-2025: Petrol station, Wangsa Maju Seksyen 1 and 10 as a pilot project ◢ 2026-2030: Wangsa Maju Seksyen 1,2,4,5,10 ◢ >2030: 100% of RA in Wangsa Maju
Implementers	Resident Association, NGOs, Private Organisations
Agency	Solid Waste Management and Public Cleansing Corporation (SW Corp), Department of Environment (DOE)
Stakeholders	Petroliam Nasional Berhad (PETRONAS), Alam Flora Sdn. Bhd, iCycle Malaysia, Kloth Malaysia Sdn Bhd, Residents Assoc/ Management Corporation, NGOs, Private Organisations and other relevant stakeholders
KLCH dept.	JPRB (LA21 KL), JPLR, JKAS

Table 3.22: The Details Step-By-Step Process Implementation

Project Stage	Details
Stage 1 - Preliminary Planning	The initial step involve three (3) steps to develop a successful recycling program ◢ Designate a recycling coordinator to set up the various program components. This individual is responsible designing the collection program, arranging in-house transportation of materials, facilitating education and outreach, and tracking progress. ◢ Determine the availability of potential markets for recyclable materials through discussion with solid waste agencies or environment department to figure out what is currently being thrown away and identify how much of each material ◢ Identify the facilities and technological assistance * The collection methods either drop off or curbside methods. For Wangsa Maju, the collection method must be drop-off centers because have a low capital costs and ease in collecting more categories of materials than with curbside collection.
Stage 2 - Designing Your Program	◢ Plan the layout and the tentative program. The coordinator must be plan the layout and schedule for the program where they are most convenient and close to where the recyclables are collect such as shopping mall and community hall. ◢ The plan must be included: Venue, Time & Date, Targets group, Staff and volunteer, The weighting of recyclables that can be traded for necessities (in kilograms). For example 300 kg of recyclables can be redeemed for 50 units of sugar, incentives/rewards and enforcement for waste recycling ◢ Select a contractor as transporting recyclables from the program site to a recycling centre.
Stage 3 - Operating Your Program	◢ Inform the public of program requirements and solicit their support. The information must be included: * The why, what, how, where, and when of the program. * Awareness on carbon neutrality and 3R * Share metrics of recycling success (diversion of landfills) and benefits of recycling ◢ Provide easy-to-understand instructions on how to participate, and keep communications positive through mass media announcements, printed materials and direct communication with the community. ◢ Monitor and Evaluate the Recycling Program

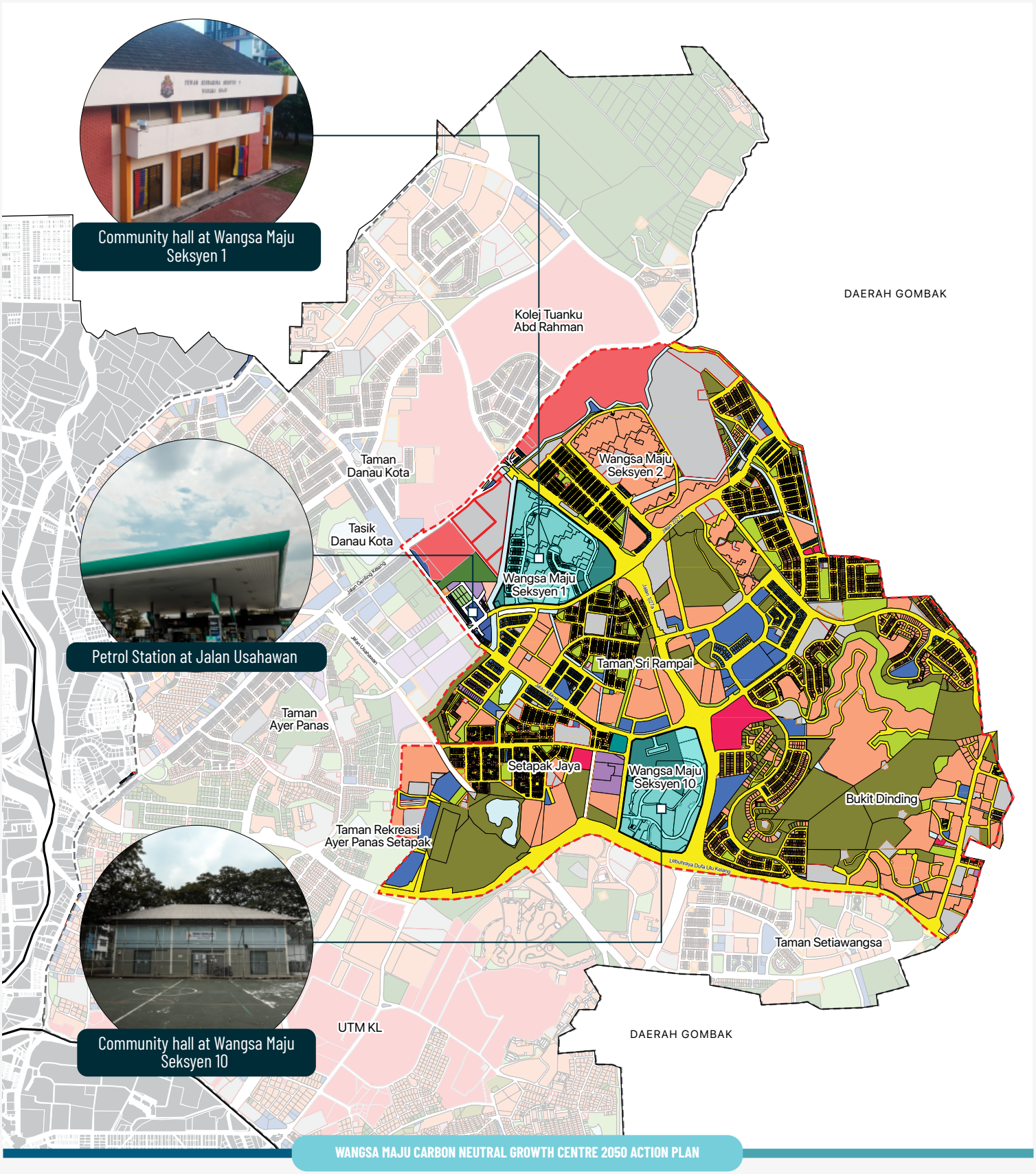


FIGURE 3.56

Potential Zero Waste Community Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary
- Wangsa Maju Seksyen 1 and 10 Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

FIGURE 3.57

Zero Waste Community Potential Sites from the Aerial View

Zero Waste Community

Wangsa Maju CNGC Boundary

Wangsa Maju Seskyen 1 and Seksyen 10 Boundary

N

NOT TO SCALE

KL 2050 CARBON NEUTRAL

Source: **Google Earth, 2021**

6 Strengthen School Community through Concentrated Efforts

In Johor, the framework to strengthen the concentrated low carbon efforts in the school community has been successfully modelled by environmental education experts from Universiti Teknologi Malaysia (UTM). The framework required the top bottom approach from all stakeholders in designing and implementing all the modules, competitions, training and ultimately to develop champions from students, teachers and schools' management. Johor State Education Department (JPNJ) plays a vital role in establishing an environment education action plan to ensure that the successful implementation of green education towards all schools in Johor.

In 2019, JPNJ launched the Pelan Tindakan Pendidikan Kelestarian Johor 2019-2023 (*Figure 3.58*). This action plan is relevant and practical as it acknowledges the challenges faced by the school community which then were addressed through strategic and collaborative efforts by the stakeholders. Hence, to ensure the environment education in WPKL can be implemented and sustained, LA21 KLCH as they led agency should spearhead the effort by re-arranging the priority of the projects and roles of the stakeholders.

Based on the findings, the model to inculcate carbon neutrality awareness to school community for KLCH is proposed as in *Figure 3.35* Through the model proposed, the organized involvement from parents, students, teachers, management and stakeholders can ensure efficient and effective efforts towards developing the school community and wider on carbon neutrality awareness. The details of project implementation status that involve building partnership for Strengthen School Community through Concentrated Efforts are explained in *Table 3.23*.

Table 3.23: Building Partnership for Strengthen School Community through Concentrated Efforts

	Building Partnership
Implementation Approaches	The top bottom approach from all stakeholders
Estimated Cost	N/A
Timeline	2021-2025
Implementers	JPWPKL
Agency	Department of Environment (DOE), Federal Territory of Kuala Lumpur Education Department (JPWPKL), Solid Waste Management and Public Cleansing Corporation (SW Corp)
Stakeholders	Yayasan Hijau, Ecoknights Malaysia, Alam Flora Sdn Bhd, schools and other relevant stakeholders
KLCH dept.	JPRB (LA21 KL), JPLR, JPPPK

Figure 3.58: Pelan Tindakan Pendidikan Kelestarian Johor 2019-2023 (PTPKJ 2019-2023)

PROJECT COMPONENTS

- **(a)** Regular meeting of stakeholders with LA21 KLCH
- **(b)** All carbon neutrality projects or activities at KL schools to be recommended by LA21 JPWPKL and approved by LA21 KLCH.
- **(c)** A database of all the carbon neutrality projects or activities at KL schools to ensure all schools in KL are involved and carbon calculation can be computed for reporting.
- **(d)** Develop a roadmap for all KL schools to be involved in carbon neutrality programs
- **(e)** Assess and appoint Green schools

TARGET/OUTCOME

- **(a)** The model to inculcate carbon neutrality awareness to school community for KLCH *(refer to Figure 3.59)*

This can be done through the concentrated effort from the bottom up to top on the establishment of school clubs, competitions, talks, modules, training and focus group discussion respectively. To sustain the behaviour and awareness, it is important to conduct research where the data are crucial to further improved all the initiatives implemented and proved the effectiveness of the programs. Besides that, it is significant to provide recognition for the commendable effort towards carbon neutrality as a booster for the school community to move forwards.

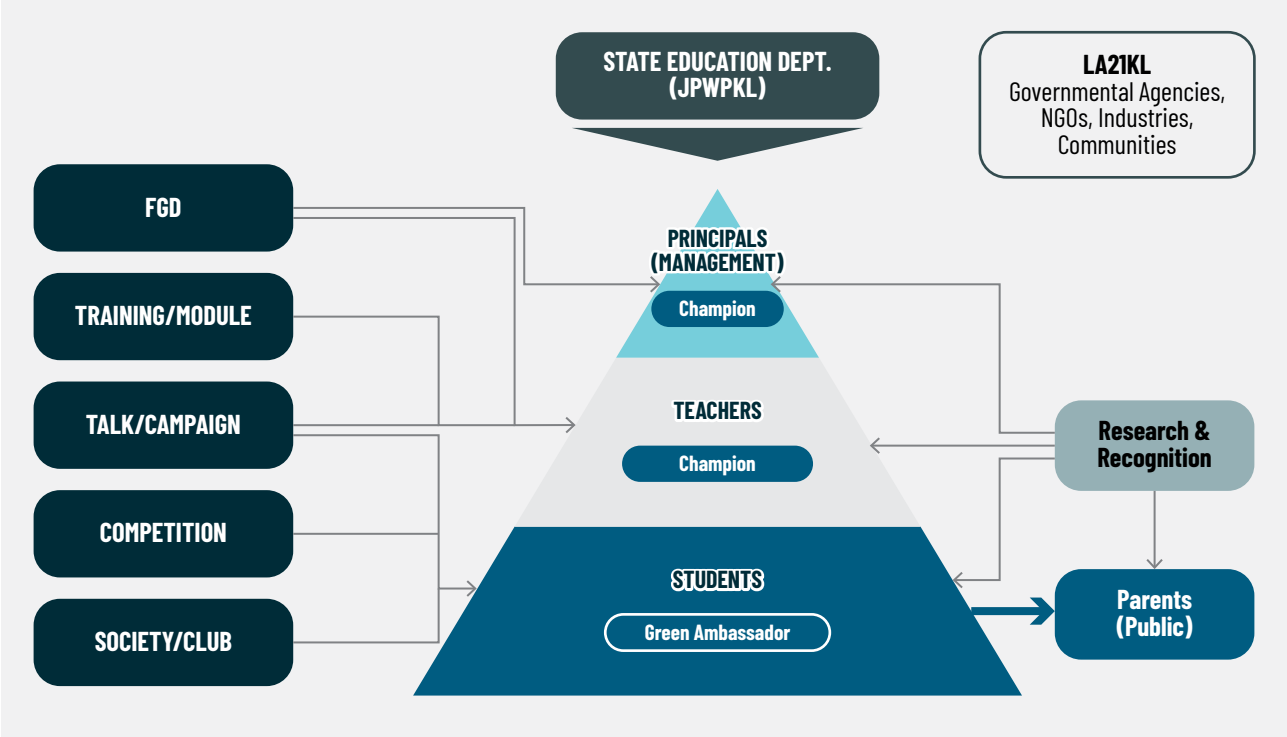


Figure 3.59: Model to Inculcate Carbon Neutrality Awareness to School Community for KLCH

7 Introduce Carbon Neutrality Challenge (CNCP)Programs in Schools

In total, there are 295 schools in Wilayah Persekutuan Kuala Lumpur (WPKL), from Primary Schools (SK), Secondary School (SMK), Special Schools, National Type Schools (Chinese and Tamil), Boarding Schools, and Vocational College. These schools are managed by the Jabatan Pendidikan Wilayah Persekutuan Kuala Lumpur (JPWPKL), which are further divided into three Pejabat Pendidikan Daerah (PPD), they are PPD Keramat, PPD Sentul, and PPD Bangsar Pudu. The number of schools and students in 2020 are as in *Table 3.24*.

Table 3.24: Number of Schools and Students by PPD in Kuala Lumpur (2020)

District Education Office	Primary Schools		Secondary Schools		Total	
	Schools	Students	Schools	Students	Schools	Students
Keramat	41	30,680	25	18,620	66	49,300
Sentul	57	33,991	25	24,600	82	58,591
Bangsar Pudu	93	66,878	54	43,872	147	110,750
Total	**191**	**131,549**	**104**	**87,092**	**295**	**218,641**

The involvement of schools in JPWPKL towards environmental initiatives has been going on since 2011. With supervision from JPWPKL, there are a lot of environmental education and awareness activities carried out by schools in WPKL, as listed below:

- Sekolah Lestari Anugerah Alam Sekitar (SLAAS).
- Talk and exhibition
- Upcycling competition
- Environmental Workshop
- Environmental Quizzes and Interactive Games for Pre-school children
- Invention and Innovation Competition using recycling item
- Drawing and Digital Poster Competition
- Environmental Poem Recital

An example of environmental initiative by a school in WPKL. Air Panas Girl School collaborates with Fujimigaoka High School for Girls from Tokyo, Japan to learn carbon neutrality issues and propose solutions to combat the issues through online collaboration in 2021

BEST PRACTICES

- In Malaysia, only Johor State Education Department have its own Johor Environmental Education Action Plan, PTPKJ 2023. According to PTPKJ, Iskandar Malaysia Ecolife Challenge (IMELC) is the most effective environmental education practices for all primary schools in Johor. Even though IMELC is a supplementary learning activity or inter-school competition, it has successfully transformed a number of schools and teachers to become champions in low carbon.

Source: imelc.my

- This is due to its comprehensive Low Carbon Society (LCS) module that is conducted as formal or informal education at school setting. Hence, IMELC has successfully established climate change makers since 2013 in Johor.
- This successful story of IMELC is achieved through supports and commitment by all stakeholders which are Iskandar Regional Development Authority (IRDA), Universiti Teknologi Malaysia (UTM) and Jabatan Pendidikan Negeri Johor (JPNJ), and supported by other partners such as SWM Environment Sdn Bhd, Sustainable Energy Development Authority (SEDA) Malaysia, Medini Iskandar Malaysia Sdn Bhd, Malaysian Industry-Government Group for High Technology (MIGHT) and others over the years.
- Each stakeholder plays significant roles from coordination, sponsorship, module development and etc. Each stakeholder also has a clear and explicit objective to achieve the target of carbon reduction for Iskandar Malaysia by year 2025 as outlined in the Low Carbon Society Blueprint for Iskandar Malaysia 2025 as well as to realize the Johor Environmental Education Action Plan 2023.

To ensure that WPKL will lead and be the first carbon neutral zone in Malaysia, it is important to leverage the school community through a strategic effort. However, based on the studies, schools can only become carbon neutral zones if there is buy-in from the school management, and support from PPD and JPWPKL, consistent projects and programs for students and teachers, as well as research and recognition.

Based on the successful implementation of IMELC, it is proposed that Carbon Neutrality Challenge Programs (CNCP) to be implemented in schools in PPD Keramat as pilot. CNCP aims to educate teachers, students, and school community on carbon neutrality lifestyle, through a series of activities, including trainings, campaigns and workshops that will be conducted to promote carbon neutrality awareness and develop champions.

CNCP will start with FGD with school management to develop consensus. This will be followed by webinars for capacity building for teachers and students. The students will compete in several online, school-based and home-based competitions after the webinar. The schools will submit carbon neutrality project proposals to pitch a RM5,000 grant from KLCH to develop their projects at schools. The projects will be monitored and evaluated to identify successful projects to be showcased through exhibitions at public areas such as AEON Taman Maluri Mall. This will become an annual program and expand to more schools until all 295 schools in KL (*Table 3.23*) are covered by 2025. The details of project implementation status that involve building partnership for CNCP program are explained in *Table 3.25*.

Table 3.25: Building Partnership for CNCP Program

	Building Partnership
Implementation Approaches	FGD with school management to develop consensus, Private Public Partnership
Estimated Cost	RM100,000
Timeline	2021-2025
Implementers	Schools
Agency	Department of Environment (DOE), Federal Territory of Kuala Lumpur Education Department (JPWPKL), Solid Waste Management and Public Cleansing Corporation (SW Corp)
Stakeholders	Yayasan Hijau, Ecoknights Malaysia, Alam Flora Sdn Bhd, schools and other relevant stakeholders
KLCH dept.	JPRB (LA21 KL), JPLR, JPPPK

PROJECT COMPONENTS

(a) Engagement with JPWPKL, PPD, Principals for consensus building is required
(b) Trainings, campaigns and workshops for teachers and students to develop champions
(c) KLCH will provide seed grants for each school to develop carbon neutrality projects
(d) Evaluation, monitoring and competition of the carbon neutrality projects annually
(e) Showcase of green schools with promising carbon neutrality projects through visits and exhibitions.

TARGET/OUTCOME

Projections of school involvement in Carbon Neutrality Challenge Program (CNCP)

(a) 2022: **20 schools** in Wangsa Maju
(b) 2023: **66 schools** in PPD Keramat
(c) 2024: **148 schools** in PPD Keramat and Sentul
(d) 2025: **295 schools** in JPWPKL

POTENTIAL LOCATIONS

As a pilot case, only 20 schools within Wangsa Maju CNGC will be involved. After 2 years, additional 70 schools from Wangsa Maju Maluri will be involved (refer to *Figure 3.60* and *Figure 3.61*).

1. **11 Primary schools in Wangsa Maju CNGC:**

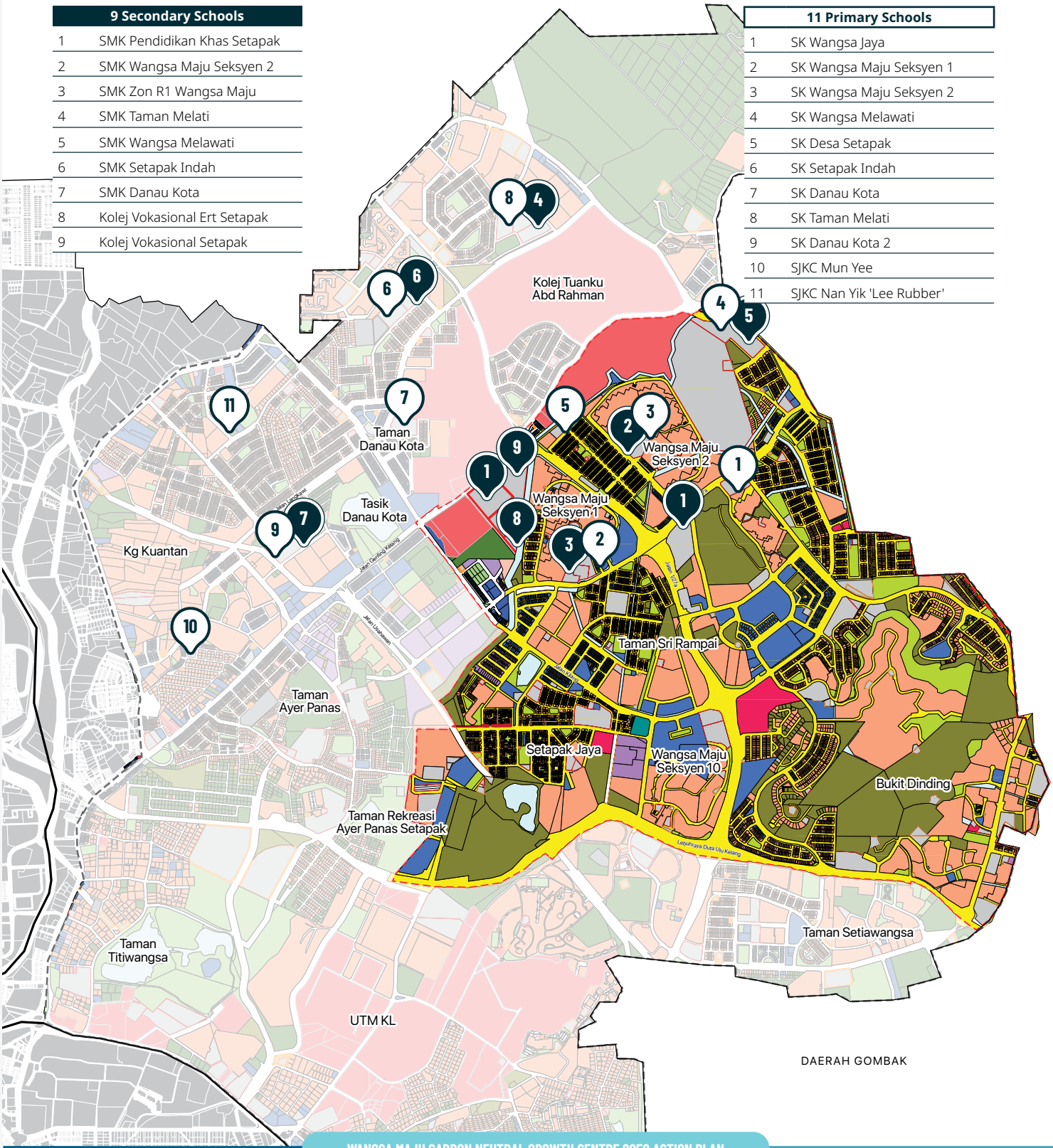
   SK Wangsa Jaya, SK Wangsa Maju Seksyen 1, SK Wangsa Maju Seksyen 2, SK Wangsa Melawati, SK Desa Setapak, SK Setapak Indah, SK Danau Kota, SK Taman Melati, SK Danau Kota 2, SJKC Mun Yee, SJKC Nan Yik 'Lee Rubber'

2. **9 Secondary schools in Wangsa Maju CNGC:**

   SMK Pendidikan Khas Setapak, SMK Wangsa Maju Seksyen 2, SMK Zon R1 Wangsa Maju, SMK Taman Melati, SMK Wangsa Melawati, SMK Setapak Indah, SMK Danau Kota, Kolej Vokasional ERT Setapak, Kolej Vokasional Setapak

9 Secondary Schools	
1	SMK Pendidikan Khas Setapak
2	SMK Wangsa Maju Seksyen 2
3	SMK Zon R1 Wangsa Maju
4	SMK Taman Melati
5	SMK Wangsa Melawati
6	SMK Setapak Indah
7	SMK Danau Kota
8	Kolej Vokasional Ert Setapak
9	Kolej Vokasional Setapak

11 Primary Schools	
1	SK Wangsa Jaya
2	SK Wangsa Maju Seksyen 1
3	SK Wangsa Maju Seksyen 2
4	SK Wangsa Melawati
5	SK Desa Setapak
6	SK Setapak Indah
7	SK Danau Kota
8	SK Taman Melati
9	SK Danau Kota 2
10	SJKC Mun Yee
11	SJKC Nan Yik 'Lee Rubber'



WANGSA MAJU CARBON NEUTRAL GROWTH CENTRE 2050 ACTION PLAN

FIGURE 3.60

Potential Location of Schools for Carbon Neutrality Awareness & Carbon Neutrality Challenge Program (CNCP)

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary
- Primary Schools
- Secondary Schools

N

NOT TO SCALE

Source: **KLCH, 2021**

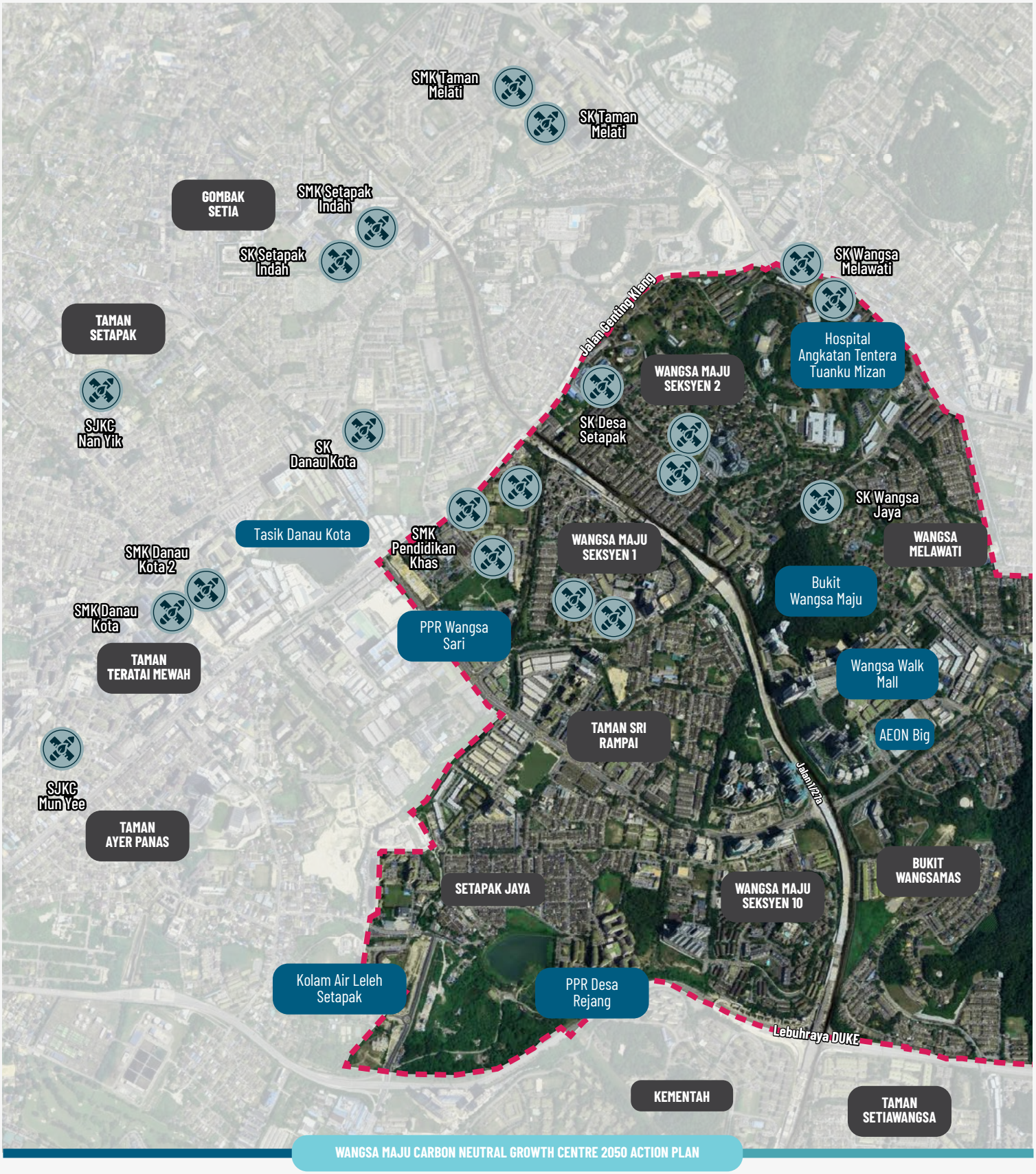


FIGURE 3.61

Potential Location of Schools for Carbon Neutrality Awareness & Carbon Neutrality Challenge Program (CNCP) from the Aerial View

Community Farming

Wangsa Maju CNGC Boundary

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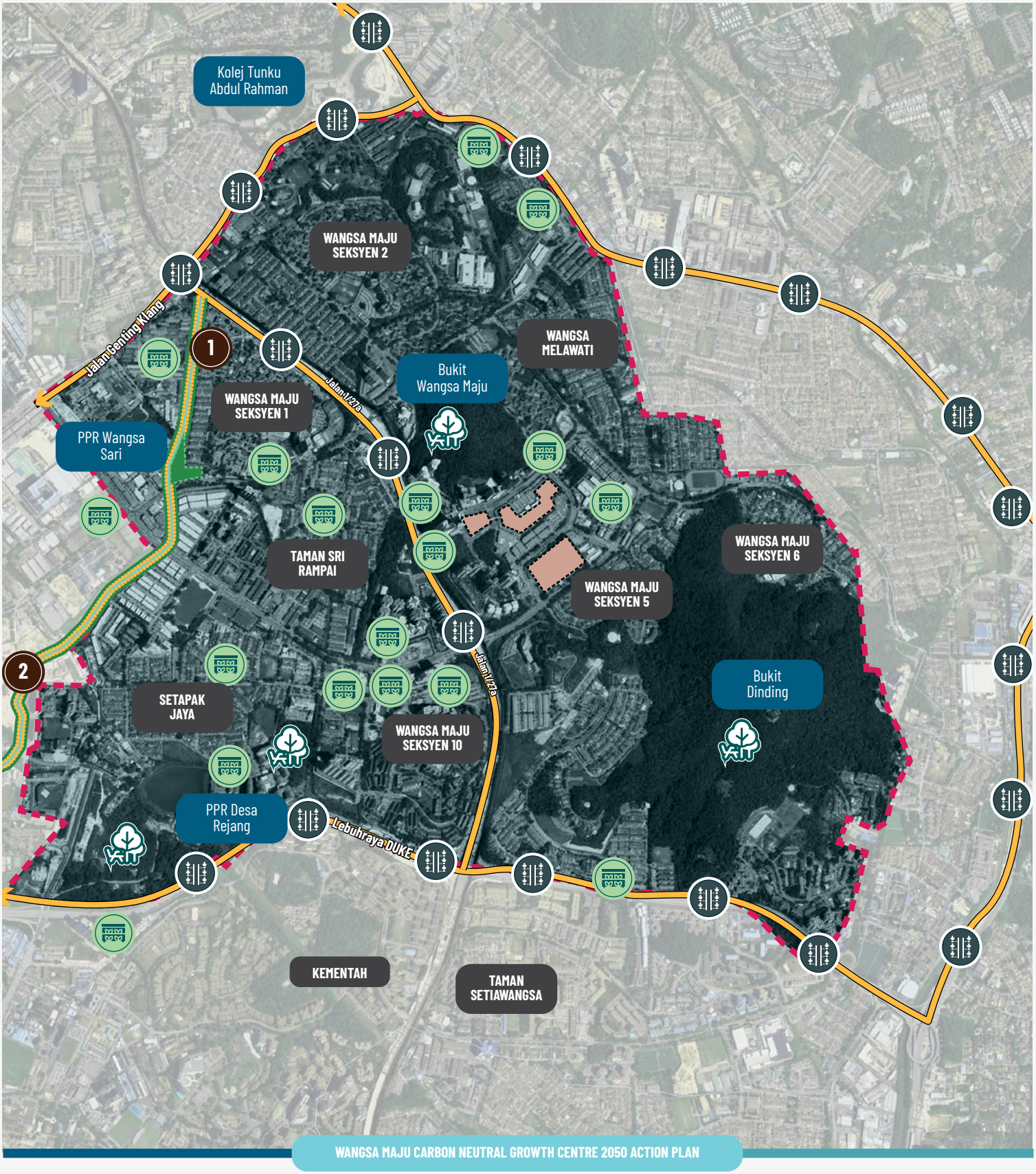
NOT TO SCALE

KL2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**



The Four (4) Proposed Initiatives of Green Sectors

Protect Existing Parks and Open Spaces

- Protect Parks and Open Spaces

Introduce Vertical and Roof Gardens

- Exterior Wall Fencing
- Retaining Wall Flyover Pillars
- Roof Garden

Create Linear Urban Parks Along River and Waterways Reserves

- Eco Park
- Linear Urban Park

Organise "Clean Up A River" Program

- Mudball Event (1 & 2)

- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

3.2.5 Green

The system of urban green and blue (water) spaces serves as the ecological framework for environmental and economic sustainability and social well-being. It is also an essential part of local climate management strategies because urban forestry and habitat restoration are among the simple and low-cost ways for carbon sequestration and for urban air quality management.

Urban green infrastructure is also a key measure for responding to the urban heat island effect through evaporative cooling and shading to create cooler microclimates. In the context of achieving carbon neutrality, urban greenery offers the potential to offset any remaining GHG emissions that may still be present. There are four (4) proposed initiatives as follow:

PROPOSED INITIATIVES

1. **Protect Existing Parks and Open Spaces**
2. **Introduce Vertical and Roof Gardens**
3. **Create Linear Urban Parks along River and Waterways Reserves**
4. **Organise "Clean Up A River" Program**

1 Protect Existing Parks and Open Spaces

Park and open space is defined as any area of land either specified or not, allocated or reserved wholly or partially specifically for public gardens, public parks, public sports and recreation fields, public leisure spaces, public pedestrian walkways or as public places. (National Landscape Policy, 2011).

There are seven (7) categories of open spaces according to the open space and recreational park hierarchy *(refer to Table 3.26)*. This hierarchy is adopted from the GP005-A 9th edition, Planning Guideline for Open Space and Recreation, Department of Town and Country Planning, Ministry of Housing and Local Government (2013).

TARGET/OUTCOME

(a) Carbon reduction contribution. According to Chave et al. (2005) trees in urban parks can sequester up to 179.0 tCO_2 per hectare.
(b) Co-benefit; greenery, shading, noise reduction, air temperature regulation, healthy living environment and aesthetical value

GUIDELINES/REFERENCES

1. Panduan Pelaksanaan Inisiatif Pembangunan Kejiranan Hijau
2. Garis Panduan Taman atas Bumbung by PLANMalaysia

Table 3.26 : Hierarchy of Open Space and Recreational Park

Hierarchy	Area (Hectare)	Population Threshold
Taman Nasional (National Park)	No limit	Throughout country
Taman Wilayah (Regional Park)	100	Throughout region
Taman Bandaran (Town Park)	40	50,000 people and above
Taman Tempatan (Local Park)	8	12,000 - 50,000 people
Taman Kejiranan (Neighbourhood Park)	2	3,000 -12,000 people
Padang Permainan (Playground)	0.6	1,000 - 3,000 people
Lot Permainan (Playing Lot)	0.2	300 - 1,000 people

Source: Photo by Abbilyn Zavgorodniaia on Unsplash

Parks and Open spaces are vital. Tree stands at the parks and open spaces play a significant role in carbon offsetting through sequestration of carbon dioxide emissions produced in the city. According to Chave et al. (2005), trees can sequester up to 179.0 tCO_2 per hectare. According to the Carbon Free Boston Summary Report (2019), carbon offsets will be necessary to achieve carbon neutrality. Parks and open spaces are also capable of reducing the air and land surface temperature and air pollution. Moreover, they are an important source for shades and biodiversity. Malaysia has been recognised as one of the 12 known 'mega-diversity' countries in the world (Forestry Department of Peninsular Malaysia, 2016). Cities with more parks and open spaces boost social cohesion and relations. It increases the well-being and health of people (release the stress of city life).

Unfortunately, to provide parks and open spaces is challenging especially in Kuala Lumpur. This is to due land scarcity and high land value. Urbanisation leads to the growth of cities and population. To accommodate population increase, land is developed into buildings and other artificial and impervious surfaces. Hence, it limits the availability of land for parks and open spaces. Currently, tree canopy cover of Kuala Lumpur is about 17% (KL LCSBP 2030).

By comparison, the City of Melbourne has set a target of 40% tree cover by year 2040 (Melbourne, 2014). Apart from carbon sink, tree canopy cover is also found to increase property value up to 38% at the county-level and 30% at the property level in the United Kingdom (Siriwardena et al. (2016).

BEST PRACTICES

1. Helsinki, Finland

- The estimate made in 2014, the tree stand, vegetation and soil of the Helsinki urban area have sequestered approximately 1,250 kilotonnes of carbon
- Forests and wooded areas owned by the City of Helsinki (including City-owned areas outside the City borders) will be kept vegetative, covered and diverse with various tree species and sustainable forestry. Meanwhile, the forest network in the Helsinki city plan (including conservation areas and forests in the green network) will be implemented by reforesting open spots and complementing the city structure with tree stands that do not cast shadow on the solar power potential.
- Duration or implementation timeline : Council term (2017–2021), continuous

PROJECT COMPONENTS

(a) Review of related policies, guideline, law and act

Parks and open spaces provides the natural and economical values for urban dwellers. Managing and protecting the parks and open spaces are not an easy task. Review on policies or by-laws related to the preservation and protection of trees can helps managing and protecting the parks and open spaces *(refer to Table 3.27)*. It aid in better clarification and management, protect the important function of parks and open spaces as well as prevents intruder to carry put illegal activities such illegal tree cutting.

Table 3.27: Review on Policies or By-Laws Related to the Preservation and Protection of Trees

Policies or by-laws	Details
Federal Territory (Planning) Act 1982 (Act 267)	**Part V** Preservation and Planting of Trees 35. Tree preservation order If it appears to the Commissioner that it is expedient in the interest of amenity to make provision for the preservation of any tree, trees or groups of trees in the Federal Territory, he may for that purpose make an order, which in this Act is referred to as a "tree preservation order", with respect to such tree, trees or groups of trees as may be specified in the order, and in particular, provision may be made by any such order— (a) for prohibiting the cutting down, topping, lopping or wilful destruction of trees, except with the consent of the Commissioner; and (b) (b) for securing the replanting in such manner as may be directed by or under the order: Provided that this section shall not apply to the cutting down, topping or lopping of trees which are dying or dead or for the prevention of imminent danger.
Local Government Act 1976 (Act 171)	**Part XII** Further Powers of Local Authority 101.In addition to any other powers conferred upon it by this Act or by any other written law a local authority shall have power to do all or any of the following things, namely— (b) to plant, trim or remove trees; (c) (i) to construct, maintain, supervise and control public parks, gardens, esplanades, recreation grounds, playing fields, children's playgrounds, open spaces, holiday sites, swimming pools, stadia, aquaria, gymnasia, community centres and refreshment rooms; (ii) to lease, acquire, let, layout, plant, improve, equip and maintain lands for the purpose of being used as public parks, gardens, esplanades, recreation grounds, playing fields, children's playgrounds, open spaces, holiday sites, swimming pools, stadia, aquaria, gymnasia and community centres and to erect thereon any pavilion, recreation room or refreshment room or other buildings; (iii) to support or contribute to the support of public parks, gardens, esplanades, recreation grounds, playing fields, children's playgrounds, open spaces, holiday sites, swimming pools, stadia, aquaria, gymnasia, community centres and charitable, religious, educational, social or welfare organizations or institutions;
Planning Guideline for Open Spaces, Kuala Lumpur City Plan (2015)	6.0. Guideline (i) Public Open Spaces Applicable for development proposals involving gross site area in excess of 10 acres. Specifications of public open spaces are as follows: ◢ 5% of net site area ◢ Marked and submitted for public open spaces ◢ Open space can also be provided in the form strata ownership (ii) Centered Open Spaces Applicable for development proposals involving net site area in excess of 20,000 square feet. Specifications of centered open spaces are as follows: ◢ 10% of net site area ◢ Area of centered open spaces is not less than 8% on land can be allowed with conditions provide at least 16% (net site area) open space on the podium level. ◢ Marked on the approval plan and maintained by the owner or MC to be established. ◢ Open space requirements based on plot separate after the process of subdivision of land lots.

PROJECT COMPONENTS

(b) Tree inventory program

Tree inventory should be conducted to understand current situation such as species composition and tree condition in Wangsa Maju. Tree inventory also creates a valuable database for KLCH and public to identify, monitor, maintain and report any incidents to the trees.

Currently such complete and comprehensive inventory is not available although inventory or directory of public parks is available. KLCH has started Global Positioning System tagging of trees planted since 2011 under the Greener KL and has completed Global Positioning System (GPS) tagging of ~85,000 trees (PEMANDU, 2013). According to the Landscape and Recreation Development Department (JPLR), KLCH, the total number of 12,319 trees in Wangsa Maju have been inventoried. With a more complete and comprehensive database, an enforcement of the Tree Preservation Order may become possible in the future to protect trees in Kuala Lumpur.

- Inventory of available trees in Kuala Lumpur city including their species, age, location, size, health and function
- Use of geospatial technologies such as drone, satellite images and GIS can help the process of tree inventory in Wangsa Maju
- Develop Tree Inventory Summary Report. The report discuss the species composition, tree condition and maintenance recommendations *(refer to Figure 3.62)*.

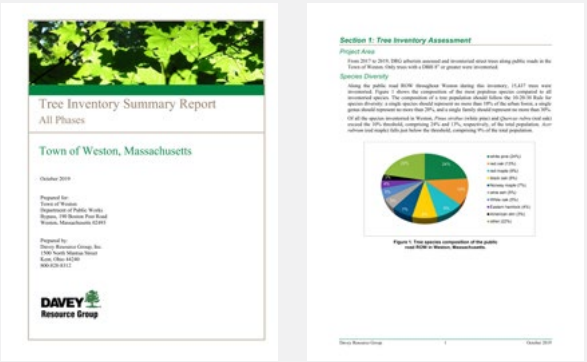


Figure 3.62: Example of Tree Inventory Summary Report

(c) Tree planting plan through 'One Resident One Tree' program

Planting trees is necessary to maintain canopy cover and replace trees that have been removed or lost to natural mortality (expected to be 1–3% per year) or other threats (for example, construction, invasive pests, or impacts from weather events such as storms, wind, flooding, and drought).

Each resident of Wangsa Maju should be encouraged to plant a tree within their residential areas or take part in the tree planting activities. Standards to select appropriate tree species to be planted at a particular location can be developed. Several measures should be taken into consideration during the selection of trees namely;

- Tree species and their function
- Native or non-native species. Native species with long-lived capability, low maintenance cost, visually attractive, high adaptive capacity and suitable to the site conditions are more encouraged to be planted in Kuala Lumpur
- Form and size of the trees. as trees may experience space constraints at maturity. Large canopy trees are suitable for open parks whereas tall trees with narrow crowns are best to be planted between buildings. For example, Hopea Odorata is very suitable to be planted along walkway and roadside because it can be maintained easily and can provide shades with its dense crown. Meanwhile, Samanea saman which has large and attractive canopy could be a good choice for public parks.
- The ease of tree maintenance including branch felling and shallow rooted trees
- Soil condition, exposure to available sunlight and surrounding environmental conditions
- For long term health it is critical to select species that are resilient to insects and diseases

Table 3.28 shows that example of the tree species and their characteristics as a general guide for planting considerations. The details of project implementation status that involve building partnership for Protect Existing Parks and Open Spaces are explained in Table 3.29.

PROJECT COMPONENTS

Table 3.28: Examples of Tree Species with Their General Characteristics and Suitable Locations

No.	Species Scientific name	Shape	Height	Growth rate (per year)	Management	Suitable location
1	Cinnamomum iners *Kayu Manis Hutan*		10 - 15 m	1.5 - 2.5 m	Medium	(1) roadside/railway; (2) park; (3) residential; (4) parking lot; (5) facilities; (6) industry; (7) river; (8) public building
2	Delonix regia *Semarak api*		10 - 15 m	> 2.5 m	Medium	(1) park; (2) industry; (3) river
3	Fagraea fragrans *Tembusu*		> 15 m	< 1.5 m	Medium	(1) park; (2) industry; (3) river (4) facilities; (5) cemetery; (6) public building
4	Khaya senegalensis *Khaya*		10 - 15 m	1.5 - 2.5 m	Easy	(1) park; (2) industry; (3) river; (4) public building; (5) residential; (6) pedestrian/ bicycle lane; (7) parking lot
5	Melaleuca leucadendron *Gelam*		10 - 15 m	1.5 - 2.5 m	Medium	(1) roadside/railway; (2) park; (3) facilities; (4) industry; (5) river; (6) public building
6	Mimusops elengi *Tanjung*		10 - 15 m	< 1.5 m	Medium	(1) roadside/railway; (2) park; (3)public building; (4) residential; (5) river; (6) pedestrian/bicycle lane; (7) parking lot
7	Pterocarpus indicus *Angsana*		> 15 m	1.5 - 2.5 m	Medium	(1) park; (2) river; (3) facilities; (4) industry
8	Adenanthera pavonina *Saga*		10 - 15 m	< 1.5 m	Easy	(1) roadside/railway; (2) park; (3) river; (4) pedestrian/bicycle lane; (5)industry

Table 3.29: Building Partnership for Protect Existing Parks and Open Spaces

	Building Partnership
Implementation Approaches	KLCH to work with MNS, LA21 and Community
Estimated Cost	Tree planting : RM 10-15 mill. (per year) Technology (Tree Inventory) : RM 200,000- RM 2,000,000
Timeline	◢ 2022-2025 : tree planting, site inventory (including developer and private site) ◢ > 2030 : Use of geospatial technologies for tree inventory
Implementers	KLCH (JPLR), Residents Assoc/ Management Corporation, Private Sectors
Agency	-
KLCH dept.	JPLR, JPPH, JPRB (LA21 KL), JKAS

POTENTIAL LOCATIONS

1. Neighbourhood open spaces and recreational areas (refer to *Figure 3.63*, *Figure 3.64* and *Figure 3.65*)
   - Public open spaces (OS1): 165.54 acre
   - Private opens spaces (OS2): 354.05 acre
2. Bukit Wangsa Maju
   - Area: 38.88 acre
   - Height: 190 meter
   - Lot 28143
3. Bukit Dinding (Part of)
   - Area: 50.61 acre
   - Height: 290 meter

FIGURE 3.63

Location of Parks and Open Spaces

- Vacant Land
- Open Space
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

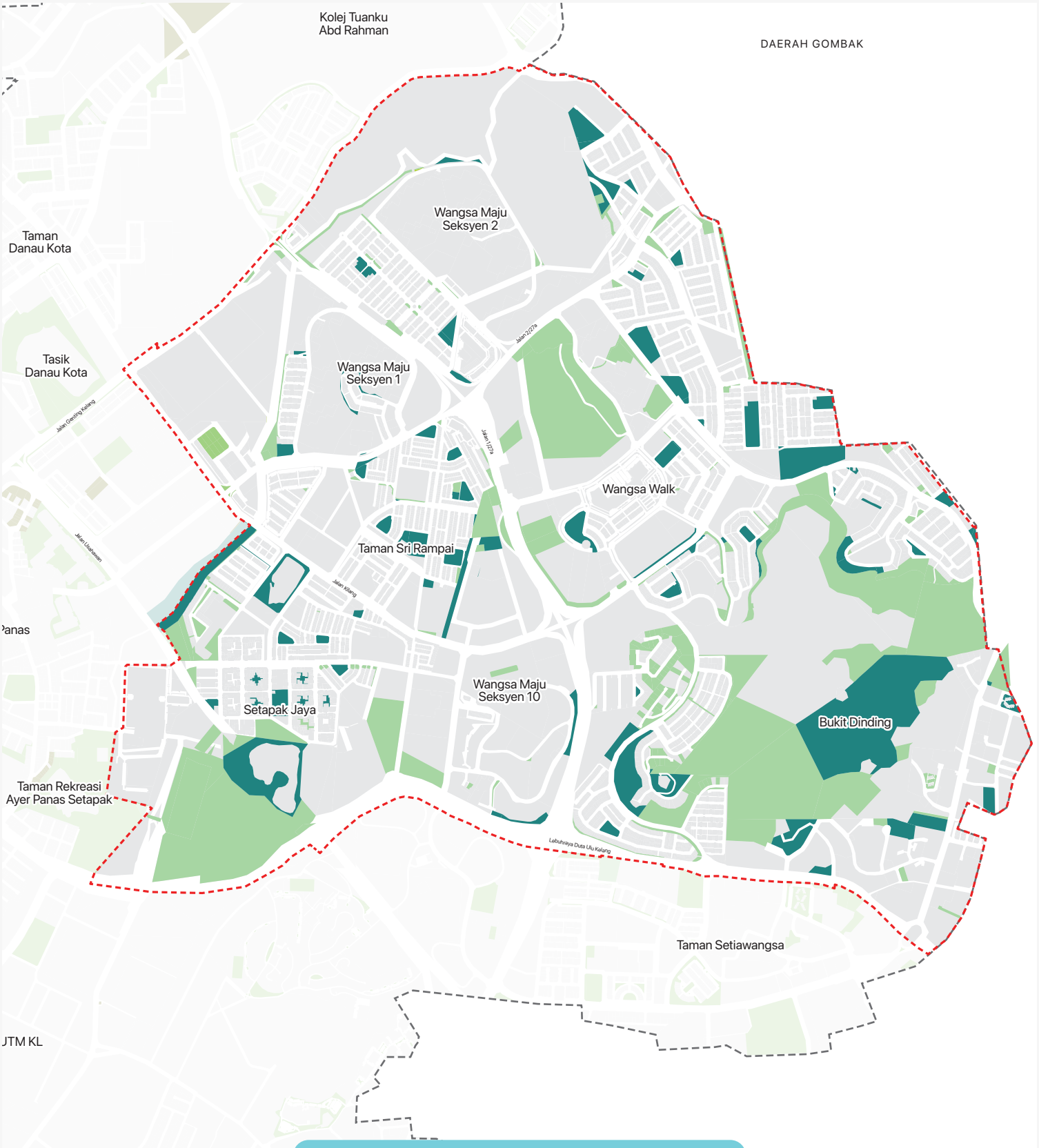


FIGURE 3.64

Status of Parks and Open Spaces

- Public Open Spaces (OS1)
- Private Open Spaces (OS2)
- Wangsa Maju CNGC Boundary

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NOT TO SCALE

Source: **KLCH, 2021**

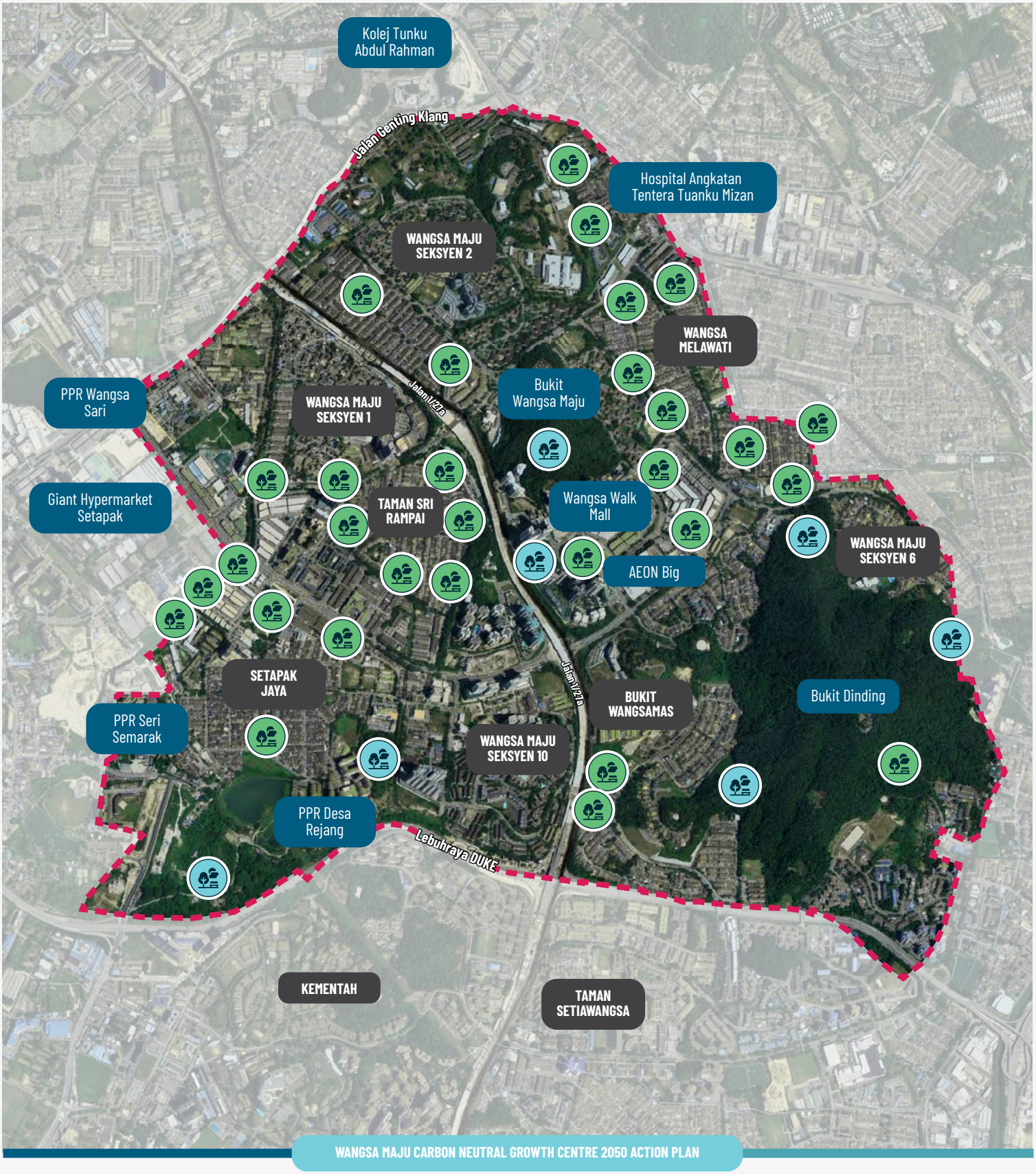

FIGURE 3.65

Parks and Open Spaces from the Aerial View

Private Open Spaces

Public Open Spaces

Wangsa Maju CNGC Boundary

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NOT TO SCALE

Source: **Google Earth, 2021**

2 Introduce Vertical and Roof Gardens

The first step toward making the cities healthier is to plan for green spaces wherever possible. Adding a layer of vegetation to rooftops and creating green roofs, for example, has been shown to reduce the urban heat island effect.

Meanwhile, vertical greening, also known as facade greening, green wall, vertical garden, or living wall, is a living and self-regenerating cladding system that could be applied on the interior and exterior wall of buildings. The wall will be covered with greens by self-clinging or growing on supporting structures is known as vertical greening.

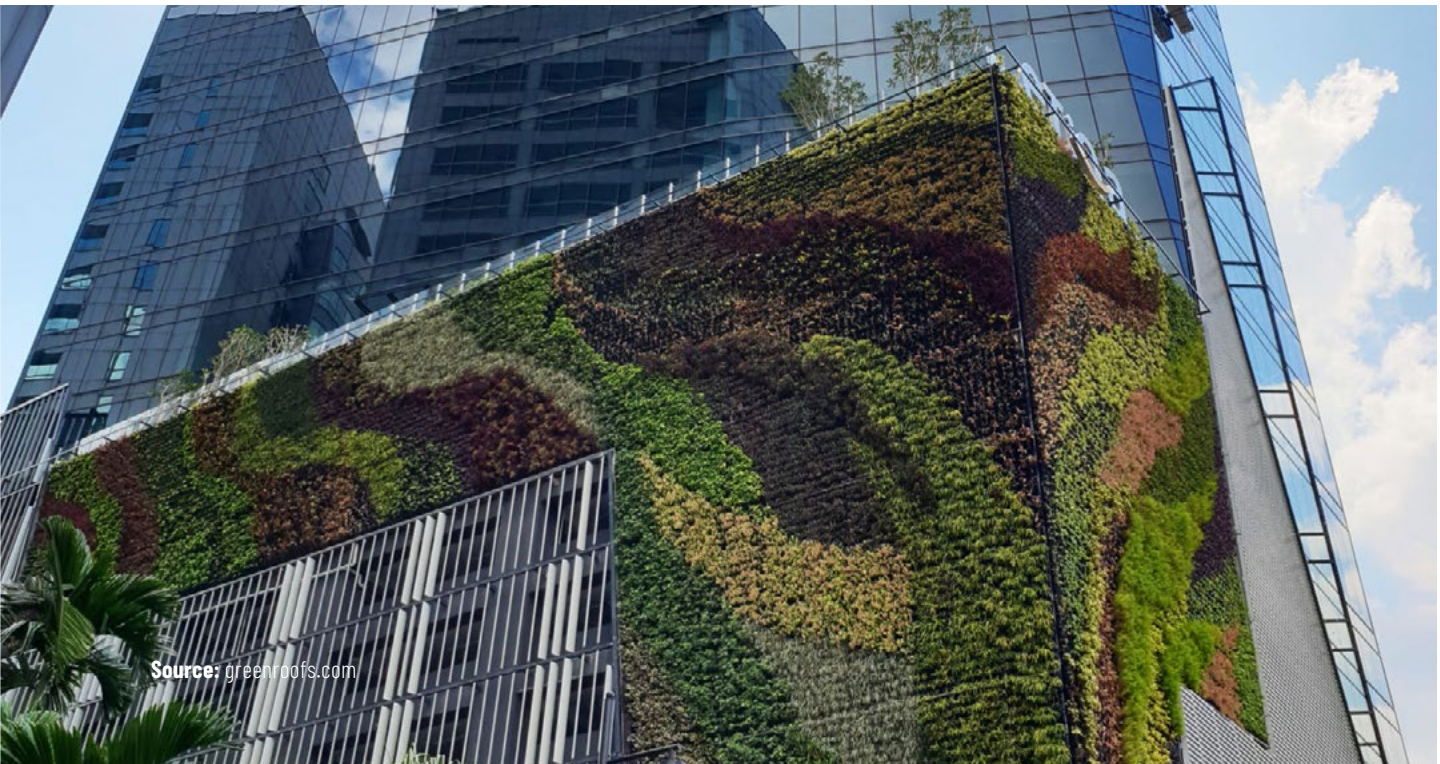
Soil, plants, and greenery on building envelopes (roof and walls) would reduce surface temperature while also acting as insulation for the structures below, lowering the amount of energy required to heat and cool the buildings. Green roofs and vertical walls can also help to regulate rainwater by catching it as it falls and filtering it to remove pollutants.

The vertical and roof top greening can help to absorb carbon dioxide in the urban area then replace with oxygen to improve carbon neutralization. green walls exemplify sustainability, not just for the building itself, but also for those who use it, and have become an integral part of the green building or sustainable construction movement, which has been growing in popularity since the early 1990's. Thus, the proposal of Vertical Green and Roof garden applications aims to reduce greenhouse effect in Wangsa Maju, Kuala Lumpur towards a low carbon city by year 2050.

BEST PRACTICES

1. Menara Etiqa, KL (Veritas, 2020)

- The Etiqa Office Tower is an office development comprising of a 35-storey office tower with an 8-storey podium car-park located on a site of 50,000 sm along Jalan Bangsar, Kuala Lumpur.
- The project is seeking two sustainability certifications: gold certification under the Green Building Index (GBI) and platinum certification under GreenRe.
- One of the building's most distinctive features is its striking green façade, which covers approximately 1,000 square metres and wraps around one corner of the parking podium.
- The covered all of the building's exterior edges and created an enveloping effect when fully planted with VersiWall® GP 2060 (VGP) Trays Mounting Panels.
- VGP 2060 Trays were installed on the external façade of Menara Etiqa. Each tray can be serviced from the multi-storey parking garage. The 1,000 m^2 green wall was constructed using 1,200 VGP Trays.
- Each tray is made up of 1,200 VGP trays filled with 34 species of plants. Water and fertiliser were fed to each tray directly from irrigation pipes, segmented into zones for efficiency and longevity. Each tray has a baffle plate and reservoir installed to maintain healthy plant growth.



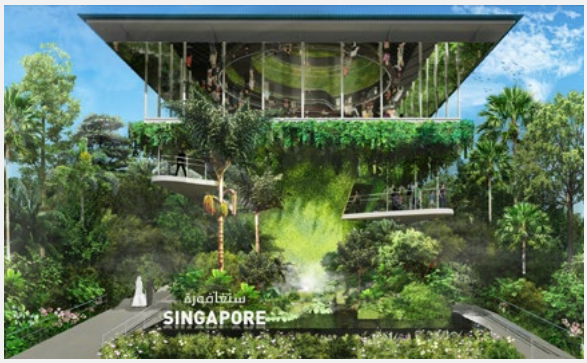
Source: greenroofs.com

BEST PRACTICES

2. Raffles Place, Singapore

- At 19 metres tall and 110 metres wide, this stunning green wall on the Ocean Financial Centre once held a Guinness World Record for being the world's largest vertical garden, made up of 57,000 plant pots.
- All 25 plant species in this garden are used to create a three-dimensional map of Singapore, Southeast Asia, and the world. To create a 3D effect, plants of various sizes were cleverly designed to protrude, mimicking mountain ranges and waves.
- On top of its engineering marvel, the green wall also provides environmental benefits by removing carbon dioxide and pollutants from the atmosphere, which lowers temperatures and reduces greenhouse gas emissions. In addition to lowering surface temperatures, it also reduces energy consumption in interior spaces because it is located outside.
- As a high-rise building, Ocean Financial Centre is known as one of the greenest in the country, so this green piece of art is a perfect fit for the building.

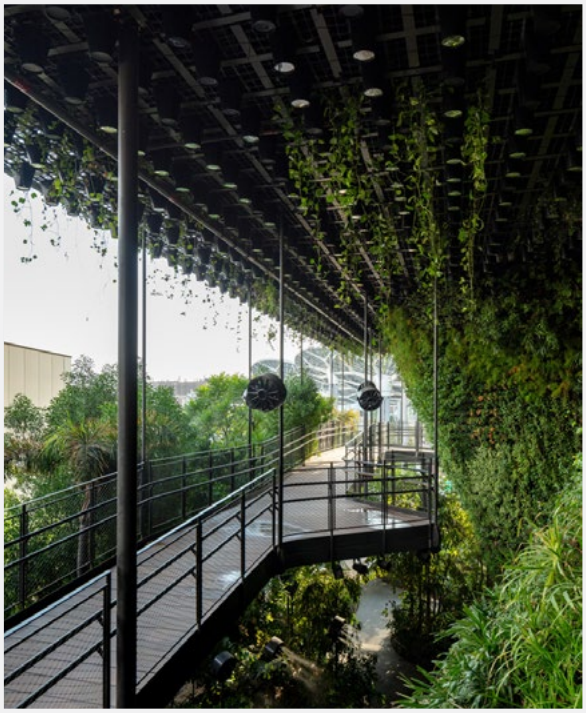
Source: rafflesplace.sg



Source: www.archdaily.com

3. Singapore Pavilion, Dubai (Cutieru, 2021)

- The Singapore Pavilion at Expo 2020 Dubai demonstrates the city's vision for a sustainable future that integrates architecture, nature, technology, and culture. "Nature.Nurture. Future" is the name of the pavilion designed by Salad Dressing and WOHA Architects, which demonstrates Singapore's City in Nature vision by displaying a small sample of the city's urban landscape.
- Technology and nature merge to create an eco-system highlighting the concepts of sustainability and resilience through a multi-layered landscape.
- Singapore's tropical rainforests, mangrove swamps and forest streams are all depicted in the pavilion's three-dimensional green space, which includes more than 170 varieties of plants from Singapore's diverse habitats. On-site solar desalination water is used for drip irrigation, which reduces water consumption by a significant amount.



Source: www.archdaily.com

PROJECT COMPONENTS

Greening the building envelope is not just a matter of covering the exterior of the structure with vegetation. The use of greening systems, such as green roofs and green walls, is becoming increasingly popular as an architectural feature. Even with today's cutting-edge systems, plants can still provide a significant functional benefit to buildings, and this can be used as part of a more long-term approach to urban rehabilitation and building retrofitting.

(a) The types of the green walls

As shown in number of studies conducted in recent years, green walls can help to restore an area's natural beauty and increase its energy efficiency (Manso and Castro-Gomes, 2015). According to the content analysis, there are four types of vertical green wall available in the market, namely Cassette system, Planter system, pocket system and support system as shown in Table 3.30. The types of the green walls are applicable to the Wangsa Maju context including building facades, fencing of the building boundaries, public amenities and infrastructures. The classifications of the types of vertical green wall as listed.

Table 3.30: The Types of Vertical Green Wall

System	Cassette	Planter	Pocket	Support
				
Type	Interior, Exterior, decorative wall	Exterior	Exterior	Exterior
Maintenance cost	High	Median	Median	Low
Preference	Private property	Private property	Private property	Public amenities & Infrastructure

(b) The role of green wall

Green walls alone will not solve the problems caused by urbanisation. They can, however, be an important part of a larger strategy to increase the sustainability of the built environment: some of the benefits include reduced noise pollution, improved air quality, and cost savings (Mulhern, 2020). Based on *Figure 3.66* shows that the mean wall surface temperature in summer for a) exterior wall and b) interior wall. The role of green wall in climate change mitigation includes the followings:

Regulating Energy Use
Reduce the energy consumption of buildings by creating microclimates within the urban environment that help regulate temperatures.

Cities with Lungs
The greeneries absorb and store carbon dioxide which is the primary greenhouse gas. With ever denser cities, space available to greenery becomes ever more limited as the need to provide shelter continues to grow.

Recycling Buildings
The aesthetic appeal of green walls cannot be overlooked, despite the fact that they are not directly linked to climate change mitigation

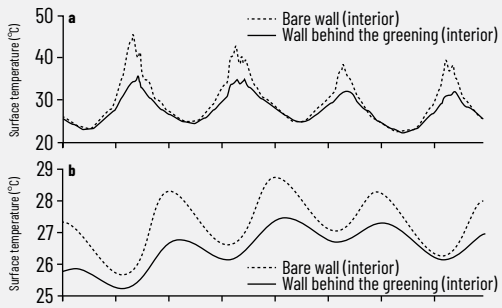


Figure 3.66: Mean Wall Surface Temperature in Summer for a) Exterior Wall and b) Interior Wall

Source: Hoelscher, M.-T., Nehls, T., Jänicke, B. & Wessolek, 2016)

PROJECT COMPONENTS

(c) Carbon Sequestration Calculation (Groundcovers, climbers, creepers):

Carbon dioxide emissions can have a negative impact on the surrounding environment. Due to the rise in carbon emissions, which is a major contributor to the greenhouse effect, particularly in urban areas. Carbon sequestration is defined as a method or process of moderating carbon dioxide in the atmosphere to prevent it from polluting it. (Othman and Kasim, 2016).

It's a promising method for reducing carbon dioxide emissions to the atmosphere by selecting an appropriate plant species and arranging plant materials in a more efficient manner. The rate of carbon sequestration is strongly influenced by factors such as location, age, diameter, and height in addition to plant characteristics. The formula below shows the methodology of carbon sequestration on climbers, shrubs and groundcovers (Zaid et al., 2018).

Carbon Rating System Point (tCO_2e): tCO_2e I = $TCO_2W/1000$
TCO_2W (Total CO_2 Weight) = TCW × 3.6663
TCW (Total Carbon Weight) = TDW × 0.427
TDW (Total Dry Weight) = 0.56 × area in meter squared

1 sqm x VGS (Vertical Green System)

tCO_2e: tCO_2e I = 0.877/1000	= 0.0009
TCO_2W = 0.239 × 3.6663	= 0.877
TCW = 0.56 × 0.427	= 0.239
TDW = 0.56 × 1	= 0.56

(d) Type of Plants

Photosynthesis allows all plants to capture and store carbon in their bodies. Plants with high carbon sequestration rates, on the other hand, are critical for effectively reducing carbon in the atmosphere. Plants with larger surfaces and dark green leaves, such as Petrea Volubilis (Sandpaper vine), Argyreia nervosa (Elephant creeper), Quisqualis indica (Rangoon creeper), Cucumis sativus (Cucumber), and Sechium edule (Chayote), have a higher carbon capture rate because they have a large surface area with a high amount of chlorophyll for maximum photosynthetic rate (A. Abdullah, 2011). Plants with a high Leaf Area Index (LAI) sequestered CO_2 effectively (Gratani, Varone and Bonito, 2016). However, some plants with small leaf areas, such as Clitorea ternatea (Bluebell vine) and Psedocalymma alliaceum (Garlic vine), can achieve the same photosynthetic rate as larger leaf plants by having more leaves.

Apart from leaves, stems play a significant role in carbon sequestration. Woody plants with many branches store a lot of carbon, about 2.35–2.5 times more than soft stemmed plants According to various studies, trees with large trunks can sequester more carbon than trees with small trunks (Othman and Kasim, 2016). (Isa et al., 2014, Terakunpisut et al., 2007).

Table 3.31 shows the list of several tropical flowering climbers for high potential carbon sequestration rates based on plants features, while Table 3.32 shows the lists of several climbing vegetable for potential carbon sequester plants in tropical area.

GUIDELINES/REFERENCES

1. Panduan Pelaksanaan Inisiatif Pembangunan Kejiranan Hijau
2. Garis Panduan Taman atas Bumbung by PLANMalaysia
3. Garis Panduan Perancangan Kejiranan Hijau
4. A Handbook On Developing Sustainable Highrise Gardens [Bringing Greenery Skywards]

TARGET/OUTCOME

Application of Vertical Green Wall System estimated to target total carbon sequestration approximately 14.8, based on the estimated total area of VGS area 16,455 sqm around the Wangsa Maju area

Table 3.31: The List of Several Tropical Flowering Climbers

Species	Plants Characteristics	Environmental Requirements	Others
 Scientific name: *Cliwri.a l'ernatea* Common name: Bluebell vine	• Height: 1.83 m • Leaves: small, many, dark green, 3-5cm • Stems: thin, twining, <2cm diameter	• Light: full sun/ partially shade • Moderate water • Very low maintenance	• Rapid growth • Used in traditional medicine & as food coloring agent • Can grow in wide range soils however, suits to grow in moist and soil pH 6.6-7.5 • Air Pollution Tolerance Index: 12.26-14.14 (Pandey et al. 2015) • Native to Africa and Indian Ocean (Cook et al., 2005)
 Scientific name: *Congea wmenwsa* Common name: Shower orchid	• Height: could reach 6.1 m • Leaves: broad, light green • Stems: woody • Roots: Fibrous	• Full sunlight • Water regularly • (moderate) • Prune may required	• Fast growth • Flowers will initially white color and change into pink later • Native to Indian sub-continent (India, Bangladesh), China (Yunan), Indonchina (Thailand, Myanmar, Laos, Vietnam) and Malaysia (NParks, 2013)
 Scientific name: *Argyreia nervosa* Common name: Elephant creeper	• Height: 9-15m • Leaves: large dark green • Stems: thick and become woody with age • Roots: Tap root	• Water: regularly (moderate) • Light: full sun	• Fast growth rate • Preferred acidic soils (pH = 5-6), well drainage • Ornamental plants • Air Pollution Tolerance Index: 13.03-15.13 (Pandey et al., 2015) • Native to India (NParks, 2013)
 Scientific name: *'J'ri.s!'ellateia australasiae* Common name: Australian gold vine	• Height: 10m • Leaves: oblong (7-12cm), lush green • Stems: woody, various long stem	• High water requirement • Light: full sun • May require little pruning	• Fast growth rate • Loam or sand soil type • Native to Tai wain, Southeast Asia to Australia, and the western Pacific (NParks, 2013)
 Scientific name: *Petrea volubilis* Common name: Sandpaper vine	• Height: reached 12 m • Leaves: broad, dark green on above part, light green on below part • Stems: twining woody stem	• Full sun/semi-shade • Medium water	• Medium growth rate • Ornamental plants • Prefer fertile and well dra ined soils • Air PolJution Tolerance Index: 16.69-19.21 (Pandey et al., 2015) • Native to tropical America (NParks, 2013)
 Scientific name: *Pseudocalymma alliaceum* Common name: Garlic vine	• Height: up to 12m but usually 3m • Leaves: small, bright green • Stems: woody	• Full sun/ half shade • Moderate water • Moderate fertilizing • Pruning (If necessary)	• Moderate growth • Ornamental plants, leaves garlic-like smell • Have medicinal values • Native to tropical America (NParks, 2013)
 Scientific name: *Thunbergia laurifolia* Common name: Blue trumpet vine	• Height: grows up to 12 m • Leaves: bright green, broad • Stems: woody, thick • Roots: Tuberous	• Full sun • Water moderate & regularly • Required slightly acidic soil • Need to pruning	• Fast growing • Ornamental flowers • Need fertile and well drainage • Native to India and Malaysia (NParks, 2013)
 Scientific name: *Antigorwn lepwpus* Common name: Honolulu creeper	• Height: Grow up to 10-13 m • Leaves: broad, light to dark green • Stems: branched, old stem became woody • Roots: Fibrous	• FulJ sun • Prefer little water • Require regular pruning	• Fast growing • Can adapt in most soil type • Air Pollution Tolerance Index: 21.07-23.98 (Pandey et al., 2015) • Native to Mexico (NParks, 2013)
 Scientific name: *Quisqualis indica* Common name: Rangoon creeper	• Height: grows up to 15 m • Leaves: broad, dark green • Stems: woody	• Full/ partial sun • Moderate water	• Fast growth • Soil requirements: rich, moist and well drained soil • Air Pollution Tolerance Index: 18.20-20.15 (Pandey et al.,m2015) • Native to Philippines, India and Malaysia (NParks, 2013)

Species	Max. carbon sequestration	Plants Characteristics	Environmental Requirements	Others
 Scientific name: *Vallaris glabra* Common name: Bread flower	• > 0.05 tCO_2e (Othman and Kasim, 2016)	• Height: 2-3 m • Stem: thin, woody • Leaves: broad • Flowers: small whitish fragrance, inflorescence • Roots: Tap root • Have dry fruits • Reproduce via roots & shoots	• Water: regularly (moderate) • Light: full sun exposure • May need prune to control shape & size	• Moderate growth rate • Grow in moist and well-drained soils • Ornamental plants • Flowers attract bees, butterflies & birds • Native to Jawa, Indonesia (World Plants, 2015)
 Scientific name: *Thunbergia grandiflora alba* Common name: White sky vine	• > 0.05 tCO_2e (Othman and Kasim, 2016)	• Height: grows up 15 m • Stem: woody, thick • Leaves: bright green, larger • Flowers: white color • Roots: tuberous • Reproduce via seed, shoots & roots	• Full sun • Moderate water	• Fast growing • Ornamental plants • Need fertile and well drainage • Native to Indian sub-continent, southern China and Myanmar (BioNET-EAFRINET, 2011)
 Scientific name: *Psophocarpus tetragonolobus* Common name: Winged bean	• 0.94 kg CO_2/year/m^2 (Amir et al.,2014)	• Height: grows up 4 m • Stem: thin, twinning • Leaves: large • Flowers: light-blue/ white • Roots: tuberous • Have edible fruits • Reproduce via seeds	• Full sun tolerance • Require lots of water • Does well in variety soils except sands or high salinity • Soils pH: 4.3-8.5.	• Fast growing, however slow growth rate during seedlings (0-6 weeks). • Have medicinal properties • Edible plant • Nitrogen fixer • Native to East Africa, Papua New Guinea and India (NParks, 2013)

Table 3.32: The List of Several Climbing Vegetable for Potential Carbon Sequester Plants in Tropical Area

Species	Plants Characteristics	Environmental Requirements	Others
 Scientific name: *Phase lus vulgaris* Common name: Common bean	• Height: up to 3 m • Leaves: Long & wide, dark green • Stems: thin, twining • Roots: Fi bro us	• Full sun • Moderate water	• Rapid growth • Require well-drained, sandy loam, silt loam or clay loam soils, rich in organic content. • Soils pH: 4-9 • Native to Peru (Amir et al., 2011)
 Sc ientific name: *Vigna unguiculata sesquipedalis* Common name: Long bean	• Height: up to 4 m • Leaves: Long & wide, dark green • Stems: thin, twining • Roots: Tap root with many lateral root	• Full sunlight • Water regularly (moderate)	• Fast growth • Grows well in poor soil s with more than 85% sand and with less than 0.2% organic matter and low levels of phosphorus. • Soil pH: 4.3-7.5 • Native to Africa and Asia (Burnham, 2013)
 Scientific name: *Pisum sativwn* Common name: Pea	• Height: up to 3. 7 m • Leaves: small, broad, dark green • Roots: Tap root	• Full sun • Moderate water	• Fast growth • Slightly acidic, well-drained soils. • Soil pH: 6.0-7.0 • Native to Asia or possibly Europe and Southwest Asia (Burnham, 2013)
 Scientific name: *Cucumis salivus* Common name: Cucumber	• Height: up to 2 m • Leaves: wide, broad, dark green • Stems: thick • Roots: Thick, long tap root	• Full sun • Regular water	• Fast growth rate • Preferred well drained soils and suitable for light sandy, medium loamy & heavy clay suiis • Native to Southern Asia (Burnham, 2013)
 Scientific name: *Sechium edule* Common name: Chayote	• Height: up to 15m • Leaves: wide, broad, dark green • Stems: thick • Roots: tuberous	• Full/ partial sun • Average water	• Fast growth • Edible almost all parts • Grows in well drained soils, preferred sand & loam soils • Soils pH: 5-6 • Native to Mexico, Guatemala (NParks, 2013)

PROJECT COMPONENTS

(e) Manufacturer and Supplier Input

In order to understand the details of vertical green roof and urban farming, the interviews have been conducted by the project team. Two manufacturers or suppliers of urban farming products and vertical green wall suppliers have been approached by the team. The findings of the interviews presented as follows:

(a) UFT TECH HUB (Urban Farming Consultancy)

Aquaponics Farming

The advantages of the proposed urban farming prototypes include:

- Can integrate with fish pond
- Edible plants
- Enhance interaction with the users (especially school projects)
- Require higher maintenance and quality control
- Consider the life cycle of the plants (growth, mature, dead), may affect its physical appearance

A school project located in Petaling Jaya, Kuala Lumpur. The installation of Aquaponics system with fish pond to advocate urban farming in the school, interaction of the students with the system is addressed from this project. The cost of the project is around RM 7000, including the cost of the system, equipment cost and installation cost.

Source : www.urbanfarmtech.my

(b) Belalang Inovasi

Based on Table 3.33, there are 2 types of Green Wall System and 1 type of Green Roof System introduced by Belalang Inovasi as the case study, namely:

- **GWS Modular (Pot) System**
- **GaiaWall (Soil-less) System**
- **GaiaMat System**

Table 3.33: The Types of Green Wall System and Green Roof System

System		
GWS Modular System	**GaiaWall (Soil-less) System**	**GaiaMat System**
Type		
Pot system	Piece of board attached to existing surface	A roll-able mat placed on roof surface
Cost/sqm		
RM1200 - RM1400	RM1000 - RM1200	RM250 - RM300
Others		
○ Neatly Arrange ○ Customizable (Wording, brand's name)	○ Easy installation ○ More sustainable ○ More natural appearance	○ Max roof pitch 40° ○ Hardy plants ○ Less maintenance ○ Easy installation

PROJECT COMPONENTS

GWS Modular (Pot) System

Belalang Inovasi has good experience in working with similar context in the city of Singapore. This system is suitable to be implement in indoor and outdoor, while it is applicable to the context of Wangsa Maju. The appearance of this system is more organized, we can customize the plants to showcase the name, branding, pattern or any wordings.

The pot system is installed at the fencing along

Source: belalang.com.my

the road, similar strategy to our proposal which we will install at the fencing of the schools and public institutions.

The system acts as feature wall and shows the name of the area. Various interesting patterns could be designed with this system.

Gaia Wall System (Soil-less)

A more sustainable solution which does not require plastic pot material to contain the plants.

The system can be installed by attaching the system to the existing wall, it presents a more natural and soft character to the space, enhance the natural ambience of the place.

Source: belalang.com.my

GaiaMat System (Green Roof)

This green roof system is flexible and easy to install. A piece of mat is sufficient give a natural and green character to the building's rooftop. The system uses hardy plants as a more sustainable solution to reduce the maintenance cost.

Source: belalang.com.my

The rooftop should be accessible for installation and maintenance, sloping angle of the pitch roof may not exceed 40 degree for this system. Recommend to replace with VGS if the roof pitch sloping angle exceeds 40 degree.

A project done in Johor Bahru, this system is applicable to steel, concrete and glass roof materials. This system can give a natural look to the roof and building.

Source: belalang.com.my

Source: belalang.com.my

VGS integration in urban areas is one effective strategy for mitigating UHI impacts, as vegetation provides carbon sequestration potential, shade and lowers urban temperatures, and fresh air and oxygen to urban dwellers in close proximity. Application of Vertical Green Wall System estimated to target total carbon sequestration approximately 14.8, based on the estimated total area of VGS area 16,455 sqm around the Wangsa Maju area.

The factors affecting the carbon sequestration value including 1) Vegetation specifications (tree height, diameter, and age) 2) Type of plant materials group (Tree, palm, shrub) 3) Quantity and quality of plant materials. 4) Percentage of green area 5) Landscape design *(refer to Figure 3.67)*. The details of project implementation status that involve building partnership for Vertical and Roof Gardens are explained in *Table 3.34*.

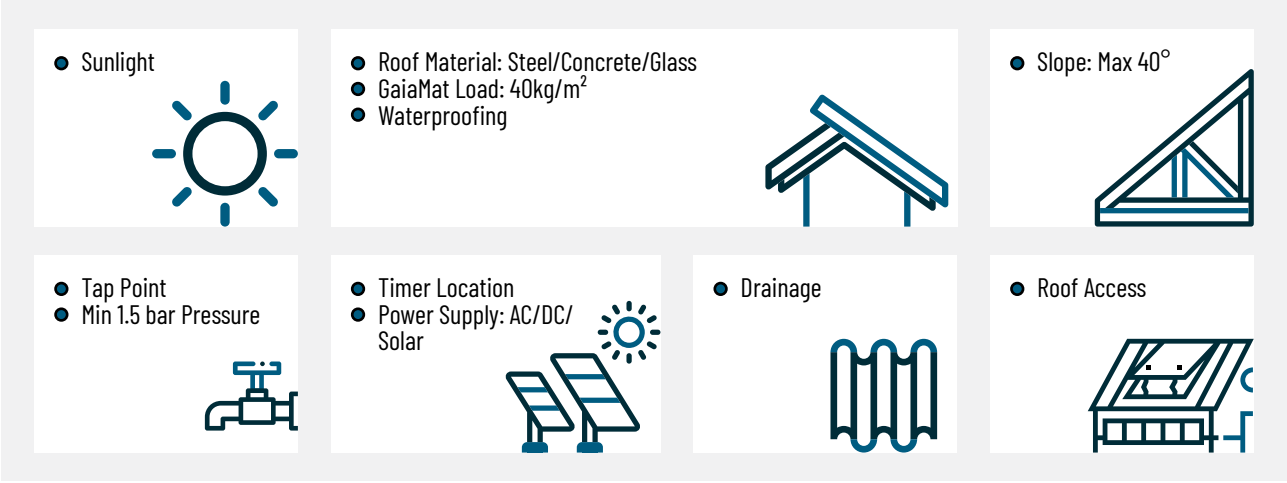


Figure 3.67: Factors Influencing the Application of Green Roof

Table 3.34: Building Partnership for Vertical and Roof Gardens

	Building Partnership
Implementation Approaches	◢ Identifying & Defining the infrastructure ownerships ◢ Upgrading existing public building facade/ fencing/ amenities for small scale vertical green ◢ Implementation of vertical green on public buildings as initiatives ◢ Private-partnership - Implementation of Vertical Green on private property (fencing or external façade ◢ Implementation of Guidelines for the Vertical Green
Estimated Cost	◢ Vertical Green System (rm/sqm): RM100-RM1500 ◢ Rooftop Garden Mat System (rm/sqm): RM250-RM300
Timeline	◢ 2021 - 2025: Upgrading public buildings and Initiative actions ◢ 2026 - 2030: Private-partnership & collaborations ◢ >2031: Implementation of Guidelines
Implementers	Urban green specialist, Landscape specialist for private property
Agency	Ministry of Energy and Natural Resources (KeTsa), Malaysian Green Technology and Climate Change Centre (MGTC), Malaysia Green Building Council (MGBC), Prasarana Malaysia Berhad, Federal Territory of Kuala Lumpur Education Department (JPWPKL)
KLCH dept.	JPRB, JPLR, JKB

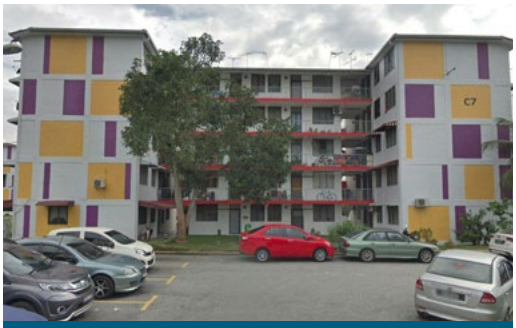
POTENTIAL LOCATIONS

- The proposed locations for the implementation of vertical green will be based on the type of amenities and property ownerships.
- Preferably, public amenities and properties owned by KLCH are targeted. Specific types of system are suggested for implementation at different locations based on different site conditions and other technical considerations (refer to *Figure 3.80*, *Figure 3.81*, *Figure 3.82*, Table 3.35, Table 3.36, and Table 3.37).

Table 3.35: Potential Building and Location

Phase	Typology	Location / Name	Area of Intervention
Phase 1	Residential Property (Owned by KLCH)	◢ PPR Wangsa Sari ◢ PPR Seri Semarak ◢ PPR Desa Rejang ◢ Flat Wangsa Maju Seksyen 1,2,4,10 (refer to Figure 3.68, Figure 3.69, Fiigure 3.70 and Figure 3.71)	Exterior Wall
	Commercial (Owned by DBKL)	◢ Medan Selera Seksyen 1 ◢ Pasar Wangsa Maju Seksyen 1 ◢ Dewan Serbaguna Seksyen 1 (refer to Figure 3.76) ◢ Dewan Serbaguna Seksyen 2 ◢ Pusat Penjaja Sekyen 2 ◢ Dewan Serbaguna Seksyen 4 ◢ Medan Selera Seksyen 4 ◢ Kompleks Sukan Seksyen 5 refer to Figure 3.77) ◢ Dewan Serbaguna Seksyen 10 ◢ Pejabat Cawangan Setiawangsa ◢ Dewan Serbaguna Desa Rejang ◢ Medan Selera D'Tasik ◢ Medan Selera D'Rejang	Exterior Wall Fencing
	Public Infrastructure	◢ Along Sungai Bunus (refer to Figure 3.72)	Fencing Side Walk
Phase 2	Public Institution	◢ SMK Wangsa Melawati ◢ SRK Wangsa Melawati ◢ Vocational College Setapak ◢ SRK Wangsa Maju Seksyen 1 (refer to Figure 3.73) ◢ SMK Seksyen 5 Wangsa Maju ◢ SM Taman Sri Rampai ◢ SRK Taman Sri Rampai ◢ Kolej Kediaman Siswa Jaya ◢ SRK Wangsa Maju Zon R10 ◢ SMK Taman Setiawangsa ◢ Sri Utama Schools	Fencing
Phase 3	Public Infrastructure	◢ Jalan Genting Kelang ◢ DUKE (Toll Road) ◢ Jalan 1/27A ◢ Jalan Mohd Yatim Yahaya ◢ Jalan Setiawangsa (Figure 3.74) ◢ Jalan Lingkaran Tengah 2	Retaining Wall Flyover pillars Fencing
	Private Property	◢ Platinum Splendor Residensi ◢ Residensi Hedgeford 10 ◢ Lexa Residence ◢ Fera Residence ◢ Residensi WangsaMas ◢ Wangsa 9 Residency (refer to Figure 3.75) ◢ TM Wangsa Maju	Exterior Wall Fencing
	Commercial	◢ New Development shop lot or shopping mall etc.	Rooftop Facade

Figure 3.68: Before and After Installing Vertical Green System (VGS) in Flat Wangsa Maju Seksyen 1



Before

Source: Google Streets, 2021

After

Source: UTM-LCARC, 2021

Figure 3.69: Before and After Installing Vertical Green System (VGS) in Flat Wangsa Maju Seksyen 2

Before

Source: Google Streets, 2021

After

Source: UTM-LCARC, 2021

Figure 3.70: Before and After Installing Vertical Green System (VGS) in Flat Wangsa Maju Seksyen 4

Before

Source: Google Streets, 2021

After

Source: UTM-LCARC, 2021

Figure 3.71: Before and After Installing Vertical Green System (VGS) in Flat Wangsa Maju Seksyen 10

Before

Source: Google Streets, 2021

After

Source: UTM-LCARC, 2021

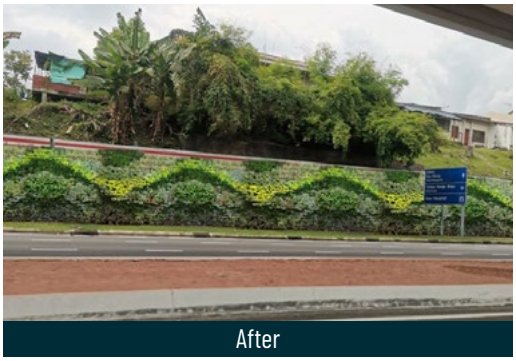
Figure 3.72: Before and After Installing Vertical Green System (VGS) along Sg Bunus in Wangsa Maju Seksyen 1

Source: Google Streets, 2021

Source: UTM-LCARC, 2021

Figure 3.73: Before and After Installing Vertical Green System (VGS) in SK Wangsa Maju Seksyen 1

Source: Google Streets, 2021



Source: UTM-LCARC, 2021

Figure 3.74: Before and After Installing Vertical Green System (VGS) in Wangsa 9 Residency

Source: Google Streets, 2021

Source: UTM-LCARC, 2021

Figure 3.75: Before and After Installing Vertical Green System (VGS) at Jalan Setiawangsa

Source: Google Streets, 2021

Source: UTM-LCARC, 2021

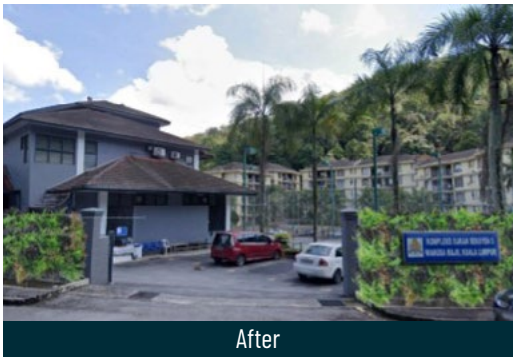
Figure 3.76: Before and After Installing Vertical Green System (VGS) at Dewan Serbaguna Seksyen 1

Source: Google Streets, 2021

Source: UTM-LCARC, 2021

Figure 3.77: Before and After Installing Vertical Green System (VGS) at Kompleks Sukan Seksyen 5

Source: Google Streets, 2021



Source: UTM-LCARC, 2021

Table 3.36: The Perimeter of VGS on Building's Fencing (Flat Wangsa Maju Seksyen 1 as A Pilot Projects)

VGS on Building's Fencing (Flat Wangsa Maju Seksyen 1 as a pilot projects) (refer to Figure 3.78)	
Estimated number of block	70 blocks
Area of VGS for each block	(6m x 15m) x 2 facade = 180 sqm
Total area of VGS	= 70 X 180 sqm = 12,600 sqm
Estimated Total Carbon Sequestration	
Total VGS area x Carbon Rating System Point	= 12,600 sqm x 0.0009 = 11.34

Figure 3.78: Estimated Area of VGS

Source: UTM-LCARC, 2021

Table 3.37: The Perimeter of VGS on Commercial Building Owned by KLCH

VGS on Commercial Building owned by KLCH (refer to Figure 3.71 and Figure 3.79	
Estimated number of Community Hall	5 units
Area of VGS for each block	(3m x 6m) x 6 facade = 108 sqm
Total area of VGS	= 5 X 108 sqm = 540 sqm
Estimated Total Carbon Sequestration	
Total VGS area x Carbon Rating System Point	= 540 sqm x 0.0009 = 0.486

Table 3.38: The Perimeter of VGS on Building's Fencing (Public Institution)

VGS on Building's Fencing (Public Institution)	
Name of schools	**Perimeter**
Wangsa Melawati Primary School	439 m
Wangsa Jaya Primary School	337 m
SMK Wangsa Melawati	603 m
Vocational College Setapak	724 m
SK Wangsa Maju Seksyen 1	664 m
SMK Seksyen 5 Wangsa Maju	574 m
SK Wangsa Maju Zon R10	467 m
SMK Taman Setiawangsa	448 m
Sri Utama Schools	529 m
Sekolah Kebangsaan Taman Seri Rampai	480 m
Taman Seri Rampai Secondary School	555 m
Kolej Kediaman Siswa Jaya	762 m
Total Perimeter	6,582 m
Estimated Total Area of VGS	
Assuming Fencing Height	2.5 m
Total VGS area	= 6,582 x 2.5 = 16,455 sqm
Estimated Total Carbon Sequestration	
Total VGS area x Carbon Rating System Point	= 16,455 sqm x 0.0009 = 14.8

Figure 3.79: Estimated Area of VGS

Implementation Strategy:

Survey and studies have been done to evaluate the possibility of implementing vertical green wall in Wangsa Maju townscape. To enhance the viability of the project, our team suggest to focus on the implementation of VGS at public institutions (government schools, government buildings and KLCH buildings), as the first phase of the overall project duration due to the reason that these buildings are relatively easier to cooperate and communicate.

A good opportunity to observe the performance and effects to the surrounding context and building's energy efficiency, study and discover any issues and problems as efficient as possible. Hence, further improvement and enhancement could be made to the other buildings in other phases after the implementation in the first phase has been done successfully.

FIGURE 3.80

Vertical and Roof Gardens Potential Sites from the Aerial View (Seksyen 1)

N

NOT TO SCALE

- Wall Area
- Exterior Area
- Sungai Bunus
- Vertical Green System

Source: **Google Earth, 2021**

KLCH Assets	
1	PPR Wangsa Sari
2	PPR Seri Semarak
3	PPR Desa Rejang
4	Flat Wangsa Maju Seksyen 1,2,4,10
5	Along Sungai Bunus

Public Institutions	
1	SMK Wangsa Melawati
2	SK Wangsa Melawati
3	Vocational College Setapak
4	SK Wangsa Maju Seksyen 1
5	SMK Seksyen 5 Wangsa Maju
6	SM Taman Sri Rampai
7	SK Taman Sri Rampai
8	Kolej Kediaman Siswa Jaya
9	SRK Wangsa Maju Sek 10
10	SMK Taman Setiawangsa
11	Sekolah Sri Utama

Public Infrastructures	
1	Jalan Genting Kelang
2	DUKE (Toll Road)
3	Jalan 1/27A
4	Jalan Mohd Yatim Yahaya
5	Jalan Setiawangsa
6	Jalan Lingkaran Tengah 2

Private Properties	
1	Platinum Splendor Residensi
2	Residensi Hedgeford 10
3	Lexa Residence
4	Fera Residence
5	Residensi WangsaMas
6	Wangsa 9 Residency
7	TM Wangsa Maju

FIGURE 3.81

Vertical and Roof Gardens Potential Sites

- Housing
- Commercial
- Facilities
- Industry
- Institutional
- Infrastructure and Utility
- Open Space
- Lake/river
- Vacant land
- Transportation
- Wangsa Maju CNGC Boundary
- KLCH Assets
- Public Institution
- Public Infrastructure
- Private Property

N

NOT TO SCALE

Source: **KLCH, 2021**

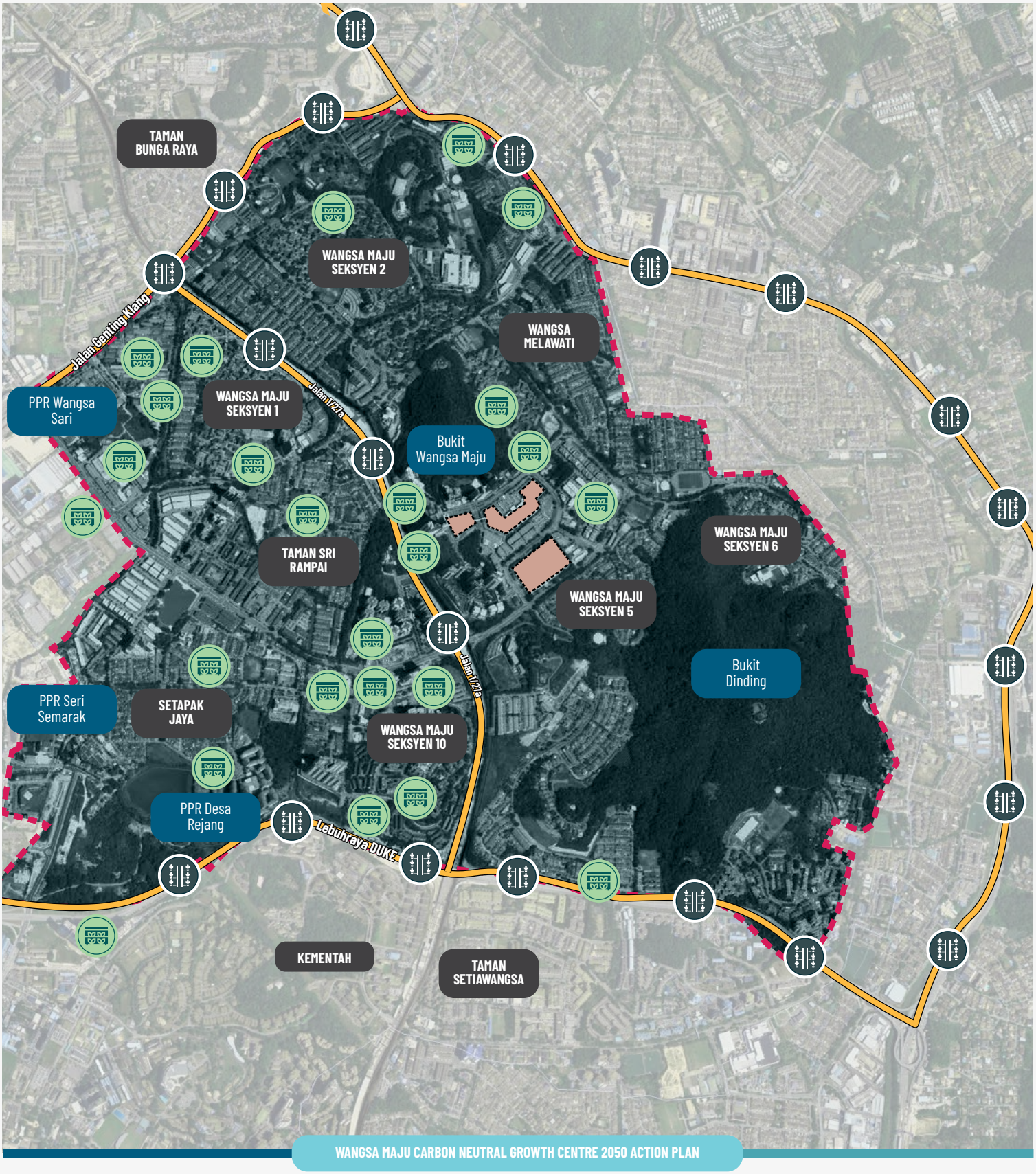


FIGURE 3.82

Vertical and Roof Gardens Potential Sites from the Aerial View

- Exterior Wall Fencing
- Retaining Wall Flyover Pillars
- Roof Garden
- Wangsa Maju CNGC Boundary

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

3 Create Linear Urban Parks along River and Waterways Reserves

Urban green space is an important element of land use planning that deserves consideration for its potential to reduce net GHG emissions. Urban green space serves diverse purposes, ranging from neighbourhood and city parks to river parkways, bike paths, and street trees, which in turn can produce GHG reduction benefits. Riverfront areas are now becoming popular choices of location for urban green space planning and part of nature based solution (NBS).

Sungai Bunus is one of the main rivers in Kuala Lumpur and Wangsa Maju CNGC natural features. Some of the areas along the river provide pedestrian and cycling pathways such as in China and Singapore. However, lack of maintenance and discontinuous green linkages create unattractive trail for pedestrians and cyclist. Therefore, linear parks are seen as intervention strategies for Sungai Bunus that potentially reintegrate the urban river with the surroundings and connect people seamlessly.

Linear parks include greenways and waterfronts in urban areas linking major urban nodes. Unlike other types of green areas, people use linear parks for moderate and vigorous physical activities. Also, because of their linearity, they can be used by more people and contribute climatic and aesthetic improvement. In many cities, they are being planned as drivers for the regeneration of deprived areas and for residents to be more physically active that enable active and passive recreational experiences. They also function as connectors or "commuting axes" that provide good access and amenities. In the context of Wangsa Maju, linear parks will provide residents with the opportunity to engage in healthy outdoor activities and enhance active mobility.

Connector Linear Park

Commuting axes - natural settings with good access, act as cool and quiet routes through which to pass on the way to other destinations such as shops, services and bus stops

Waterfront Linear Park

Provide active recreation and activities linked with water but are used less for commuting. It is also function as meeting points for social events.

Aerobic Linear Park

The dominant role is for daily recreation that provide overall physical benefit as indicated by active recreation

BEST PRACTICES

1. The Red Ribbon: Tanghe River Park, Qinhuangdao, China

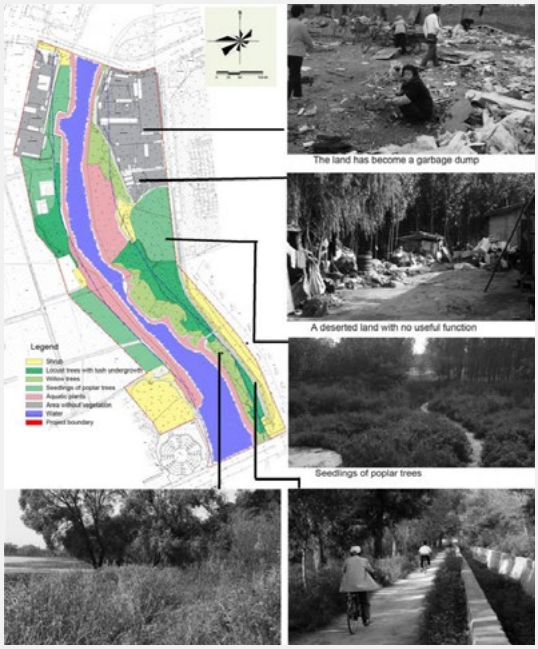
This project is one of the minimum intervention approach to create urban greenway that demonstrates how a minimal design solution can achieve a dramatic improvement to the landscape. The main objective of this project is to preserve the natural habitats along the river while creating the new urban uses for recreation and education.

The Red Ribbon project component:

- Stretches for 500 metres along the riverbank
- Integrating a boardwalk, lighting, seating and environmental orientation.
- The red ribbon specification is 60 cm high and the width is varies from 30-150 cm.
- Four pavilions provided along the ribbon
- Four flower garden
- Cycle path
- Parking

This project has been urbanized and modernized which attract the local residents and maintaining the ecological process of the existing river.

Source: Chinese-architects.com



The Transformation of The Red Ribbon at Tanghe River Park

Source: Chinese-architects.com

PROJECT COMPONENTS

Figure 3.83 and *Figure 3.91* shows detailed of proposed project component for Section 1: Sungai Bunus - PPR Wangsa Sari - Eco Park.

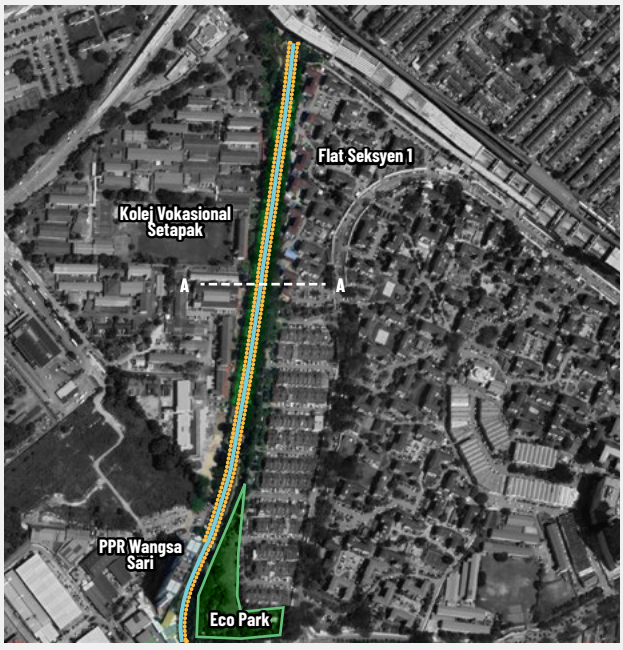


Figure 3.83: Section 1: Sungai Bunus - PPR Wangsa Sari - Eco Park

Component 1

Reuse existing space along drainage as a 'Nature Walk Belt' (refer to Figure 3.84)

- Improve the space along the drainage (1 km)
- Walkways
- Bicycle lane
- Connectivity for surrounding community (provide access)

Component 2

Propose sustainable approach

- Solar street lighting

Component 3

Beautification of the area

- Dual function of space
- Urban farming
- Element of landscaping
- Mural painting

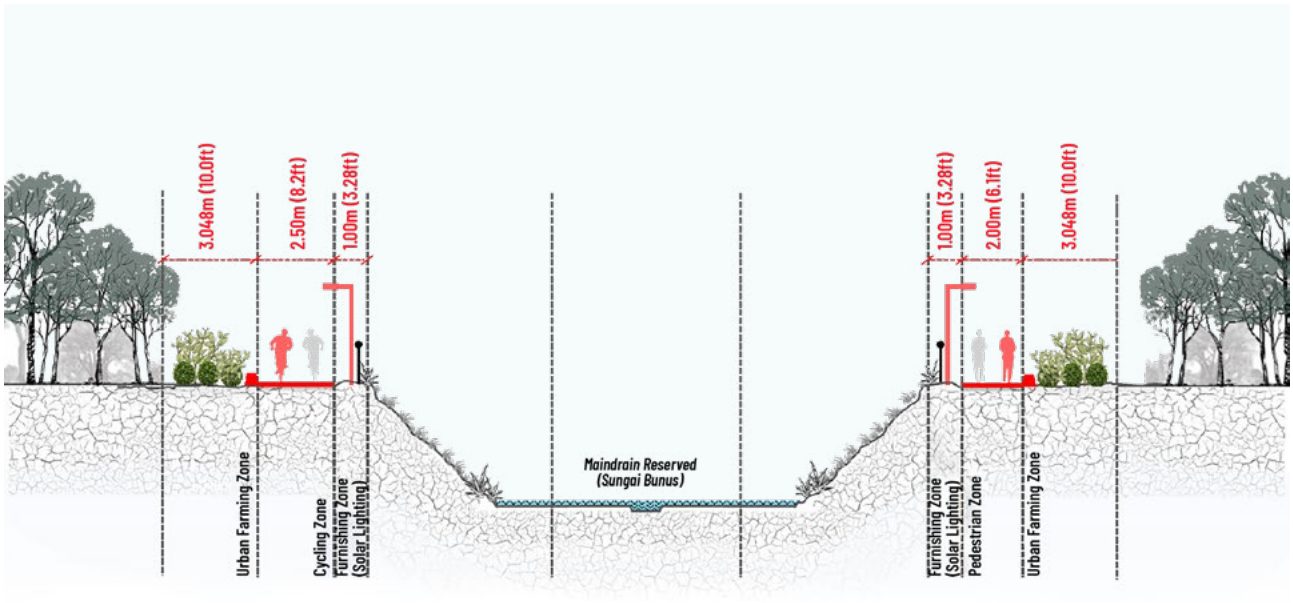


Figure 3.84: Detailed Cross Section for Proposed Pedestrian and Cyclist Pathway Along Sungai Bunus in Section 1

PROJECT COMPONENTS

Figure 3.85 and *Figure 3.92* shows detailed of proposed project component for Section 2: Eco Park - Sungai Bunus - Tasik Sri Rampai

Figure 3.85: Section 2: Eco Park - Sungai Bunus - Tasik Sri Rampai

Component 1

Reuse existing space along drainage as a 'Seamless Connectivity' (refer to Figure 3.86)

- Improve the space along the drainage (900m)
- Walkways
- Bicycle lane
- Connectivity to Tasik Sri Rampai (provide access)

Component 2

Propose sustainable approach

- Pedestrian crossing traffic light
- Solar street lighting

Component 3

Beautification of the area

- Dual function of space
- Element of landscaping
- Reuse vacant spaces into pocket park (with amenities)

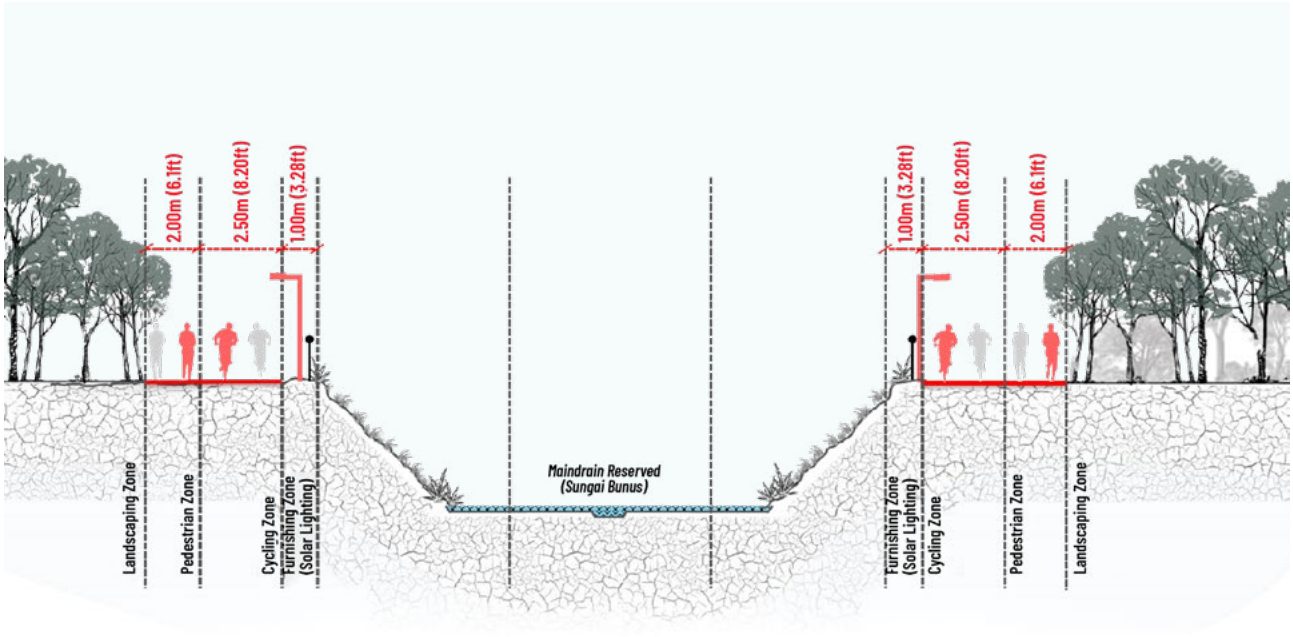


Figure 3.86: Detailed Cross Section for Proposed Pedestrian and Cyclist Pathway Along Sungai Bunus in Section 2

PROJECT COMPONENTS

Figure 3.87 and *Figure 3.93* shows detailed of proposed project component for Section 3: PPR Sri Semarak -Tmn. Rekreasi Ayer Panas

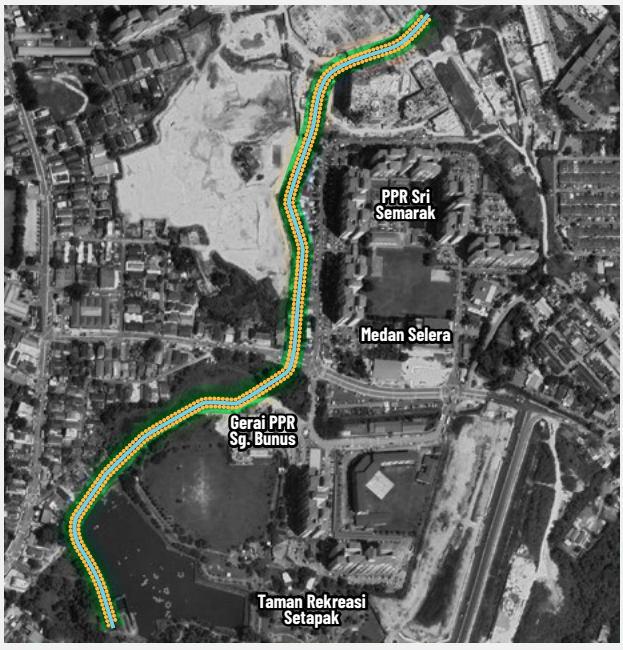


Figure 3.87: Section 3: PPR Sri Semarak -Tmn. Rekreasi Ayer Panas

Component 1

Reuse existing space along drainage as a 'The Living Waterfront' (refer to Figure 3.88)

- Improve the space along the drainage (1.2km)
- Walkways (integrate with running trails)
- Bicycle lane
- Connectivity to Taman Rekreasi Setapak

Component 2

Propose sustainable approach

- Pedestrian crossing traffic light
- Solar street lighting

Component 3

Beautification of the area

- Element of landscaping
- Reuse vacant spaces into pocket park (with amenities)
- Enhance recreational activities

Figure 3.88: Detailed Concept for Proposed Pocket Park to Promote Active and Livable Linear Park in Section 3

POTENTIAL LOCATIONS

Justifications of the site selection:

- Located within the urban matrix, easy access and secure connections across the linear park and with other places in the Wangsa Maju CNGC
- The existence of nature elements to provide recreational activities (fishing, cycling or scenic views)

Locations:

- Sungai Bunus
- Divided into 3 sections (part of 16 km)(refer to *Figure 3.89* and *Figure 3.90*):
- Section 1: Sungai Bunus - PPR Wangsa Sari - Eco Park
- Section 2: Eco Park - Sungai Bunus - Tasik Sri Rampai
- Section 3: PPR Sri Semarak -Tmn. Rekreasi Ayer Panas

TARGET/OUTCOME

i. Increase 10% active mobility among KL and Wangsa Maju Residents
ii. Revitalization of Sungai Bunus

GUIDELINES/REFERENCES

To be integrated with existing guideline or modification subject to the local context

1. Green Neighbourhood Development Initiative Implementation Guide (Neighbourhood Garden Development)
2. Urban Community Garden Implementation Guideline (KPKT)
3. Garis Panduan Perancangan Tanah Lapang dan Kawasan Rekreasi
4. Kuala Lumpur Pedestrian and Cycling Masterplan 2019-2028

The details of project implementation status that involve building partnership for Linear Urban Parks are explained in *Table 3.39*.

Table 3.39: Building Partnership for Linear Urban Parks along River and Waterways Reserves

	Building Partnership
Implementation Approaches	◢ Prepared detailed landscape master plan together with KLCH Landscape Department, JPS and surrounding community (especially section 1 which involve urban farming) ◢ Site clearance (within river reserve) phase by phase ◢ Public private partnership for solar lighting system along Sungai Bunus ◢ Work with KLCH Transportation Department for constructing pedestrian and cyclist crossings (explore the opportunity for smart sensor/detection to prioritize the cyclist and pedestrians) ◢ Develop monitoring plan for maintenance ◢ Planned activities (focusing on Section 3) to promote livable and active riverfront for example: (a) Organize Throw a Mudball program once in a month (b) Include the linear park as Car Free Day route
Estimated Cost	Cost breakdown: ◢ Section 1: RM 300,000 ◢ Section 2: RM 600,000 ◢ Section 3: RM 1,000,000 Financial resources can be obtained through the annual allocation of the local authority
Timeline	The implementation timeline for each section: ◢ Section 1: 2020-2025 ◢ Section 2: 2020-2025 ◢ Section 3: 2025-2030
Implementers	KLCH
Agency	Tenaga Nasional Berhad (TNB), Department of Irrigation and Drainage (JPS), Department of Environment (DOE), National Landscape Department
KLCH dept.	JPLR, JKAS, JPRB (LA21 KL)

FIGURE 3.89

Potential Linear Urban Park Sites along River and Waterway Reserves

Public Open Spaces

Water Bodies

Wangsa Maju CNGC Boundary

N

NOT TO SCALE

Source: **KLCH, 2021**

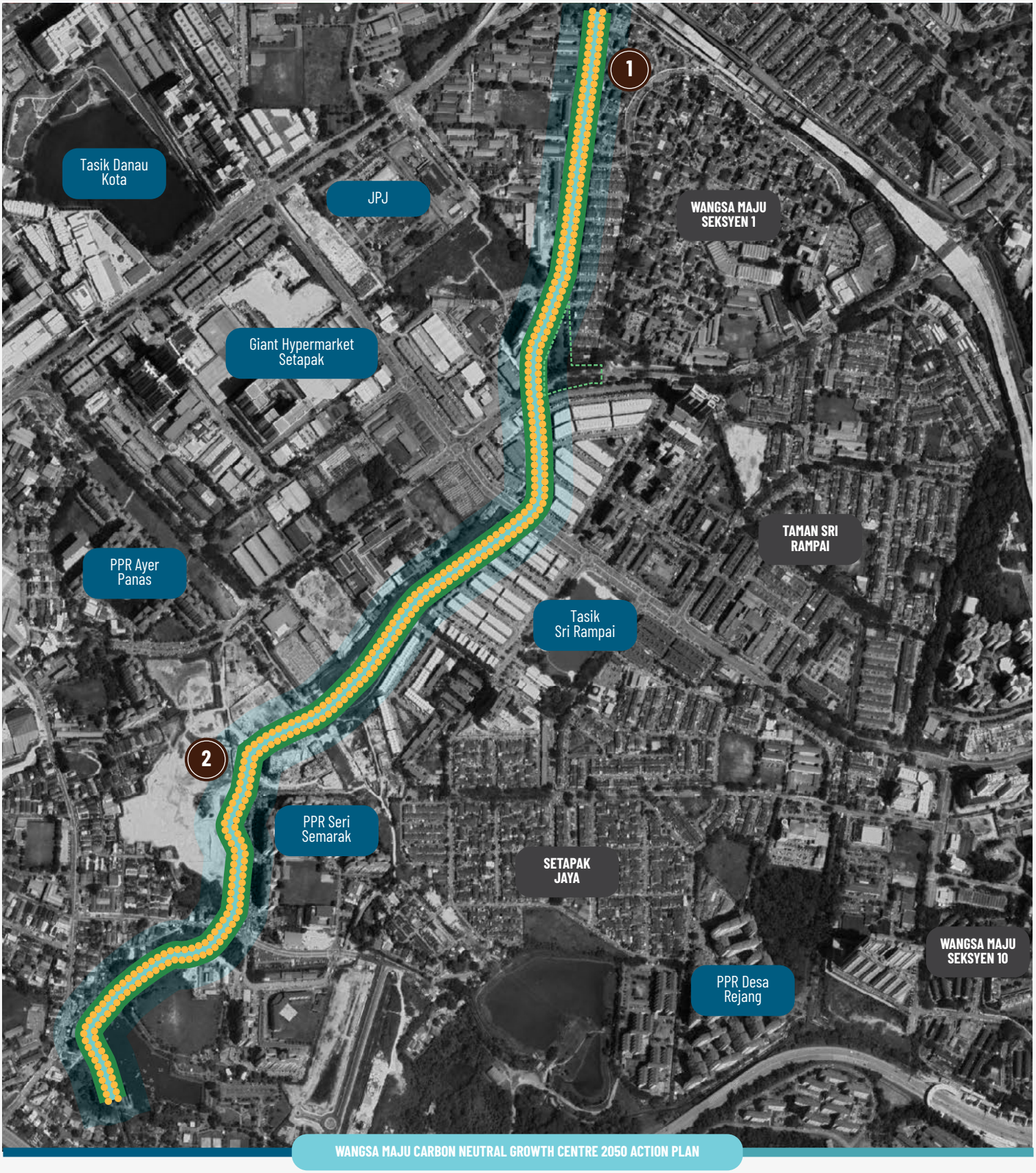


FIGURE 3.90

Potential Linear Urban Park Sites along River and Waterway Reserves & Mudball Event

Linear Urban Park

Mudball Event (1 & 2)

N

NOT TO SCALE

KL CN 2050 KUALA LUMPUR CARBON NEUTRAL

Source: **Google Earth, 2021**

FIGURE 3.91

Project Component for Section 1

- Origin
- Destination
- Eco Park
- Bridge
- Solar Street Lighting
- Urban Farming
- Access
- Mural Painting

N

NOT TO SCALE

Source: **KLCH, 2021**

FIGURE 3.92

Project Component for Section 2

- Origin
- Destination
- Eco Park
- Bridge
- Solar Street Lighting
- Green Landscape
- Walking Route
- Pedestrian Crossing
- Pcoket Park
- Existing Pedestrian Pathway

N

NOT TO SCALE

KLCH2050 KUALA LUMPUR CARBON NEUTRAL

Source: **KLCH, 2021**

FIGURE 3.93

Project Component for Section 3

- Origin
- Destination
- Bridge
- Solar Street Lighting
- Green Landscape
- Pedestrian Crossing
- Playground
- Entrance
- Active Zone

N

NOT TO SCALE

Source: **KLCH, 2021**

4 Organise "Clean Up A River" Program

Based on the findings in the Draft of PTKL 2040, the Water Quality Status for Sungai Bunus is categorised as level 4 which indicates as polluted. Towards being a carbon neutral growth centre, it is important to improve the water quality of Sungai Bunus. The lack of education and awareness of the general public is a key factor that led to poor river water quality. The "Clean Up A River" program will focus on promoting community participation and stakeholders involvement in a river protection. This program can be divided into two (2) components. Firstly, the river pollution treatment program by using Effective Microorganism (EM) mud ball. Secondly, river beautification program which objectively creates a healthy and attractive environment for recreation. This second component is supported by Create Linear Urban Parks along River and Waterways Reserves programs. The details of project implementation status that involve building partnership for Organise "Clean Up A River" Program are explained in *Table 3.40*.

Source: astroawani.com

BEST PRACTICES

1. River Revival : River Restoration Project by Management & Science University (MSU)

MSU has organised the largest Mud ball-Throwing Event of the River Revival project at Sungai Damansara. The Sungai Damansara is a 20.75 km tributary of Sungai Klang, a heritage river meandering through the state of Selangor and the federal territory of Kuala Lumpur towards the Straits of Malacca.

- The Making of Mud ball

There are 178,900 enzymatic mud balls made from soil added to a concoction of 1,851 kg fruit peel mixed with brown sugar and water that fermented in 1,234 five-litre bottles for three months.

- How Mud balls Works?

Enzymatic mud balls help by decomposing sludge. The decomposition produces nutrition that feeds oxygen-increasing phytoplankton. The resulting rise of oxygen activates oxidative bacteria, further accelerating sludge decomposition. Fragmented floating detritus may still give a river the polluted look but as they go on breaking down and flowing along the river, they feed the river's inhabitants. A river thriving with fish attracts more birds, enriching the river ecosystem.

PROJECT COMPONENTS

i. Stakeholders and Participant

Stakeholders and community from community farming / eco park committee are involved in the program. Schools and public or private universities may also participate.

ii. Mudball Making Knowledge

Knowledge sharing on how to make mudball. Stakeholders should supports the necessary items and provide training to the community.

iii. Mud balls Throwing Events

For EM mud balls to work, they have to be continuously tossed into the river. Organising mud ball throwing events regularly will improve the river water quality.

Table 3.40: Building Partnership for Organise "Clean Up A River" Program

	Building Partnership
Implementation Approaches	(a) Assign roles for the community garden / eco park committee and appoints program head to coordinate and organise events to engage the other members of the group and stakeholders. (b) Organize sharing sessions: ◢ Stakeholders or KLCH may conduct a workshop on how to make a mud balls and the benefits / expected outcome from the programs ◢ Schools and universities may join together and participate (c) Plan activities yearly: ◢ Mud balls preparations (1-10 days) ◢ Mud balls throwing events (2 time per month) (d) Monitor the water quality from time to time to ensure the expected outcome is achieve
Estimated Cost	(a) Cost breakdown (per year): ◢ Soil (RM 12.50 x 96 bags (20 litre)): RM 1,200.00 ◢ EM Solution (RM 125 x 48 bottles (20 litre)): RM 6,000.00 ◢ Bran (RM 30 x 48 bags (10 kg): RM 1,440.00 ◢ Others related cost (tools & appliances): RM 2,000.00 (b) Financial resources can be obtained through the annual allocation of the local authority
Timeline	2021-2025
Implementers	Residents Association, NGO's, Schools
Agency	Department of Irrigation and Drainage (JPS), Department of Environment (DOE), Public-Private Universities, Federal Territory of Kuala Lumpur Education Department (JPWPKL)
KLCH dept.	JKAS, JPRB (LA21 KL)

TARGET/OUTCOME

i. Improve Sungai Bunus water qualities and prevent river pollution
ii. Revitalization of Sungai Bunus
iii. Preserve the ecosystems

GUIDELINES/REFERENCES

A Guide to Make a Mud Balls

1. Ingredients:
   - Clay Soil - 10 parts
   - Bran - 1~2 parts
   - EM Solution - 1~2 parts
2. Method:
   - Mix bran into soil.
   - Pour the EM Solution onto the mixture and mix well.
   - Once the mixture has become muddy and thick, form it into the size of tennis ball.
   - Place the balls out of the rain and direct sunlight for 7-10 days in order to allowed white fungus covered.
   - The balls are ready to be used.

POTENTIAL LOCATIONS

Justifications of the site selection:

- The Water Quality Index for Sungai Bunus was categorised as Level IV (Polluted)
- To support the Linear Park program, it is important to improve the water quality of Sungai Bunus
- Enhance the biodiversity

Locations:

- Sungai Bunus
- Divided into 3 sections (part of 16 km):
- Section 1: Sungai Bunus - PPR Wangsa Sari - Eco Park *(refer to Figure 3.94)*
- Section 2: Eco Park - Sungai Bunus - Tasik Sri Rampai
- Section 3: PPR Sri Semarak -Tmn. Rekreasi Ayer Panas *(refer to Figure 3.95)*

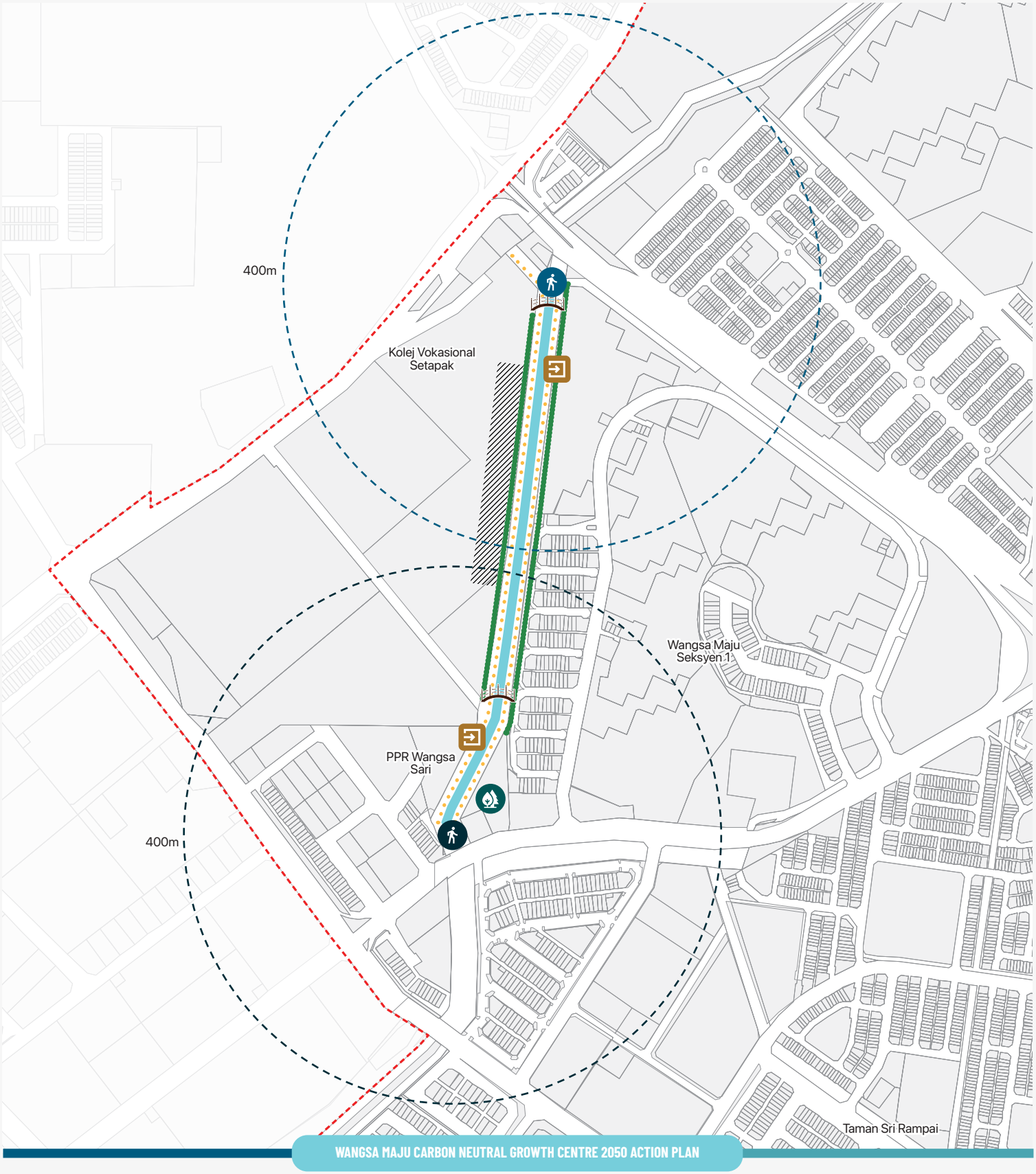


FIGURE 3.94

Potential Location for Mud Balls Throwing Event

- Origin
- Destination
- Eco Park
- Bridge
- Solar Street Lighting
- Urban Farming
- Access
- Mural Painting

N

NOT TO SCALE

Source: **KLCH, 2021**

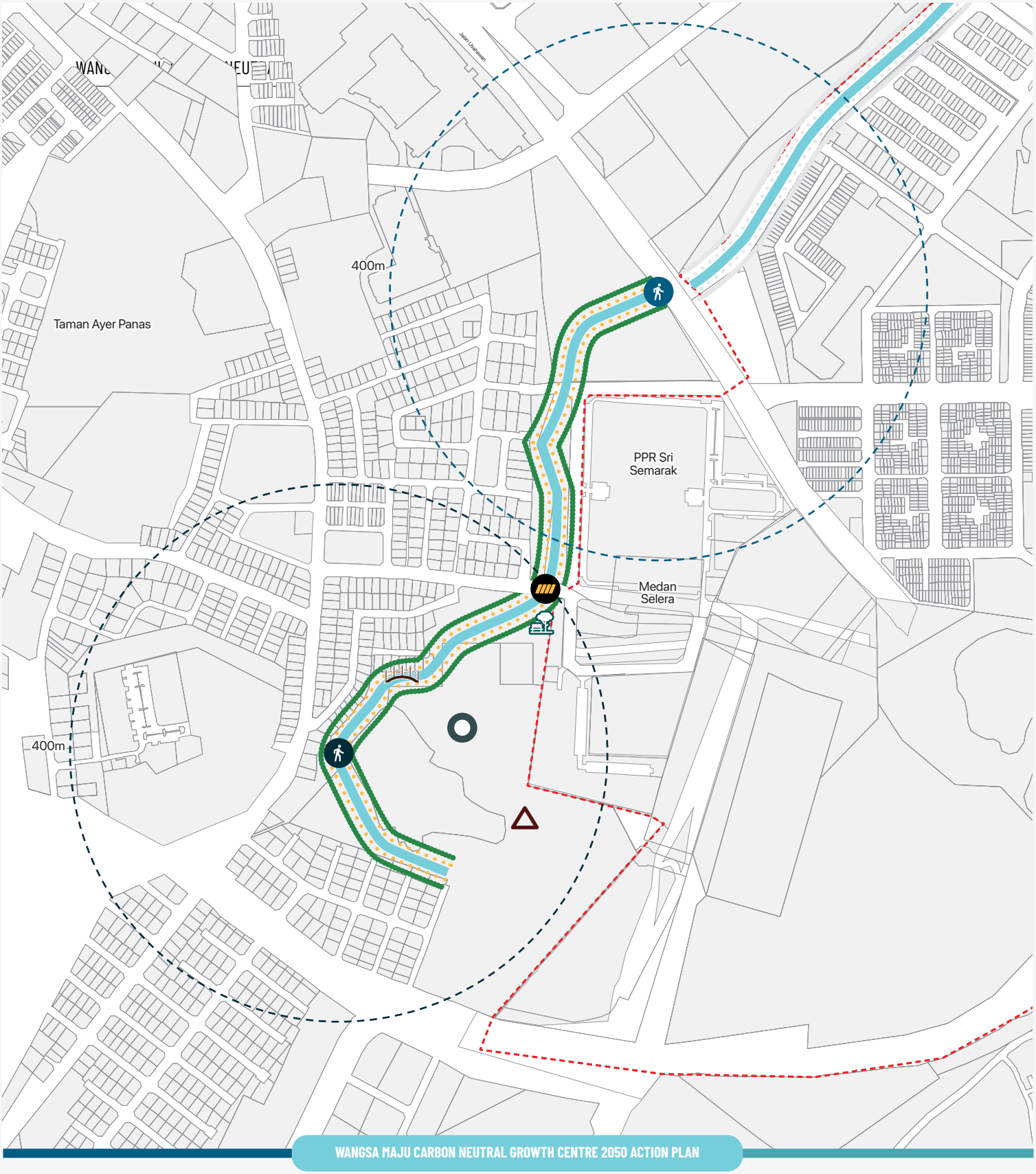


FIGURE 3.95

Potential Location for Mud Balls Throwing Event

- Origin
- Destination
- Bridge
- Solar Street Lighting
- Green Landscape
- Pedestrian Crossing
- Playground
- Entrance
- Active Zone

N

NOT TO SCALE

KLCH2050 KUALA LUMPUR CARBON NEUTRAL

Source: **KLCH, 2021**

CHAPTER 4

ROAD TO WANGSA MAJU CARBON NEUTRAL GROWTH CENTRE 2050

4.1

Summary

This draft report as a whole discusses the technical details of each initiatives to ensure the projects are implementable in the Wangsa Maju CNGC 2050. Each chapter is interrelated which will justify the list of initiatives outlined. Site visits and engagements with community and stakeholders also help the study to identify the key sector for the proposed initiatives.

4.2

List of Key partners and KLCH Departments

The list of initiatives in each sector are proposed as guidance for key partners and KLCH departments towards achieving carbon neutrality by 2050. Proper work tasks, responsibilities and funding are needed from various actors for successful implementation.

The key partners refer to the technology providers, funding agencies or entities and relevant government agencies with approving authority for and/or statutory duty of regulating, facilitating, and overseeing the implementation of programs. KLCH departments with primary responsibility for initiating, coordinating, liaising with relevant external agencies, monitoring and improving implementation of initiatives.

The potential key partners are listed in *Table 4.1*. The focus group discussion with potential stakeholders will be conducted to ensure each proposed initiative complies with the technical requirements and receives support from stakeholders.

Table 4.1: Potential Key Partners and KLCH Departments by Sectors

Initiatives	Key partners	KLCH Departments
Energy		
(1) Install Solar on Infrastructure (a) Installation Rooftop Solar PV (b) Solar for Pedestrian Mist	◢ Sustainable Energy Development Authority (SEDA) ◢ Energy Commission (ST) ◢ Ministry of Science, Technology and Innovation (MOSTI) ◢ Malaysian Green Technology and Climate Change Centre (MGTC) ◢ Malaysian Green Building Council (MGBC) ◢ Malaysia Association of Energy Service Companies (MAESCO) ◢ Tenaga Nasional Berhad (TNB) ◢ Daikin Malaysia Sales & Service Sdn. Bhd ◢ Solar PV technology suppliers ◢ Building owners	◢ Project Implementation and Building Maintance Department (JPPPB) ◢ Building Control Department (JKB) ◢ Civil Engineering and Drainage Department (JKAWS) ◢ Mechanical and Electrical Engineering Department (JKME) ◢ Property Management and Valuation Department (JPPH) ◢ Landscape and Recreational Development Department (JPLR)
(2) Floating Solar PV		
(3) District Energy System		
Waste		
(4) Anaerobic Digester	◢ Sustainable Energy Development Authority (SEDA) ◢ Solid Waste Management and Public Cleansing Corporation (SW Corp) ◢ National Solid Waste Management Department (JPSPN) ◢ Indah Water Konsortium Sdn Bhd (IWK) ◢ Alam Flora Sdn. Bhd	◢ Health and Environment Department (JKAS) ◢ City Planning Department (JPRB-LA21 KL) ◢ Community Developmet and Urban Well Being Department (JPKKB) ◢ Licensing and Business Development Department (JPPP)
(5) Develop Waste Composting Plant	◢ Department of Environment (DOE) ◢ Solid Waste Management and Public Cleansing Corporation (SW Corp) ◢ National Solid Waste Management Department (JPSPN) ◢ Alam Flora Sdn. Bhd ◢ Tzu Chi Foundation Malaysia	◢ Health and Environment Department (JKAS) ◢ City Planning Department (JPRB-LA21 KL) ◢ Community Developmet and Urban Well Being Department (JPKKB) ◢ Licensing and Business Development Department (JPPP)
(6) Provide Waste Recycling Kiosk		
Mobility		
(7) Improve Pedestrian and Cycling Network	◢ Ministry of Transport Malaysia (MOT) ◢ Malaysian Institute of Road Safety Research (MIROS) ◢ Public Works Department Malaysia (JKR) ◢ Elina with Bike Club	◢ Infrastructure Planning Department (JPIF) ◢ Urban Transportation Department (JPB) ◢ Landscape and Recreational Development Department (JPLR) ◢ Mechanical and Electrical Engineering Department (JKME) ◢ City Planning Department (JPRB) ◢ Property Management and Valuation Department (JPPH) ◢ Project Implementation and Building Maintance Department (JPPPB) ◢ Economic Planning and Development Department (JPEP) ◢ Licensing and Business Development Department (JPPP) ◢ Civil Engineering and Drainage Department (JKAWS)
(8) Improve Public Transport	◢ Mass Rapid Transit Corporation Sdn Bhd (MRT Corp.) ◢ Ministry of Transport Malaysia (MOT) ◢ Prasarana Malaysia Berhad	
(9) Adopt Station Area Planning (SAP)	◢ Energy Commission (ST) ◢ Sustainable Energy Development Authority (SEDA) ◢ Petroliam Nasional Berhad (PETRONAS) ◢ Federal Territories Directors of Lands and Mines Office (PPTGWPKL) ◢ Public Works Department Malaysia (JKR) ◢ Tenaga Nasional Berhad (TNB) ◢ Real Estate and Housing Developers' Association Malaysia (REHDA) ◢ Prasarana Malaysia Berhad	

Initiatives	Key partners	KLCH Departments
Community		
(10) Develop an Eco Park	◢ Department of Agriculture (DOA) ◢ Universiti Teknologi Malaysia (UTM) ◢ Residents Assoc/ Management Corporation	◢ City Planning Department (JPRB-LA21 KL) ◢ Landscape and Recreational Development Department (JPLR) ◢ Health and Environment Department (JKAS) ◢ Community Developmet and Urban Well Being Department (JPKKB)
(11) Promote Community Farming	◢ Department of Agriculture (DOA) ◢ Federal Territories Directors of Lands and Mines Office (PPTGWPKL) ◢ Federal Territory of Kuala Lumpur Education Department (JPWPKL) ◢ Department of Irrigation and Drainage Malaysia (JPS) ◢ Residents Assoc/ Management Corporation ◢ Schools ◢ NGOs ◢ Private Company (CSR)	
(12) Introduce Community Water and Energy Saving Program	◢ Sustainable Energy Development Authority (SEDA) ◢ Suruhanjaya Perkhidmatan Air Negara (SPAN) ◢ Air Selangor ◢ Ministry of Housing and Local Governance (KPKT) ◢ Federal Territory of Kuala Lumpur Education Department (JPWPKL) ◢ Tenaga Nasional Berhad (TNB) ◢ Residents Assoc/ Management Corporation	◢ City Planning Department (JPRB-LA21 KL) ◢ Landscape and Recreational Development Department (JPLR) ◢ Health and Environment Department (JKAS) ◢ Community Developmet and Urban Well Being Department (JPKKB) ◢ Wangsa Maju Branch Offices
(13) Transform the Existing Resident Association into Carbon Neutral Community	◢ Ministry of Housing and Local Governance (KPKT) ◢ Residents Assoc/ Management Corporation	
(14) Zero Waste Community	◢ Solid Waste Management and Public Cleansing Corporation (SW Corp) ◢ Department of Environment (DOE) ◢ Petroliam Nasional Berhad (PETRONAS) ◢ Alam Flora Sdn. Bhd ◢ iCycle Malaysia ◢ Kloth Malaysia Sdn Bhd ◢ Residents Assoc/ Management Corporation ◢ NGOs ◢ Private Organisations	
(15) Strengthen School Community through Concentrated Efforts	◢ Department of Environment (DOE) ◢ Federal Territory of Kuala Lumpur Education Department (JPWPKL) ◢ Solid Waste Management and Public Cleansing Corporation (SW Corp) ◢ Yayasan Hijau ◢ Ecoknights Malaysia ◢ Alam Flora Sdn Bhd ◢ 20 Schools	
(16) Introduce Carbon Neutrality Challenge Programs in Schools		

Initiatives	Key partners	KLCH Departments
Green		
(17) Protect Existing Parks and Open Spaces	◢ Residents Assoc/ Management Corporation ◢ Private Sectors	◢ City Planning Department (JPRB-LA21 KL) ◢ Property Management and Valuation Department (JPPH) ◢ Landscape and Recreational Development Department (JPLR) ◢ Health and Environment Department (JKAS) ◢ Building Control Department (JKB)
(18) Introduce Vertical and Roof Gardens	◢ Ministry of Energy and Natural Resources (KeTsa) ◢ Prasarana Malaysia Berhad ◢ Federal Territory of Kuala Lumpur Education Department (JPWPKL) ◢ Malaysian Green Technology and Climate Change Centre (MGTC) ◢ Malaysian Green Building Council (MGBC)	
(19) Create Linear Urban Parks and Along River and Waterways Reserves	◢ Department of Environment (DOE) ◢ Department of Irrigation and Drainage Malaysia (JPS) ◢ Tenaga Nasional Berhad (TNB) ◢ National Landscape Department	
(20) Organise "Clean Up a River" Program	◢ Department of Environment (DOE) ◢ Department of Irrigation and Drainage (JPS), ◢ Public-Private Universities ◢ Federal Territory of Kuala Lumpur Education Department (JPWPKL)	

4.3

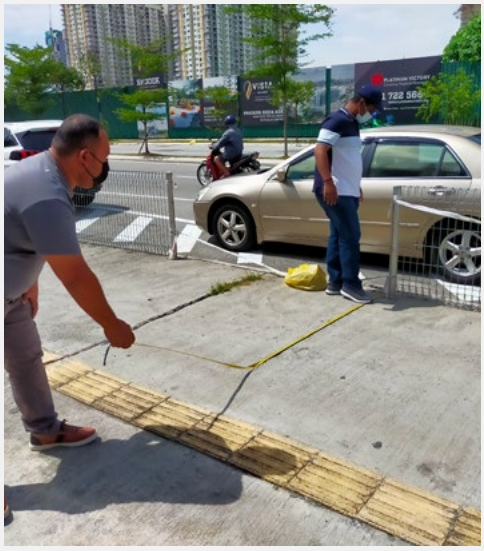
Program Implementation Timeline

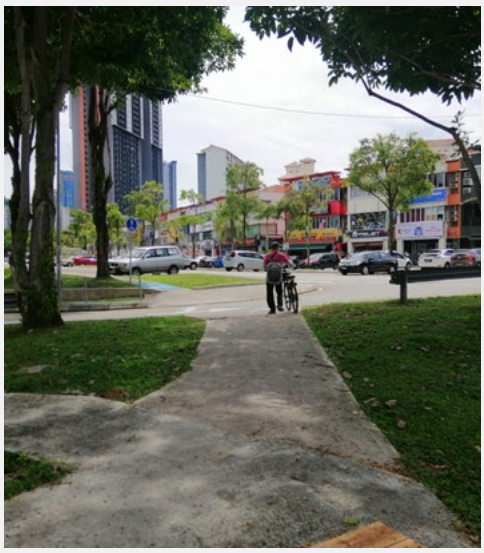
The Wangsa Maju CNGC 2050 Action Plan program implementation timeline was divided into three period of target years which are (2021-2025, 2026-2030 and beyond 2030 *(refer to Figure 4.1)*.

	INITIATIVES	2021 - 2025	2026 - 2030	Beyond 2030
Energy	**(1)** Install Solar on Infrastructure			
	(a) Install Rooftop Solar PV	●	●	●
	(b) Introduce Pedestrian with Mist System		●	● →
	(2) Floating Solar PV		●	● →
	(3) District Energy System			● →
Waste	**(4)** Anaerobic Digester	●	●	●
	(5) Develop Waste Composting Pant	●	●	● →
	(6) Provide Waste Recycling Kiosk	●	●	●
Mobility	**(7)** Improve Pedestrian and Cycling Network	●	●	●
	(8) Improve Public Transportation	●	●	
	(9) Adopt Station Area Planning (SAP)	●	●	● →
Community	**(10)** Develop an Eco Park	●	●	●
	(11) Promote Community Farming	●	●	● →
	(12) Introduce Community Water and Energy Saving Program	●	●	
	(13) Transform the Existing Resident Association into Carbon Neutral Community	●	●	
	(14) Zero Waste Community	●	●	● →
	(15) Strengthen School Community through Concentrated Efforts	●	●	
	(16) Introduce Carbon Neutrality Challenge Programs in Schools	●	●	
Green	**(17)** Protect Existing Parks and Open Spaces	●	●	● →
	(18) Introduce Vertical and Roof Gardens	●	●	● →
	(19) Create Linear Urban Parks and along River and Waterways Reserves	●	●	●
	(20) Organise "Clean Up a River" Program	●	●	

Figure 4.1: Program Implementation Timeline by Sectors

APPENDIX





APPENDIX 1

Site visit for Pedestrian Infrastructure Quality-of-Service (PIQOS)™ and Bicycle Infrastructure Quality of Service (BIQOS)™

DATE	22 October 2021
DAY	Friday
TIME	9.00 am to 3.30 pm

ATTENDEES

i. TPr. Dr. Gobi Krishna Sinniah
ii. Mohamad Firdaus Bin Hashim
iii. Muhamad Noor Aiman Bin Bani

THE PURPOSE OF THIS SITE VISIT IS TO:

i. To audit pedestrian and cycling lane.
ii. To survey the current condition of the site for Carbon Neutral study

THE SITE VISIT RESULTS OBTAINED ARE:

i. The issues and problems of current network link as well as quality of service components for pedestrian & Cycling lane facilities
ii. The location and current condition of the study site
iii. Identified existing facilities of pedestrian and cycling lane around the site
iv. Potential crossing lane at major road

APPENDIX 2

Site visit for Community Farming Program, Vertical Rooftop Garden and Linear Park Program

DATE	28 October 2021
DAY	Thursday
TIME	2.30 pm to 4.30 pm

ATTENDEES

i. TPr. Dr. Siti Hajar Misnan
ii. Dr. Gabriel Ling Hoh Teck
iii. Dr. Lee Pau Chung
iv. Nur Syahidah Binti Sulaiman
v. Farid Azhar bin Zainal Arifin

THE PURPOSE OF THIS SITE VISIT IS TO:

i. To know the location of site for Community Farming, Vertical Rooftop Garden and Linear Park Program
   - Site visit 850m along Sg Bunus from Eco Park (Wangsa Sari) to
   - Kebun Komuniti, Blok D, Wangsa Maju Seksyen 1
   - Public amenities

ii. To survey the current condition of the site

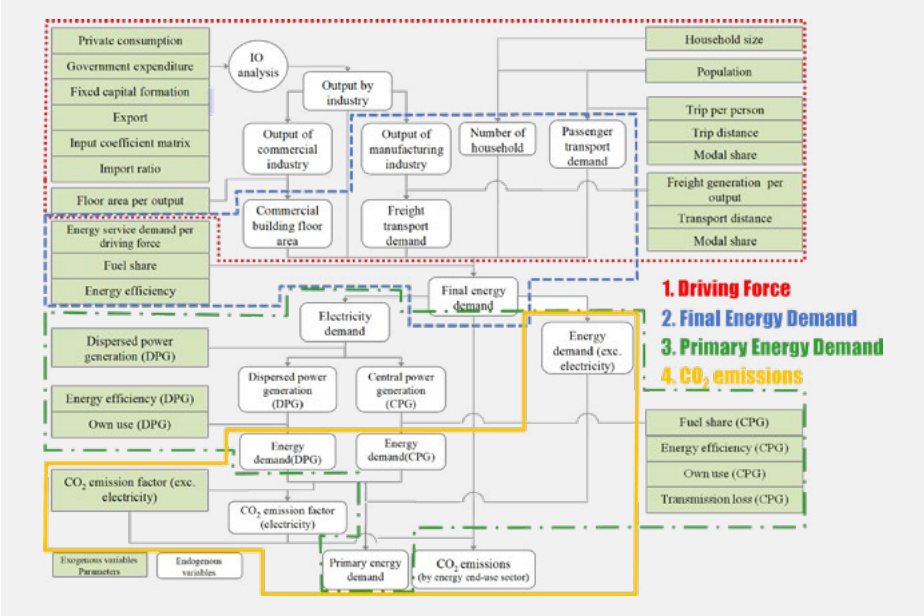
THE SITE VISIT RESULTS OBTAINED ARE:

i. The location and current condition of the site
ii. Identified the number and area of existing community site along Sungai Bunus Wangsa Maju Seksyen 1
iii. Identified existing facilities around the study site

APPENDIX 3

Baseline Data for 2010 Used in KL LCSBP 2030

The Extended Snapshot tool is a key component of the aforementioned Asia-Pacific Integrated Model (AIM) developed by Kyoto University and NIES, Japan. It is a modelling tool to assess future energy consumption, power generation, transportation, industrial outputs, residential and commercial activities and waste generation and GHG emissions, coupling with predetermined socio-economic, industrial and demographic scenarios in a particular future year (the target year).



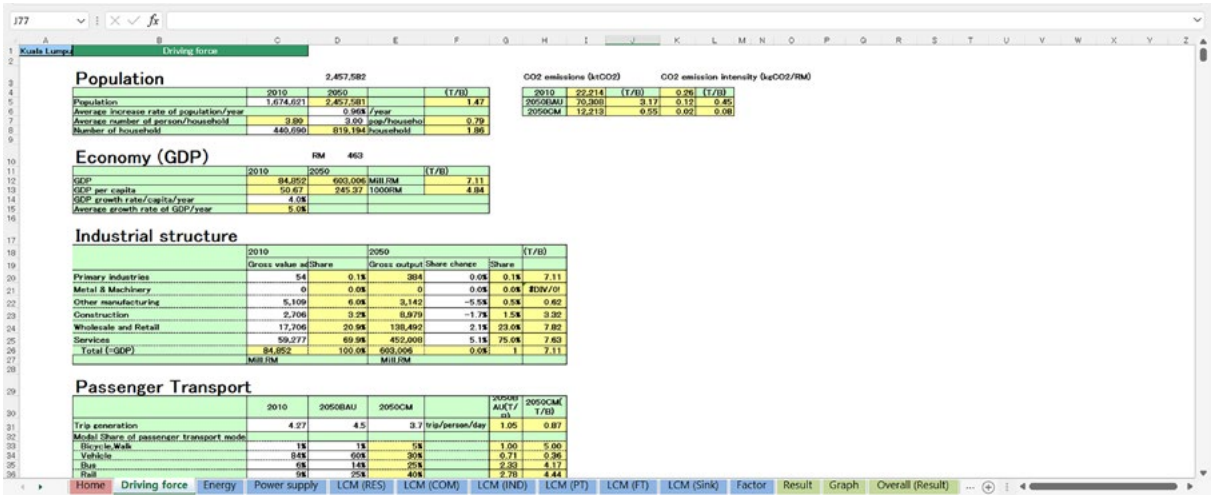
Structure of the ExSS Tool

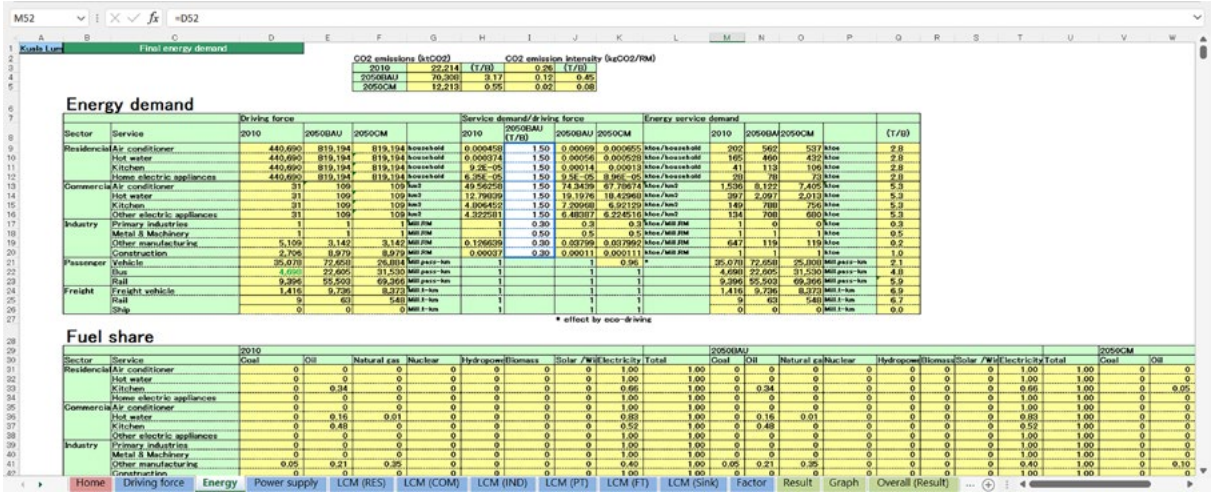
ExSS comprises four modules (driving forces, final energy demand, primary energy supply and GHG emissions) with input parameters, exogenous variables and variables between modules. ExSS is a system of simultaneous equations. Given a set of exogenous variables and parameters, solution is uniquely defined. In this simulation tool, only CO_2 emissions from energy consumption are calculated. In many LCS scenarios, exogenously fixed **population** data are used.

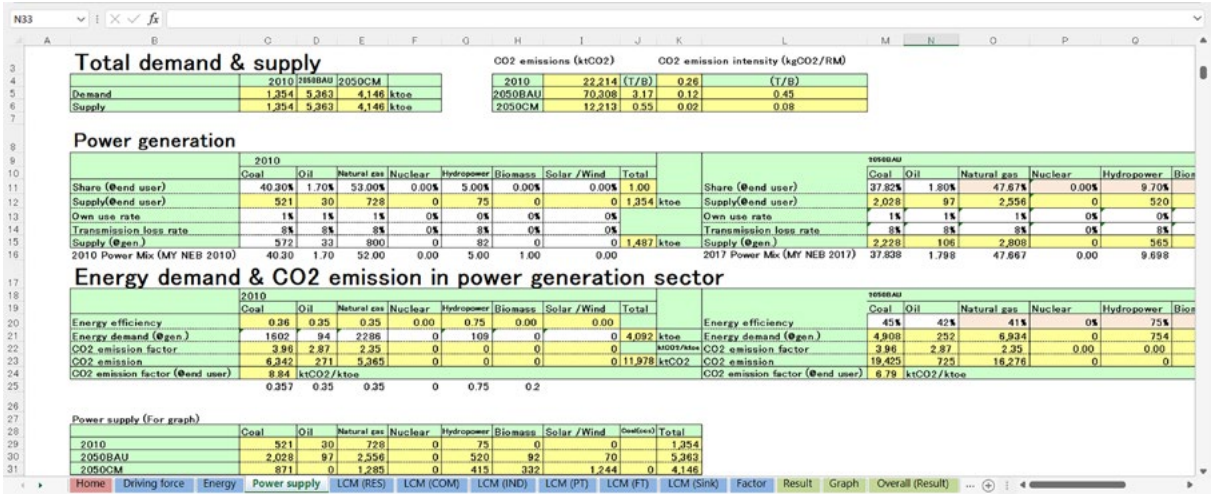
To determine output of **industries**, the 'export-base' input-output approach is combined in line with the theory of regional economics. Industries producing export goods are called basic industries. Production of basic industries induces other industries, i.e. non basic industries, through demand of intermediate input and consumption of their employees. This model enables us to consider viewpoints of regional economic development to estimate energy demand and CO_2 emissions. For future estimation, assumption of export value is especially important if future development of the target region is expected to (or desired to) be led by particular industries, such as automotive manufacturing or petrochemical industries.

Passenger transport demand is estimated from the population and **freight transport** demand, which is taken as a function of output by manufacturing industries. **Floor area** of commercial activities is determined from output of tertiary (service) industries. Other than driving force, activity level of each sector and energy demand by fuels are determined with three parameters: energy service demand per driving force, energy efficiency and fuel share. Diffusion of countermeasures changes the value of these parameters and so GHG emissions.

The estimated results of the future socio-economic indicators and energy demand in 2050 are based on the modelling of the socio-economic variables and energy balance table in 2017. Most of the socio-economic indicators and energy balance table for Kuala Lumpur are obtained from official and published statistics and secondary sources. Assumptions are used where information for macroeconomic analysis is not available for the Kuala Lumpur.







Sector/Aspects	Components	2010
Driving Force		
Population (person)		1,674,621
GDP (RM Mill.)		84,852
Economy Structure (RM Mill.)	Primary (Agriculture, Mining, Quarrying)	54
	Secondary (Manufacturing, Construction)	7,815
	Tertiary (Services, Wholesale and Retail)	76,983
Transport		
Trip Generation (trips/person/day)	Transport	4.27
Mode Share (%)	Public Transport	16
	Private Transport	84
Average Trip Distance (km)	Public Transport	71
	Private Transport	16
Passenger Vehicle by Fuel Type* (%)	Conventional Vehicle Oil	96
	Conventional Vehicle (Biodiesel)	0
	Hybrid (Oil)	0
	Hybrid (Biodiesel)	0
	Electric Vehicle	0
Bus by Fuel Type (%)	Conventional (Oil)	100
	Hybrid Bus (Oil)	0
	Hybrid Bus (Biodiesel)	0
Rail (%)	Conventional Passenger Train (Electric)	100
	High Efficiency Train	0
Behaviour Change (%)	Eco-Driving (Percent of drivers)	0
Freight Vehicle by Fuel Type (%)	Conventional Vehicle (Oil)	100
	Conventional Vehicle (Biodiesel)	0
	Hybrid Vehicle (Oil)	0
	Hybrid Vehicle (Biodesel)	0
Rail (%)	Conventional Freight Train (Electric)	100
	High Efficiency Freight Train (Electric)	0
Waste		
Recycling Rate (%		12
Composting Rate (%)		1
Energy		
Power Generation (%)	Solar	0
	Hydropower	6
	Coal	50
	Oil	5
	Natural Gas	39
	Biomass	0

***Note:** 4% from Natural Gas as in section Fuel Share (Energy Tab)

Sector/Aspects	Components	2010
Low Carbon Green Building		
Commercial Buildings		
Floor Area of Commercial Building (km²)		31
Air Conditioner (%)	High Efficiency Air Conditioner	0
	Conventional Air Conditioner	100
Water Heating (%)	High Efficiency Oil Water Heater	0
	Conventional Oil Water Heater	16
	High Efficiency Electric Water Heater	0
	Conventional Natural Gas Water Heater	1
	Conventional Electric Water Heater	83
	Solar Water Heater	0
Kitchen (%)	High Efficiency Gas Cooking Stove	0
	Conventional Gas Cooking Stove	0
	High Efficiency Oil Cooking Stove	0
	Conventional Oil Cooking Stove	48
	Conventional Electric Cooking Stove	52
	IH Cooking Device	0
Other Electrical Appliances (%)	High Efficiency Electric Appliances	0
	Conventional Electric Appliances	100
Building (%)	Solar Power Generation	0
	Insulation of Commercial Building	0
Behaviour Change (%)	Energy Saving Action (percent of commercial buildings)	0
Residential Buildings		
Air Conditioner (%)	High Efficiency Air Conditioner	0
	Conventional Air Conditioner	100
Water Heating (%)	High Efficiency Oil Water Heater	0
	Conventional Oil Water Heater	0
	High Efficiency Electric Water Heater	0
	Conventional Electric Water Heater	100
Kitchen (%)	High Efficiency Gas Cooking Stove	0
	Conventional Gas Cooking Stove	0
	High Efficiency Oil Cooking Stove	0
	Conventional Oil Cooking Stove	34
	Conventional Electric Cooking Stove	66
	IH Cooking Device	0
Home Electrical Appliances (%)	High Efficiency Home Electric Appliances	0
	Conventional Home Electric Appliances	100
Building (%)	Solar Power Generation (percent of residential buildings)	0
Behaviour Change (%)	Energy Saving Action	0
Industry		
Equipment (%)	Energy Efficiency Improvement	0
Carbon Sink		
Green Spaces (hectares)		2,455
Number of Street Trees		546,322

APPENDIX 4

List of Community and Stakeholder Engagement

1. Sesi Perbincangan bersama Institute for Global Environmental Strategies (IGES) (Online meeting)

24 Ogos 2021 (Selasa) - 3.30 pm

Objektif

- Membincangkan rancangan kerjasama antara sekolah Fujimigaoka High School for girls dengan ialah satu sekolah perempuan di wangsa maju untuk program 'Worldwide learning consortium-International Problem Based Learning'

Output

- Sekolah yang akan terlibat dengan program ini telah dikenalpasti
- Satu tarikh mesyuarat yang akan melibatkan semua pihak yang terlibat dengan program ini telah dirancang

i. IGES

- Dr Junichi Fujino
  Email: fujino@iges.or.jp

ii. UTSB

- Prof. TPr. Dr. Ho Chin Siong
  Email: ho@utm.my
- Prof. Dr. Fatin Aliah Phang
  Email: p-fatin@utm.my
- Dr. Nina Diana Nawi
  Email: ninadiana@utm.my
- Dr. Noor Izzati AriffW
  Email: nizzati89@gmail.com

2. Sesi Perbincangan bersama JPWPKL, IGES, Fujimigaoka High School for Girls, dan SMK (P) Air Panas (Online meeting)

27 Ogos 2021 (Jumaat) - 3.30 pm

Objektif

- Memperkenalkan wakil Fujimigaoka High School dengan wakil SMK (P) Air Panas
- Membincangkan latar belakang dan butiran program
- Merancang garis masa bagi aktiviti program antara pelajar dari 2 sekolah ini

Output

- Garis masa program telah ditetapkan.
- Kedua sekolah bersetuju untuk mengadakan mesyuarat sekali lagi sebelum program melibatkan pelajar bermula.

i. JPWPKL

- En. Nor Adzmi Baba
  Email: adzmi.baba@moe.gov.my
- En. Sanusi
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- En. Reza
- Pn. Norleen

ii. UTSB

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- Prof. Dr. Fatin Aliah Phang
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- Dr. Nina Diana Nawi
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- Dr. Noor Izzati Ariff
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iii. IGES

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iv. SMK (P) Air Panas

- Mdm Norzila binti Ali Musa, Principle
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- Mdm Salma Wahab, Teacher
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- Mdm Naziha Khorlid, Teacher
  Email: g-84416640@moe-dl.edu.my
- Mdm Tg Norli Tg Ramli, Teacher
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v. Fujimigaoka High School

- Mr. Kunihiko Hakuo, Vice Principal
  Email: hakuo@fujimigaoka.ac.jp
- Mr. Narutoshi Yoshida, Assistant to Principal
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- Mr. Kazunari Sato, Deputy Vice Principal
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- Ms. Naoko Minobe, Teacher for Global Course
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- Ms. Hayashi, Science Teacher
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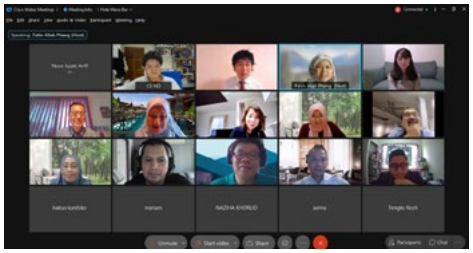

3. Sesi Perbincangan dan Lawatan Tapak ke Wangsa Maju bersama DBKL dan Komuniti PPR Wangsa Sari, Wangsa Walk Sungai Bunus

Lawatan Khas Pegawai DBKL ke MGIT untuk perbincangan minyak masak terpakai ke Bio Diesel B10

9 September 2021 (Khamis) - 10.00 am

Objektif

- Membuat lawatan tapak ke kebun komuniti di PPR Wangsa Sari dan Sungai Bunus
- Membuat lawatan tapak Eco Park
- Memberi taklimat kepada perunding berkaitan kebun komuniti sedia ada di PPR Wangsa Sari dan Sungai Bunus

Output

- Menambahbaik komponen projek dan potensi lokasi untuk cadangan kebun komuniti dan Eco Park
- Taklimat yang diberi dijadikan input dalam engagement bersama komuniti untuk mendapatkan maklumbalas

i. Pihak DBKL

ii. Penduduk PPR Wangsa Sari

- En. Ismail Bin Mohamad

iii. UTSB

- Prof. TPr. Dr. Ho Chin Siong
- Prof. Ir. Dr. Haslenda Hashim
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- TPr. Chau Loon Wai
  Email: lwchau@utm.my
- Dr. Teh Bor Tsong
  Email: tehbortsong@gmail.com
- Pn. Mlysha Nursyhla
  Email: myshysha@gmail.com
- Cik Nur Syahidah Sulaiman
  Email: syahidah2033@gmail.com

4. Sesi Perbincangan bersama JPWPKL, IGES, Fujimigaoka High School for Girls, dan SMK (P) Air Panas (Online meeting)

15 September 2021 (Rabu) - 2.30 pm

Objektif

- Kedua sekolah membentangkan tajuk perbincangan berkaitan dengan karbon neutral.
- Membincangkan butiran program, dan mengemaskini garis masa

Output

- Kedua sekolah bersetuju untuk terus menjalankan program bersama pelajar.
- Perjumpaan seterusnya telah dirancang untuk memperkenalkan pelajar dari kedua sekolah.

i. JPWPKL

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- En. Reza
- Pn. Norleen

ii. UTSB

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- Prof. Dr. Fatin Aliah Phang
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- Dr. Nina Diana Nawi
  Email: ninadiana@utm.my
- Dr. Noor Izzati Ariff
  Email: nizzati89@gmail.com

iii. IGES

- Dr Junichi Fujino
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iv. SMK (P) Air Panas

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- Mdm Salma Wahab, Teacher
  Email: g-60417797@moe-dl.edu.my
- Mdm Naziha Khorlid, Teacher
  Email: g-84416640@moe-dl.edu.my
- Mdm Tg Norli Tg Ramli, Teacher
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v. Fujimigaoka High School

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  Email: narutoshi@fujimigaoka.ac.jp
- Mr. Kazunari Sato, Deputy Vice Principal
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- Ms. Naoko Minobe, Teacher for Global Course
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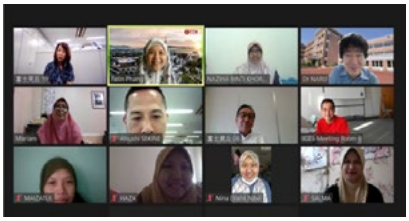
- Ms. Hayashi, Science Teacher
  Email: hayashi@fujimigaoka.ac.jp



5. Sesi Perbincangan bersama Jabatan Pendidikan Wilayah Persekutuan Kuala Lumpur (JPWPKL) (Online meeting)

22 September 2021 (Jumaat) - 8.30 pm

Objektif

- Membentangkan program-program rendah karbon yang telah dijalankan di sekolah-sekolah di Iskandar Puteri.
- Memohon kerjasama dari JPWPKL untuk menjalankan program karbon neutral di sekolah.

Output

- Pihak JPWPKL menyatakan sokongan penuh dan bersetuju untuk memberi kerjasama pada program yang dirancang.

i. JPWPKL

- En. Nor Adzmi Baba
  Email: adzmi.baba@moe.gov.my
- En. Sanusi
  Email: sanusi.mansur@moe.gov.my
- En. Reza
- Pn. Norleen

ii. UTSB

- Prof. TPr. Dr. Ho Chin Siong
  Email: ho@utm.my
- Prof. Dr. Fatin Aliah Phang
  Email: p-fatin@utm.my
- Dr. Nina Diana Nawi
  Email: ninadiana@utm.my
- Dr. Noor Izzati Ariff
  Email: nizzati89@gmail.com

6. Mesyuarat Pelan Tindakan Wangsa Maju untuk Energy Efficiency (EE) dan Renewable Energy (RE) bersama Aeon Malaysia

15 Oktober 2021 (Jumaat) - 3:00pm

Objektif

- Memberi taklimat berkaitan cadangan projek pemasangan panel solar di Aeon Wangsa Maju Alpha Angle sebagai projek perintis usahasama DBKL untuk pusat komersial
- Mendapatkan maklumbalas dari TMG dan AEON untuk cadangan ini

Output

- Pihak Aeon Malaysia bersetuju dan berminat untuk terlibat dalam kajian ini dan melantik Mini CEO bagi tujuan ini

i. Aeon (M) Sdn Bhd

- En. Shafie Shamsudin, Managing Director/CEO
- Tsutomu Motomura, Deputy CEO
- Nobutada Hanaoka, Chief Governance Officer
- Dr Kasuma Satria, Chief HR Officer
- Puan Salmieh Mohd Zin, Secretary and Public Outreach
- Datin Rajeswari Dhanam, Head of Wangsa Maju Mall
- Email: rajesh.dhanam@aeonbig.com.my
- Tsunenori Futagi, Strategy Dept. Senior Director
- Puan Hamidah Bohri, Strategy Dept. Senior Manager
- En Farquar Haqqani Fadhullah Suhaimi, Strategy Dept., Senior Manager
- En Farquar Haqqani Fadhullah Suhaimi

ii. SEDA

- Ts. En. Steve Anthony Lojuntin
  Email: steve@seda.gov.my

iii. UTSB

- Prof. TPr. Dr. Ho Chin Siong
- TPr. Chau Loon Wai

iv. IGES

- Junichi Fujino
- Ryoko Nakano
- Michiko Inoue

v. Tokyo Metropolitan (TMG)

- Toshiko Chiba
- Kumiko Sugawara
- Takumi Niino

7. Sesi Perbincangan Pengurusan Sisa @ Wangsa Maju bersama Alam Flora (Online meeting)

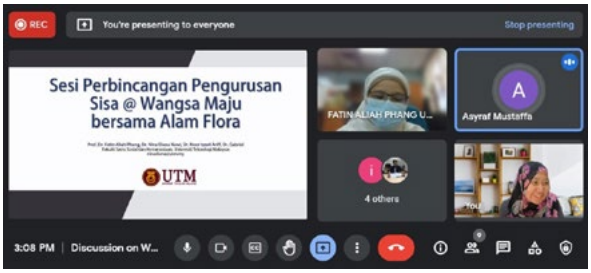
20 Oktober 2021 (Rabu) - 3.00 pm

Objektif

- Berkongsi maklumat program pengurusan sisa yang dilaksanakan oleh UTM di Johor
- Mendapatkan maklumat program pengurusan sisa di Kuala Lumpur oleh Alam Flora

Output

- Menambah baik komponen projek dan potensi lokasi bagi Program 1 Komuniti 1 Kitar Semula



i. Alam Flora Sdn Bhd

- Pn Ismi azura Istear khan, Project Manager
  Email: feedback@alamflora.com.my
- En Asyraf Mustaffa
- En Farid Wajdi
  Email: mdfarid@alamflora.com.my

ii. UTSB

- Prof. Dr. Fatin Aliah Phang
  Email: p-fatin@utm.my
- Dr. Nina Diana Nawi
  Email: ninadiana@utm.my
- Dr. Gabriel Ling Hoh Teck
  Email: gabriel.ling@utm.my
- Dr. Noor Izzati Ariff
  Email: nizzati89@gmail.com
- Cik Nur Syahidah Sulaiman
  Email: syahidah2033@gmail.com

8. Sesi Perbincangan bersama pihak pengurusan sisa fabrik Kloth Cares (Panggilan telefon)

20 Oktober 2021 (Rabu)

Objektif

- Meminta persetujuan dari pihak Kloth untuk pengumpulan dan pengurusan sisa fabrik di sekolah dan komuniti

Output

- Pihak Kloth bersetuju untuk membantu pengurusan sisa fabrik di sekolah
- Satu kawasan pengumpulan sisa fabrik yang sedia ada telah beroperasi dalam kawasan Wangsa Maju

i. Kloth Cares

- En. Zaki
  Email: ask@kloth.com.my

ii. UTSB

- Dr. Nina Diana Nawi
  Email: ninadiana@utm.my

9. Sesi perbincangan mengenai pengurusan sisa minyak masak terpakai (Panggilan telefon)

20 Oktober 2021 (Rabu)

Objektif

- Membincangkan kemungkinan jika pihak apeiron menjalankan kutipan sisa minyak masak terpakai di kawasan Wangsa Maju

Output

- Pihak Apeiron bersetuju dan memberikan harga yang tinggi untuk minyak masak terpakai

i. Apeiron bioenergy

- Email: abmy.enquiry@apeirontrading.com
- No.tel: 07-868 9812

ii. UTSB

- Dr. Nina Diana Nawi
  Email: ninadiana@utm.my

10. Sesi Perbincangan bersama Elena with Bike Club KL

21 Oktober 2021 (Khamis) - 10.00 am

Objektif

- Mengenalpasti titk tumpuan basikal dan pejalan kaki

Output

- Elena with Bike Club berpendapat kemudahan tempat letak basikal perlu diutamakan di kawasan Wangsa Maju
- Menambah baik komponen projek Pedestrian and Cycling

i. Elena with Bike Club

- En. Shamrin Tamrin
  Email: shahrimtamrin@gmail.com

ii. UTSB

- TPr. Dr. Gobi Krisnan
  Email: sgobi@utm.my
- En. Mohamad Firdaus Bin Hashim

11. Sesi Perbincangan Awal bagi Persediaan sesi rundingan bersama pihak perunding (Skop Komuniti - Kumpulan Sasaran Sekolah dan Agensi Luar)

27 Oktober 2021 (Rabu) - 9.30 am

Objektif

- Mendedahkan amalan terbaik rendah karbon di kalangan sekolah dan komuniti di Johor
- Berkongsi dapatan dari sesi engagement bersama pemegang taruh (JPNKL, Iges Japan, Alam Flora, Kloth dan Apeiron Bio Energy)

Output

- Pihak DBKL bersetuju dan berminat dengan cadangan yang dibentangkan
- Jabatan dalaman DBKL memberi maklum balas dan cadangan agar laporan lebih jelas dan padat.

i. Pihak DBKL

- Tn Hj. Rosli, JPRB
- Pn. Norazmin Adibah Othman, LA21
- Pn. Norhayati Mohd Said, JKAS
- En. Muhammad Aiman Abdul Hakim, JPLR
- Pn. Noor Shatina, JPRB
- Pn. Najwatul Husna, JPRB
- Pn. Siti Hajar Madina, LA21

ii. UTSB

- Prof. Dr. Fatin Aliah Phang
  Email: p-fatin@utm.my
- Dr. Nina Diana Nawi
  Email: ninadiana@utm.my
- Dr. Gabriel Ling Hoh Teck
  Email: gabriel.ling@utm.my
- Dr. Noor Izzati Ariff
  Email: nizzati89@gmail.com
- Cik Nur Syahidah Sulaiman
  Email: syahidah2033@gmail.com

12. Sesi Perbincangan bersama komuniti Wangsa Maju

19 Oktober 2021 (Khamis) - 8:00 am

Objektif

- Berkongsi maklumat program komuniti yang dicadangkan oleh UTM di Wangsa Maju
- Mendapatkan maklumbalas dan verifikasi daripada komuniti untuk 4 program *(Eco Park, Community Farming, Waste Recycling Centre, 1 Community 1 Recycling)*

Output

- Menambah baik komponen projek dan potensi lokasi bagi 4 program

i. LA21 dan wakil Jabatan yang relevan

- Tn Hj. Rosli, JPRB
- Pn. Norazmin Adibah Othman, LA21
- Pn. Norhayati Mohd Said, JKAS
- En. Muhammad Aiman Abdul Hakim, JPLR
- Pn. Noor Shatina, JPRB
- Pn. Najwatul Husna, JPRB
- Pn. Siti Hajar Madina, LA21

ii. Wakil Penduduk Wangsa Maju

- En. Mohd Yusuf Hj Susein, Wakil penduduk Sek. 2
- En. Razali Hj Sulaiman, wakil penduduk Sek.2
- Pn. Norhayati Dakil, wakil penduduk Sek 10
- Pn. Naemah Nasir, wakil penduduk Sek. 10
- En. Azly Abd Muis, wakil penduduk Sek. 2
- Tn. Hj. Mustafa Mohd Auf, wakil penduduk Sek.1
- En. Ismail Mohammad, wakil penduduk PPR Wangsa Sari

iii. UTSB

- Prof. Ir. Dr. Haslenda Hashim
  Email: haslenda@cheme.utm.my
- Prof. Dr. Lee Chew Tin
  Email: ctlee@utm.my
- Dr. Gabriel Ling Hoh Teck
  Email: gabriel.ling@utm.my
- Cik Nur Syahidah Sulaiman
  Email: syahidah2033@gmail.com

13. Sesi Perbincangan bersama pihak berkepentingan untuk sektor tenaga dan sisa

7 November 2021 (Selasa) - 2.30 pm

Objektif

- Berkongsi maklumat program dalam sektor tenaga dan sisa yang dicadangkan oleh UTM di Wangsa Maju
- Mendapatkan maklumbalas dan verifikasi daripada pihak berkepentingan untuk program sektor tenaga dan sisa

Output

- Menambah baik komponen projek dan potensi lokasi

i. Pihak DBKL

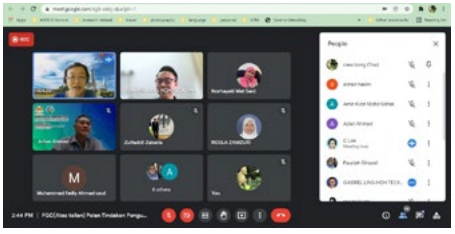
- En. Mohd Yushanizar Md Yusof, JPRB
- Pn Norazmin Adibah Othman, LA21
- Pn Norwahidah Abdul Wahid, JPRB
- Cik Nurul Hidayah Zawawi, JPRB
- En. Mohd Firdaus Abu Hassan, JPRB
- Cik Sharifah Athirah Izyan Wan Kassim, JPRB
- Cik Siti Hajar Madina Mohd Zain, LA21
- Pn Norhayati Mohd Said, JKAS
- En. Muhammad Aiman Abdul Hakim, JPLR
- Mohd Rashid Jamaluddin, JPPP
- En. Amir Aizat Mohd Sahak, JKME
- IR. Mohd Osnizam Othman, JKME
- Mohd Rozaidi Md Yusoff, JPPH

ii. Agensi

- Zamakhshari b. Hanipah, JPSPN
  Email: kpjpspn@kpkt.gov.my
- Shahrizal bin Samad (Pengarah- Bahagian Sisa Domestik dan Pembersihan Awam), SWCorp
  Email: shahrizal@swcorp.my
- Luqman Bin Baharudin (Penilaian (EIA), DOE
  Email: luqman@doe.gov.my
- En. Ibrahin Ariffin, SEDA

iii. UTSB

- Prof. Dr. Lee Chew Tin
  Email: ctlee@utm.my
- Dr. Gabriel Ling Hoh Teck
  Email: gabriel.ling@utm.my
- Dr. Cassendra Bong Phun Chien
  Email: nitecass@gmail.com
- Cik Nur Syahidah Sulaiman
  Email: syahidah2033@gmail.com



14. Focus Group Discussion (FGD) bersama pihak berkepentingan

22 Disember 2021 (Rabu) - 8.30 am

Objektif

- Berkongsi maklumat semua program yang dicadangkan oleh UTM di Wangsa Maju
- Mendapatkan maklumbalas dan verifikasi daripada pihak berkepentingan untuk semua program di Wangsa Maju

Output

- Menambah baik komponen projek, potensi lokasi dan pihak/ agensi yang terlibat

i. DBKL

- Ir. Mohd Osnizam Othman, JKME
- Siti Nor Fairus binti Mohd Darus, JKB
- Nurfatin Izzati Ahmad Kamal, JKAS
- Masitah Salleh
- Syahirah Zulkiplee
- Muhammad Azrii bin Abdul Aziz
- Rahayu Muhammad Taib
- Noormin Ismail
- Raja Abd Rahman Bin Raja Omar (Urus Setia, LA21)
- Cik Siti Hajar Madina, LA21
- Norizatul Ziha Bt. Shahril, LA21
- En Hanafi B. Amil, Jab. Perlesenan
- En Irwan Shafari Wahab, JPEP
- En Yusman Harith, JPKKB
- Muhd Aiman b. Abd. Hakim, JPLR

ii. Agensi

- Ahmad Faizal b. Ahmad Tarmizi, Aeon
- Mark Yong (GM), Aeon
- Edmund Lau (MCL Land, GM Project)
- Mohd Zhafri (MCL Land, Ass. Manager O&M Chargeman)
- Nur Azam Kamarudin, ST
- Koshminder Singh, MOSTI
- Siti Azulainey Mohd Aslan, JPSPN
- BK Sinha, MGBC
- Nik Fadzillah Nik Zulkarnain, MOT
- Ts. Dr. Rizati Hamdan, MIROS
- Justin Lee Kah Wai, Bike with Elena
- Julie Choh, REHDA
- Za'im Shahid (TD), Ranhill Bersekutu
- Ir. Ravi Shankar (Transport), Ranhill Bersekutu
- Aznie Rahim, KASA
- En Firdzaus Bin Said, PPD Keramat
- Pn Mastura Omar, SK Setiawangsa (PKKD)
- Pn Norfouwiza Jalani, SK AU Keramat (PK1)
- En Noor Azizan Abd Hadi, SMK Tmn Setiawangsa (Pengetua)
- Pn Siti Najwa Hashim, SMK Desa Tun Hussien Onn (PK Kokurikulum)
- Ahmad Faizal b. Ahmad Tarmizi , JPS

iii. UTSB

- Prof. TPr. Dr. Ho Chin Siong
  ho@utm.my
- Prof. Ir. Dr. Haslenda Hashim
  haslenda@cheme.utm.my
- TPr. Chau Loon Wai
  lwchau@utm.my
- Prof. Dr. Lee Chew Tin
  Email: ctlee@utm.my
- Dr. Gabriel Ling Hoh Teck
  Email: gabriel.ling@utm.my
- TPr. Dr. Siti Hajar Misnan
  Email: shajar@utm.my
- Dr. Cassendra Bong Phun Chien
  Email: nitecass@gmail.com
- Prof. Dr. Fatin Aliah Phang
  Email: p-fatin@utm.my
- Dr. Leng Pau Chung
  Email: pcleng2@utm.my
- Assoc. Prof. Ts. Dr. Ho Wai Sin
  Email: howaishin@petroleum.utm.my
- Cik Rohayu Binti Abdullah
  Email: ayu_abdullah91@yahoo.com
- Cik Nur Syahidah Sulaiman
  Email: syahidah2033@gmail.com
- Cik Norhayati Zainon
  Email: norhayati.z@graduate.utm.my
- Nur Hanie Irdina Jamaludin
  Email: nhirdinawork@gmail.com

APPENDIX 5

Guideline

(a) NEM 3.0 Programme

The Government has introduced the Net Energy Metering Scheme in November 2016 with quota allocation of 500 MW up to year 2020 to encourage Malaysia's Renewable Energy (RE) uptake. The concept of NEM is that the energy produced from the solar PV installation will be consumed first, and any excess will be exported to TNB at prevailing displaced cost.

As an effort to encourage the NEM uptake, the NEM 2.0 was introduced on 1st January 2019, and the true net energy metering concept was adopted, where it allows excess solar PV generated energy to be exported back to the grid on a "one-on-one" offset basis. The NEM scheme were executed by the Ministry of Energy and Natural Resources (KeTSA), regulated by the Energy Commission (EC), with Sustainable Energy Development Authority (SEDA) Malaysia as the Implementing Agency (IA). The 500MW quota under the NEM 2.0 has been fully subscribed by 31st December 2020.

Due to overwhelming response from the PV industry and in an effort to boost the usage of Solar energy, the Energy and Natural Resources Minister via a press statement by KeTSA on 29th December 2020 has introduced the new Net Energy Metering 3.0 programme (NEM 3.0) to provide more opportunities to electricity consumers to install solar PV systems on the roofs of their premises to save on their electricity bill. The NEM 3.0 will be in effect from 2021 to 2023 and the total quota allocation is up to 500 MW. The NEM 3.0 will be divided into the following three (3) new initiatives/categories in the table.

Quota Allocation and Opening date of NEM 3.0 Programme

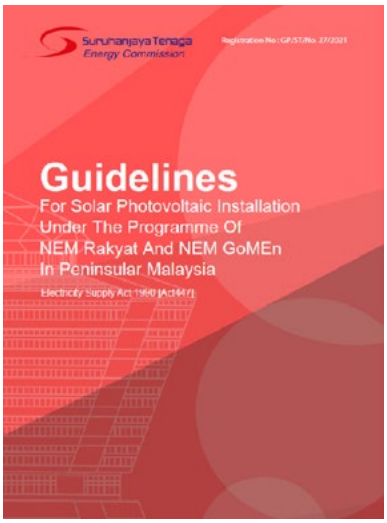
Initiative	Quota Allocation (MW)	Quota Opening Date
NEM Rakyat	100	1st February 2021– 31st December 2023
NEM GoMen	100	1st February 2021– 31st December 2023
NOVA	300	1st April 2021– 31st December 2023

Source: SEDA, 2021

(b) Guideline for Solar Photovoltaic Installation under The Programme of NEM Rakyat and NEM GoMEn in Peninsular Malaysia

These Guidelines are developed by the Commission for the following objectives:

- to prescribe the principles of two (2) initiatives under the NEM 3.0 Programme, namely NEM Rakyat and NEM GoMEn;
- to set out roles and responsibilities of the Implementing Agency, Distribution Licensee and NEM Consumer in NEM Rakyat and NEM GoMEn; and
- to regulate matters relating to the implementation and operation of the NEM Rakyat and NEM GoMEn.



Source: SEDA, 2021

These Guidelines shall apply to:

- any Domestic Consumer and Government Agency complying with these Guidelines in participating in the NEM Rakyat and NEM GoMEn in Peninsular Malaysia;
- the relevant Distribution Licensee, whose Distribution System is connected to the NEM Consumer; and
- the Implementing Agency for the NEM Rakyat and NEM GoMEn.

Eligibility Capacity and Period of Application

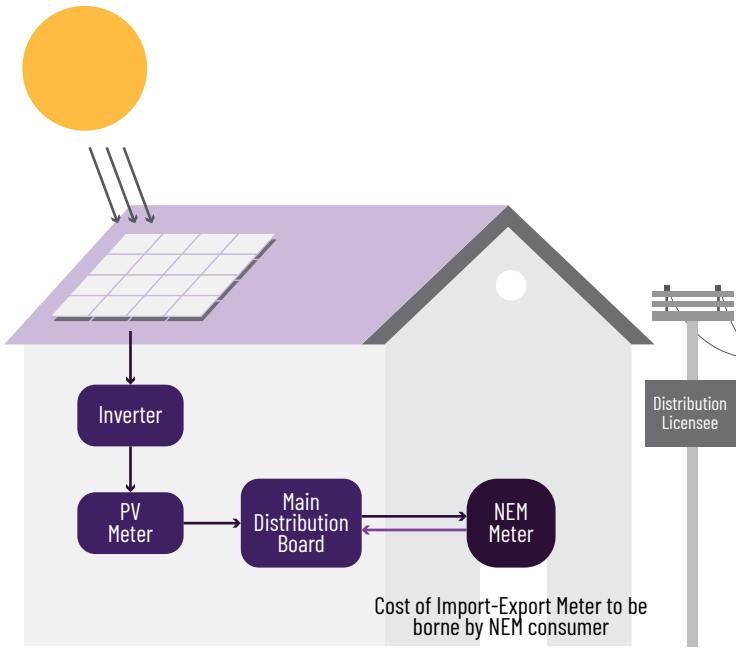
The total capacities eligible for application under the NEM 3.0 Programme in Peninsular Malaysia are as follows:

- For Domestic Consumer – up to 100,000 kW; and
- For Government Agency – up to 100,000 kW.

The NEM Rakyat and the NEM GoMEn are open for application from 1 February 2021 to 31 December 2023 and are available on a first-come-first-served basis.

Connection of Solar PV Installation

Connection to the Distribution System shall be through Indirect Connection. Figure below shows the diagram of the connection between the NEM Consumer's solar PV Installation and the Distribution Licensee's Distribution System.



The connection of a solar PV installation to the Consumer electrical installation

GLOSSARY

NEM GoMEn means one of the initiatives under the NEM 3.0 Programme for government ministries and entities, which had not participated in any of the prior solar programmes

NEM Rakyat means one of the initiatives under the NEM 3.0 Programme for Domestic Consumer(s) who have not participated in any of the prior solar programmes;

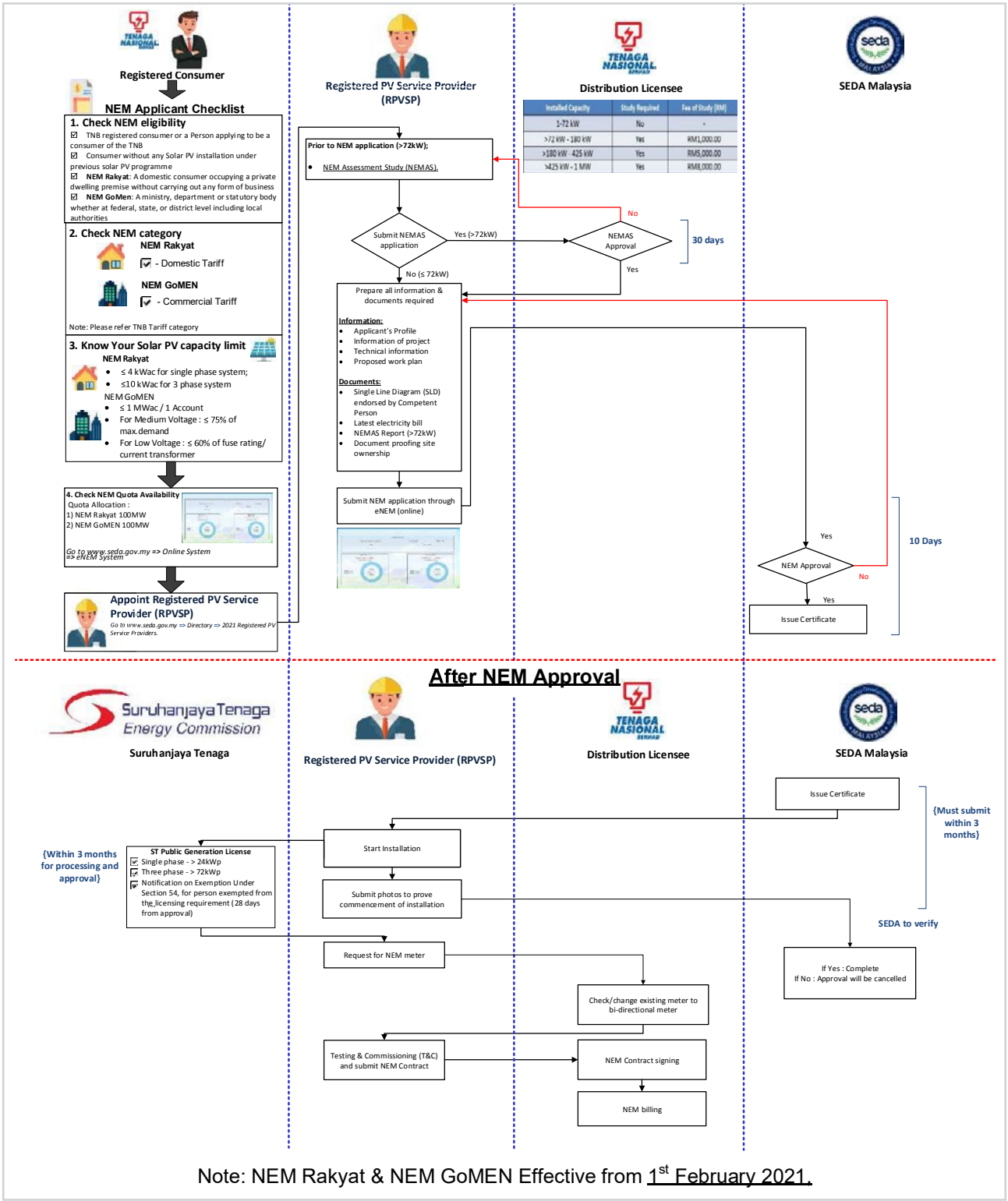
Procedure for Application

Any application for the NEM 3.0 Programme shall be on a first-come-first-served basis up to the allocated capacity for each category or up to 31 December 2023, whichever comes first.

The application shall be submitted to the Implementing Agency with supporting documents. An application fee of RM10 per kW will be charged for an application by the NEM Consumer.

The Implementing Agency shall publish the NEM Rakyat and NEM GoMEn programmes, the available capacity for application up to the previous day, these Guidelines, the procedure of application and application form on its website.

The Implementing Agency shall make copies of the procedure of application and application form to be provided to any Applicant for the NEM 3.0 Programme. The details of procedure and application form is attached in figure below.



The application flow of NEM Rakyat and NEM GoMen

(c) Guideline for Solar Photovoltaic Installation under Net Offset Virtual Aggregations (NOVA) Programme in Peninsular Malaysia

The NOVA Programme is a programme under which a consumer can install solar PV installation for self-consumption in its own Premises. The solar PV Installation shall be designed primarily for self-consumption. In order to enhance the cost efficiency of the solar PV Installation and maximising the use of Energy produced by the solar PV Installation, any excess Energy which is not consumed at the Premise where the PV Installation is located due to operational constraints or monthly or seasonal variation in load demands at the said Premises may be exported through the Supply System under one of the following categories.

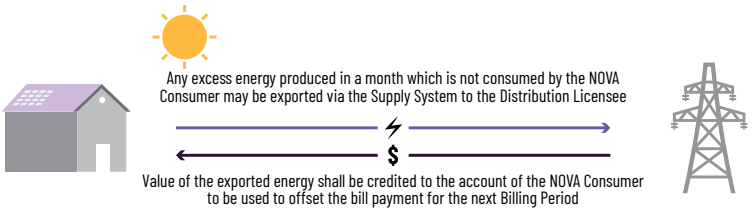


Figure 1: Category A

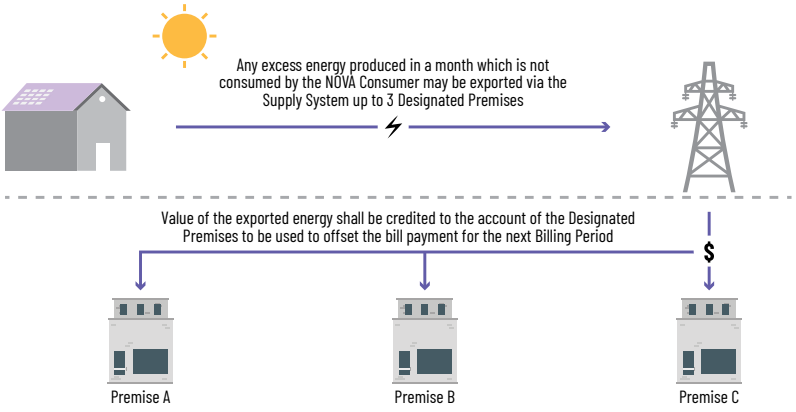
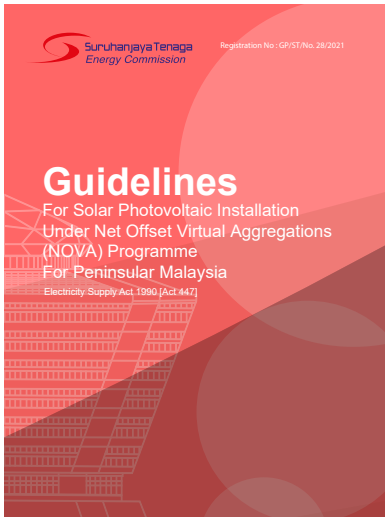


Figure 2: Category B

These Guidelines shall apply to:

- the Peninsular Malaysia NOVA Programme Non-domestic Consumer(s) participants;
- the relevant Distribution Licensee, who is distributing, supplying and retailing electricity to the NOVA Consumer;
- the Grid Owner, whose Transmission System is directly connected to the NOVA Consumer; and
- the Implementing Agency for the NOVA Programme



Source: SEDA, 2021

There two (2) Categories in NOVA Programme:

Category A

Any excess Energy produced in a month which is not consumed by the NOVA Consumer may be exported via the Supply System to the Distribution Licensee.

Category B

Any excess Energy produced in a month which is not consumed by the NOVA Consumer may be exported via the Supply System up to three (3) Designated Premise

These Guidelines are developed by the Commission with the following objectives:

- to prescribe the principles of the NOVA Programme;
- to set out roles and responsibilities of the Implementing Agency, Distribution
- Licensee, Grid Owner and NOVA Consumers in the NOVA Programme; and
- to regulate matters relating to the implementation and operation of the NOVAProgramme.

Period of Operation Under The Nova Programme

- The period of operation under the NOVA Programme shall not be more than ten (10) years from the Commencement Date of the solar PV Installation. Subsequent to the end of the validity of the NOVA Programme, the NOVA Consumer may operate its solar PV Installation strictly for self-consumption only and no export of Energy will be allowed.

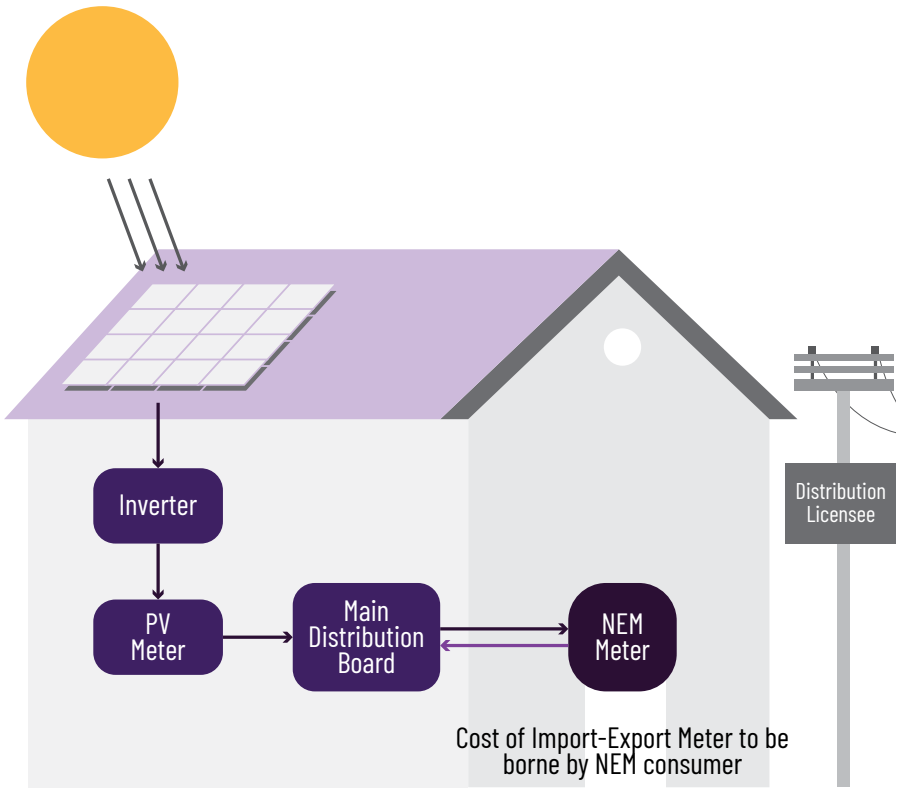
Available Capacity and Period of Application

A total capacity of up to 300MW is available under the NOVA Programme in Peninsular Malaysia:

- A NOVA Consumer under Category A shall not install more than 1,000kW for net offset
- A NOVA Consumer under Category B shall not install more than 5,000kW for net offset

Point of interconnection of the Solar PV Installation

- The solar PV installation shall be connected at a point at the NOVA Consumer's Installation before the Bi-directional Meter of the Distribution Licensee, or commonly known as behind the meter connection or Indirect Connection.
- The connection between the NOVA Consumer's solar PV Installation and the Supply System is as illustrated in the figure below:

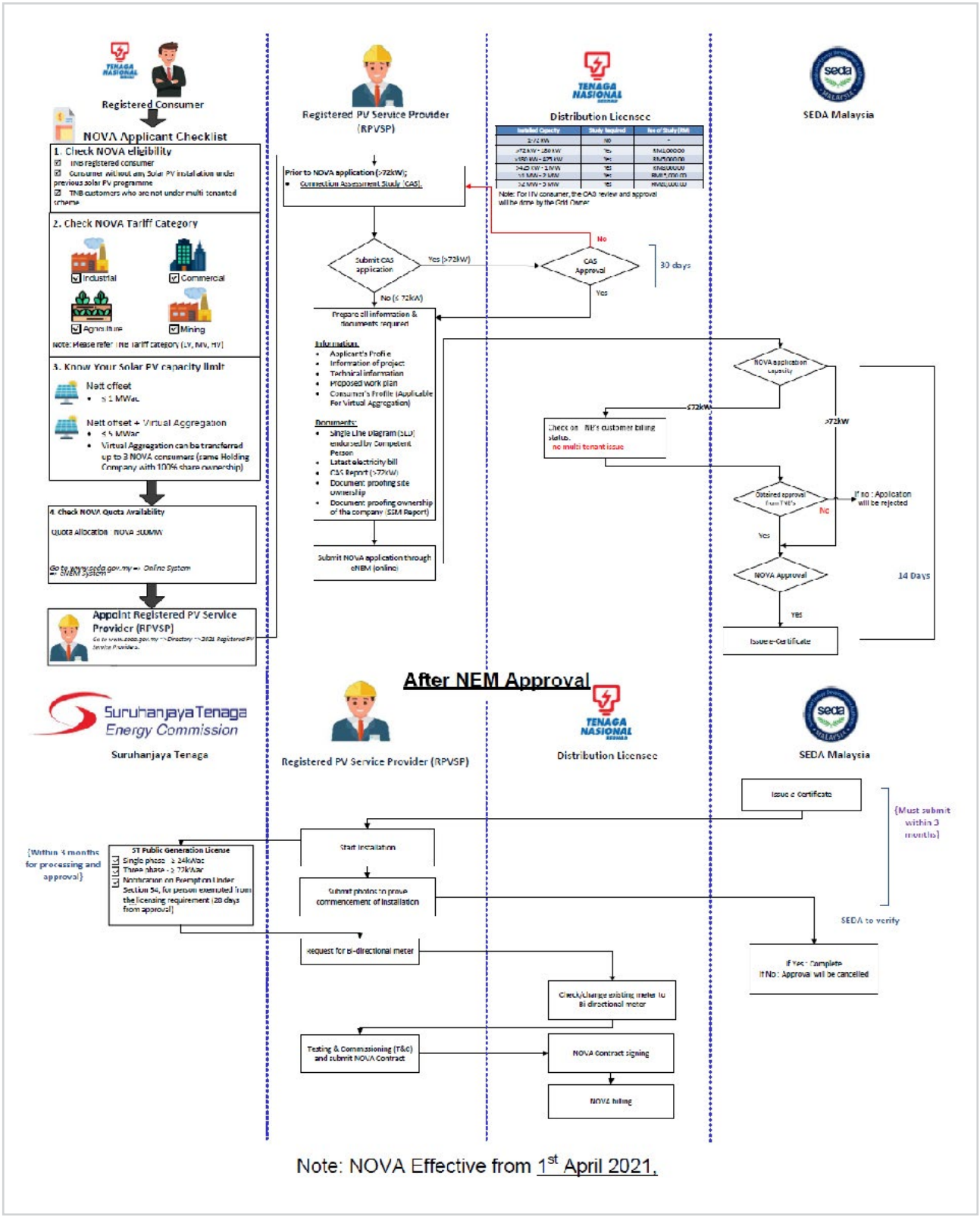


The connection of a solar PV installation to the Consumer electrical installation

Procedure for Application

The Implementing Agency shall publish the NOVA Programme, the available capacity for application up to the previous day, these Guidelines, the application procedures and the application form on its website.

The Implementing Agency shall make copies of the application procedures and the application form to be provided to any Applicant for the NOVA Programme. The details of the application procedures and the application form are attached in figure of these Guidelines.



The application flow of NOVA programme

APPENDIX 6

Focus Group Discussion (FGD) for: Kajian Pelan Tindakan Pusat Pertumbuhan Neutral Karbon Wangsa Maju 2050

- Date : 22 Disember 2021 (Wednesday)
- Time : 10.00 am
- Venue : Pullman Kuala Lumpur City Centre - Hotel & Residences, 4, Jalan Conlay, Kuala Lumpur, 50450 Wilayah Persekutuan Kuala Lumpur

The purpose of this FGD session is to inform all stakeholders about the efforts by KLCH to make Wangsa Maju as a Carbon Neutral Growth Center by 2050. In addition, this session can provide opportunities for stakeholders in Wangsa Maju to also contribute ideas, views and suggestions in the preparation of the Wangsa Maju Carbon Neutral Growth Center Action Plan 2050 for the Energy, Transportation, Waste, Green and Community sectors.

The method of implementation of FGD is:

Time	*Details*
10.00 am	Registration
10.15 am	Welcoming speech by KLCH
10.30 am	Introduction Presentation by Prof Ho Chin Siong
11.00 am	**Focus Group Discussion based on Sectors** Group Division **Group 1:** Energy Prof Ir.Dr. Haslenda Hashim Prof. Dr. Ho Wai Shin **Group 2:** Waste Prof Lee Chew Tin **Group 3:** Mobility TPr. Dr. Gobi Krishna Sinniah TPr. Chau Loon Wai **Group 4:** Community Prof. Dr. Fatin Aliah Phang TPr. Dr. Siti Hajar Misnan **Group 5:** Green TPr. Prof Ho Chin Siong Prof Mohd Hamdan Ahmad Dr. Gabriel Ling Hoh Teck
1.00 pm	Lunch
2.00 pm	Continues Focus Group Discussion based on Sectors
4.30 pm	End

The list of agencies present and FGD findings by sector are as follows:

(1) Energy Sector

(A) ATTENDANCE

Facilitator: Prof Ir.Dr. Haslenda Hashim, Assoc. Prof. Dr. Ho Wai Shin, Cik Norhayati Zainon

No.	Agency	Name/Position	Email
		Energy	
1	AEON Co. (M) BHD	Ahmad Faizal b. Ahmad Tarmizi	andrew.teoh@aeonretail.com.my
		Mark Yong (GM)	mark.yong@aeonretail.com.my
2	MCL Land (M) SDN NHD	Edmund Lau (GM Project)	edmund@mclland.com.my
		Mohd Zhafri (Ass. Manager O&M Chargeman)	zhafri@mclland.com.my
3	Energy Commission (ST)	Nur Azam Kamarudin	nurazam@st.gov.my
4	Ministry of Science, Technology and Innovation (MOSTI)	Koshminder Singh	
5	KLCH (JKME)	Ir. Mohd Osnizam Othman	osnizam@dbkl.com.my
6	KLCH (JKB)	Siti Nor Fairus binti Mohd Darus	sitinorfairus@dbkl.com.my

(B) INPUT

No.	Project	Feedbacks Summary
1	Rooftop Solar PV	◢ In Progress Implementation in Aeon Alpha Angle (selco), Aeon Big still in study on rooftop suitability ◢ Aeon Big has potential of 5-6 MWp but need less than 2 MWp ◢ Need to expedite quota for NEM from SEDA, suggest a special quota for Wangsa Maju area. ◢ They have more than enough space for PV installation, and in fact, had to scale down to comply with ST guidelines. However if they can obtain NEM, they can go larger. ◢ Agree with the project and suggest for supported letters from the mayor ◢ Cannot commit for 20 years because the building is too old and might go for redevelopment. However if the solar can be dismantled and reinstalled, it will be more viable.
2	Solar PV on Public Facility	◢ Currently there is no provision (special incentive) for battery technology for solar PV ◢ Not eligible for NEM, NEM only for building ◢ Current project: Installation of solar PV only focuses on taxi and bus stations (20 locations) however for lighting purposes only. ◢ It will be too much to install along the walkway for street lighting. (Wastage) ◢ Suggest for cooling mist for pedestrian walkway to improve pedestrian comfort so that energy can be used during the day (avoid battery) ◢ Battery is too expensive to be economically feasible. ◢ Can be done for mid-term planning once battery price start to decrease Notes: JKR need to be involved in rooftop solar PV project
3	Floating Solar PV	◢ Need to confirm the ownership of the place ◢ Floating solar for self-consumption as there is no guideline for NEM for floating solar ◢ Ownership of lake and building that is of different owner also post a challenge toward floating solar implementation ◢ Will be a wastage to generate energy just for lighting in the park ◢ A lot of private industry are showing interest ◢ Additional cost for cable and floating device, should focus on low hanging fruit like solar on building ◢ Focus on floating solar from mid to long term ◢ Should be given incentive since implementation of floating solar is more costly

No.	Project	Feedbacks Summary
4	District Cooling System (DCS)	◢ The project will have an issue because this is a retrofitting project, difficult to be implemented in existing building ◢ Requires very large scale implementation to justify its economic performance ◢ There is no agencies for regulation of DCS ◢ Opportunity to be pilot for other councils to plan, if there is policy on DCS ◢ Suggested for feedback from DCS Putrajaya ◢ New building should consider DCS at design stage ◢ Long term implementation
5	Microgrid	◢ In line with MySTIE, to consider microgrid ◢ Microgrid can cater for upcoming technology like EV and also allow higher penetration of solar, possibly to go higher than 75% of peak demand as mentioned in ST guideline ◢ Starting point of microgrid short term implementation strategy is to implement EMS and progressively enhanced into a microgrid ◢ Microgrid still in research and development phase ◢ Will be able to cater for demand side response, peak curtailment and load management ◢ Currently no guideline for microgrid implementation
6	Heat Recovery from Air Conditioner	◢ Focus on EE ◢ Recover heat from air conditioner to provide low heat supply to heating demand in hotel and hospital ◢ Possible for solar thermal integration ◢ Suggested Hospital Angkatan Tentera Tengku Mizan ◢ Will arrange for discussion between Daikin, UTM, and Hospital

(C) PICTURES

(2) Waste Sector

(A) ATTENDANCE

Facilitator: Prof. Dr. Lee Chew Tin, Dr. Cassendra Bong Phun Chien

No.	Agency	Name/Position	Email
		Waste	
1	Jabatan Pengurusan Sisa Pepejal Negara (JPSPN)	Siti Azulainey Mohd Aslan	-
2	Malaysia Green Building Council	BK Sinha	-
3	Aeon Sdn Bhd	Andrew Teoh	andrew.teoh@aeonretail.com.my
		Mark Yong	mark.yong@aeonretail.com.my
4	KLCH (JKAS)	Nurfatin Izzati Ahmad Kamal	nurfatinizzati@dbkl.gov.my

(B) INPUT

No.	Project	Feedbacks Summary
1	Organic Waste Management	◢ Continuous community outreach through educational/mindset change and getting efficient waste segregation ◢ The balance between localised treatment facilities and centralised plant to maximise resource allocation and minimise loses ◢ Waste hierarchy ranking for options available ◢ Waste management with Integrated facilities, e.g. WtE (e.g. biogas) + sanitary landfill ◢ Partnership with enterprises, e.g.One-stop recycling hub at AEON ◢ AEON is going with solar PV installation which the RE can be channelled to in-vessel composter , Setting up buy-back centre accessible by AEON, F&B, community ◢ UMCARES, UNILEVER, PHILIPS (CSR) Kg. Kerinchi Segregation of waste into food waste to AD, biogas produced to GENSET for LED lights along the corridor; requires different parties intervention at different stages
2	Waste recycling	◢ Closing the loop through educational/mindset change from continuous outreach and getting efficient waste segregation ◢ Coupling Cash converter unit with Recycling points/centre could help to accelerate waste recovery, not to have too specific kiosks (the different selling rate/demand for recyclables) ◢ Partnership for necessities, (LA and NGO) e.g. DBKL's 1C1R and mobile kiosk where B40 exchanged recyclables with food necessities, Bali's plastic exchange program for rice
3	Others discussion on data required	◢ To follow up with JKAS (Izayati) for data from Alam Flora/SW Corp ◢ Target set for each implementation phases, emission before and after

(C) PICTURES

(3) Mobility Sector

(A) ATTENDANCE

Facilitator: TPr. Chau Loon Wai, Nur Hanie Irdina Jamaludin

No.	Agency	Name/Position	Email
		Mobility	
1	Ministry of Transport Malaysia (MOT)	Nik Fadzillah Nik Zulkarnain	nik.fadzillah@mot.gov.my
2	Malaysian Institute of Road Safety Research (MIROS)	Ts. Dr. Rizati Hamdan	rizati@miros.gov.my
3	Elena with Bike	Justin Lee Kah Wai	bikecommutekl@gmail.com
4	Real Estate and Housing Developers' Association Malaysia (REHDA)	Julie Choh	julie@ajc.com.my
5	Ranhill Bersekutu Sdn Bhd	Za'im Shahid (TD)	Zaim.s@ranhill.com.my
		Ir. Ravi Shankar (Transport)	rushen@gmail.com.my
6	Kementerian Alam Sekitar dan Air (KeTSA)	Aznie Rahim	aznie@kasa.gov.my
7	KLCH	Masitah Salleh	masitah@dbkl.gov.my
		Syahirah Zulkiplee	nursyahirah@dbkl.gov.my
		Muhammad Azrii bin Abdul Aziz	muhammadazri@dbkl.gov.my
		Rahayu Muhammad Taib	rayahutaib@dbkl.gov.my
		Noormin Ismail	

(B) INPUT

No.	Project	Feedbacks Summary
1	Pedestrian & Cycling Network	◢ Design for improvement proposals need to be detail along with the infrastructure and utilities (cross-section) ◢ CPTED implementation for walkway and bicycle lane ◢ Educate at early age and promote the adoption of walking and cycling for daily routine (Best Practice : Bicibus, Barcelona Spain) ◢ Potential of traffic calming and need to de-emphasize car traffic
2	Public Transportation	◢ Community survey to study the demand of EV ◢ Route lengths implication on journey time ◢ Educate and promote our students at early age because they will be in future that need this improvements by hosting event such as Car Free Day of Wangsa Maju ◢ Need to overlay LRT and proposed MRT line/station with EV bus route ◢ Culture and mindset may work against achievement of intended modelshift ◢ Should include school buses
3	Station Area Planning (SAP)	◢ Key criteria of SAP; mix-used, higher density zoning and high quality public realm (Best Practice : La Rambla, Barcelona & Stroget, Copenhagen) ◢ Caution: En-block redevelopment if too wide spread may be perceive as "invasive" ◢ Need to identify potential links/corridors to connect LRT and proposed MRT stations

(C) PICTURES

(4) Community Sector

(A) ATTENDANCE

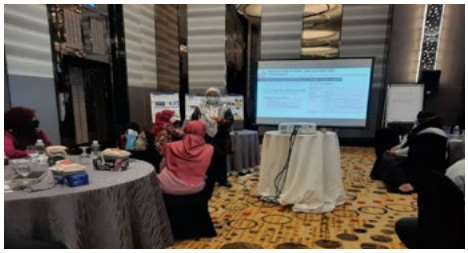
Facilitator: Prof. Dr. Fatin Aliah Phang, TPr. Dr. Siti Hajar Misnan, Cik Nur Syahidah Sulaiman

No.	Agency	Name/Position	Email
		Community	
1	Pejabat Pelajaran Daerah (PPD Keramat)	En Firdzaus Bin Said	Firdzaussaid94@gmail.com
2	SK Setiawangsa	Pn Mastura Omar (PKKD)	masturaomar@gmail.com
3	SK AU Keramat	Pn Norfouwiza Jalani (PK1)	wizajalani@gmail.com
4	SMK Tmn Setiawangsa	En Noor Azizan Abd Hadi (Pengetua)	azizan.hadi@gmail.com
5	SMK Desa Tun Hussein Onn	Pn Siti Najwa Hashim (PK Kokurikulum)	ctnajwa6060@gmail.com
6	KLCH (JPRB - Unit LA21)	Raja Abd Rahman Bin Raja Omar (Urus Setia)	rajaabdulrahman@yahoo.com
		Cik Siti Hajar Madina (Peg. Perancang Bandar)	
		Norizatul Ziha Bt. Shahril	
	KLCH (Jabatan Perlesenan)	En Hanafi B. Amil	mohdhanafiamil@gmail.com
	KLCH (JPEP)	En Irwan Shafari Wahab	irwan@dbkl.gov.my
	KLCH (JPKKB -Pejabat Cawangan Wangsa Maju)	En Yusman Harith	yusman@dbkl.gov.my

(B) INPUT

No.	Project	Feedbacks Summary
1	Eco Park	◢ All agencies agree with the project ◢ Potential location in the school must be consider in this project ◢ Project costing to be share among partners/stakeholder
2	Community Farming	◢ All agencies agree with the project ◢ Potential location in the school must be consider in this project ◢ LA21 will be provide SOP and guideline for community farming project to be incorporate in step by step approach ◢ Project costing to be share among partners/stakeholder ◢ Issue: Implementation approach (bottom up)
3	Zero Waste Community	◢ Agencies agree with the project ◢ Project costing to be share among partners/stakeholder Agencies agree with the project
4	Community Water and Energy Saving Program	
5	Transforms community to Carbon Neutral Community	
6	Strengthen School Community through Concentrated Efforts	◢ Schools agree with this project ◢ Improvement of agencies
7	Introduce Carbon Neutrality Challenge (CNCP) Programs in Schools	◢ Schools agree with the project ◢ DBKL suggest project costing to be share among partners/ stakeholder

(C) PICTURES



(5) Green Sector

(A) ATTENDANCE

Facilitator: Dr. Gabriel Ling Hoh Teck, Dr. Leng Pau Chung, Cik Rohayu Abdullah

No.	Agency	Name/Position	Email
		Green	
1.	Department of Irrigation and Drainage Malaysia (JPS)	Ahmad Faizal b. Ahmad Tarmizi	faizaltarmizi@water.gov.my
2.	Jabatan Pembangunan Landskap & Rekreasi, DBKL	Muhd Aiman b. Abd. Hakim	aimanhakim.dbkl@gmail.com

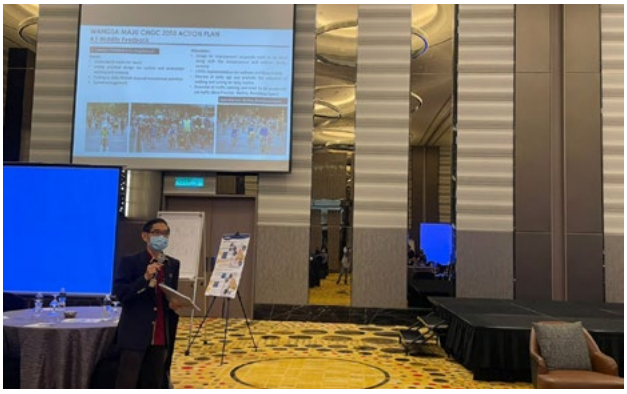
(B) INPUT

No.	Project	Feedbacks Summary
1	Protect Existing Parks and Open Spaces	◢ Open spaces ownership status ◢ Change of guideline (Garis Panduan Perancangan Keperluan Kawasan Lapang) ◢ Review of tree species for planting in Wangsa Maju ◢ Extension inventory within Bukit Dinding (remote sensing technology)
2	Introduce Vertical and Roof Gardens	◢ Incorporate PSKL 40% vertical green for Wangsa Maju development ◢ Introduce guideline at the first stage (2022-2025) ◢ Tabulating the total estimated area of building to implement vertical green
3	Create Linear Urban Parks Along River and Waterways Reserves	◢ Review of park connector for section 2 ◢ Updated of Sungai Bunus cross-section
4	Organise "Clean Up A River" Program	◢ Water quality status ◢ Maintenance of river;- floating log boom and other mechanism ◢ Review of location where to throw mudballs

(C) PICTURES

(6) Conclusion Session



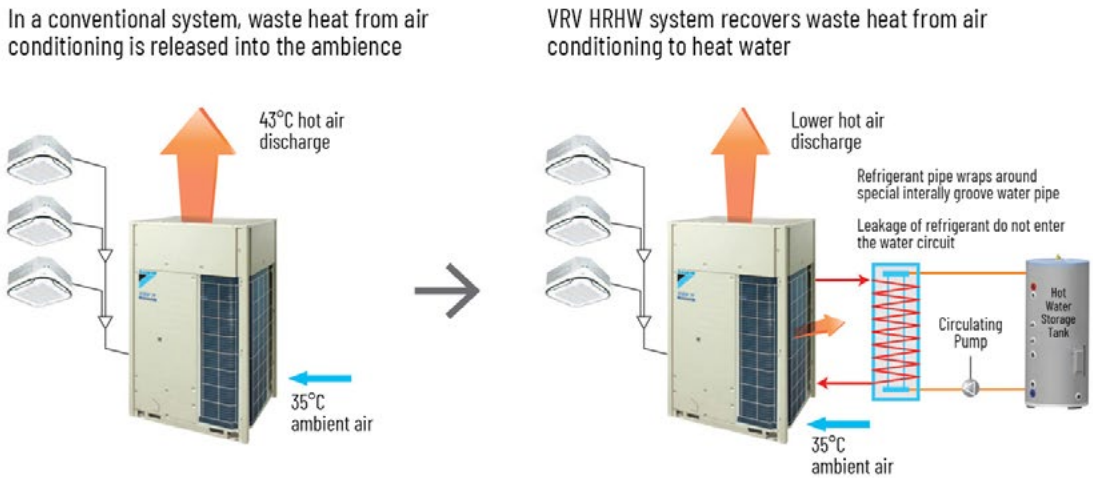




APPENDIX 7

Other Project

Heat Recovery Hot Water System

In conventional air-conditioning system, waste heat is generated from the cooling process and is discharged directly from the outdoor unit into the ambient. The concept of heat recovery technology is based on the recovery of such waste heat through heat exchanger. The recovered waste heat can be used to heat up the water (up to 65 ˚C) from the storage tank. The heat exchange process takes place between the water and refrigerant in the serpentine heat exchanger. The differences between the conventional air-conditioning system and with heat recovery system are illustrated in below. One of the major advantages of employing heat recovery system is energy savings following the reduced needs for boilers and water heater installation for hot water supply. Another major advantage is carbon emission reduction due to a better operation efficiency and reduced amount of heat processed by the outdoor unit.



A comparison between the conventional air-conditioning system and VRV HRHW system (DAIKIN)

BEST PRACTICE 1

Location : Senawang, Negeri Sembilan
Application : Hospital
Total HP : 218 HP

BEST PRACTICE 2

Location : Kuala Lumpur
Application : Condominium
Total HP : 32 HP

APPENDIX 8

Project Team Members

SENIOR EXPERT

1. Prof. TPr. Dr. Ho Chin Siong
2. Prof. Dr. Fatin Aliah Phang
3. Prof. Ts. Dr. Mohd Hamdan Ahmad
4. Prof. Ir. Dr. Haslenda Hashim
5. Prof. Dr. Lee Chew Tin
6. TPr. Chau Loon Wai
7. TPr. Dr. Siti Hajar Misnan
8. Ts. Steve Anthony Lojuntin
9. TPr. Dr. Gobi Krishna Sinniah
10. Assoc. Prof. Ts. Dr. Ho Wai Sin
11. Dr. Gabriel Ling Hoh Teck
12. Dr. Teh Bor Tsong
13. Dr. Nina Diana Nawi
14. Dr. Leng Pau Chung
15. Dr. Nurhasmiza Binti Abu Hasan Sazalli
16. Dr. Alafiza Binti Yunus
17. Dr. Cassendra Bong Phun Chien
18. Dr. Noor Izzati Bte Ariff

RESEARCH ASSISTANT

1. Rohayu Binti Abdullah
2. Nur Syahidah Binti Sulaiman
3. Nazia Khalida Binti Sulaiman
4. Mohamad Firdaus Bin Hashim
5. Aw Kai Hoong
6. Norhayati Binti Zainon

Wangsa Maju

Carbon Neutral Growth Centre

2050

ACTION PLAN