



POTENTIAL SENSORY TRAIL AT UMK JELI CAMPUS : A PRACTICAL DESIGN APPROACH

by

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DECLARATION

I declare that the title "Potential Sensory Trail at UMK Jeli Campus: A Practical Design Approach" is the result of my own study, apart from the references listed. The thesis has not been approved for any degree and is not being presented concurrently with any other degree candidacy.

Signature : 

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Date :24 AUGUST 2024.....

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Thank you for your constant support and contributions !

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Potential Sensory Trail at UMK Jeli Campus : A Practical design approach

ABSTRACT

A sensory trail is a recreational area meant to encourage the exploration of diverse feelings while participating in activities. The Sensory Trust in the United Kingdom asserts that sensory trails provide users with a variety of sensory experiences as they go along the specified path. However, there is lack of a comprehensive structure for assessing the efficiency and effect of sensory pathways on various demographic groups. This gap underlines the need to investigate how diverse sensory aspects might be effectively combined to provide more engaging and inclusive paths for a variety of users, including those with sensory impairment. Addressing this gap might improve the design's sensory experience and accessibility. The objective of this study is to develop a sensory trail at Universiti Malaysia Kelantan in Jeli, Kelantan, as well as creating an interactive map of the trail. Creating a sensory trail requires careful consideration of several components to ensure that participants enjoy an immersive and engaging experience. Trails must also include development and maintenance agreements that may be sponsored by local communities. Point sampling is a popular approach for estimating area and determining plot locations. Point sampling is a method of collecting data from a certain geographic region by selecting points within it. As a result, five maps with features are created, and one interactive map contains all the path directions. There are five routes: route A, B, C, D, and E. Each station route represents a separate sensory journey. They have five sections: touch, smell, sight, taste, and sound. As a conclusion, this sensory trail design enables the creating of an interactive map for building a sensory trail.

Potential Sensory Trail at UMK Jeli Campus : A Practical design approach

ABSTRAK

Jejak deria ialah kawasan rekreasi yang bertujuan untuk menggalakkan penerokaan perasaan yang pelbagai semasa mengambil bahagian dalam aktiviti. The Sensory Trust di United Kingdom menegaskan bahawa jejak deria menyediakan pengguna dengan pelbagai pengalaman deria semasa mereka melalui laluan yang ditentukan. Walau bagaimanapun, terdapat kekurangan struktur komprehensif untuk menilai kecekapan dan kesan laluan deria ke atas pelbagai kumpulan demografi. Jurang ini menggariskan keperluan untuk menyiasat cara pelbagai aspek deria boleh digabungkan dengan berkesan untuk menyediakan laluan yang lebih menarik dan inklusif untuk pelbagai pengguna, termasuk mereka yang mengalami masalah deria. Menangani jurang ini mungkin meningkatkan pengalaman deria reka bentuk dan kebolehcapaian. Objektif kajian ini adalah untuk membangunkan jejak deria di Universiti Malaysia Kelantan di Jeli, Kelantan, serta mencipta peta interaktif jejak. Mencipta jejak deria memerlukan pertimbangan teliti beberapa komponen untuk memastikan peserta menikmati pengalaman yang mengasyikkan dan menarik. Laluan juga mesti termasuk perjanjian pembangunan dan penyelenggaraan yang mungkin ditaja oleh komuniti tempatan. Persampelan titik ialah pendekatan popular untuk menganggarkan kawasan dan menentukan lokasi plot. Persampelan titik ialah kaedah mengumpul data dari kawasan geografi tertentu dengan memilih titik di dalamnya. Hasilnya, lima peta dengan ciri dicipta dan satu peta interaktif mengandungi semua arah laluan. Terdapat lima laluan: laluan A, B, C, D, dan E. Setiap laluan stesen mewakili perjalanan deria yang berasingan. Mereka mempunyai lima bahagian: sentuhan, bau, penglihatan, rasa, dan bunyi. Sebagai kesimpulan, reka bentuk jejak deria ini membolehkan penciptaan peta interaktif untuk membina jejak deria.

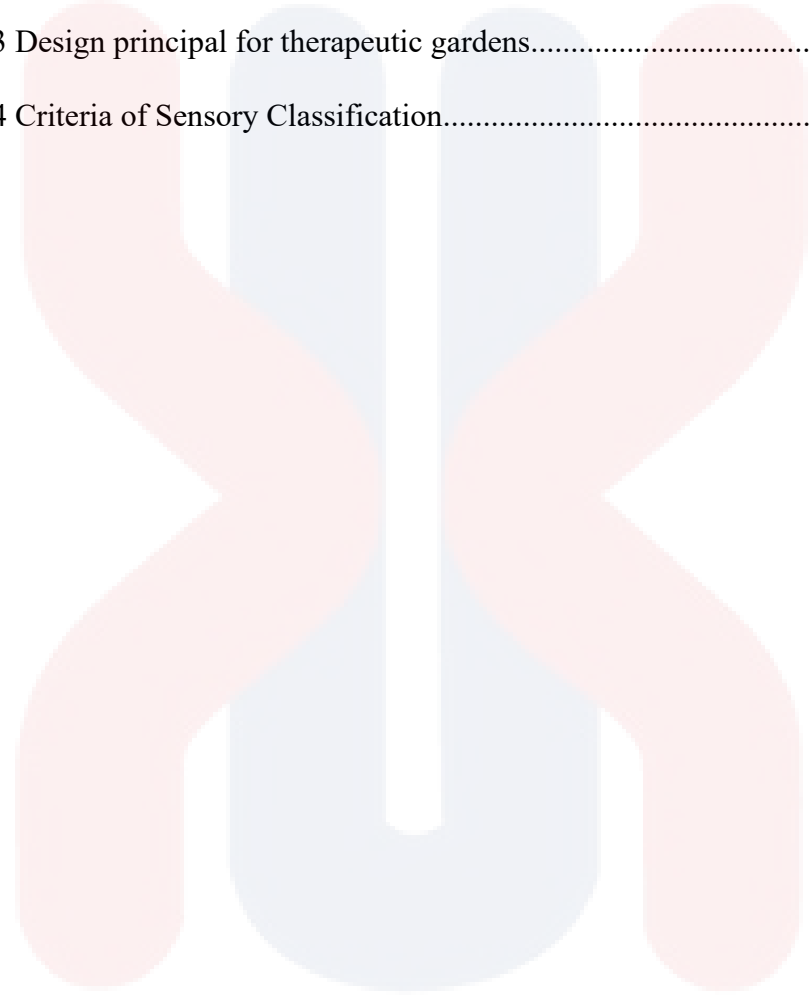
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LIST OF ABBREVIATIONS

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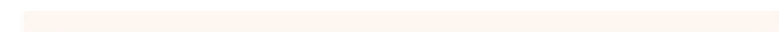
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CHAPTER 1

INTRODUCTION

1.1 Background of study

The term well-being, which can also be referred to as happiness, is a multifaceted idea that encompasses both optimal functioning and experience, according to researchers such as Ryan and Deci (2001). Two distinct approaches exist for defining and assessing well-being: hedonic and eudaimonic. In modern psychology, this approach is best psychological well-being (PWB), which concerns personal growth and meaning. Conversely, the hedonic approach focuses on the attainment of pleasure and avoidance of pain, and this is best captured by the concept of subjective well-being (SWB) in contemporary psychology.

Holistic wellness is an integration of mental, physical, and spiritual health that involves nourishing the body, cultivating the mind, and nurturing the spirit (1). While it does involve the pursuit of good health, it is primarily about living life to the fullest (1) and is defined as "a personalized lifestyle approach to living life in a way that enables you to reach your full potential, given your circumstances and destiny" (2). Taking care of our own well-being is an essential aspect of wellness, not only for our own sake but also for the sake of those who care for us and whom we care for.

American Trail Staff: The National Recreational Trails Program (2021), defines a trail as follows "A trail is a trail created by construction or use that is traversable by at least one or more of the following modes of transportation, including but not limited to: pedestrian traffic, livestock, watercraft, bicycles, direct traffic Inline skates, wheelchairs, cross-country skis, off-road recreational vehicles (such as motorcycles,

snowmobiles, all-terrain vehicles and four-wheel drives). A path through a landscape, mountain, or forested area, usually created or used for a specific purpose.

According to Wairarapa New Zealand Riding for the Disabled Abilities (2014), a sensory trail is a recreational space that is designed to facilitate the exploration of various sensations while engaging in activities. The Sensory Trust in the United Kingdom claims that sensory trails offer a multitude of sensory experiences to users as they traverse the designated path. As the Sensory Trail emphasizes movement and the journey itself, it is a direct application of orientation skills. The "Sensory Trail," also referred to as the "Senses Trail," is a path that individuals traverse while walking.

Encouraging individuals to fully engage with their surroundings, one effective method is to guide them through a trail that allows for complete immersion in the environment. The Botanic Gardens of South Australia (2022). A sensory trail offers a multitude of ways for individuals to interact with nature. According to Merriam-Webster's definition (n.d.), sensation is the physiological feeling or perception that occurs when the body experiences something. By processing these sensations through various means such as sight, sound, touch, smell, and taste, a sensory experience is created (Molineux, 2017).

Based on Sensory Integrated Education (2021), sensory trails are a great way to create a range of sensory experiences in a natural environment. This is a relatively cheap and simple intervention where the effort is directly reflected in the reward. Some of the best hiking trails change with the seasons, taking users on a journey of the senses. The Sensory Trail offers a range of experiences along the way designed to appeal to different senses, allowing people to immerse themselves together on a multi-sensory journey. They are used in a variety of outdoor areas - city parks, farms, forests,

schools, hospitals, and nursing homes - and are also ideal for indoor use, such as schools, care facilities and museums.

The upcoming sensory trail project at UMK Jeli campus holds great importance in the betterment of both prospective students and staff. These trails will serve as ideal locations for unwinding and reducing stress levels, thus improving one's mental health through the exposure to natural elements during walks. Furthermore, these sensory trails can be fashioned as communal spaces for the promotion of social interactions amongst faculty, staff, and students. These areas can be utilized for future group activities, collaborative projects, and events, ultimately fostering a sense of community on campus. Overall, the sensory trail initiative will be a positive step towards promoting the welfare of all members of the campus community.

1.2 Importance of sensory trail

Numerous studies have shown that sensory gardens offer significant advantages, particularly for specific groups, such as people with dementia, nursing home inhabitants, those with visual impairments, and individuals on the autism spectrum, notably, children (Bourdon & Belmin, 2021, Collins et al., 2020; Gonzalez and Kirkevold 2013, Hussein, 2010, Yusop, 2020; Zajadacz and Lubarska, 2020). Research has demonstrated that people with dementia have experienced enhancements in their overall well-being, quality of life, and feelings of liberation (Bourdon & Belmin, 2021; Collins et al., 2020). This is achieved by stimulating different senses and merging relevant sensory experiences with past adventures or memories (Bourdon & Belmin, 2021; Collins et al., 2020). Sensory gardens offer an inclusive opportunity for individuals with vision impairments, as they provide non-visual stimuli that promote a sense of freedom, belonging, and pleasant experiences

through engagement with the senses (Zajadacz & Lubarska, 2019). Nursing home residents also benefit from sensory gardens, as it encourages social connectedness and increases their exposure to the outdoors (Gonzalez & Kirkevold, 2015). For individuals with ASD, sensory gardens have been found to be effective in promoting calmness and joy, creating an environment that encourages teamwork, concentration, and social interaction (Hussein, 2010; Yusop, 2020).

1.3 Problem statement

Due to its considerable distance from the city, the university students themselves find it challenging to have a port for stress reduction and well-being. This is precisely why the establishment of a sensory trail at UMK Jeli, Kelantan, is of utmost importance. However, there are some challenges encountered in the sensory path at UMK Jeli due to specific factors. One of the factors is the lack of effective sensory pathways on the UMK-Jeli campus.

1.4 Objective

The objective of this study is

- i. To design a sensory trail in Universiti Malaysia Kelantan, Jeli, Kelantan
- ii. To create an interactive map for the sensory trail.

1.5 Scope of study

This study was to develop an inclusive sensory path that can be enjoyed by individuals of all ages and abilities, including children, teenagers, adults, the elderly, and persons with disabilities. Additionally, the creation of an interactive map was deemed crucial to not only engage the local community of UMK-Jeli campus, but also

to attract visitors from outside. Moreover, this initiative aims to foster positive emotional experiences in natural surroundings, alleviate stress and anxiety, and promote a profound sense of well-being and tranquillity. Furthermore, the development of an interactive map holds significant importance in capturing the attention of the public, extending beyond just the residents of UMK-Jeli campus.

1.6 Significance of study

Sensory trails provide valuable opportunities for environmental education. Exploring these trails can help improve educational programs and materials and ensure visitors, especially children, gain a deeper understanding of the natural environment and agricultural practices. Additionally, understanding the effectiveness of accessibility measures and inclusive features can lead to better, more accessible designs in the future. This ensures that people with disabilities can also benefit from the sensory path experience. The research results can provide valuable feedback for campus planning and development and help UMK optimize the academic and personal development environment for students. In addition, thoughtfully designed and soothing sensory pathways also help establish a positive image of UMK, attracting prospective students and enhancing the university's reputation.

CHAPTER 2

LITERATURE REVIEW

2.1 Trail Recreation planning

According to American Trail Staff: The National Recreational Trails Program (2021), defines a trail as "an established path, route or route that regularly passes through a natural area and is used by people for non-motorized leisure activities such as walking, running, cycling, mountain biking and horse riding". In most cases, recreational trails are used for non-motorized recreational activities such as hiking, biking, horseback riding, canoeing, or scuba diving. However, in some cases, trails may be designed for use by small, wheeled vehicles (such as electric wheelchairs) to provide access for people with reduced mobility. The trails are a major attraction for domestic and international visitors and support healthy lifestyles for local communities in the area.

Most recreational trails are used for non-motorized activities such as walking, cycling, horseback riding, canoeing, or scuba diving. Trails can, however, be designed in some cases for use by small, wheeled vehicles such as motorised wheelchairs to allow access for people with mobility impairments. The trails are popular with both domestic and international visitors, and they promote healthy lifestyles in the region's communities. Trail users are becoming more discerning, with high expectations for their trail experience, which means that quality infrastructure and services, as well as marketing and promotion activities, are becoming increasingly important, and the user experience is central to every aspect of trail design and management.

When planning new recreational environments, it should also be considered that the position of people within a given landscape affects the character of the landscape. Fry and Sarlov-Herlin suggested designing trails at forest edges that, in addition to providing many ecological benefits, contribute to aesthetics and increase the recreational potential of the forest. One can hypothesize that stands may be more attractive when viewed inward from a visually open landscape, or that such stands may provide attractive views when viewed outwardly from a visually open landscape.

It can be determined that there is a clear need to investigate tourist preferences for landscape elements when planning leisure routes, especially considering the seasonal factors of the recreational value of leisure landscapes. Trails must be managed in a way that they remain ecologically resilient and economically viable as more hikers use them. For example, reminding people to stay on the trail, keep water out of the trail, follow natural paths and contours, and be aware of the slope of the trail can make trails ecologically resilient (Widawski & Oleśniewicz, 2019). Trails must also develop construction and maintenance agreements that can be financially supported by local communities. There must be a partnership between local people, the public and private sectors to provide collective support. There is also a need for environmental awareness and education about what a sustainable system is.

In an article titled “Educating Trail Users,” California State Parks (1994) states: “See the trails the way visitors see them”. This is great advice because it allows sign creators to stand out and address what they know questions and communicate with others to help them achieve what they want. Seeing things from different perspectives is a great way to convey information to others, as it gets them out of their own heads and helps guide the design in the practical direction they want. The main types of signage used by Sendero Pacífico are navigational, interpretive, and

directional signage. Each of these has a key element in the signage hierarchy that enables effective trail marking.

As per the teachings of Sensory Integration Education (2021), sensory trails are an excellent method to provide a sequence of sensory encounters within a natural setting. This intervention is comparatively inexpensive and straightforward, where the outcome is directly proportional to the effort invested. The most desirable sensory trails change with the seasons and transport the user on a sensory excursion. These trails comprise a series of sensory experiences that are strategically placed along a path to engage various senses and to create an immersive, multi-sensory experience. They are utilized in diverse outdoor settings, including city parks, farms, woodlands, schools, hospitals, and care homes. Moreover, they can also be used indoors, for example, in schools, museums, and care facilities. The focal point of a sensory trail is the expedition and movement.

2.2 Planning for sensory trail

2.2.1 Example from Pulau Ubin, Singapore

Creating a sensory trail necessitates careful consideration of various components to ensure an immersive and captivating experience for participants. The trail's arrangement is meticulously crafted to actively involve the senses, incorporating a wide range of natural elements and interactive elements. The first step involves evaluating the terrain and vegetation of the location, strategically selecting a path that maximizes exposure to diverse sensory stimuli. A sensory trail refers to a designated pathway or route specifically designed to engage and stimulate the senses, offering a multi-sensory encounter that often revolves around nature or specific themes.

There are various rules that must be followed while creating a sensory trail to ensure it fulfils safety and regulatory requirements. These guidelines are primarily designed for interior areas, thus special thought must be given when moving them to an outside space, particularly national parks. For instance, consider the design of the sensory path. The sensory trail's design must be user-friendly for people of all abilities. The next step is to design for access and mobility, as well as colour standards. The standards provide considerable detail regarding how to make public areas accessible. For example, consider walkway width, height, circulation space, floor surfaces, signs, tactile ground indications, ramps, and rails.

For example, consideration how these colours may need to be incorporated into the sensory trail, and how this may affect or contribute to the sensory experience. These colour standards will be especially important for persons who are visually impaired. (Australia Human Rights Commission, 2014) Aside from that, there are safety concerns around disabilities. When bushwalking with a physical impairment,

key considerations include entry, exit, and trail accessibility (gradient, stairs, surface), as well as an evacuation strategy in the event of an emergency medical need. For wheelchair users, the path should be reasonably flat with no stairs. Furthermore, for persons with chronic diseases such as arthritis, back pain, or pulmonary issues that decrease their energy levels, having chairs along the walk is critical. (Maplesden, 2012)

2.2.2 Impactions student well-being, learning, and engagement

Located on the southern end of Pulau Ubin, an island situated off Singapore's northeastern coast, is the Sensory Trail, a 1.5km nature trail. Visitors to this trail are encouraged to engage all five senses - sight, touch, smell, taste, and hearing - to experience the various plants and wildlife along the way. Originally designed for those with visual impairments, the trail was created with specific features to cater to their needs. These include a guiding rope at the beginning of the trail, a levelled path, and an emphasis on utilizing all senses. However, it is not limited to just those with impairments, as anyone can enjoy a stroll through nature while engaging all their senses on this trail.(National parks board, 2021)

This leisurely stroll takes approximately an hour to complete. The trail winds through the lush backyard gardens of the village homes on the island, where you can find a variety of fruit trees such as papaya, banana, rambutan, and breadfruit. The diverse assortment of vegetables, herbs, and spices that were once grown by the villagers for their own consumption can also be observed. Additionally, information about the importance of economic crops during the 1970s, which were crucial to the livelihood of Pulau Ubin, will be learned. The Sensory Trail is a great way to get acquainted with the rustic and natural charm of the island.(Pereira et al., 2023)

2.3 Design principal for sensory trail

When creating a sensory trail, several standards must be followed to ensure that it meets safety and legal requirements. These standards are primarily designed for indoor spaces; therefore, when transferring these standards to an outdoor space, particularly in national parks, care must be taken. To comply with the Disability Discrimination Act, the sensory trail must be designed to be accessible to people of all abilities. This Act states that it is illegal to discriminate against another person based on the other person's disability, including access to public facilities (Disability Discrimination Act, 1922)

It is essential that trails be socially, economically, and environmentally sustainable. As a result, it is critical that high-quality recreational experiences are created in landscapes that can support them. The development of the trail network should be based on the conservation and enhancement of natural areas, the protection of biodiversity, and the raising of environmental awareness. This can be accomplished through proper trail design, site selection, and ongoing management. Trails must be economically and socially sustainable as well.

The sensitivities and desires of our local communities must also be considered in the development of the trails. Trail users and the local community are central to trail development, so there must be a strong emphasis on engagement. A planned and strategic approach to engagement will facilitate effective debate and collaboration, as well as generate trust and goodwill and contribute to ongoing support. Prior to considering new trail projects, it may be necessary to review the location, design, and management, for the purpose of achieve a network of sustainable trails.

Furthermore, when designing safety signs, it is critical to consider which designs will be most effective in conveying their intended message. Colour scheme, font, layout, and complexity are all factors to consider. Investigating how different colour schemes might affect the effectiveness of safety signs. The Physiological

Experimental study on the Effect of Different colour of safety signs on a virtual subway fire escape – An Exploratory case study of Zijing Mountain Subway Station stated that "in China, safety signs are green, whereas in the United States, safety signs can be red or green". This observation demonstrates the lack of an international standard for safety sign colours. Their research found that, while a green and black sign was the most effective, there was not a significant difference between this and other colour combinations.(Chen et al., 2020)

According to the Harries et al. (2023) offers design considerations to apply to every component of all therapeutic gardens. There are 11 of important principles or elements of design principal for therapeutic gardens such as for sensory trail.

Table 2.3: Design principal for therapeutic gardens

Features	Description
Safety, Security, and Privacy	Outdoor spaces, particularly those within healthcare facilities, serve people who may be vulnerable in one way or another. All aspects of the outdoor space must ensure users’ physical and emotional safety and security.
Accessibility	Ensuring safe and comfortable use for all people regardless of age or ability is essential. The design should adhere to Universal Design (UD) principles ¹ as much as possible.
Physical and Emotional Comfort	The overall goal is to create an environment in which people feel cared for and nurtured. When people are physically and emotionally comfortable, they tend to stay in a garden longer and benefit more from the experience. ² The design should provide safe and comfortable places to walk and sit as well as create opportunities for social connection.
Positive Distraction	Elements in the garden should, as much as possible, distract users from stress. The purpose of the garden should be to provide a place of natural beauty to let users get away, both physically and emotionally, from interior environments that may be alien, stressful, threatening, or intimidating.
Engagement with Nature	Research has shown that connection to nature, especially in healthcare settings, is one of the most effective forms of positive distraction. Planting, natural materials and sounds, and the presence of water are some examples of positive natural distractions.
Maintenance and Sustainability	All therapeutic gardens must be properly maintained to function as safe, useful and enjoyable spaces for their target

	users. Damaged garden elements such as paving, or seats can compromise users' safety. Also, plants that are not properly maintained may affect the mood of users and create a negative experience towards the garden.
Wayfinding	This includes signage placed around the garden either providing direction or identifying plants. This was thought to be important to encourage exploration and engagement.
Fostering Serenity	Promote reflection and self-awareness in the garden with use of quiet spaces to provide a feeling of relief for garden users by introducing sound with use of water and chimes and nature'.
Variety of Planting	Multisensory planting was discussed as providing different colours, scents, textures, and edible plants. The use of wild and local flora was thought to be important for creating a connection to place and encouraging local wildlife and biodiversity.
Spatial Organization	The importance of creating different spaces around the garden. This can be done with the creation of different 'rooms' using trees, climbers, grasses, walls, and fencing. There should be open spaces providing views and enclosed spaces providing a sense of safety, seclusion, and privacy.
Cultural Artefacts	Provide people with a sense of connection to the garden. This included historical, a historical place facilitating fascination with the course of time. Use of focal points such as fountains, sculptures, and cultural artefacts.

(Source: Harries et al., 2023)

2.3.1 Incorporating nature element

Sensory Trail - also known as "Senses Trail" - according to Botanic Gardens of South Australia, 2022. A journey through a trail that encourages people to immerse themselves in the environment and use their imagination to guide them through the trail. Sensory Garden, on the other hand, is a self-contained garden area with the central theme of appealing to some or all the senses of sight, taste, touch, hearing, and smell (Gonzalez & Kirkevold, 2013)

However, sensory trails remain a subject that lacks abundance of information regarding its nature and features. Adelaide Botanic Gardens, however, is a prime example of a garden that does feature a sensory trail. It is defined as a pathway through which visitors can take a journey, allowing them to fully immerse themselves in the

environment and utilize their imagination while traversing the path (Botanic Gardens of South Australia, 2022). Sensory trails also encourage visitors to engage all five senses to gain a deeper understanding of the various plants that can be found along the trail.



Figure 2.1 Adelaide Botanic Garden (Visitor Map)

Source: Google (<https://justalittlefurther.com/just-a-little-further/oceania/australia/adelaides-historic-botanic-gardens>)

Visiting national parks and participating in bush walks can be considered leisure or self-care activities. Leisure activities are often undervalued, in part because people face barriers in pursuing them, such as lack of time, money, and motivation (Reichert et al., 2007). Especially in Western cultures, productivity (i.e., working time) is highly valued, which results in a reduction in time and value for leisure activities. In Eastern cultures, such as Aboriginal and Torres Strait Islander cultures, the opposite values are adopted, where leisure is equally important as productivity and is actively integrated into their daily lives (Pidgeon, 2015).

2.3.2 Accessibility and inclusivity in design

“Experience is a cover-all term for various modes through which a person knows his world. Some sensory modes are more passive and direct than others. With taste, smell, and touch, we feel as though we are simply registering sensations provoked by external stimuli. With hearing, and particularly with seeing, we seem to be actively exploring the world beyond us and getting to know it objectively. Seeing is thinking, in the sense that it is a discriminating and constructive activity; it creates patterns of reality adapted to human purposes. Even taste, smell, and touch are affected by thought in the above sense: they discriminate among stimuli and are able to articulate gustatory, olfactory, and tactual world” Tuan, Yi-Fu (1975). The quotes were presented by Mr. Yi-Fu (1975). They pertain to discussions on the impact of sensory experiences, particularly the dominance of visual experiences, on the excitement and enjoyment in travel and tourism.

According to Hussein (2009a), the goal is to create green areas that promote sensory stimulation, physical mobility, and social skills. Other researchers added that, rather than making 'special' provisions for disabled people, the incorporation of green areas contributes to health improvements (Vries & S. D, 2010), environmental education, emotional growth (Maller & Townsend, 2006), and mental development (Maller & Townsend, 2006). The term 'multi-sensory environment' (Pagliano, 1999) with a focus on sensory gardens raised several preliminary questions: Isn't it true that not all gardens are sensory? What makes up a sensory garden? How do people interact with the sensory gardens? Hussein (2009) began his research by understanding a review of existing literature on these gardens.

There are two major issues with sensory gardens, the first of which is design. Often, a creator's biggest mistake is in presuming that he or she knows that the needs

of the users. For example, while a creator may be aware that water is significant feature of a garden in that it appears to a user's senses of hearing and touch in some sensory gardens, the water is not easily accessible. Therefore, the feature might not be inaccessible to some users. This excludes certain users from sections of the garden and may leave them unable to access some of the features. Secondly, the issues of associates with the maintenance of sensory gardens. Gardens that are not maintained in the years following their creation will lose their sensory impact and thus will not entice people to visit.

2.3.3 Multi-sensory experience for diverse need

A sensory trail is a well-planned path that provides a multisensory experience by engaging various senses such as sight, touch, smell, sound, and, in some cases, taste. These trails are frequently designed to be immersive and therapeutic, particularly in natural settings such as parks, botanical gardens, or nature reserves. There will be five sections along the trail route. These sections include touch, sound, taste, sight, and smell.

King et al. (2014) examined the benefits of participation in leisure activities on the health and well-being of adolescents with severe disabilities. This study found that participating in leisure activities is fun and provides a sense of belonging, choice, control, and competence. It was clear that participants wanted more opportunities to socialize and be part of the community to enhance these benefits. Sensory experiences can have a significant impact on emotional experiences during activities. Experiencing a variety of different sensations contributes to overall enjoyment of the activity. For example, use movement or exercises to challenge participants and ensure relaxation. Another important aspect mentioned in this study was the importance of

being able to choose the activities completed, as this was linked to a greater sense of independence.

These findings are similar to those of Hussein's (2010) study, which involved observing children with special needs at school while they were engaged in a multi-sensory environment. Hussein (2010) discovered that the children's educational development and social skills in their interactions improved, as did their cognitive development. As the children had to identify specific features in the environment and explore together, social interaction was improved (Hussein, 2010).

Individuals with disabilities who engage in leisure occupations may face stigma, discrimination, and environmental, social, and economic barriers (Condie, 2019). Many public spaces are inaccessible, resulting in decreased community participation and leisure occupation participation for people with disabilities (Van der Westhuizen et al., 2022). People can benefit from leisure occupations, according to the literature (Hussein, 2010; King et al., 2014; Paggi et al., 2016). A sensory trail can be a form of recreation and thus provide many benefits to people of various abilities.

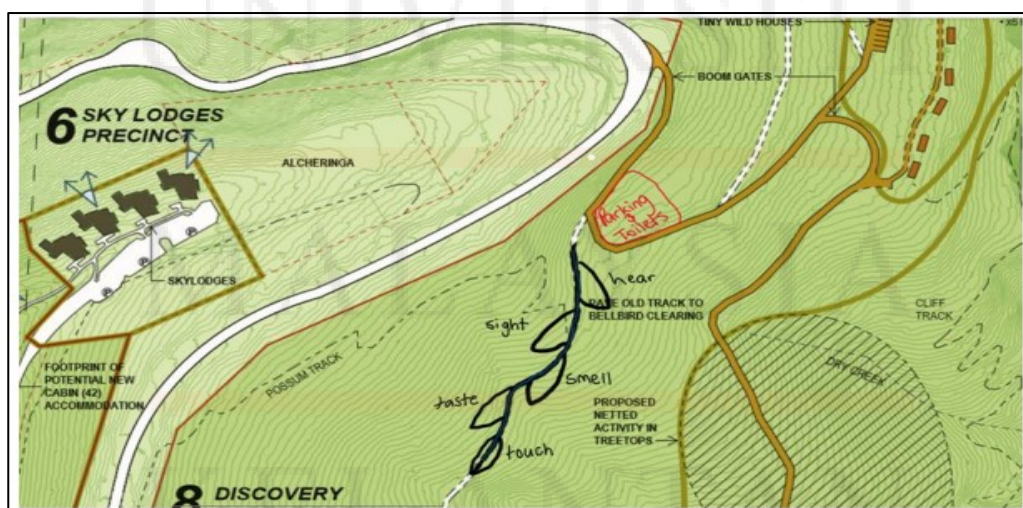


Figure 2.2 The example of sensory trail concepts

Source: Google (<https://www.binnaburralodge.com.au/wp-content/uploads/2022/10/Reconnecting-with-Community-and-Nature-through-an-accessible-Sensory-Trail-at-Binna-Burra-Lodge.pdf>)

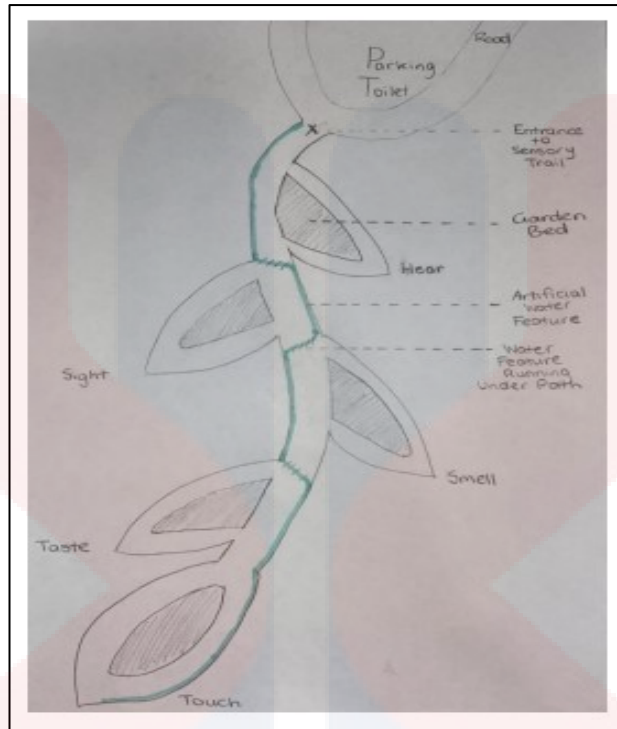


Figure 2.3 The example of the route trail design

Source: Google (<https://www.binnaburralodge.com.au/wp-content/uploads/2022/10/Reconnecting-with-Community-and-Nature-through-an-accessible-Sensory-Trail-at-Binna-Burra-Lodge.pdf>)

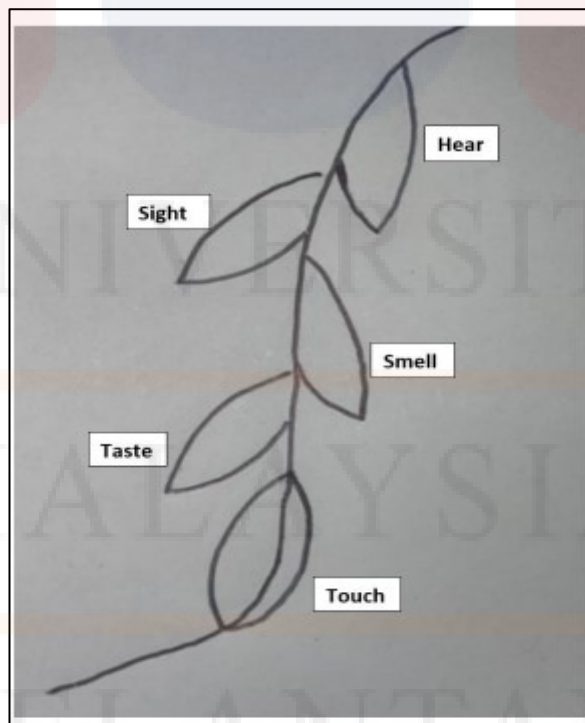


Figure 2.4 The example of the route trail design

Source: Google (<https://www.binnaburralodge.com.au/wp-content/uploads/2022/10/Reconnecting-with-Community-and-Nature-through-an-accessible-Sensory-Trail-at-Binna-Burra-Lodge.pdf>)

In the upcoming design, the touch section will be a prominent feature in the upcoming garden design, providing a diverse sensory experience. The garden will feature a variety of texture-rich plants with soft leaves, rough bark, and smooth petals that have been carefully selected to engage and delight the sense of touch. Tactile pathways will also be seamlessly integrated, with various surfaces such as gravel, grass, soil, and smooth stones. These pathways will contribute to a multifaceted tactile encounter, ensuring that the garden becomes a haven for future touch exploration.

Furthermore, the smell section. The smell section will feature an abundance of herbs, providing a rich olfactory experience. The enticing aromas of fragrant flowers and herbs, including lavender, roses, and aromatic herbs like mint and basil, will greet visitors. The garden will feature scented pathways with fragrant ground covers planted along the walking paths. This thoughtful arrangement will ensure that visitors will be able to enjoy a diverse range of captivating scents as they stroll through the garden in the future, enhancing their sensory experience.

Additionally, the sight section. The sight section will feature stimulating textures and colours, accentuated by uniquely shaped plants such as succulents, flowers, and shrubs, as well as textured bark. Colourful blooms will be used, including a variety of flowers in vibrant colours, to create a visually appealing environment. Mixing different foliage colours, shapes, and sizes will create visual contrasts, enhancing the overall visual appeal of the garden. The flower section will feature a variety of colours including yellow, purple, and pink. To add interest and beauty to the space, artistic elements such as sculptures, installations, or visually striking features will be incorporated. A chair made from natural resources, for example, will be included, adding to the garden's unique and artistic ambiance.

Besides, the sound section. The gentle sound of the wind moving through the leaves and branches will fill the garden in the future, creating a peaceful atmosphere. The sweet chirping of birds will provide a harmonious backdrop to nature's symphony. Wind chimes will be strategically placed to enhance the auditory experience, producing soothing sounds that dance with the breeze. Bird-attracting plants will also be carefully selected and cultivated, ensuring that the garden is alive with the natural melodies of feathered visitors, creating a tranquil and melodic environment for all to enjoy.

Finally, the taste section. It will emphasise the taste aspect, with a focus on the herb garden. Visitors will be able to sample a variety of flavours by investigating the inclusion of edible plants ranging from aromatic herbs to delectable fruits. The garden will not only be a visual treat, but also a culinary adventure, with a wide variety of flavours. Educational components will be integrated into the garden to enhance the experience. To provide visitors with valuable insights and to enhance the educational aspect of the garden, informative signage about the edibility of specific plants and their culinary uses will be strategically placed.

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CHAPTER 3

MATERIALS AND METHODS

3.1 Study Area

The study was conducted at Agropark Universiti Malaysia Kelantan, Jeli, Kelantan. The area of this place with the coordinate of 5°44'49.23" N, 101°52'07.62" E. The location is at Agropark, FSB UMK Jeli. UMK Jeli campus, one of the UMK campuses, became fully operational on January 1, 2012. UMK Jeli campus is in the Gemang forest area and is surrounded by charming hills. The Jeli campus is strategically located between Bandar Tanah Merah and Bandar Jeli, on the east-west road connecting the east and west.

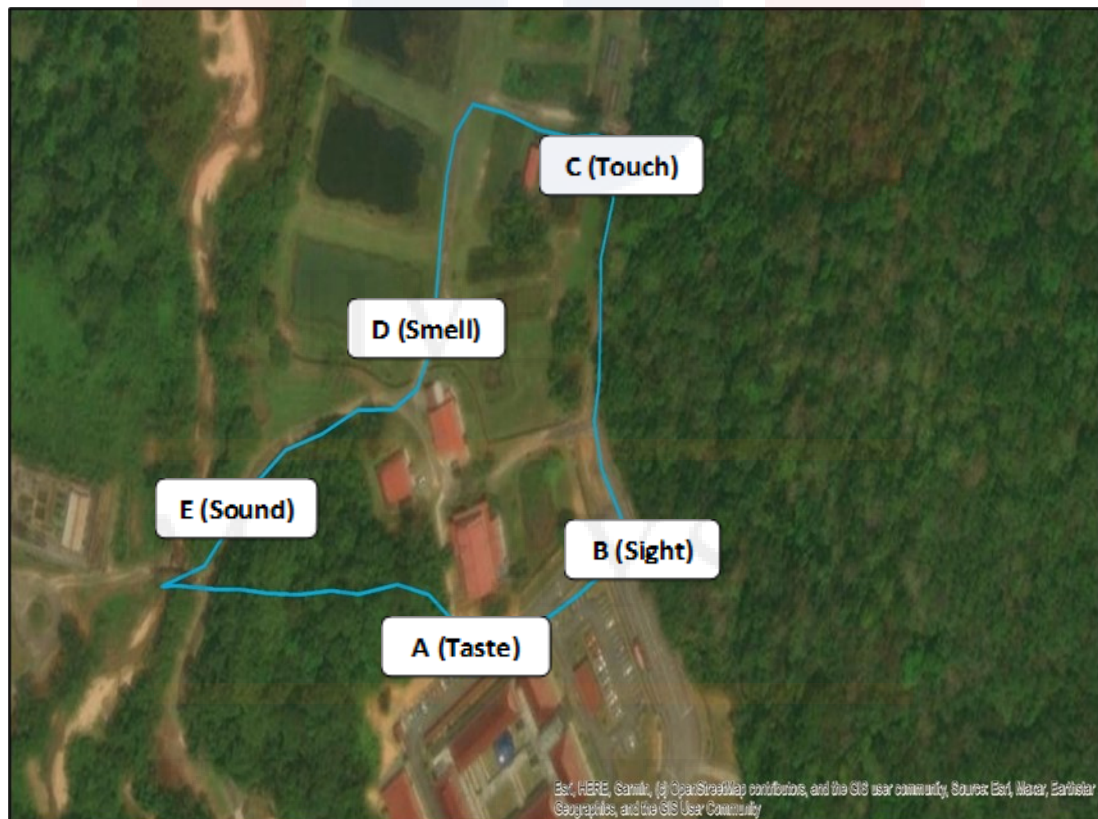


Figure 3.1 Design of the sensory trail route base maps

Source: Google earth pro (2020)

The Jeli campus covers an area of 279 hectares and currently has three faculties such as Faculty of Agricultural Enterprise (FIAT), Faculty of Earth Science (FSB) and Faculty of Bioengineering and Technology (FBKT), as well as multiple university centers for excellence in teaching, learning and research activities namely Agricultural Technology Park (ATP), Institute of Food Security and Sustainable Agriculture (IFSSA) and Gold Rare Earth and Materials Technology Entrepreneurship Center (GREAT). (Aramugam, 2017)

The selection of the trail along the FSB building about 0.67 km nature trails. The trail route will be close to the FSB car park and the FSB faculty itself. This area is also surrounded by hills and forests. The reason for choosing this location is that it is suitable for all age groups, including children, teenagers, adults, the elderly, and individuals using wheelchairs. This is due to its proximity to a spacious parking area and a well-maintained road.

3.2 Material

Creating a sensory trail route involves thoughtful consideration of various elements to engage participants' senses. A smartphone can be utilized for GPS navigation and capturing multimedia content to enhance the experience. Computers or laptops may be employed for route planning and designing engaging informational signs. A compass aid in orientation, adding an element of navigation skill development to the trail. Natural materials, like textured surfaces or scented plants, offer tactile and olfactory experiences, contributing to a multi-sensory journey. Measuring tape ensures consistent spacing between sensory stations, maintaining a well-organized trail.

Informational signs, possibly incorporating braille or audio elements, provide context and educational content. Maps help participants understand the overall trail layout and make informed decisions about their journey, fostering independence. Together, these elements create a rich and inclusive sensory trail experience for participants. Also, for these informational maps, maps from google earth, exported in the form of a shapefile. A shapefile in ArcGIS is created from Google Earth data by first capturing the desired area in Google Earth and saving a high-resolution image. The image is then imported into ArcGIS and georeferenced to align with spatial coordinates. This process results in the acquisition of a geospatial dataset in shapefile format.

3.3 Desk Research

According to Editorial (2022), desk research is a method that involves the examination of pre-existing documents and previous research, also known as secondary data, to gather information pertaining to a specific topic. Desk Research involves using data that has been previously collected by others. Consulting past studies and experts' opinions on a specific topic is always beneficial, as it allows for the utilization of existing information. Desk research is often more cost-effective than primary research methods such as surveys or experiments. This will be crucial to ensure the assessment of the UMK Jeli campus landscape, to gather more information about the area and its landscape characteristics at the UMK Jeli campus. For this study quantitative approach was used.

3.4 Site Analysis

3.4.1 Identification of potential location for sensory trail

Sensory categorisation uses different criteria for each sense. According to Stein and Schettler (2014), it is important to have a broad, flat, open area to plant aromatic herbs and flowers since smells can improve mood, reduce stress, and boost overall well-being. Furthermore, scents can elicit memories and emotional responses (Herz, 2004). Stimulating taste may enrich sensory experiences and generate lasting associations, while integrating taste with other senses can improve the whole experience (Spencer, 2015).

Lederman & Klatzky (2009), emphasise the importance of touch in spatial awareness and environmental interaction, and a diversity of textures can stimulate the senses. Natural noises could increase well-being and link people to nature (Pijanowski et al., 2011), but they may also affect emotions and behaviour. Finally, visual components such as green areas and trees can improve mood, reduce anxiety, and contribute to general well-being since their aesthetic appeal is linked to emotions of pleasure, satisfaction, and contentment (Carlson and Lintott, 2010).

3.4.2 Point Sampling

The use of point sampling is a frequent method of obtaining area estimations or defining plot locations. A point is defined as an abstract location used for reference purposes. Point sampling is the technique of acquiring data from a geographical area by selecting points within it. This can be achieved by randomly selecting points on a map, aerial photograph, or in the field. The primary function of these points is to locate and collect data from specific sites. Point sampling is a useful tool for rapidly acquiring and monitoring area estimates, as well as selecting a suitable plot location.

Beyond its application in deriving area estimates, point sampling is also utilized in monitoring changes to the land base.

The trail along Agropark UMK, Jeli, was selected as a 0.67 km nature trail with the coordinate of 5°44'46.96"N, 101°52'5.02"E. Five routes, namely A, B, C, D, and E were established. Route A, known as the Taste section, covered 0.14 km with incorporates flavours like spicy, sweet, sour, salty, and bitter. This trail was designed for everyone, regardless of age or ability, and featured textured surfaces for a pleasant touch, ensuring wheelchair accessibility. To assist those with visual impairments, braille signs and audio descriptions were placed along the trail. Resting spots with benches were provided to enhance comfort for older individuals, encouraging them to enjoy the natural surroundings. Additionally, low-height interactive panels were installed to engage children in a fun and educational experience.

Route B, designated as the Sight section, covered 0.12 km, and was carefully designed to provide a delightful sensory experience. Along this charming path stimulating textures, colours and uniquely shaped plant, featuring succulents and flowers or shrubs as well as textured bark. There were also vibrant colours in the flower section such as yellow, purple, and pink colours. Also, there are also bird watching here especially in the evening. Additionally, the trail prioritized inclusivity by providing smooth and level pathways, ensuring wheelchair accessibility, and making it easy for people with different abilities to explore and enjoy the sight section.

Route C, known as the Touch section, spanned a delightful 0.12 km and showcased a captivating sensory garden featured different textures. In this touch section, there are different texture walk, a path with different textures such as smooth pebbles, rough bark, small stones and soft moss. This activity would encourage

visitors to walk barefoot. Also, benches strategically positioned along the path served as resting spots to make it easier for visitors to relax and calm.

Route D provided an exciting 0.13 km experience known as Smell section. The smell aspects of this section are this sensory garden featured a lot of herbs and plant a variety of fragrant flowers. Benches and seating areas were placed thoughtfully, allowing people to relax and fully enjoy the artistic features. Create pathways where visitors can walk through and enjoy the aromas.

Finally, Route E with 0.16 km known as Sound section, the sound of the wind moving through the leaves and branches was the source of the sound. There was also a small river nearby, and the sound of the river flowing as well as the source of the sound. Benches and seating areas were also provided to make it easier for visitors to relax and enjoy the relaxing atmosphere.

3.5 Design process

In order to gather input on the desired sensory experience, it was crucial for designing the sensory trail that was to be created. This process enabled interactive design development. To ensure that the resulting design was suitable for implementation and well-received by the public, especially students, staff, and the campus community, it was important to seek input and preferences from these stakeholders.

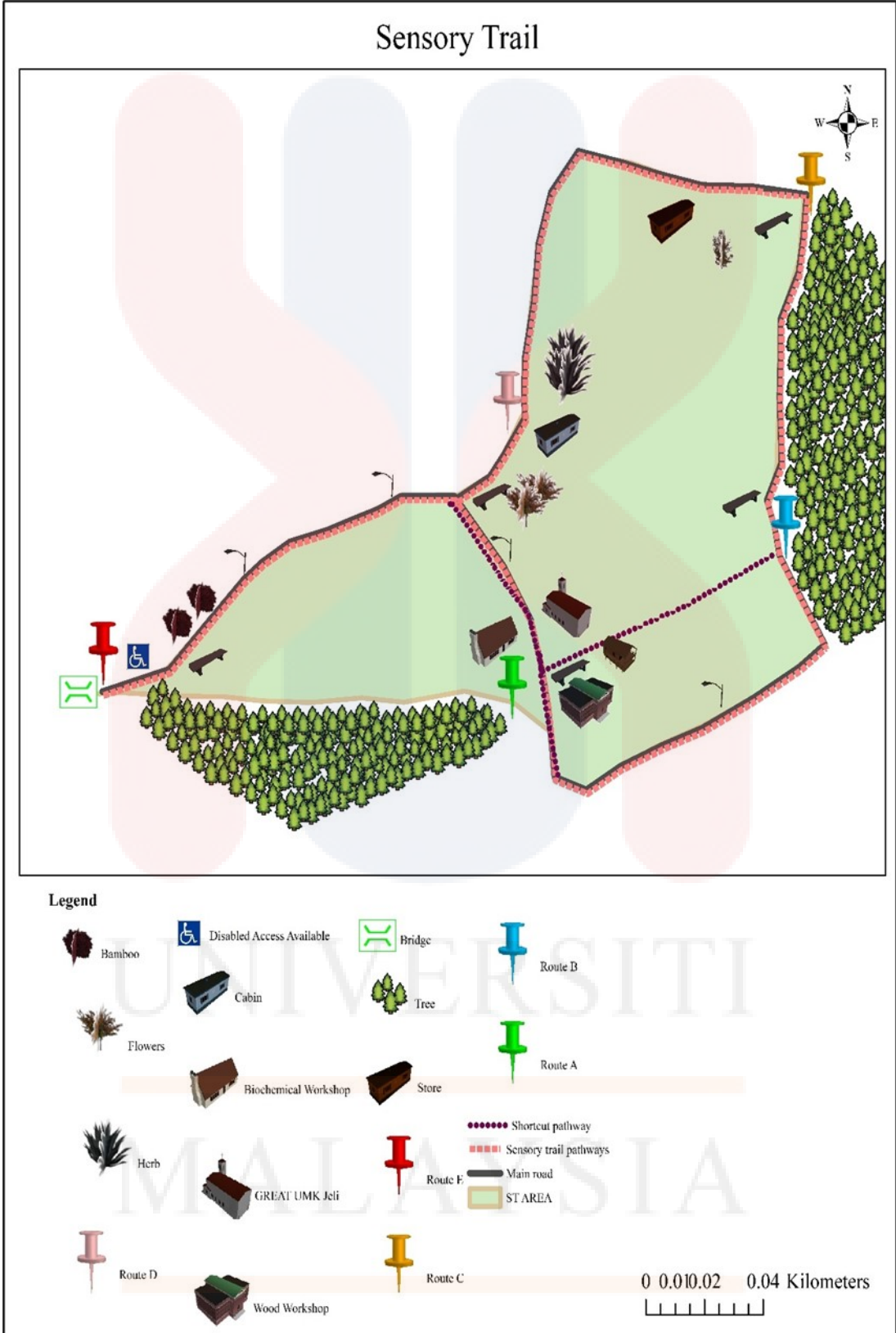


Figure 3.2 Sensory Trail Map Design
Source: ArcMap GIS

Figure 3.2 illustrate the design of a sensory trail featuring five routes, namely Route A, B, C, D and E. Each route has varying distances and different environmental conditions. There are five sections on the route such as taste, sight, touch, smell, and sound. The trail along Agropark UMK, Jeli, was selected as a 0.67 km nature trail. With a minimum elevation of 46 m, average of elevation 58 m, and max 69 m. Total range of distance is 671 m. Elevation gain or loss 37.8 m to 34.0 m. Maximum slopes are 23.7% to 37.8%. And the average slope was 8.9% to 8.5%. This is important to determine the level of suitability and accessibility of everyone on each route or section. They will also know their level of suitability and ability. This difference is determined in terms of road surface, elevation or slope of the area of each route according to the physical condition of visitors.

Table 2.4 Criteria of Sensory Classification

Sensory classification	Criteria
Smell	-Large flat open area so that the planting of fragrant herbs and flowers can be implemented. - Scents can improve mood, reduce stress, and enhance well-being. (Stein & Schettler, 2014) - Scents can evoke memories and emotional responses. (Herz, 2004)
Taste	-Taste stimulation may improve the sensory experience and foster memorable connections. - Combining taste with other senses can improve the entire experience. (Spencer, 2015)
Touch	-Touch is important for spatial awareness and environmental interaction. (Lederman & Klatzky 2009). -A range of textures may stimulate and engage the senses. Gibson (1963).
Sound	-Natural sound can improve well-being and link individuals to nature. Pijanowski et al. (2011). -Sound may affect emotions and behavior.
Sight	-Nature, particularly green spaces with trees, can increase mood, reduce anxiety, and boost overall well-being. -The visual attraction of green environments has been linked to feelings of pleasure, satisfaction, and overall contentment. (Carlson, Lintott, 2010).

(Source : Bergner et.al, 2013)

This research took a year to complete, and several actions were carried out throughout that time. First, conduct a site survey. A site survey is necessary to determine whether the region is suitable for the creation of a sensory trail activity. The next step is to collect the data. Collect all available data, whether from the internet or the survey site. The data will subsequently be analysed. Data analysis was conducted using previously gathered data. And the final map design. Create the sensory trail map directly.

RESEARCH FLOW CHART

This research project took one year to complete, and various activities were carried out during this period:

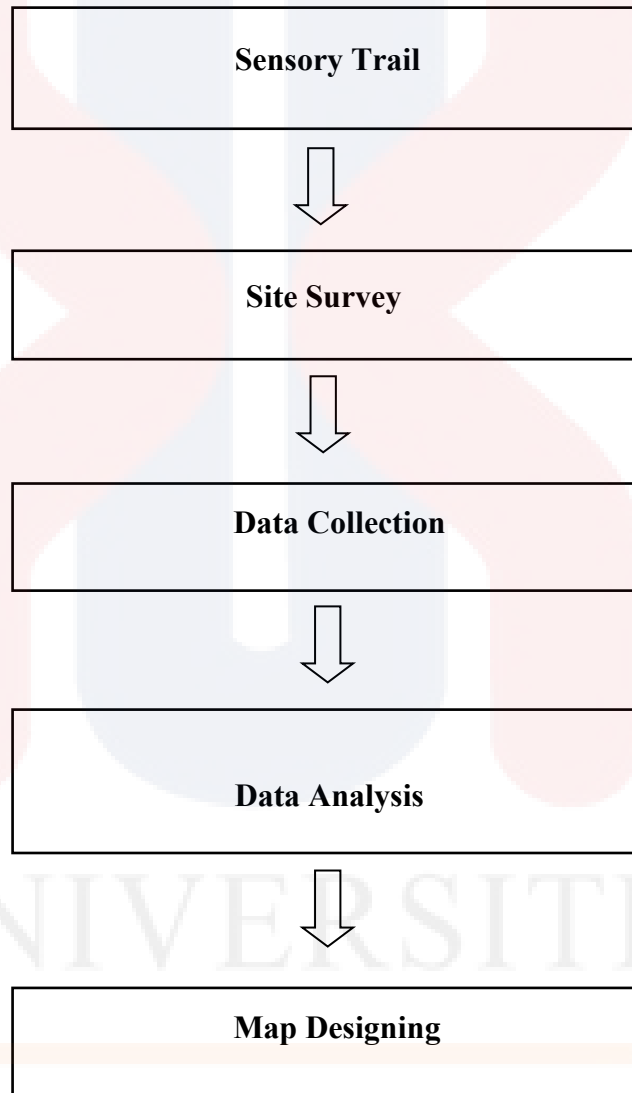


Figure 3.3 Research Flow chart

CHAPTER 4

RESULT AND DISCUSSION

4.1 Route of the sensory trail

Route A



Figure 4.1 Handles and fences for stairs
Source: Study area of Sensory Trail



Figure 4.2 Braille sign and informative panel
Source: Study area of Sensory Trail

Figure 4.1 and figure 4.2 depict the sensory trail region for Route A, Taste portion. This is the starting point for Route A, which is 0.14 km long and has an elevation range of 58 to 62 meters. Visitors can park their vehicles at the neighboring parking lot, as seen in the image above. This path includes tasting portions with flavors including spicy, sweet, sour, salty, and bitter. There is a section with a little hut (30.48 m height, 30.48 m width, and length) made of wood where people may try different flavors such as spicy chili peppers, which they can taste in modest amounts. Next, for something sweet, add some candy. Citrus fruits like calamansi or lime can be used to make sour drinks. Next for bitter taste, include samples of bitter ground or bitter tea. And for a salty taste, serve some salty snacks such as salted peanuts. There are also ‘The Curb-Cut effect’ to facilitate movement of persons with disabilities, especially those who use wheelchairs as shown as figure 4.5.

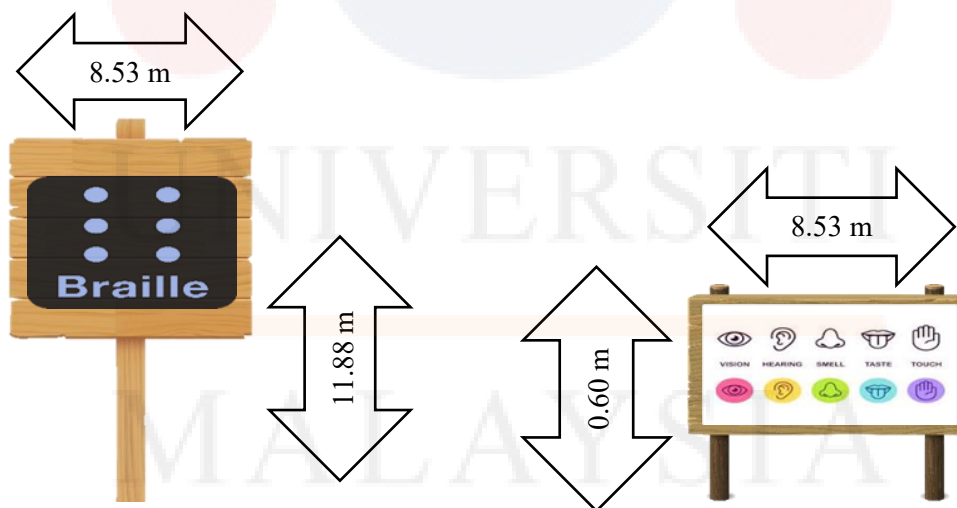


Figure 4.3 Design braille sign and interactive panel

Source: Study area of Sensory Trail



Figure 4.4 Design handles and fences for stairs

Source: Study area of Sensory Trail



Figure 4.5 Little hut for Taste sections

Source: Study area of Sensory Trail

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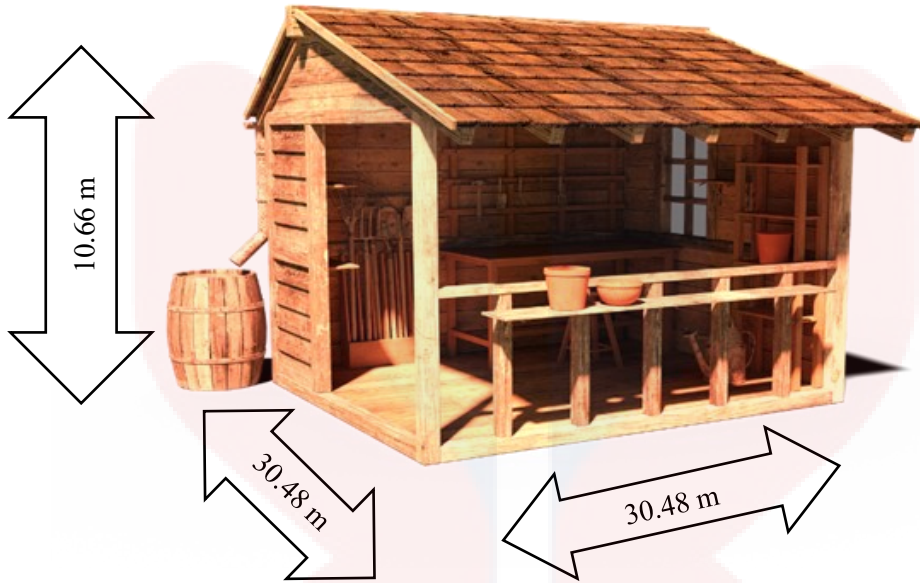


Figure 4.6 Design of the little hut
Source: Study area of Sensory Trail

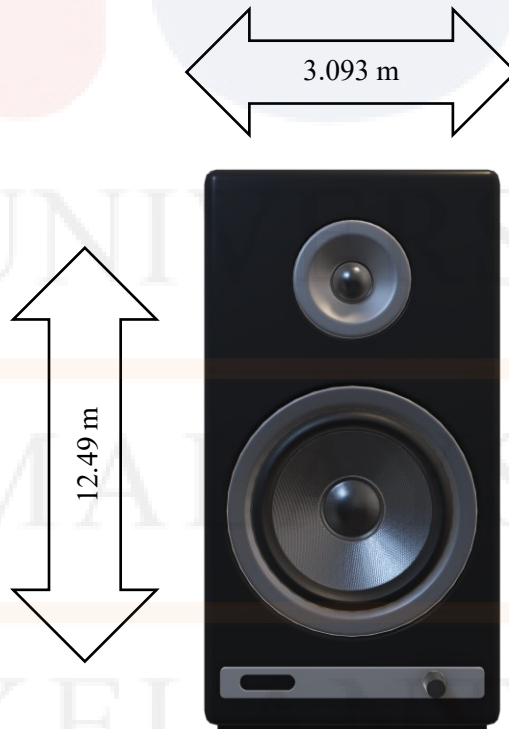


Figure 4.7 Design audio description
Source: Study area of Sensory Trail

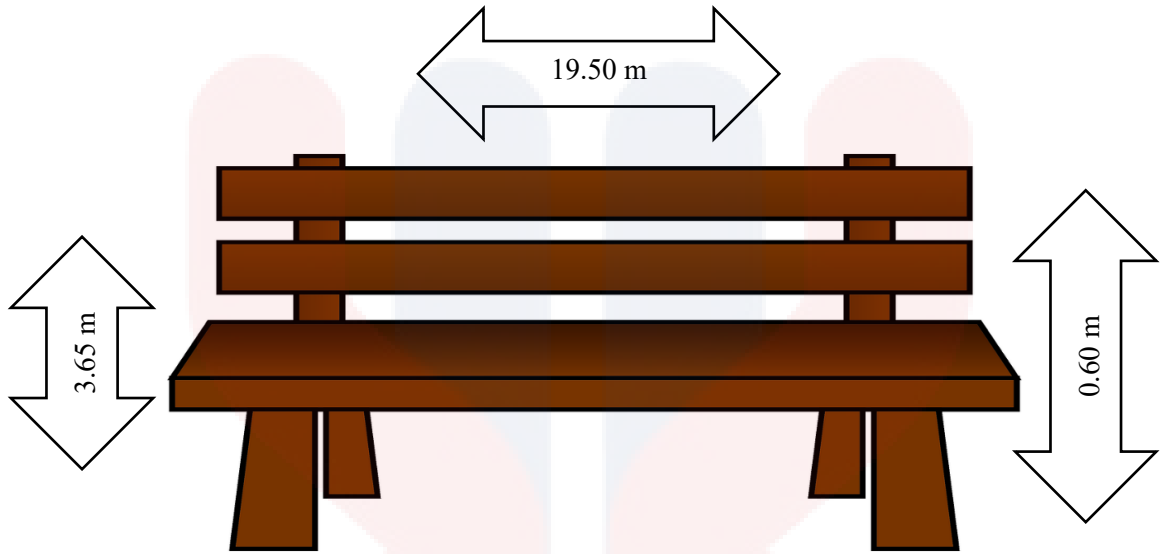


Figure 4.8 Design of the benches
Source: Study area of Sensory Trail



Figure 4.9 The benches
Source: Study area of Sensory Trail



Figure 4.10 Pathways for the wheelchair's user

Source: Study area of Sensory Trail

On this route, there are many interesting activities that have been prepared, it is designed for everyone regardless of age or ability. Featured asphalt (2 m width) as a path textured surfaces for a pleasant touch, ensuring wheelchair accessibilities. Braille signs (11.88 m height and 8.53 m width), low-height interactive panels (11.887 m height and 8.53 m width), and audio descriptions (11.88 m height and 8.53 m width) are placed along the route, this is to facilitate visitors, especially children and people with disabilities. Resting spots such as benches (19.50 m length, 3.65 m width, and 6.40 m height) were provided there to enhance comfort especially for the elderly. Visitors can also use the stairs near the starting line of Route A to go down. There are also handles and fences (11.58 m height) install on the side of the stairs to facilitate the movement and safety of visitors, especially the children. Installing a curb cut effect might make it easier for wheelchair users to move.

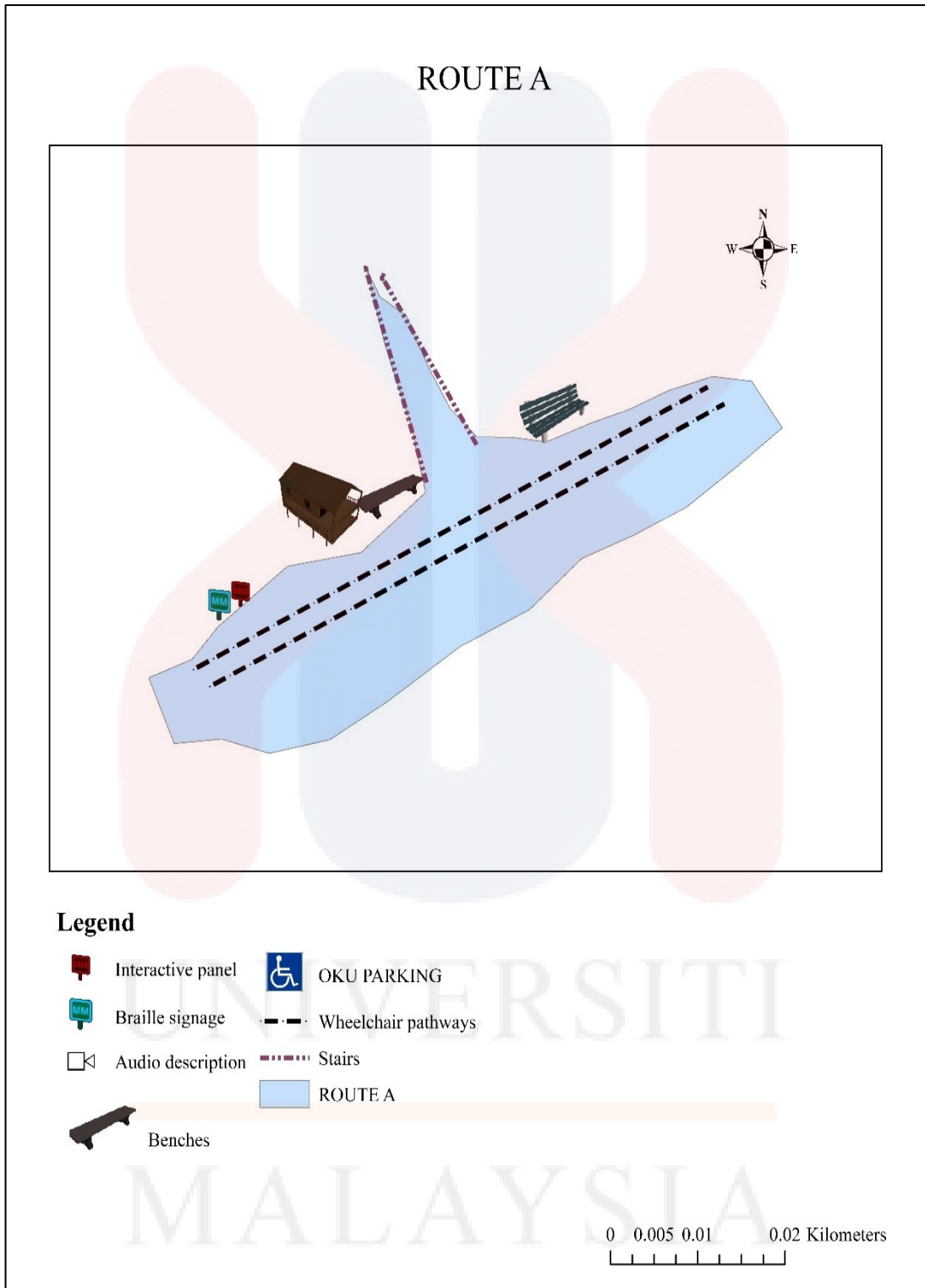


Figure 4.11 Map for Route A (Taste Section)

Source: ArcMap GIS

Route B



Figure 4.12 Route B for sensory trail

Source: Study area of Sensory Trail

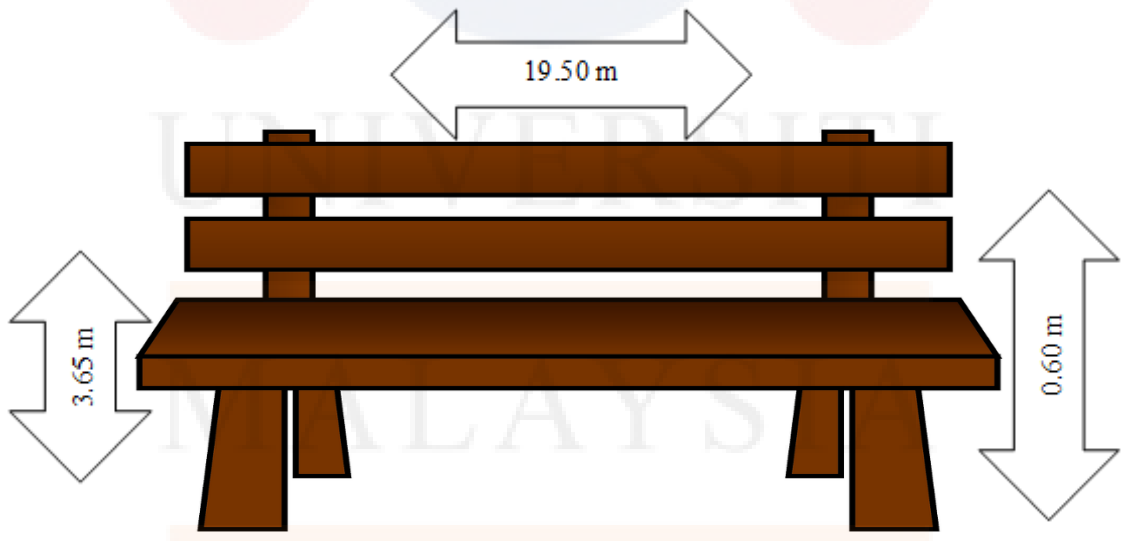


Figure 4.13 Design of the benches

Source: Study area of Sensory Trail



Figure 4.14 Area for unique shaped of plant and vibrant colors of plant
Source: Study area of Sensory Trail



Figure 4.15 Route B for Sensory Trail
Source: Study area of Sensory Trail

Next, figures 4.14 and 4.15 show the Route B route, commonly known as the sight section, which is 0.12 km long with 63 to 68 m range of elevation. This region is likewise appropriate for people of all ages and those with disabilities attributed to the asphalt walkways and paved roads. Along this attractive route, there are two areas for fascinating textures, colours, and wonderfully shaped plants, including succulents, flowers, shrubs, and textured bark measuring 42.75 m in length and width. In addition, there were brilliant hues in the flowers area, including yellow, purple, and pink, with a length and breadth of 42.75 meters. Furthermore, along this walk, there are enormous green trees on the right side that are ideal for bird watching, especially in the evening when sitting on the benches (19.50 m length, 3.65 m width, and 6.40 m height).

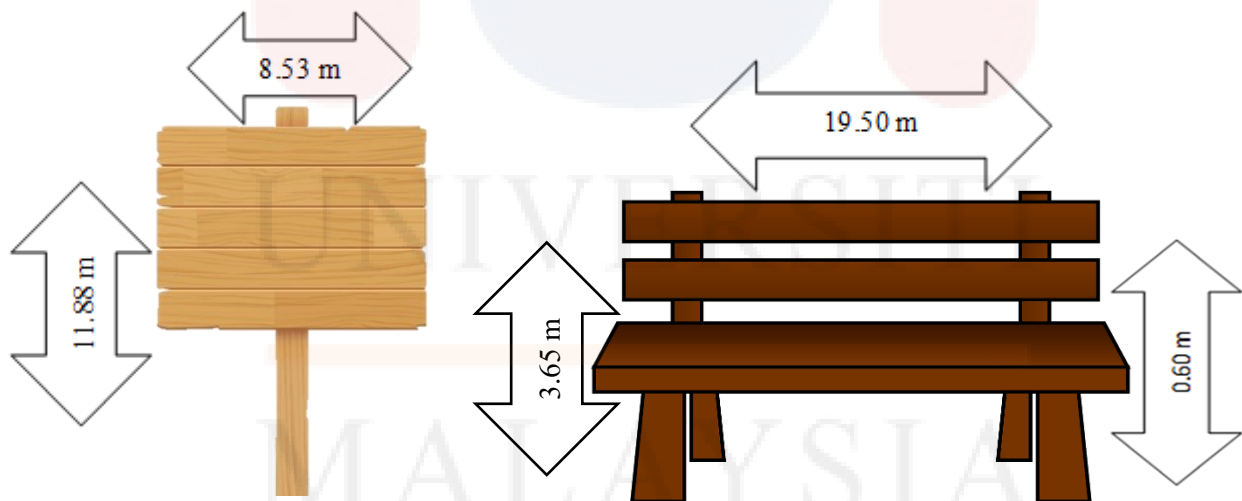


Figure 4.16 Design for informative sign and bench

Source: Study area of Sensory Trail

It is also conveniently accessible because it is adjacent to the parking area, allowing individuals of all abilities to explore and enjoy the garden's sensory delights. Visitors can experience and appreciate the wonderful nature and flora in this location. Visitors can also use the shortcut located at the intersection of route B. Route D is accessible by a shortcut on the left side of the road. The tarred and asphalt surface makes it simpler for those with impairments, particularly those using wheelchairs, to get there. Furthermore, the height is low, and the slope is gentle, making it easily accessible to them.



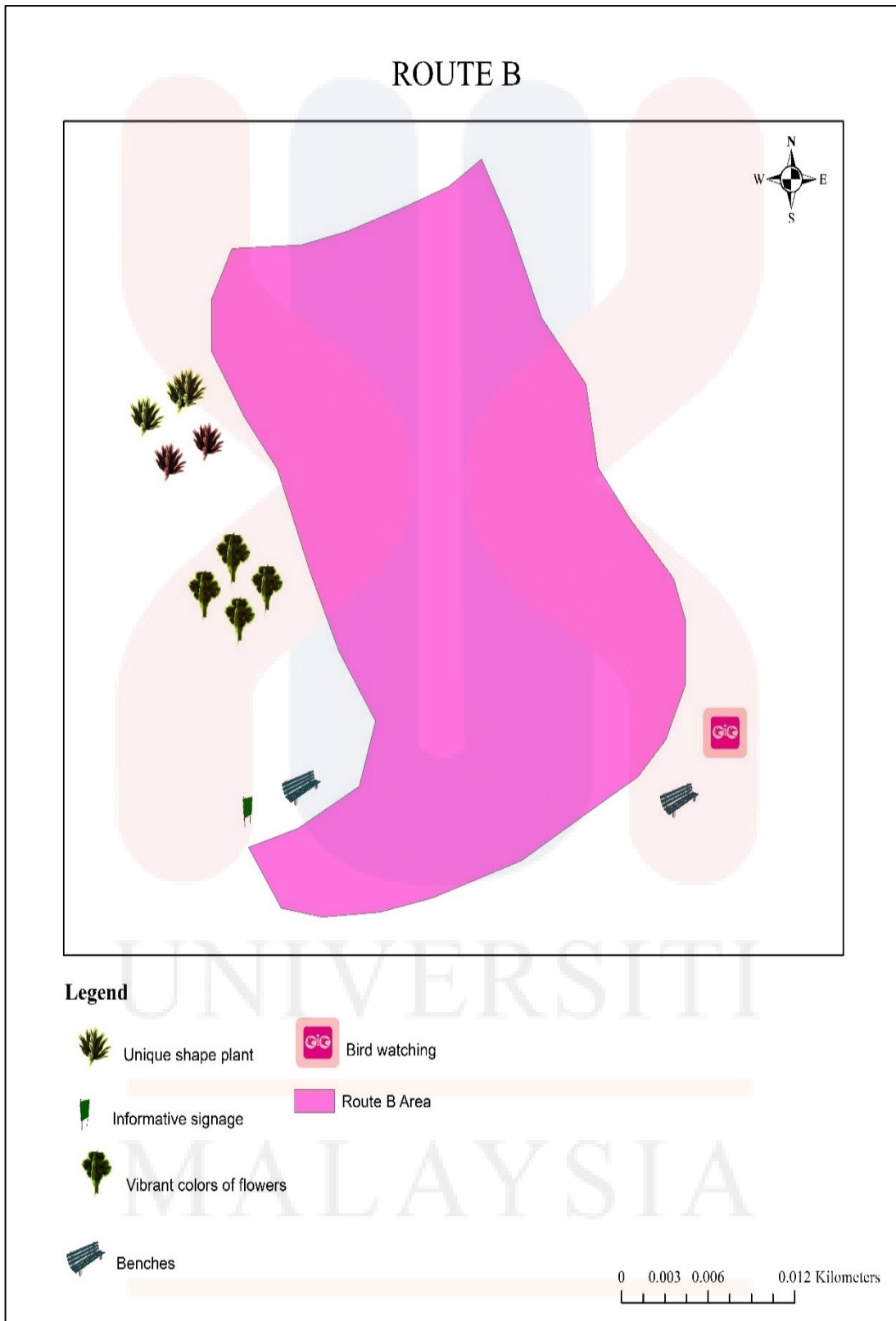


Figure 4.17 Map for Route B (Sight Section)

Source: ArcMap GIS

Route C



Figure 4.18 Informative sign at Route C
Source: Study area of Sensory Trail

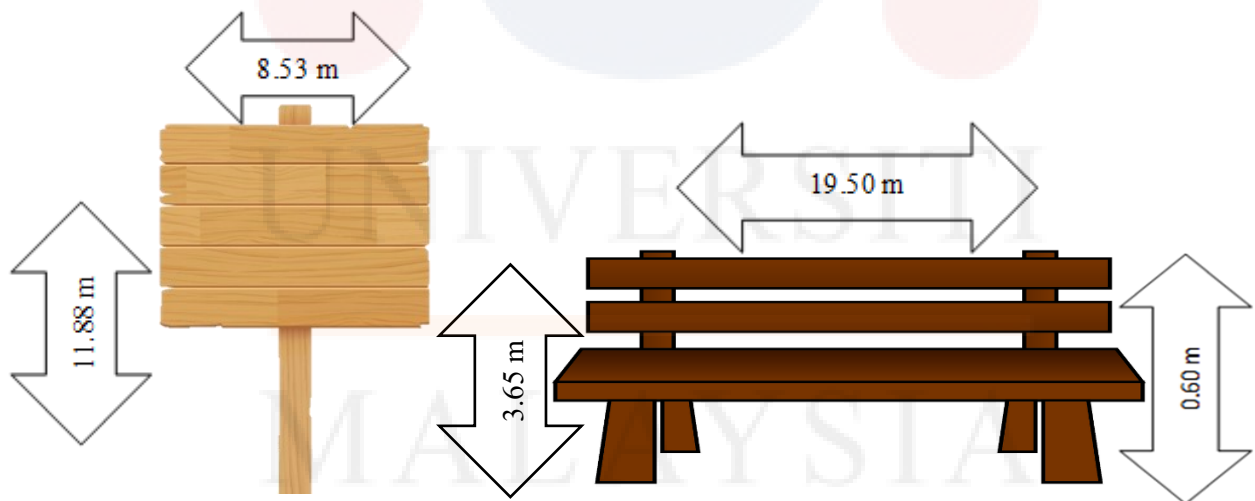


Figure 4.19 Design for informative signage and benches
Source: Study area of Sensory Trail



Figure 4.20 Four sections of different elements
Source: Study area of Sensory Trail

Aside from that, figures 4.18 and figure 4.20 show the continuation of route B to route C, also known as the Touch section, which is 0.12 km long and has an elevation range of 46 to 64 m. This portion features a variety of texture walks, including smooth pebbles, sand, grass, and rough bark, and is separated into four sections, each measuring 38.1 m in length and width. Benches (19.50 m length, 3.65 m width, and 6.40 m height) strategically placed throughout the walkway provided resting areas for the elderly and others with mobility issues. The terrain, high height, and steep slope make the area unsuitable for those with impairments, particularly those using wheelchairs. The structural conditions are quite hilly.

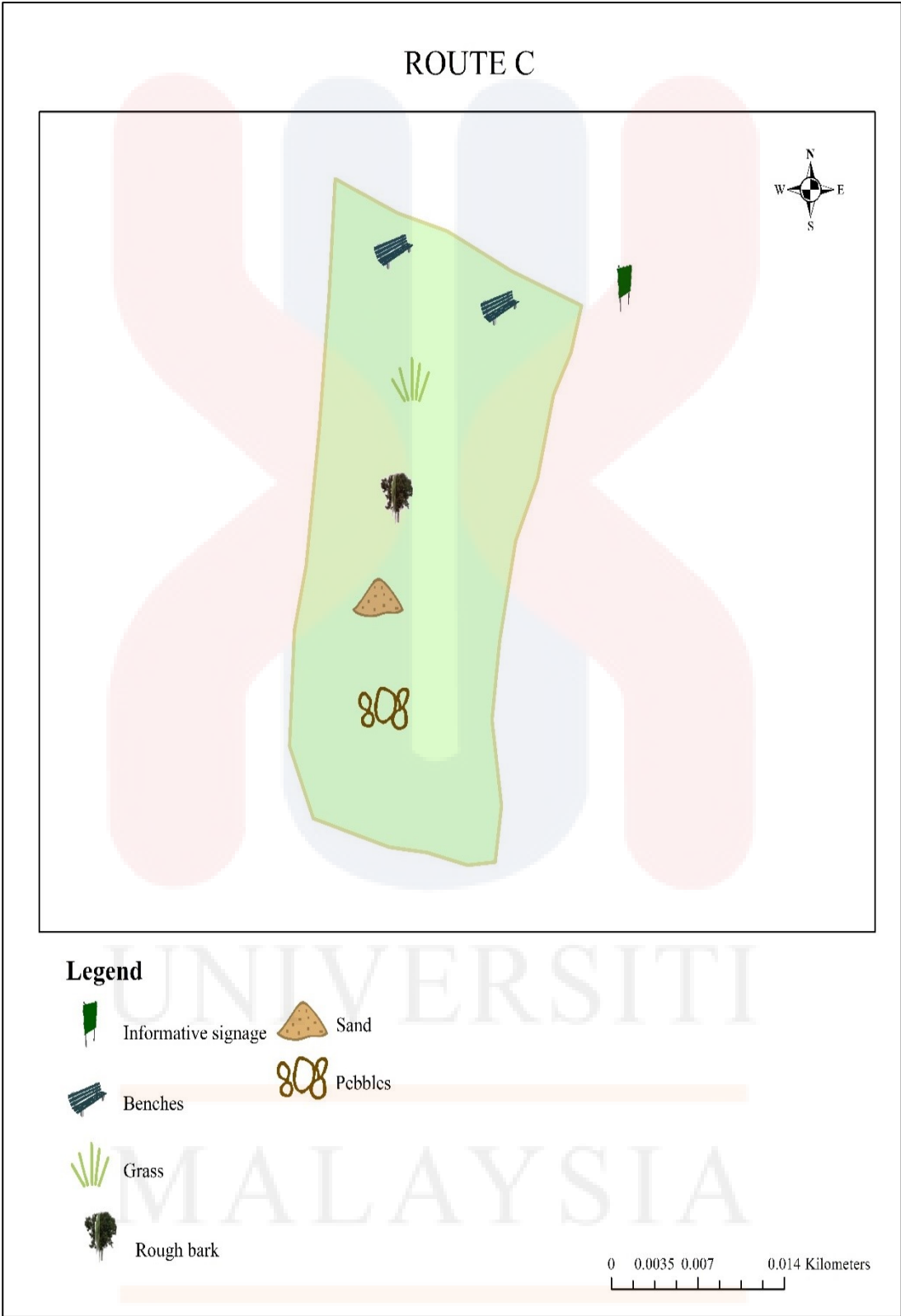


Figure 4.21 Map for Route C (Touch Section)
Source: ArcMap GIS

Route D



Figure 4.22 Variety of fragrant flowers
Source: Study area of Sensory Trail



Figure 4.23 Bench and variety of fragrant herbs
Source: Study area of Sensory Trail



Figure 4.24 Bench allowing people to sit and relax
Source: Study area of Sensory Trail

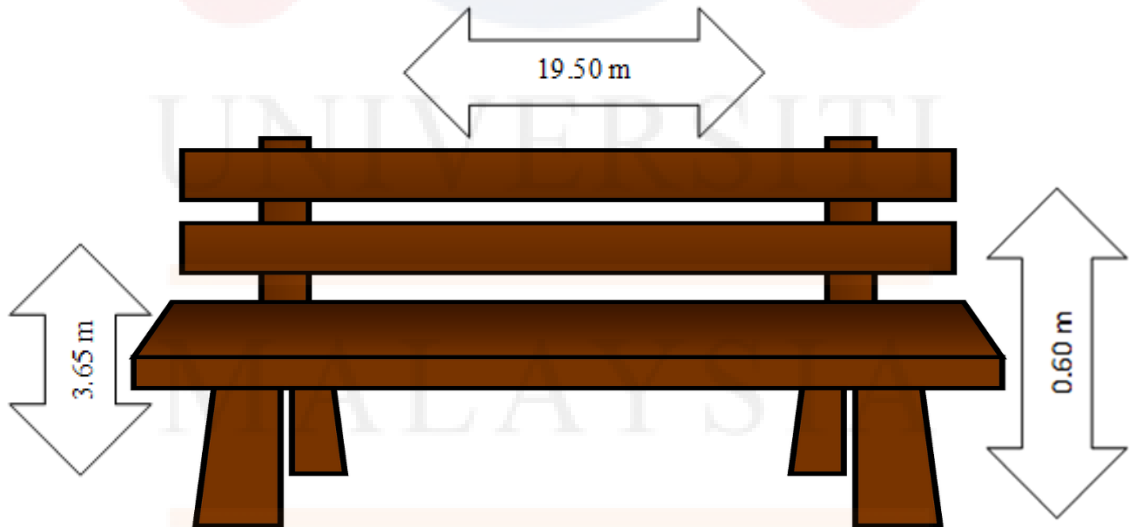


Figure 4.25 Design of the benches
Source: Study area of Sensory Trail

Next, figure 4.22 and figure 4.23 shows the Route D known as smell section, with 0.13 km and a 52 to 56 m range of elevation. The smell aspects of this section are this sensory garden featured a lot of herbs such as lemongrass, pandan, and ginger and plant a variety of fragrant flowers such as frangipani, jasmine, and ylang-ylang. The width of each herb and flowers section is 38.1 m length and width. Benches (19.50 m length, 3.65 m width, and 6.40 m height) were placed thoughtfully, allowing people to relax and fully enjoy the artistic features. The visitors can walk through and enjoy the aromas. This location is not suited for those with impairments, particularly those who use wheelchairs, because the surface is uneven, smooth, and rocky, rather than tarred like asphalt. Although there is a shortcut, however the road conditions are rough, and the height is inaccessible to people with impairments who use wheelchairs.

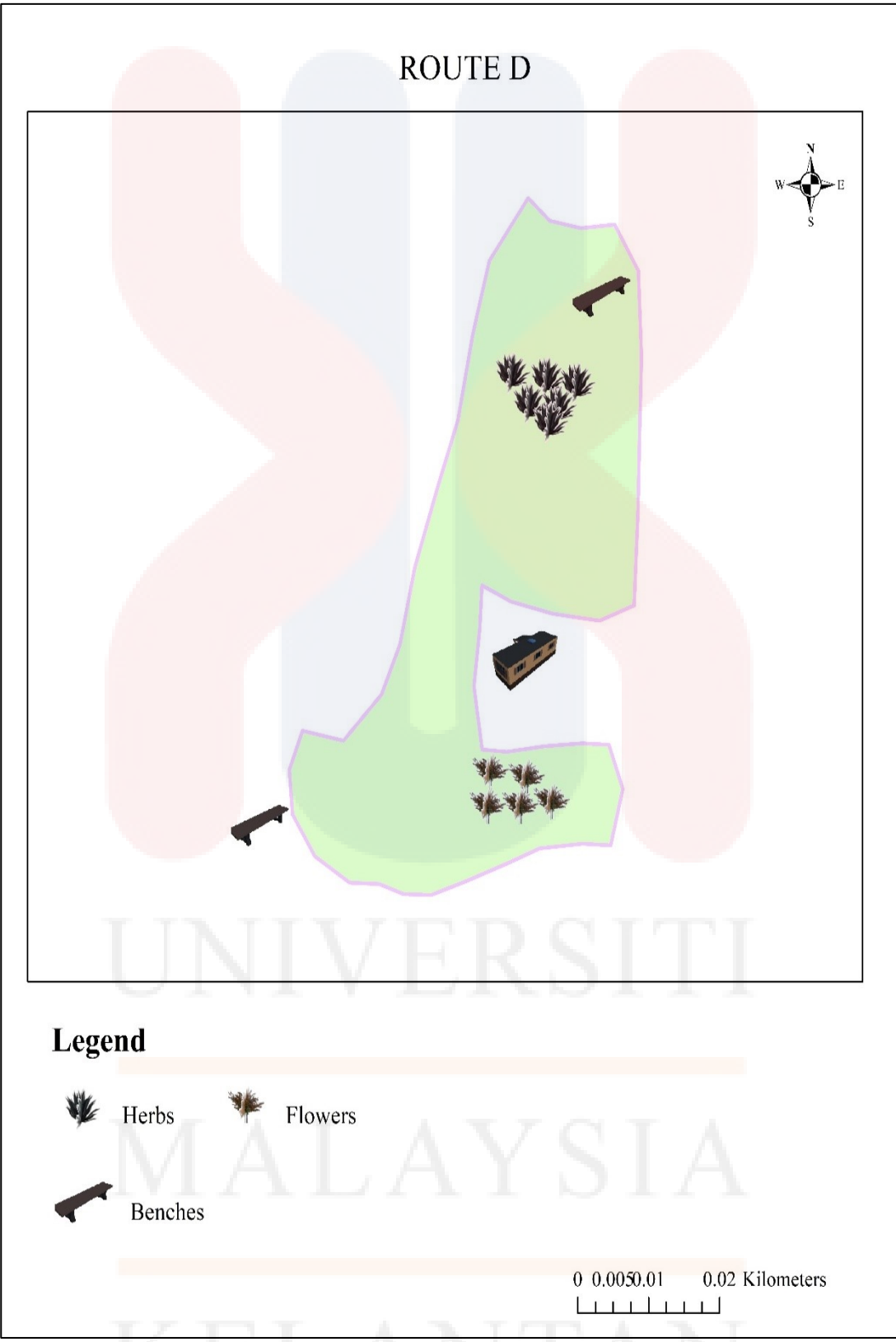


Figure 4.26 Map for Route D (Smell Section)
Source: ArcMap GIS

Route E



Figure 4.27 Informative sign at Route E
Source: Study area of Sensory Trail

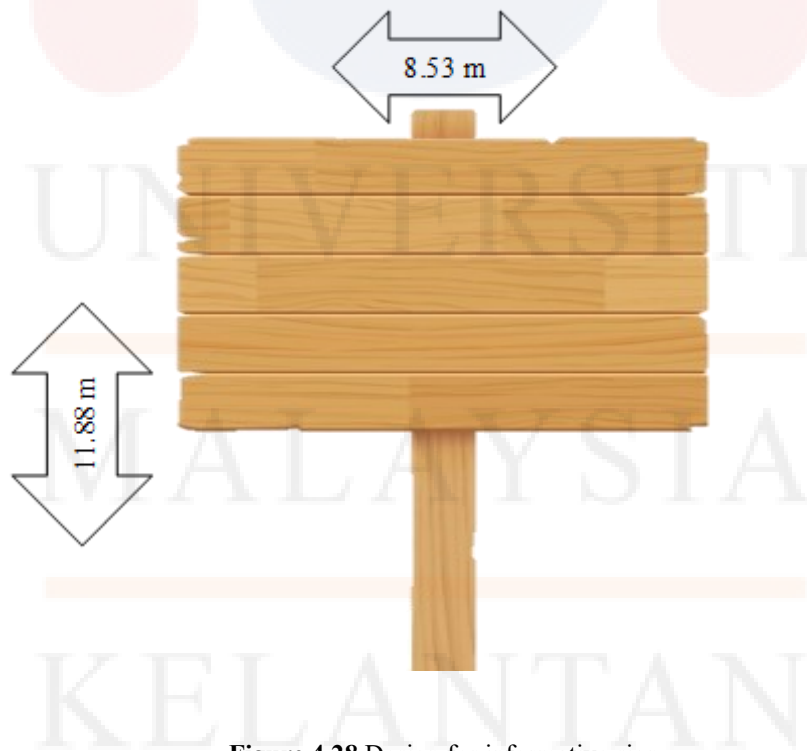


Figure 4.28 Design for informative sign
Source: Study area of Sensory Trail



Figure 4.29 Route E for Sensory Trail
Source: Study area of Sensory Trail

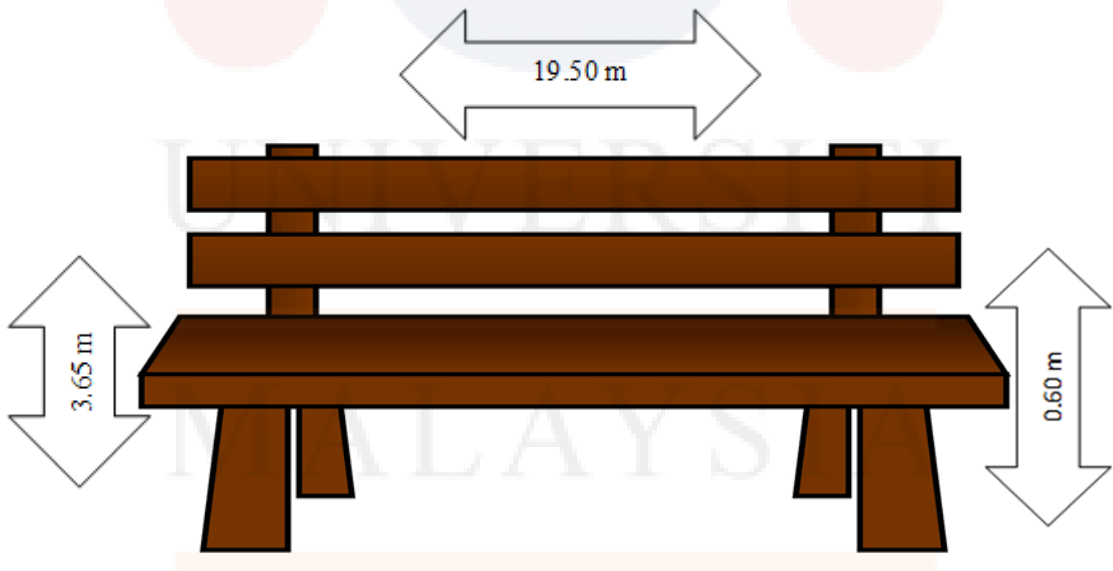


Figure 4.30 Design for the benches
Source: Study area of Sensory Trail

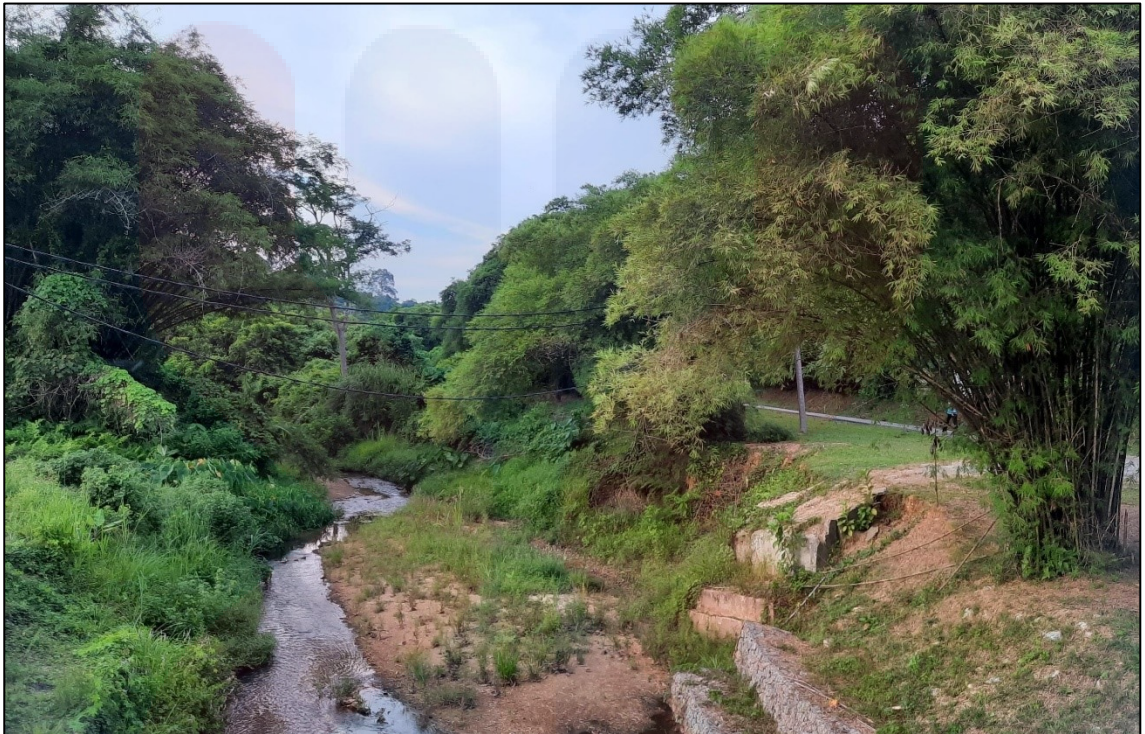


Figure 4.31 Surrounding of Route E
Source: Study area of Sensory Trail



Figure 4.32 Route E for Sensory Trail
Source : Study area of Sensory Trail



Figure 4.33 Shortcut to Route E from Route B

Source : Study area of Sensory Trail

Finally, figures 4.27 and figure 4.29 Route E, also known as the sound section, which is 0.16 km long with 52 to 60 m range of elevation. The natural sound was created by the wind passing through the leaves and branches also the sound of trees rustling in the breeze creates a sense of peace. This location has huge trees and bamboo trees. Visitors can also find tranquillity by listening to the sound of running water from the nearby stream. Benches (19.50 m length, 3.65 m width, and 6.40 m height) are also available, allowing visitors to relax and completely appreciate the natural surroundings. This segment is unsuitable for those with impairments, particularly those who use wheelchairs, because it is relatively far from the parking lot. Although there is a shortcut, the road conditions are rough, and the height is inaccessible to people with impairments who use wheelchairs.

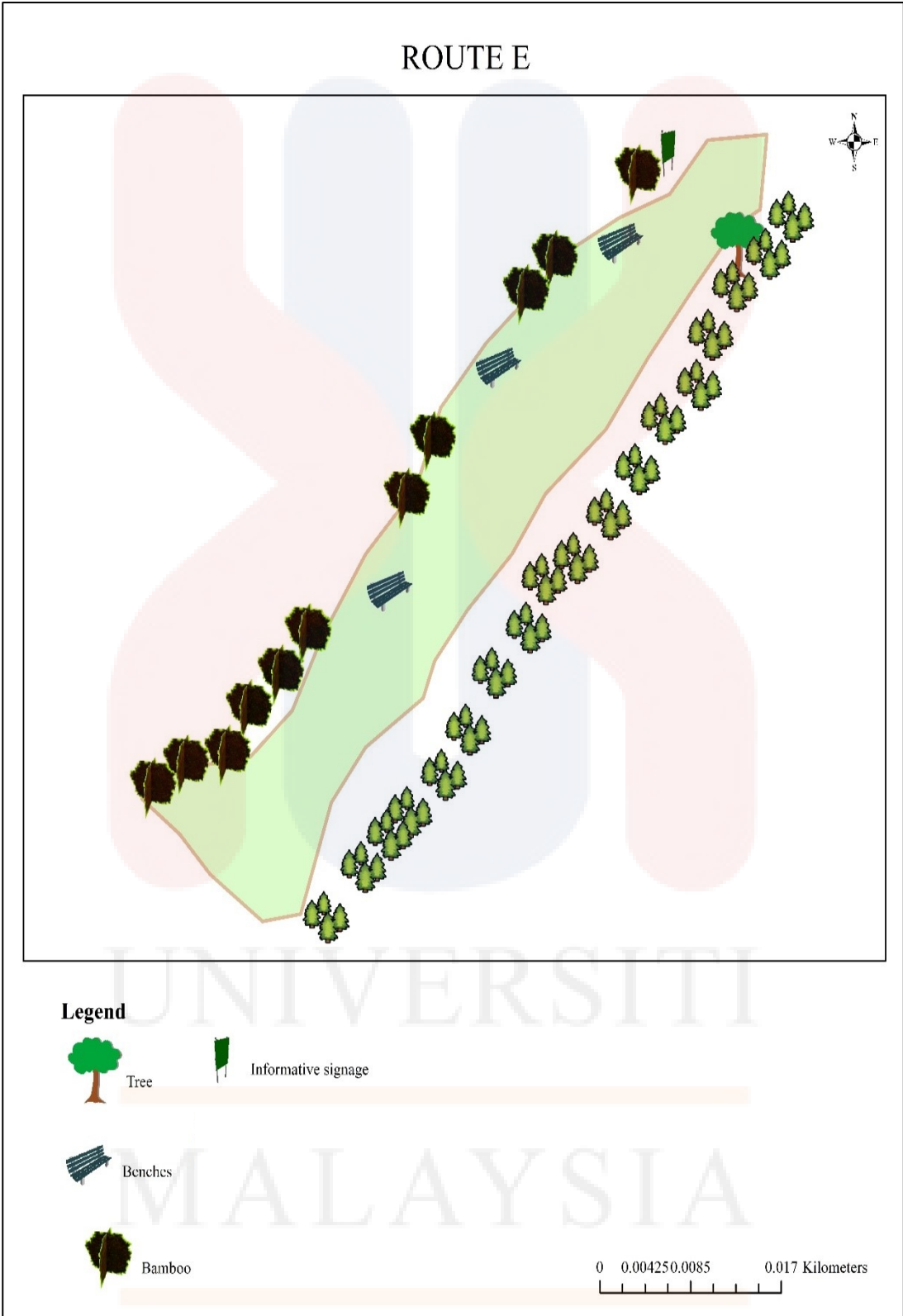


Figure 4.34 Map for Route E (Sound Section)
Source : ArcMap GIS

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

In conclusion, this sensory path aims to attract a diverse spectrum of users, from children to the elderly, in order to foster a deep relationship with nature and the environment. An efficient and orderly design may meet the needs of all individuals, even those with sensory impairments. There are numerous things that must be considered when designing this sensory trail to fit the requirements and abilities of everyone. Examples include the area's height, slope, and surface. This is to ensure that different groups feel and have a unique experience. A good design can be achieved by proper and precise design planning.

Not only that, but an effective design can result in an interactive map. Interactive maps are significant because they may improve user experience, inclusivity, safety, and provide feedback and improvement. All these factors are important in developing an interactive map. The interactive map is particularly significant since it keeps visitors interested in our design and makes the sensory trail easier to understand. Interactive maps, for example, might have a colourful design, intriguing activities, and features, among other things. And, most importantly, this map design allows visitors to tailor their trail experience based on their preferences and skills, selecting the route that best suits their ability. Despite limitations and hurdles, persons with disabilities or wheelchair users can still enjoy the sensory path based on their ability.

Based on the current studies, the suggestions for the next research are that ongoing maintenance establishing a maintenance plan is important to ensure the longevity and effectiveness of the sensory element. Furthermore, local engagement is crucial. This is because incorporating the local population, such as UMK students, in the design and maintenance process fosters consensus and collaboration in decision-making while creating the sensory trail map.

Next, the sensory trail's needs upgraded. This entails improving the standards in each stage or route of the sensory trail to make it simpler for all groups to participate. Improving features throughout each sensory path route. For example, adding some missing or unfinished pieces to each route. Next, organize a campaign or program. By launching a campaign or initiative to educate the public about the Sensory Trail. Many individuals are unaware of what a 'sensory trail' is and the benefits it provides. Finally, searching for funds and partnerships. Obtain financing from government agencies, non-governmental organizations (NGOs), or partners to help design and build 'sensory trails' in the real world in FSB UMK Jeli.

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