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COMMUNITY PERCEPTION ON LAND-USE CHANGE IN VICINITY OF FLOOD DETENTION PONDS IN KUALA LUMPUR

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Abstract

Escalating urban flash floods have become a critical socio-environmental crisis. The continuous conversion of natural, permeable landscapes into impervious urban surfaces such as asphalt and high-density concrete has drastically accelerated surface water runoff. This study aims to understand the community's knowledge, flood experiences, and the authority's response and planning around the flood detention pond area. The research methodology uses a structured survey format, ensuring the collection of standardised data that can be objectively compared across the various detention pond catchment areas. Analysis shows that over 83.5% (mean = 3.28) of respondents observe intensive construction around detention basins, mirrored by an 82.7% (mean = 3.26) agreement rate that natural green buffers have diminished over the past five years. Residents expressed confidence in the physical safety (mean = 3.22) and routine upkeep (mean = 3.15) of local detention ponds, their trust declined (mean = 2.99) in the ponds' ability to prevent overflow during prolonged, multi-day rainfall. In addition, the community is not inherently opposed to development but instead requests sustainable planning that balances economic growth with rigorous environmental safeguards.

Keywords: community knowledge, detention ponds, flash flood, Kuala Lumpur, perception

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INTRODUCTION

Escalating urban flash floods have become a critical socio-environmental crisis in tropical metropolises. Driven by climate change-induced erratic rainfall and rapid urban expansion, cities like Kuala Lumpur face severe hydrological imbalances (D'Ayala et al., 2020). The continuous conversion of natural, permeable landscapes into impervious urban surfaces, such as asphalt and high-density concrete, has drastically accelerated surface water runoff, fundamentally altering catchment hydrology, and overwhelming the existing municipal drainage infrastructure (Stewart, 2023).

To manage these peak discharge rates, Kuala Lumpur relies on a network of decentralised structural mitigation assets, specifically flood detention ponds managed by the Department of Irrigation and Drainage (JPS) and Kuala Lumpur City Hall (DBKL). These facilities are engineered to capture and temporarily store excess stormwater, thereby protecting downstream zones from sudden inundation (Takaikudin et al., 2012). However, aggressive micro-level land-use changes and spatial encroachment increasingly compromise these assets' operational integrity.

Recent governance assessments in Kuala Lumpur have highlighted critical institutional failures. According to a 2026 investigation by the Malaysian Anti-Corruption Commission (MACC), the failure to gazette Kuala Lumpur's flood detention ponds for 18 years created a loophole that allowed 32 hectares of protected land to be alienated for mixed development projects, despite the areas being approved for reservation as early as 1998 (The Star, 2026). Furthermore, Federal Territories Minister Hannah Yeoh (2026) revealed that the alienation of 17 land lots within the Jinjang and Batu detention pond zones to private developers since 2015 has reduced their active water storage capacity by an estimated 70%. Technical assessments by the Department of Irrigation and Drainage (JPS) confirmed that this rapid encroachment has hindered crucial maintenance and desilting works, directly exacerbating local flood risks (Yeoh, 2026).

Despite these technical findings, a notable research gap remains in the socio-technical reality of these sites. While hydrological data show infrastructure decline, empirical evidence on how communities living adjacent to these compromised ponds experience and perceive these changes remains limited. This study addresses this gap by utilising a community survey to evaluate the operational reality of flood infrastructure under the strain of continuous urban development. The primary objectives are to establish the demographic profile of affected residents, evaluate community perception of infrastructure effectiveness, assess governance and authority response, and identify grassroots recommendations for long-term urban flood resilience (Abid et al., 2024; Shariff & Hamidi, 2019).

To address the gap of existing studies, the study seeks to fulfil the following objectives: i) to identify the community's knowledge and perception of detention ponds around their residences; ii) to understand their perception of flood impact and land-use changes around detention ponds; and iii) to understand the authority's response and planning for flood management around the area. The findings will provide insights into community perspectives on land-use change and flood mitigation strategies while assessing the effectiveness of current planning and management approaches in enhancing urban flood resilience.

LITERATURE REVIEW

This section synthesises existing research on the intersection of rapid urbanisation, structural flood mitigation, and participatory disaster governance in the Malaysian context, specifically focusing on the Kuala Lumpur and Klang Valley regions.

Urbanisation, Land-use Change, and Hydrological Impacts

Rapid urbanisation and the proliferation of impervious surfaces are the primary drivers of increased flood vulnerability in tropical metropolitan areas such as Kuala Lumpur (Mohamed, 2024). The shift from natural, permeable landscapes to built-up urban environments characterised by concrete and asphalt drastically limits soil infiltration, accelerating surface runoff and increasing peak discharge during monsoon seasons (Mazlan, 2026; Mohamed, 2024). Research indicates that uncontrolled development in catchment areas directly correlates with increased flood frequency and severity, as existing drainage networks, often designed based on outdated historical rainfall data, have failed to accommodate current extreme weather patterns exacerbated by climate change (Liew et al., 2021; Mohamed, 2024). Consequently, hydrological modelling in the Klang Valley has consistently demonstrated that traditional urban expansion strategies without adequate green infrastructure contribute significantly to the catastrophic flooding events observed in recent years (Mazlan, 2026).

Governance and Community Participation in Disaster Management

Flood risk management in Malaysia has traditionally operated on a "top-down," government-centric model, where federal and state agencies are the primary actors in infrastructure development and crisis response (Shariff & Hamidi, 2019). However, scholars argue that this approach often results in a disconnect between policy and the lived realities of vulnerable communities (Abid et al., 2024). Evidence suggests that integrating local knowledge into flood management is essential, as residents frequently act as the "first responders" and possess granular, historical insights into local flood patterns and infrastructure vulnerabilities that external engineering models may overlook (Abid et al., 2024;

Shariff & Hamidi, 2019). Community-based disaster risk management (CBDRM) frameworks, which emphasise public education, neighbourhood-level action plans, and collaborative engagement, have been shown to strengthen community resilience and provide contextually relevant solutions that rigid structural measures often miss (Abid et al., 2024; Rameli et al., 2024).

The Psychology of Flood Risk and Lived Community Experience

A critical component of community analysis involves understanding how residents perceive structural mitigation. Reliance on large-scale engineering projects often triggers the “levee effect”, a psychological phenomenon in which communities develop a false sense of absolute security, increasing their vulnerability when these infrastructures ultimately fail or are breached during extreme events (Kuhlicke et al., 2020). Furthermore, marginalised or highly exposed communities often have unique observational data on incremental environmental degradation, such as the gradual shallowing of retention ponds, which is vital for accurate risk reduction (Few et al., 2017). Evaluating the community’s roles in mitigating and adapting to localised floods shows that public perception is directly shaped by proximity to the hazard and the transparency of local authorities (Karki et al., 2016). Li et al. (2022) found that over half of respondents reported some worry about stormwater-related damage and, overall, perceived floodable areas as less safe than retention ponds under storm conditions. The same study (Li et al. 2022) also reported that respondents who had more frequently experienced localised flooding near their homes were more worried about potential property damage from flooding. Kumaresen et al. (2025) conducted a survey in Kuala Lumpur and found that residents generally reported high levels of risk perception and preparedness. However, adaptive capacity exhibited greater variability, with a mean score of 3.97 (SD = 0.64), and a positive association was found among risk perception, flood preparedness, and adaptive capacity. Benardi et al. (2026) explained that uncontrolled land-use changes driven by rapid population growth and expanding residential development have significantly heightened flood risk in the Kendal Watershed, Kendal District. Community perceptions reveal that these land-use changes have contributed to increased flood frequency, greater flood intensity, and longer inundation duration.

RESEARCH METHODOLOGY

Study Area and Scope

This study focused on a cross-section of flood-prone catchments in Kuala Lumpur, which encompass 24 designated flood detention ponds. These sites were selected for their strategic importance to the city’s stormwater management network and because they fall under the jurisdiction of the DBKL and JPS, the

city's primary stormwater-management authorities. For a clear overview of the spatial scope of this study, Table 1 provides a complete inventory of the 24 authorised flood detention ponds categorised by their managing authority and catchment.

Table 1: Flood Detention Ponds around Kuala Lumpur

Name of Flood Retention Pond	Primary Catchment Area	Managing Authority
KTB Kg. Batu Flood	Kg. Batu, Kuala Lumpur	JPS
KTB Taman Wahyu	Jinjang / Taman Wahyu	JPS
KTB Nanyang, Delima, Jinjang	Jinjang Utara	JPS
KTB Sungai Midah	Taman Midah, Cheras	JPS
KTB Sri Johor	Sri Johor, Cheras Baru	JPS
KTB Cheras Baru	Cheras Baru	DBKL
KTB Taman Desa	Taman Desa Siputeh	JPS
KTB Air Leleh	Setapak / Air Leleh	DBKL
KTB Kg. Berembang	Kg. Berembang	JPS
KTB Danau Kota	Danau Kota, Setapak	DBKL
KTB Kg. Bohol	Pekan Sungai Besi	DBKL
KTB Lorong Maarof	Bangsar Baru	DBKL
KTB Sri Permaisuri 1	Bandar Sri Permaisuri	DBKL
KTB Sri Permaisuri 2	Bandar Sri Permaisuri	DBKL
KTB Intan Baiduri	Taman Intan Baiduri, Kepong	DBKL
KTB Pasar Borong Selayang	Selayang / Kepong Border	DBKL
KTB Kg. Melayu Kepong	Kepong	DBKL
KTB Sunway Montana	Wangsa Melati	DBKL
KTB Taman Sri Rampai	Wangsa Maju / Sri Rampai	DBKL
KTB Segambut	Segambut Luar / Dalam	JPS
KTB Sri Johor	Cheras	JPS
KTB Cheras Baru	Cheras	DBKL
KTB Tasik Ampang Hilir	Ampang Hilir Corridor	DBKL
KTB Batu 4 ½	Jalan Genting Klang	JPS

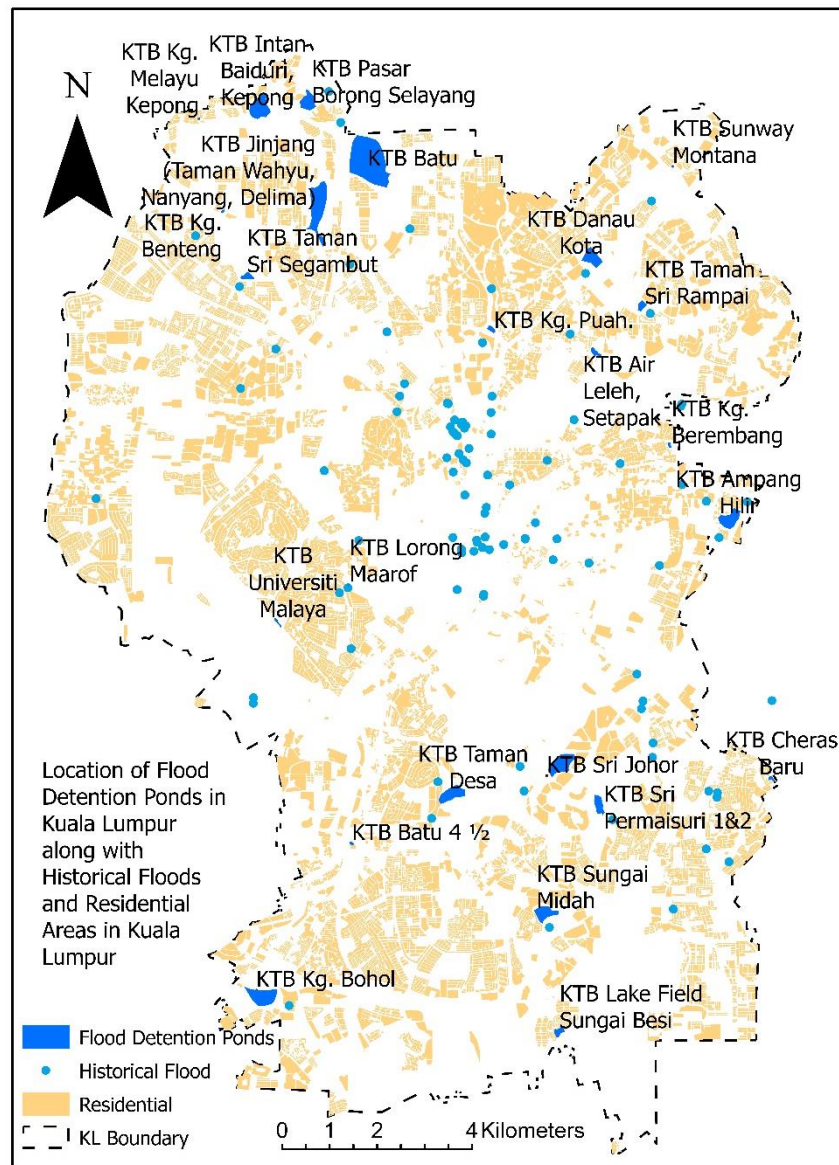


Figure 1: Spatial Distribution of detention ponds, historical floods, and residential areas

Figure 1 presents the locations of the 24 flood-detention ponds, historical floods, and residential areas in Kuala Lumpur. These ponds were overlaid with historical flood data collected from reports issued by the National Flood Forecasting and Warning Centre (available data from 2016 to 2021) and

newspaper clippings, while residential areas were extracted from land-use data. The map highlights communities that may be more exposed to flooding, enabling planners to prioritise land use monitoring and community-based flood risk management.

The inclusion of locations ranging from established neighbourhoods to rapidly developing commercial zones enabled a comparative analysis of how different land-use pressures and administrative oversight affect the perceived effectiveness of detention ponds in mitigating flash floods. This geographic spread ensured that the community perception data reflected Kuala Lumpur's broader urban landscape and flood vulnerability profile.

Most ponds are surrounded by extensive built-up development. This pattern is particularly evident around ponds in the northern and eastern parts of Kuala Lumpur, including KTB Batu, KTB Danau Kota, KTB Taman Sri Rampai, and KTB Ampang Hilir. A similar concentration is evident around several southern ponds, including KTB Taman Desa, KTB Sri Johor, and KTB Sri Permaisuri 1 and 2. The blue points show that the flood-exposed locations are distributed widely across Kuala Lumpur, with notable concentrations along the central drainage network and in the southern part of the city. Several detention ponds are located near these points, including KTB Taman Desa, KTB Sri Johor, KTB Sungai Midah and KTB Cheras Baru. This spatial proximity suggests that some detention ponds serve the communities located within or near historically affected or potentially flood-exposed areas.

Research Design

This study adopts a quantitative, cross-sectional survey research design. This approach is well suited for capturing a snapshot of community perceptions, flood experiences, and awareness levels at a specific point in time. The structured survey format ensures the collection of standardised data that can be objectively compared across the various detention pond catchment areas. The design was tailored to measure the correlation between the physical land-use changes observed by residents and their subsequent evaluation of the effectiveness of the local flood detention infrastructure.

Respondents were recruited directly from communities living near the selected flood-retention ponds, targeting at least 10 respondents per pond to ensure coverage across all study locations. Eligible residents were approached by data collectors and invited to complete the questionnaire using an online form. Although responses were submitted digitally, data collectors were present during the survey to explain the study, guide respondents through the form, and clarify any questions that they did not understand. This face-to-face, interviewer-assisted digital survey method allowed respondents to enter answers online while data collectors assisted without influencing their responses. As the questionnaire was

administered through this combined approach, balancing independent online and face-to-face samples was not applicable. This method also reduced misunderstandings of the questionnaire items and ensured that respondents from each retention pond location were adequately represented.

The instrument was structured into four components to ensure comprehensive data gathering. The first section is Respondent Profiling (Section A), which gathers respondents' demographic data, including residency duration and proximity to the detention pond, to contextualise the responses. The second section (Section B) is Perception Assessment utilises a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*) to quantify community opinion regarding the operational effectiveness of local ponds. The third section is Governance Evaluation (Section C), which probes the socio-political aspects of flood management, specifically evaluating the clarity of authority communication and the responsiveness of agencies. The final section, Qualitative Feedback (Section D) consists of an open-ended section designed to capture grassroots recommendations and concerns that are not adequately addressed by the structured Likert-scale questions. The questionnaire was distributed to communities living near the selected flood-retention ponds in Kuala Lumpur. The questionnaire was distributed through a survey link to residents living within or near the ponds and were familiar with local development and flood conditions. This sampling approach enabled the study to collect community perceptions of land-use change, retention pond effectiveness, and flood risk across different pond locations.

A total of 328 valid responses were included in the analysis. The raw survey data were processed using descriptive statistics. For the Likert-scale items in Sections B and C, mean scores and standard deviations were calculated to determine the central tendency of community opinion toward pond effectiveness and governance performance. Frequency distributions and cross-tabulating demographic profiles with perception scores were used to identify specific governance gaps and infrastructure vulnerabilities. Spearman's rank correlation was used to examine the relationship between perceived land use change and perceived flood risk around flood detention ponds because the questionnaire responses were measured using a four-point Likert scale. We calculated the composite scores by averaging the relevant items for each variable and assessed item reliability using Cronbach's alpha. Statistical significance was determined at $p < 0.05$. The correlation coefficient was used to identify the direction and strength of relationships.

The final analysis synthesised the findings towards suggesting recommendations for improving urban flood resilience and community-authority collaboration in Kuala Lumpur. To contextualise these recommendations, the study area was categorised according to administrative management. The selected

locations range from established neighbourhoods to rapidly developing commercial zones, allowing a comparative analysis of how different land-use pressures and administrative oversight affect the perceived effectiveness of detention ponds in mitigating flash floods. This geographic spread ensured that the community perception data collected in this study were representative of Kuala Lumpur's broader urban landscape and flood vulnerability profile.

Results and Discussion

Section A: Respondent Information and Demography Profiling

This section outlines the demographic profiles of the survey participants to provide essential context for the subsequent analysis. A total of 328 respondents participated in this study, representing residential communities located within the vicinity of all the detention ponds described in Table 1.

Age and Employment Distribution

Table 2 presents the demographic distribution of the 317 respondents across six age brackets and five employment statuses. Overall, the sample skews toward younger adults, with the 20–29 age group forming the largest cohort at 34.7%, followed by those aged 30–39 years (19.9%) and 40–49 years (18.3%). The rest of the respondents (11) did not answer this question.

Table 2: Distribution of Respondents by Age and Employment Category

Age Category	Student	Private	Government	Self-Employed	Unemployed	Total (n)
15 - 20	10	1	0	0	0	11
20 - 29	45	42	10	7	6	110
30 - 39	6	25	22	8	2	63
40 - 49	2	12	18	19	7	58
50 - 59	0	7	10	12	14	43
60 +	0	3	2	6	21	32
Total (n)	63	90	62	52	50	317
Percentage (%)	19.9	28.4	19.6	16.4	15.8	100

Across the sample, the private sector constituted the largest occupational group, accounting for, accounting for 28.4% of respondents, followed closely by Students (19.9%) and Government employees (19.6%). Self-employed and unemployed respondents comprised 16.4% and 15.8% of the sample, respectively.

In terms of age distribution, the survey captured a wide, multigenerational demographic, although it leans heavily toward youth and young adults. The largest segment of respondents fell within the 20–29 age bracket, accounting for more than a third of the total sample (34.9%). Combined

with the 30–39 (19.9%) and 40–49 (18.3%) age groups, most respondents (73.1%) were of working age. This high participation rate among young adults and the working-class population suggests strong civic awareness and concern about urban planning, environmental risks, and local infrastructure among those who live in and actively navigate the city itself. Representation of older adults (50–59 years at 13.5%) and seniors (60+ years at 10.1%) ensured that the survey incorporated the perspective of long-term residents who were likely to have observed historical environmental and developmental changes in Kuala Lumpur over several decades.

Duration of the Residency Profile

Understanding how long respondents have lived in their respective neighbourhoods is an important variable because long-term residents may possess historical knowledge of the area. This knowledge enables them to provide informed observations on land-use changes, the reduction of green spaces, and changes in the effectiveness of local flood detention ponds over time. Of the 328 respondents, 327 reported their residency duration. The following table (Table 3) summarises the frequency and percentage distribution of respondents based on the length of time they have resided in the area.

Table 3: Duration of Residency Profile

Category	Frequency (n)	Percentage (%)
< 1 Year	17	5.2%
1 – 5 Years	76	23.2%
6 – 10 Years	78	23.9%
> 10 Years	89	27.2%
Unspecific	67	20.5%
Total	327	100.0

As Table 3 indicates, the largest single specified proportion of respondents have lived in the area for more than 10 years, followed closely by those residing there for 6 to 10 years (23.9%). Collectively, over half of the sampled population (51.1%) were long-term residents with at least six years of experience in these catchments. Meanwhile, respondents with 1–5 years of residency accounted for 23.2%, and recent arrivals with less than 1 year accounted for 5.2%. The remaining 20.5% were categorised as unspecified. The high proportion of long-term inhabitants provides strong contextual reliability as these respondents have long-term historical awareness of neighbourhood development patterns, environmental changes and flood mitigation performance

in their localities. Data were also analysed by location and residency duration. Older settlements around detention ponds (KTB), including KTB Sg Midah (100%), KTB Sri Johor (80%), KTB Taman Sri Permaisuri (75%), and KTB Kg. Melayu Kepong (57.5%), are dominated by long-term residents who have lived in the area for more than 10 years. Areas such as KTB Lorong Maarof (58.33% residing 1–5 years) and KTB Sunway Montana (100% residing 1–5 years) reflect a concentration of newer residents, aligning with recent commercial and residential developments in their surroundings.

Proximity to Flood-Prone Areas

Respondents were asked to identify whether their current residence is located within an area known to be flood-prone (Table 4). This determines whether their perceptions of detention pond effectiveness are shaped by direct, localised experiences with flooding or by general community awareness.

Table 4: Flood-Prone Respondents Linked Directly to Detention Ponds

Category	Frequency (n)	Percentage (%)
Yes	74	22.6%
No	217	66.4%
Not Sure	36	11%
Total	327	100.0

Most of the survey participants (66.4%) reported that they did not live in designated flood-prone zones, while nearly a quarter (22.6%) explicitly stated that they did. An additional 11.0% were unsure of their area's official flood-risk status. This distribution was highly beneficial for the study. This indicates that the concerns raised about land use and pond effectiveness throughout the survey are not solely grievances from direct flood victims. Instead, they reflect the broader community awareness and public concern regarding Kuala Lumpur's flood management infrastructure. The 22.6% of respondents who live in flood-prone areas provided a sufficiently large subset of direct insights into the localised, immediate impacts of heavy rainfall and detention pond overflows, grounding the survey in lived experiences. Over 60% of respondents with direct flood risk are concentrated in two major corridors: Bukit Jalil / Kinrara (32.4%) and Kepong / Jinjang / Batu (28.4%), residents living near the Kg. Bohol Flood Detention Pond frequently report flood pressure as intense upstream development meets the basin boundaries. In Kepong and Jinjang, communities surrounding the Kg. Batu, Taman Wahyu, and Intan Baiduri Pond chains experiencing flooding challenges driven by rapid urbanisation altering natural stormwater pathways. The feedback from Lake Fields (Sungai Besi) and Ampang/Setapak reflects

localised drainage strains where high-density housing developments sit immediately adjacent to linear detention facilities like the Lake Field Sungai Besi Pond and Kg. Berembang Pond. While 66.4% of participants do not live in designated flood-prone zones, the 22.6% do provide a robust subset of direct insights into the localised impacts of heavy rainfall.

Section B: Community Perception on Land-use Changes and The Effectiveness of Flood Detention Ponds

This section evaluates the community's perceptions of physical transformations in urban land use and their direct consequences for the functionality, capacity, and management of flood detention ponds in Kuala Lumpur.

Impact of Land Use Changes Around Detention Ponds

The survey assessed how the respondents perceived recent spatial transformations around detention basins. Table 5 summarises the descriptive statistics and percentage distribution for each item under the land-use impacts.

Table 5: Impact of Land-use Changes Around Detention Ponds

Indicator	Mean (n)	Agreement (%)	Std. Dev (SD)
There is a lot of new development around the detention pond	3.28	83.5	0.86
Green areas around reservoirs have been decreasing over the past five years	3.26	82.6	0.84
Land use changes affect the effectiveness of flood detention ponds	3.28	86.6	0.82
New housing areas are built near flood catchment ponds	3.22	82	0.87
There is a change in land use from agriculture to commercial development	2.69	59.8	1.01
Development near reservoirs provides economic benefits to the economy	3.04	72.9	0.93

The data reflects a statistical convergence around physical urban transformation. Over 83.5% (mean = 3.28) of respondents report intensive construction around retention basins, mirrored by an 82.6% (mean = 3.26) agreement rate on the depletion of natural green buffers over the past five years. When cross-referenced with the inventory, this spatial pressure is most felt in high-growth corridors such as the KTB Kg. Bohol near Bukit Jalil and the KTB Lake Field Sungai Besi, where active real estate projects directly abut basin perimeters. Furthermore, the community explicitly identifies high-density residential expansion as the primary engine of this change (mean = 3.22; 82.0% agreement),

while agricultural-to-commercial shifts scored significantly lower (mean = 2.69), indicating that these catchments were already urbanised spaces whose remaining open margins and drainage reserves are now being built up. Crucially, residents make a direct cognitive link between these land-use shifts and compromised pond functionality (mean = 3.28; 86.5% agreement). Despite these profound environmental concerns, the table reveals a pragmatic public stance: 72.9% of respondents agree (mean = 3.04) that proximate developments deliver economic value. This indicates that the community is not inherently opposed to development but instead demands a sustainable planning framework that balances economic growth with rigorous environmental safeguards.

Physical and Functional Effectiveness of Flood Detention Ponds

Respondents evaluated the physical dimensions, structural integrity, maintenance standards, and safety features of the detention ponds located within their catchments, as presented in Table 6.

Table 6: Physical and Functional Effectiveness of Flood Detention Ponds

Indicator	Mean (n)	Agreement (%)	Std. Dev (SD)
I feel this reservoir is safe for the surrounding residents	3.22	80.8	0.88
This reservoir is well maintained in terms of structure and cleanliness	3.15	78.4	0.90
This reservoir design looks ideal for reducing flooding	3.09	77.4	0.91
This reservoir has a green area or good landscaping	3.08	73.5	0.92
I think this reservoir is big enough to hold heavy rain water	3.08	73.5	0.95
The depth of this reservoir is sufficient to accommodate water during continuous rain	3.02	72.6	0.96
I am sure this reservoir can hold water if heavy rain continues for several days	2.99	71.0	0.95

Residents generally give high marks to the physical safety (mean = 3.22) and routine cleanliness (mean = 3.15) of local flood ponds. These positive scores are driven by well-maintained, mature sites managed by authorities, such as the Sri Permaisuri 1 and 2, Sungai Midah, and Sri Johor ponds in Cheras, as well as Taman Sri Rampai and Danau Kota in Setapak. In these areas, regular upkeep keeps the grounds clean and secure. However, approval drops when evaluating the ponds' actual flood-holding capacity. While basic surface size (Mean = 3.08) and overall design (mean = 3.09) receive moderate support, there

are still agreement regarding pond depth during continuous rain (mean = 3.02). The lowest rating is for multi-day rain storage (mean = 2.99), where nearly 29% of respondents expressed disagreement. This concern is highest in heavily strained basins like the Kg. Bohol and Lorong Maarof (Bangsar) detention ponds. Overall, the findings suggest that while these ponds handle short, intense rainstorms well, residents fear they cannot handle prolonged monsoonal rainfall without overflowing.

Cumulative Impacts of Land Use on Drainage, Sedimentation, and Long-Term Mitigation

Table 7 reports the respondents' views on how surrounding developments physically altered hydrological dynamics within specific pond catchments, leading to drainage disruptions, siltation, and accelerated overflow risks.

Table 7: Cumulative Impacts of Land Use

Indicator	Mean (n)	Agreement (%)	Std. Dev (SD)
Land use changes increase the risk of water overflowing from reservoirs	3.27	82.6	0.82
The function of reservoirs as long-term flood mitigation is being affected by uncontrolled land use changes	3.15	81.4	0.83
Development around reservoirs disrupts water drainage	3.13	77.4	0.97
Land use changes cause reservoirs to fill quickly during heavy rains	3.12	78.7	0.86
Land use changes cause the catchment pond to become shallow due to sedimentation	3.16	78.7	0.84
Development near reservoirs increases the risk of water overflowing into residential areas	2.98	73.8	0.99
The effectiveness of reservoirs in reducing floods is decreasing due to surrounding development	2.73	58.8	0.98

Consensus was noted that urban expansion actively accelerates overflow hazards. With an 82.7% agreement rate (mean = 3.27), the respondents confirmed that replacing natural permeable ground with concrete and buildings forces basins to fill at alarming speeds during heavy downpours (mean = 3.13; 78.6% agreement), and development around reservoirs disrupts water drainage (mean = 3.12). They also strongly recognised that this silt accumulation actively reduces basins of vertical depth (mean = 3.16; 78.7% agreement). Collectively, these pressures were perceived to severely compromise the role of detention ponds as long-term macro-mitigation assets, with over 81.4% of participants agreeing (mean

= 3.15). However, respondents expressed lower agreement that surrounding development has reduced reservoirs' effectiveness in flood reduction (mean = 2.73).

Local Authority (PBT) Governance, Monitoring, and Community Engagement

The respondents appraised the regulatory oversight, planning transparency, buffer-zone enforcement, and public participation frameworks managed by Local Authorities across these specific pond catchments (Table 8).

Table 8: Local Authority (PBT) Action

Indicator	Mean (n)	Agreement (%)	Std. Dev (SD)
Local authorities monitor land use changes around flood ponds effectively	2.88	73.8	0.80
A study of the impact of development on the function of the reservoir is carried out before new projects are approved	2.88	71.3	0.91
Development around catchment ponds complies with river and pond buffer zone guidelines	2.88	71.6	0.86
Local authority provides enough information about flood-prone areas	2.82	69.8	0.86
Local authorities control land use changes in areas around reservoirs	2.79	66.8	0.86
Community has been involved in any awareness or consultation programs about flood risk or land use planning	2.75	64.9	0.90

Every indicator was below the neutral 3.0 threshold. The respondents expressed concern on three aspects of land-use governance: (i) the consistency of municipal land-use monitoring, (ii) whether development-impact assessments are conducted before new projects are approved, and (iii) compliance with river and retention-pond buffer-zone guidelines. The mean score of 2.88 indicates a moderate perception of these practices, suggesting some uncertainty regarding their consistent implementation. These findings highlight opportunities to strengthen monitoring, improve transparency in development approval processes, and communicate buffer-zone compliance more clearly to local communities.

Local zoning regulations governing detention basins received a modest mean strictness score (2.79). Residents frequently witnessed construction encroaching on official river and pond surrounding areas (mean = 2.88). Community participation received the lowest mean score (mean = 2.75), with 35.1% of respondents disagreeing or having a negative opinion. This suggests opportunities to strengthen existing public consultation mechanisms and

encourage more meaningful community involvement. Communities around the key detention nodes reported limited involvement in early-stage risk awareness initiatives, zoning decisions, and municipal planning dialogues. This suggest that while the municipal agencies demonstrated strength in mechanical maintenance, there are opportunities to improve inter-agency coordination, strengthen the integration of flood-retention engineering with transparent spatial planning, and enhance community participation.

Section C and D: Community Perspectives, Governance Preferences, and Future Outlook

This section explores the community's perspectives on the primary physical causes of flooding, the most noticeable land-use transformations, desired governance reforms, and long-term aspirations for Kuala Lumpur's 24 flood retention ponds and their surrounding catchments.

Physical Causes of Flooding in the Local Area

Respondents identified the primary physical factors contributing to flooding in their respective neighbourhoods. As multiple responses were permitted, the findings capture both natural weather phenomena and anthropogenic (human-induced) pressures linked to urban drainage.

Table 9: Physical Causes of Flooding in the Local Area

Perceived Physical Cause of Flooding	Frequency (n)	Share of Response (%)
Drainage or river blocked	122	37.2 %
Heavy rainfall	101	30.8%
Construction activities	48	14.6%
Overflow from flood retention ponds	31	9.5%
Reduction of green and open spaces	13	4.0%
Other / Unspecified / No floods	13	3.9%
Total	328	100.0%

Blocked drains and rivers emerged as the leading perceived physical cause of flooding (37.2%). This points to localised maintenance failures, such as siltation, debris accumulation, and unmaintained secondary municipal drains managed by the authority, which prevent stormwater from reaching the 24 primary retention basins. Heavy rainfall was the second major cause (30.8%), confirming that extreme precipitation events driven by climate anomalies continue to overwhelm the baseline urban drainage capacity. Significantly, 14.6% of the respondents attributed flooding directly to ongoing construction activities.

Most Changes of Land Use around Detention Pond

To identify the nature of spatial transformation, the respondents were asked to identify the most prominent land-use shifts occurring within their detention pond catchments. They were allowed to select multiple responses, with the results shown in Table 10.

Table 10: Most Significant Types of Land Use Changes

Types of Land Use Change	Frequency (n)	Percentage (%)
New housing development	186	39.5%
Clearing and removal of green areas	121	35.7%
Commercial development	95	20.2%
Industrial development	66	14.0%
Other / Minor Notes	3	0.6%
Total Cumulative Mentions	471	100.0%

New housing development was identified as the most prevalent land-use change (39.5% of the total mentions). This rapid residential expansion is acutely visible around major catchments such as the KTB Kg. Bohol in Bukit Jalil and the KTB Danau Kota and KTB Taman Sri Rampai Ponds in Setapak, where high-rise apartments and terrace housing have replaced open tracts. The aggressive removal of green buffers (25.7%) highlights the systematic replacement of natural sponges with impermeable concrete. This corroborates community concerns that natural absorption zones around basins. Commercial (20.2%) and industrial (14.0%) expansions further compound hydrological stress, sealing catchment surfaces and accelerating peak stormwater discharge into municipal drainage networks.

Relationship between perceived land-use change and perceived flood risk

Another analysis (Table 11) used two composite variables in the Spearman's correlation analysis. Perceived land-use change was measured using three items: new development, reduction of green areas, and new housing development around flood-retention ponds. Perceived flood risk was measured using eight items related to drainage disruption, sedimentation, rapid pond filling during heavy rainfall, pond overflow, flooding, risk to nearby residential areas, and the reduced long-term flood mitigation function of the ponds. We calculated the mean scores for the relevant items for each variable, with higher scores indicating stronger perceptions of land-use change and flood risk. The two variables demonstrated acceptable internal consistency, with Cronbach's alpha values of 0.698 for perceived land-use change and 0.781 for perceived flood risk.

Table 11: Correlation analysis between perceived land-use change and perceived flood risk

Variables	Mean	SD	Cronbach's α	r_s	p
Perceived land-use change	3.252	0.679	0.698	0.418	<0.001
Perceived flood risk	3.100	0.562	0.781	—	—

The Spearman's rank correlation showed a statistically significant positive relationship between perceived land-use change and perceived flood risk around the flood-retention ponds ($r_s = 0.418$, $p < 0.001$, $n = 328$). The strength of the relationship was moderate, indicating that respondents who perceived greater development pressure, housing expansion, and reductions in green areas also tended to perceive higher flood risk. The perceived risks included disrupted drainage, increased sedimentation, rapid pond filling, and possible overflow into nearby residential areas. However, the results reflect an association between community perceptions and do not confirm that land-use change directly caused flooding.

Better Governance and Policy Improvements

Respondents highlighted specific regulatory and administrative reforms they wanted local authorities to implement to improve urban flood management. Multiple responses were allowed for this question, and the results are presented in Table 12.

Table 12: Better Governance Improvements

Request for Governance Improvement	Frequency (n)	Share of Response (%)
Transparent land use planning	113	32.8%
Regular maintenance of flood ponds	80	23.2%
Community inclusion in decision-making	53	15.4%
Enforcement of no-development zones	53	15.4%
Public access to flood zone maps	27	7.8
Other / Unspecified	19	5.4%
Total Selections	345	100.0%

Transparent land-use planning ranked first as a governance priority (32.8%). The communities demanded the open disclosure of zoning approvals, Environmental Impact Assessments (EIAs), and hydrological studies before greenlighting high-density projects near basins, such as Intan Baiduri or Lorong Maarof. Regular, scheduled maintenance of retention basins (23.2%) and the

strict enforcement of statutory no-development buffer zones (15.4%) were viewed as critical deterrents against illegal encroachment. The call for community inclusion in decision-making (15.4%) and public access to hazard maps (7.8%) directly addresses the governance deficit identified in Section B. Residents expect municipal authorities to transition from top-down administration to collaborative, transparent risk governance.

Community Hopes for the Future of Retention Ponds and Land Use

The 299 valid responses to the open-ended questions revealed the public expectations and long-term aspirations for Kuala Lumpur's flood retention infrastructure. The responses were thematically analysed to systematically categorise the community's grassroots aspirations into three core domains: governance integrity, ecological harmony, and proactive resilience.

Collectively, the responses suggest that community members see urban flooding as more than an engineering or weather-related issue. They also place considerable importance on how flood risks are managed and communicated. A recurring pattern across the responses is a plea for moral integrity and diligence among municipal planners and private contractors. One respondent perfectly captured this sentiment, stating: "*Semoga tulus dalam membuat pekerjaan dan semoga masalah banjir diatasi dengan cermat*" (Hoping for sincerity in execution and careful mitigation of flood problems). Residents consistently underscored that even the most advanced engineering solutions will ultimately fail without conscientious oversight and a zero-tolerance policy for corrupt zoning practices and unauthorised land alienation. Another respondent commented: "*Harapan saya ialah untuk mengawal pembangunan dan tambahkan lagi kolam takungan*" (Hoping to see controlled development and add more flood retention ponds).

The qualitative feedback strongly advocates for a harmonious balance between urban economic growth and environmental preservation. The community members strongly resisted viewing detention ponds as merely concrete bowls intended solely for emergency stormwater storage. Instead, the communities surrounding heavily pressured basins, such as KTB Bohol and KTB Lake Fields, expressed hope that future zoning laws protect the remaining water bodies from being "choked by concrete". The overarching aspiration is for authorities to rehabilitate and transform these retention ponds into clean, functional "green lungs" and biodiverse recreational spaces that naturally absorb rainwater rather than allowing them to degrade into neglected, silt-filled stormwater sumps bordered by high-density real estate.

Table 12: Better Governance Improvements

Category	Key Insights	Frequency	Percent(%)
Keep Maintenance Routine	Demands for regular desilting, trash cleanup, drain clearing, and prompt structural repairs to prevent blockages.	38	31.10%
Development Control and Buffer Zones	Requests for strict “no-development zones,” controlled land use, and preventing commercial encroachment that compromises the pond.	31	25.40%
Flood Mitigation and Impact	Direct concerns about protecting homes/flats from overflowing, flash floods, and property damage during heavy rain.	24	19.70%
Capacity Upgrades and Infrastructure	Calls to deepen/enlarge retention ponds, widen drainage channels, and modernise water retention systems.	15	12.30%
Recreational and Green Space	Hopes to repurpose surrounding land into sustainable urban parks, community recreational zones, or eco-educational spaces.	8	6.60%
Governance, Enforcement and Public Awareness	Demands for transparent management, anti-corruption, public awareness campaigns on anti-littering, and community dialogues.	6	4.90%
Total Responses		122	100%

Finally, the qualitative data revealed widespread frustration with reactive, crisis-driven disaster management. The overarching hope for the future is a systemic shift toward proactive and long-term climate resilience. The public recognises the mechanical limitations of the current infrastructure under climate change; therefore, they wish for a city where authorities do not just wait for the monsoon season but actively prepare for it. The community demands that retention basins be continuously dredged to maintain vertical depth, secondary drainage networks be rigorously maintained year-round, and future urban density be strictly calibrated to the existing ecological carrying capacity of local catchments.

The qualitative feedback clearly showed that the community was well informed about the root causes of urban flooding. They understood that sustainable flood mitigation cannot be achieved by pouring more concrete; it requires sincere administration, legal protection of natural buffers, and relentless scheduled maintenance.

Nevertheless, the community perceptions may be affected by response bias because their assessments of retention pond effectiveness did not directly measure the actual hydrological performance. Their responses may be influenced by personal flood experiences, length of residence, proximity to the pond, familiarity with local development, recent heavy rainfall events, and the visible

condition of the pond. Respondents who previously experienced flooding may perceive the pond as less effective, whereas those without such experience may provide more favourable assessments. The presence of data collectors may also encourage socially desirable responses or general agreement with the questionnaire statements.

To reduce this limitation, future studies may compare perception findings with spatial and environmental data, including historical flood records, rainfall, elevation, slope, impervious surface percentage, land-cover change, and the MCDA flood susceptibility index. Combining community perceptions with these measurements provides a more comprehensive assessment and helps identify areas where perceived risk corresponds with observed environmental conditions. Public education can enhance community resilience (Abid et al., 2024).

An integrated strategy that incorporates development control, routine maintenance, catchment monitoring, nature-based solutions, and community involvement should be used to manage flood-retention ponds. By limiting development encroachment and mandating drainage and flood-impact evaluations for planned developments within pond catchments, related agencies can safeguard pond capacity and designated buffer zones. To prevent post-development runoff from exceeding pre-development levels, planning decisions should also account for the cumulative consequences of land-use change. To track changes in impervious surfaces, vegetation, pond area, drainage networks, and adjacent development, establish a shared GIS-based system. Retention ponds should also be integrated with rain gardens, bioswales, permeable surfaces, urban wetlands, and other blue-green infrastructure to reduce runoff at its source. Stronger coordination among DBKL, JPS, planning authorities, developers, and utility agencies is necessary to clarify responsibilities and share relevant data. Nearby communities should be involved through consultation, flood reporting, and environmental stewardship programmes, supported by clear information on maintenance, development proposals, and emergency procedures. Finally, the authorities should introduce measurable performance indicators and periodic policy reviews to ensure that pond-management strategies remain responsive to continuing urbanisation, changing rainfall patterns, and future flood risks.

CONCLUSION

This study investigated community perceptions of urban land-use changes and the operational effectiveness of Kuala Lumpur's 24 authorised flood retention ponds. The survey successfully captured a representative cross-section of Kuala Lumpur's population, anchored by a mature core of long-term residents (>51% residing in their areas for over six years) and a robust representation of working professionals and students. Over 22.6% of respondents reported experiencing

direct flood events. These events were concentrated in high-stress catchments, including KTB Kg. Bohol, KTB Taman Wahyu, and KTB Kg. Batu. Therefore, their evaluations are rooted in authentic, long-term observational knowledge rather than abstract speculation.

While the community acknowledges that municipal agencies maintain acceptable baseline structural safety and routine cleanliness (~78–80% agreement), external spatial pressures rapidly undermine this operational competence. A majority (>83%) observed intensive high-density housing construction and aggressive depletion of natural green buffers around the retention basins. This concrete expansion accelerates surface runoff velocity and generates heavy construction sediment, actively reducing retention depth, choking drainage networks, and heightening overflow risks during extreme weather.

Governance indicators received the lowest ratings, consistently falling below the neutral threshold. Community members expressed doubt regarding municipal land-use monitoring, pre-development Environmental Impact Assessments (EIAs), and the strict enforcement of statutory buffer zones. Most notably, public participation received the lowest overall rating, exposing a systemic gap in which the residents felt largely excluded from early-stage risk planning, transparent hazard mapping, and municipal zoning decisions.

To safeguard Kuala Lumpur's flood mitigation infrastructure against ongoing urban sprawl and climate uncertainty, intervention strategies must be targeted by the relevant jurisdictions. Accordingly, the recommendations are organised according to the responsibilities of local planning authorities and federal hydrological agencies. Authorities must enforce strict, statutory prohibition on development within buffer zones surrounding all 24 flood detention ponds. Commercial and residential encroachment adjacent to vulnerable basins must be halted to preserve natural hydrological absorption margins. DBKL must address the public governance deficit by publishing transparent pre-development Environmental Impact Assessments (EIAs) and open-access flood hazard maps. Multi-stakeholder public consultation frameworks must be institutionalised to ensure that local communities are actively engaged before zoning approvals are granted near detention catchments. Authorities must also implement proactive routine dredging schedules for detention basins affected by severe siltation to restore the lost vertical storage volume. In addition, the authorities must combat construction runoff upstream by enforcing mandatory silt trap compliance and requiring temporary sediment retention basins for all active development sites that drain into the primary municipal network.

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*COMMUNITY PERCEPTION ON LAND-USE CHANGE IN VICINITY OF FLOOD DETENTION PONDS IN
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