# PROVISION OF MAP PRODUCTS AND SPATIAL DATA SERVICES TO THE PUBLIC BY THE LANDS DEPARTMENT

## Executive Summary

1. Maps are closely related to daily lives of the public and are effective tools for location-searching and route-planning. They are also used for public administration, town planning, housing, land management and development, as well as leisure purposes by the Government, private sectors and the public. Spatial data refers to any data with reference to a specific geographical location. With the development of technology and the popularity of smartphones, spatial data has been integrated into daily lives and continues to change the lifestyles and habits of the public. Spatial data touches almost every aspect of daily lives and is indispensable for smart cities.

2. The Survey and Mapping Office (SMO) of the Lands Department (LandsD), among other duties, is responsible for the provision of map products (in digital and paper forms) and spatial data services to the public (including professionals from different sectors). These map products and spatial data are disseminated to the public through various channels and geospatial portals. In 2021-22, a total of 30,011 copies of map products were sold to the public (with total revenue of about $1,773,000) and the total download numbers of various digital map products and spatial data were about 3,648,000.

3. In late 2017, the Government announced the Smart City Blueprint for Hong Kong and put forward the strategy to encourage the use of open data for smart city innovations and facilitate the sharing of geospatial data and support various smart city applications. Three-dimensional (3D) digital map is one of the core components of the digital infrastructure underpinning Hong Kong's smart city development. LandsD is responsible for the development of 3D digital map. The Audit Commission (Audit) has recently conducted a review of the provision of map products and spatial data services to the public by LandsD.

## Maintenance of map products

4. ***Scope for improvement in updating of 1:1000 topographic map.*** The 1:1000 topographic map (also known as basic map) covering the whole territory of Hong Kong is the largest scale topographic map. According to LandsD, SMO (through its 10 District Survey Offices (DSOs)) adopts continuous updating approach to update the 1:1000 topographic map (comprising 3,331 map sheets as of November 2022). DSOs identify changes of map details in the basic map based on data collected from various sources and their change identification work. DSOs carry out the consequential map updating work on a job basis. A job arises when map details in a basic map are found to have changed. DSOs update the changes in the basic map as soon as practicable (paras. 1.5(a) and 2.2(a)). Regarding the updating of 1:1000 topographic map:

(a) according to LandsD's guidelines, change identification work should be scheduled for all map sheets for execution at intervals of 1 to 5 years. In other words, change identification work for each map sheet should be carried out at least once every 5 years. However, Audit noted that, as of November 2022, the latest change identification work for 96 map sheets was carried out more than 5 years and up to 12.3 years (averaging 6.4 years) ago (i.e. not meeting the stipulated timeframe in LandsD's guidelines). According to LandsD, the areas covered by the 96 map sheets were non-active or remote areas. The change identification work for 23 (24%) map sheets had been carried out between December 2022 and February 2023. For the 73 (76%) remaining map sheets, it would accord priority for the change identification work (para. 2.3(a));

(b) Audit noted that there was no time limit set for completion of basic map updating jobs by DSOs. As of December 2022, the 10 DSOs had a total of 749 outstanding basic map updating jobs, of which 305 (41%) had remained outstanding for more than 1 year and up to 7 years (averaging 2 years) after job creation between 2015 and 2021 (para. 2.3(b));

(c) according to LandsD, DSOs maintain management information (under their own templates and not standardised) on the updating status of each map sheet and the progress of basic map updating jobs. Audit noted that DSOs had not regularly provided such management information to senior management of LandsD (para. 2.3(c)); and

(d) between August and December 2022, SMO awarded three 1-year service contracts for outsourcing some basic map updating work of the 10 DSOs at a total contract sum of $3.7 million. For 16 (80%) of the 20 basic map updating jobs ordered under the service contracts and with deadlines for submission of deliverables by the contractors in 2022, there were delays in submission of deliverables by the contractors, ranging from 1 to 84 days (averaging 31 days) (para. 2.3(d)).

5. ***Scope for implementing early automatic map generalisation for updating medium to small-scale topographic maps.*** Based on the 1:1000 topographic map, SMO updates by means of map generalisation other medium to small-scale topographic maps (i.e. scales of 1:5000, 1:10000, 1:20000, 1:50000 and 1:200000). According to LandsD, the current practice of manual map generalisation leads to long revision cycle of maps (about half year) and ineffective generalisation among maps in various scales. In October 2022, LandsD obtained funding approval of $17.2 million for a project on the implementation of automatic map generalisation workflow for 1:10000 topographic map. According to LandsD, with the successful implementation of the automatic map generalisation workflow, it is anticipated that the 1:10000 topographic map dataset could be updated and released in 3 months or less after the update of the 1:1000 topographic map dataset. The project is targeted to be completed in December 2024 and was under tender preparation stage as of January 2023. In Audit's view, LandsD needs to take measures to ensure that the project is completed as scheduled with a view to implementing early automatic map generalisation for all scales of topographic maps (paras. 2.5 and 2.6).

6. ***Some digital orthophotos not updated for a long time.*** The digital orthophoto DOP5000 series and DOPM50-L0 series cover the whole territory of Hong Kong in 192 tiles and one single image respectively. They are updated as and when necessary and there is no minimum updating frequency for the two series. Audit noted that as of November 2022, 107 (56%) of the 192 tiles of DOP5000 series had not been updated for 7 or more years (up to 7.6 years) and the DOPM50-L0 series had not been updated for 6.4 years (para. 2.7).

7. ***Need to closely monitor the service conditions of large format digital aerial camera system and take measures to ensure the timely replacement of the system.*** LandsD uses a large format digital aerial camera (LFDAC) system to take aerial photographs in the territory of Hong Kong and produces photogrammetric products from these aerial photographs for usage including updating of the 1:1000 topographic

map. The digital aerial camera will be mounted on two fixed-wing aircraft of the Government Flying Service (GFS) for performing aerial photography work on a shared-use basis. Audit noted that LFDAC system was approaching its end-of-service-life in May 2023. According to LandsD: (a) with regular maintenance and supply of essential consumables and spare parts, LFDAC system is expected to maintain service in the coming years up to December 2026; and (b) replacement of LFDAC system was being planned. As the new LFDAC system needs to be compatible with GFS aircraft, LandsD started discussions with GFS in February 2022 for the replacement plan. In this connection, Audit noted that LandsD took about 4 years in the previous procurement, including installation, airworthiness certification and testing before commissioning of LFDAC system in December 2016. In Audit's view, LandsD needs to closely monitor the service conditions of LFDAC system and take measures to ensure the timely replacement of the system with a view to continuing the provision of quality aerial photography service (paras. 2.14 to 2.16).

## Dissemination of map products and spatial data to the public

8. According to LandsD, opening up digital map products would enable the public, academia and businesses to make greater use of spatial data in research and application development. Since 2012, LandsD has been identifying suitable digital map products and spatial data for opening up to the public for free browsing and downloading. As of December 2022, certain paper and digital map products were available for sale at a charge to the public through various sales channels (i.e. Hong Kong Map Service 2.0 (HKMS 2.0), SMO Map Sales Outlets and reseller outlets), while most digital map products and spatial data were released to the public for free browsing and downloading for commercial and non-commercial uses (paras. 3.2 and 3.3).

9. ***Scope for digitising more paper map products and further opening up digital map products for free downloading.*** In general, paper map products are facing diminishing demand in recent years, while the demand for digital map products and spatial data had significantly increased since opening up for free downloading. Audit noted that, as of December 2022, there was no digital version for certain paper map products (e.g. countryside maps), and digital aerial photograph (Series:DAP) products were still for sale at a charge and not opened up for free downloading. According to LandsD, it had reviewed the need for digitisation of countryside map, and needs to evaluate the financial and technical implications of opening up digital aerial

photograph (Series:DAP) products for free downloading due to their huge volume and file size. In Audit's view, LandsD needs to keep under review the need for digitising more paper map products and further opening up digital map products for the public's free browsing and downloading (paras. 3.5 to 3.7).

10. ***Need to keep under review the need for closing down SMO Map Sales Outlets.*** LandsD's reviews in May and June 2021 found 7 SMO Map Sales Outlets with more obvious drop in sales activities after the launch of HKMS 2.0 in August 2018. In the event, 4 Map Sales Outlets were closed down in December 2021. Audit noted that, as of January 2023, LandsD was considering whether the remaining 3 Map Sales Outlets at Central, Fanling and West Kowloon would be closed down. In Audit's view, LandsD needs to make early decision on whether and when to close down the remaining 3 SMO Map Sales Outlets and keep under review the need for closing down other SMO Map Sales Outlets (paras. 3.9 and 3.10).

11. ***Scope for enhancing stock management.*** Paper map products were classified as either printed map (printed by the Government Logistics Department based on LandsD's printing order) or print-on-demand maps (printed in-house by LandsD upon receipt of sales order). According to LandsD, printed map becomes unserviceable upon revision to new edition and unserviceable printed maps can no longer be sold to the public. Audit noted that, as of November 2022, the stock levels of certain types of printed maps far exceeded their respective annual sales volumes in 2021-22. For example, while the sales volume of two-dimensional Topographic Map 1:100000 (colour version) was 127 copies in 2021-22, it had stock of 1,021 copies as of November 2022 (paras. 3.11 and 3.12).

12. ***Decreasing usage and low download number of VoiceMapHK.*** According to LandsD, VoiceMapHK (a mobile app) was developed to support the digital inclusion initiative for the visually impaired community with a population of 175,000 in Hong Kong. However, Audit noted that the actual number of usage sessions of VoiceMapHK decreased from 1,511 in 2017-18 to less than 70 in both 2020-21 and 2021-22, and the accumulated number of downloads of the mobile app as of November 2022 was only about 9,000 (para. 3.18).

## Development of three-dimensional digital map

13. 3D digital map is one of the core components of the digital infrastructure underpinning Hong Kong's smart city development. LandsD is responsible for the development of 3D digital map (including territory-wide 3D digital map, 3D pedestrian network and 3D indoor map) with a funding of $150 million. It aims to develop high-quality 3D digital map by phases and strives to cover the whole territory by end of 2023 (paras. 4.2 and 4.3).

14. ***Need to continue to closely monitor the implementation progress of territory-wide 3D digital map.*** Audit noted that the implementation of territory-wide 3D digital map (comprising 6 phases) was behind schedule: (a) Phase 1 (Kowloon East) was completed 11 months later than the original target completion date; and (b) for the 5 remaining phases (involving 5 areas), as of December 2022, they were either in progress or under tender assessments, and their expected completion dates were 2 to 6 months later than their original target completion dates. According to LandsD, based on the experience gained from Phase 1 project, enhanced measures had been taken for the 5 remaining phases, such as strengthening the manpower of project consultants for monitoring the progress and improving the communication among LandsD, consultants and contractors. In Audit's view, LandsD needs to continue to closely monitor the implementation progress of territory-wide 3D digital map with a view to ensuring its timely completion (paras. 4.5 to 4.7).

15. ***Need to keep under review the utilisation of 3D pedestrian network.*** According to LandsD, the 3D pedestrian network is a set of 3D line features capable of supporting innovative applications. Its dataset was published and made free to the public in December 2020, and was further updated in September 2022. The numbers of downloads for 3D pedestrian network dataset were 200, 1,971 and 2,569 in 2020 (from December 2020), 2021 and 2022 (up to November 2022) respectively. In Audit's view, LandsD needs to keep under review the utilisation of 3D pedestrian network and step up promotional activities as needed to encourage more users to utilise the 3D pedestrian network (paras. 4.8 and 4.9).

16. ***Need to closely monitor the implementation progress of 3D indoor map.*** In 2020, LandsD commissioned a pilot project on creation of 3D indoor maps, which covered 158 buildings mainly located in Kowloon East. After the completion of the pilot project in March 2021, LandsD aims to develop the 3D indoor map by phases

to cover the accessible interior of buildings and structures for 1,250 buildings across the territory by end of 2023. As of January 2023, contracts for Phase 1 (covering 390 buildings) and Phase 2 (covering 420 buildings) were expected to be completed by March and December 2023 respectively. The contract for Phase 3 (covering 440 buildings) was planned to be awarded in third quarter of 2023 with target completion date in second quarter of 2024 (i.e. behind the scheduled date of end of 2023) (paras. 4.11 to 4.13).

17. ***Need to obtain consents from property owners/property management companies for opening up the 3D indoor map.*** According to LandsD: (a) the data of 3D indoor map was intended to be shared with government bureaux/departments for internal uses and further study. It subsequently reviewed the opening up of the 3D indoor maps of the 158 buildings under the Kowloon East pilot project and planned to release the 3D indoor maps for those buildings (with consents obtained) to the public in December 2022. As of March 2023, it was still obtaining consents of property owners/property management companies of the 158 buildings and planned to open up those 3D indoor maps upon their consents; and (b) for those 1,250 buildings across the territory (see para. 16), it would obtain consents from relevant property owners/property management companies before and during the course of project implementation period. In Audit's view, LandsD needs to take measures to early obtain consents from the property owners/property management companies for opening up their buildings' 3D indoor maps to the public (paras. 4.14, 4.16 and 4.17).

## Audit recommendations

18. **Audit recommendations are made in the respective sections of this Audit Report. Only the key ones are highlighted in this Executive Summary. Audit has *recommended* that the Director of Lands should:**

*Maintenance of map products*

(a) **regarding 1:1000 topographic map, take measures to ensure that DSOs carry out the change identification work for all map sheets in accordance with the timeframe in LandsD's guidelines (para. 2.12(a)(i));**

(b) **regarding basic map updating jobs, take measures to ensure that such jobs (particularly those long outstanding ones) are completed as early as practicable and consider setting a time limit for their completion (para. 2.12(b));**

(c) **require DSOs to provide regular management information on the updating status of each sheet of the 1:1000 topographic map and the progress of basic map updating jobs under a standard template to LandsD's senior management for monitoring purposes (para. 2.12(c));**

(d) **regarding basic map updating work under related service contracts, step up measures to ensure the timely submission of deliverables by the contractors (para. 2.12(d)(i));**

(e) **take measures to ensure that the project on the implementation of automatic map generalisation workflow for 1:10000 topographic map is completed as scheduled (para. 2.12(f));**

(f) **consider setting updating frequency for digital orthophoto DOP5000 series and DOPM50-L0 series (para. 2.12(g)(i));**

(g) **closely monitor the service conditions of LFDAC system and take measures to ensure the timely replacement of the system (para. 2.20(a));**

*Dissemination of map products and spatial data to the public*

(h) **keep under review the need for digitising more paper map products and further opening up digital map products for the public's free browsing and downloading (para. 3.15(a) and (b));**

(i) **make early decision on whether and when to close down SMO Map Sales Outlets at Central, Fanling and West Kowloon, and keep under review the need for closing down other SMO Map Sales Outlets (para. 3.15(d));**

(j) **make estimates of the print quantities of printed map as inventory as accurately as possible (para. 3.15(e));**

(k) **review whether the stocks of printed maps on hand are still serviceable and consider the disposal methods for those unserviceable printed maps (para. 3.15(g));**

(l) **keep under review the usage and download number of LandsD's mobile apps with a view to enhancing the mobile apps (para. 3.23(a));**

*Development of three-dimensional digital map*

(m) **continue to closely monitor the implementation progress of territory-wide 3D digital map with a view to ensuring its timely completion (para. 4.18(a));**

(n) **keep under review the utilisation of 3D pedestrian network and step up promotional activities as needed to encourage more users to utilise the 3D pedestrian network (para. 4.18(b));**

(o) **closely monitor the implementation progress of 3D indoor map with a view to ensuring its timely completion (para. 4.18(c)); and**

(p) **take measures to early obtain consents from the property owners/property management companies for opening up their buildings' 3D indoor maps to the public (para. 4.18(d)).**

## Response from the Government

19. The Director of Lands accepts the audit recommendations.