

Brief:

LiDAR data acquisition and processing

1. General introduction / Overview

In 2017, the Chilterns Conservation Board (CCB) were awarded a Heritage Lottery Fund (HLF) grant, for a project to study prehistoric features within the Chilterns Area of Outstanding Natural Beauty (AONB). The project focuses on up to 22 Iron Age hillforts and their context within the broader Chilterns landscape, across three key areas of activity: Discovery (Survey and Research), Learning (awareness, engagement, enjoyment) and Protection (practical conservation and enhancement).

LiDAR data capture and processing is pivotal to achieving the project's research objectives, but also in securing project legacy, through future archaeological academic study and interest. As such, it represents an immensely important part of the project, both in terms of output quality and content, as well as cost efficiency.

A number of aerial mapping contractors were approached in 2017 as part of our Development Phase work, for quotes to inform our final Stage 2 application to HLF. This specification is now part of the formal tendering process and CCB is seeking to employ a company to undertake this work.

Anticipated timetable

May - August 2018	Tendering for LiDAR quotations Appointment of contractor
Nov 2018 – Feb 2019	LiDAR capture in process
Early 2019 – Apr 2019	Processing into DTM / DSM files

Exact timescale for LiDAR capture will vary dependent on weather and season. We require a leaf-off flight capture.

Providers anticipated timescales

If you were awarded the contract for this work, please show how you would address the following:

- Once contract is awarded, how quickly would you start acquiring data?
- How many days would you anticipate for meetings, negotiation before data acquisition can start?
- How long would data acquisition take?
- How long would data processing take?

Area for data acquisition

CCB would like a quote for the LiDAR capture of the extent of each of the two areas suggested in the attached map. (approx. 1150 km² and 1300 km², referred to as Option 1 and Option 2 respectively)

CCB's priority features are the Iron Age Hillforts within and around the AONB boundary. Shapefiles identifying the location of the hillforts, plus the boundary of our AONB area, have been sent with this specification. (Taplow is an exception and need not be included in the capture unless there is no additional cost)

We are, at this stage, open to comments or suggestions on the best approach to acquiring the information needed. We would welcome any alternative solutions contractors would like to propose that will improve the overall data acquisition and visualisation processes and cost efficiency.

Data processing

In addition to LiDAR data capture, CCB is seeking quotes to process the data into DSM and DTM raster files. This work may be undertaken by a different contractor to that who acquires the data.

Specification details

CCB has worked closely with many experienced technical specialists and professional agencies such as Historic England, to establish technical specifications suitable for the needs of the project. However, we invite general comment on these, particularly if improvements can be made to the overall quality and cost efficiency of the output.

2. Data Acquisition

Summary specification of the LiDAR acquisition

- The survey will be undertaken using a class 3 or 4 laser
- The LiDAR data will be captured with a maximum scan angle of 45° and with a 55% overlap between swathes (**please provide details of proposed data capture, (including scan pattern)**)
- The data will be supplied in LAS and TXT formats
- The processed DTM will be of a **minimum** 0.5m resolution, requiring a minimum ground point density of 4 points per m² (8 ppm² with overlap) (a separate quote for 0.25m resolution would be very welcome)
- Full waveform data will be supplied in a format agreed by both parties.

Details

The provider will undertake a LiDAR survey of the project areas from a suitable base of their own determining.

CCB does not require any other imagery or data capture at the same time as the LiDAR survey, so it is at the provider's discretion at what time of day or night the flights are undertaken.

The provider must include appropriate ground control and reference these in their quality assessment.

It will be the provider's responsibility to ensure all statutory requirements and industry standards are complied with, including demonstrating appropriate insurances, securing necessary permissions and licences eg from the Civil Aviation Authority.

- **Classified point cloud** will be delivered in LAS v1.3 or higher and txt formats with all standard attributes, including:
 - a) intensity values (native radiometric resolution)
 - b) Return number
 - c) Georeferencing (to British National Grid) information in all LAS file headers
 - d) GPS times recorded as adjusted GPS time, at a precision sufficient to allow unique timestamps for each pulse
 - e) Classification
- **Waveform data** will be provided in TXT or similar ASCII format and in files no greater than 1.0 Gb in size. ***If other data formats are proposed, please specify how the data should be accessed / viewed and any necessary software needed.***
- **Metadata** on survey parameters, estimated vertical and horizontal margins of error, and quality assurance processes will be provided.
- **Provision of geo-referenced DSM** in .IMG format with a minimum 0.5m cell size (based on a minimum of 4 points per metre). **Interpolation can be used to populate empty cells, but filling of large gaps should be avoided.**
- **Provision of geo-referenced DTM** (with the same cell size and format as the DSM) following vegetation removal. Vegetation removal should result in the highest quality DTM possible, using waveform data or intermediate returns to help determine true ground points where possible. Under optimum woodland conditions (e.g. a mature broadleaf canopy with minimal understorey vegetation), differences of less than 10cm in elevation are expected to be evident within the DTM beneath, allowing more subtle features to be mapped. Filtering to remove above-ground points should be no more than necessary, to reduce the risks of archaeological features from being removed from the

DTM. Where dense vegetation prevents the vegetation removal process from determining a confident ground level, we would like some flexibility so that features are not filled in or smoothed over, such as providing continuous DTM and a mask layer. For plantations of mature, well-thinned coniferous trees, some areas of DTM creation would be anticipated. Metadata for last return point density per cell should be provided.

Please describe for options that include continuous DTM and mask layer; ensure cost differences are explained.

Examples of previous work and an overview of the provider's experience in DTM creation would be welcome.

3. Data access and management

We intend to use the data acquired for a range of purposes and for it to be shared with a number of formal partners and stakeholders. HLF requires the data to be made widely available to community groups and the public. CCB's access and management considerations are based on the following:

Project partners

- Historic Environment Records officers
- Local authorities
- Professional and academic archaeologists
- Environmental records centres
- Land managers and landowners (private and organisational)
- Specialist statutory organisations eg Historic England
- Relevant regional NGOs

Community stakeholders

- Community archaeology groups
- Heritage-focussed groups
- Schools, further education institutions

Data use

Table 1 below is a summary of how CCB and wider partnership project intend to use the LiDAR data. It is not exhaustive, but indicative of likely activity or output. This summary should be used in calculating any costs or impact on data sharing agreements between CCB (and partners) and the provider.

Table 1 Data use

Data use and purpose of use	Activity undertaken by	Frequency
Use LiDAR data visualisations to clarify integrity of features in order to establish archaeological identity (ground-truthing)	Volunteers (with support from CCB and partners)	High
Use LiDAR data visualisations and DTM / DSM, to determine and study archaeological significance of features, including identifying sites for geophysical surveys or excavation. Ongoing research, studies and spin-off projects likely over many subsequent years if archaeological findings of interest.	Academic institutions, professional archaeologists, community interest groups.	High
Provision of DTM / DSM and visualisations to Historic Environment Records centres – point-cloud and / or DTM, DSM, visualisations. Interpreted information made available through HER services to third party enquirers (the public, consultants, developers, agencies), shared as Shapefile, pdf, screenshot images.	Historic Environment Records Officers	Medium
Provide DTM / DSM or visualisations, to community groups, for sites of specific interest to their activities	CCB and partners	Medium
Provide archaeological information through raw point-cloud data and / or processed DTM / DSM and visualisations to partner landowners (eg National Trust) for eg archaeology projects, public engagement, inform site management.	CCB and / or partners	Medium

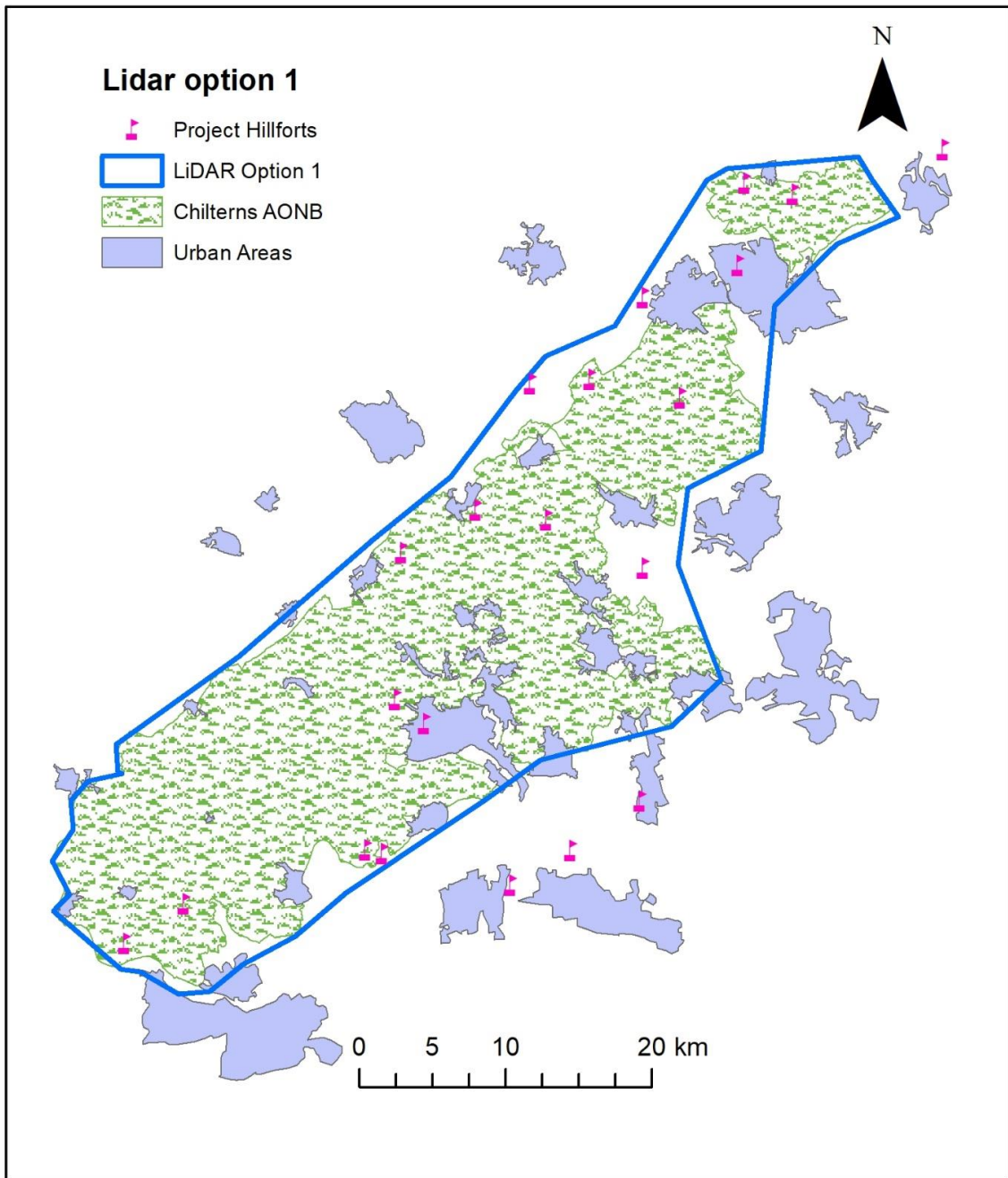
Communications: events, displays and exhibits, video, website, publications – to inform local communities, wider public and celebrate / explain wider project and partnership.	CCB and partners	Medium
Providing DSM / DTM and visualisations in response to requests from developers, statutory agencies, archaeological consultants, members of the public (to inform construction, commercial or other projects). A charge may be levied to cover staff time required in preparing this information.	CCB / or Historic Environment Records partners	Low
Provision of point-cloud data or visualisations to Historic England for use within National Mapping Programme	CCB	Low

Data access

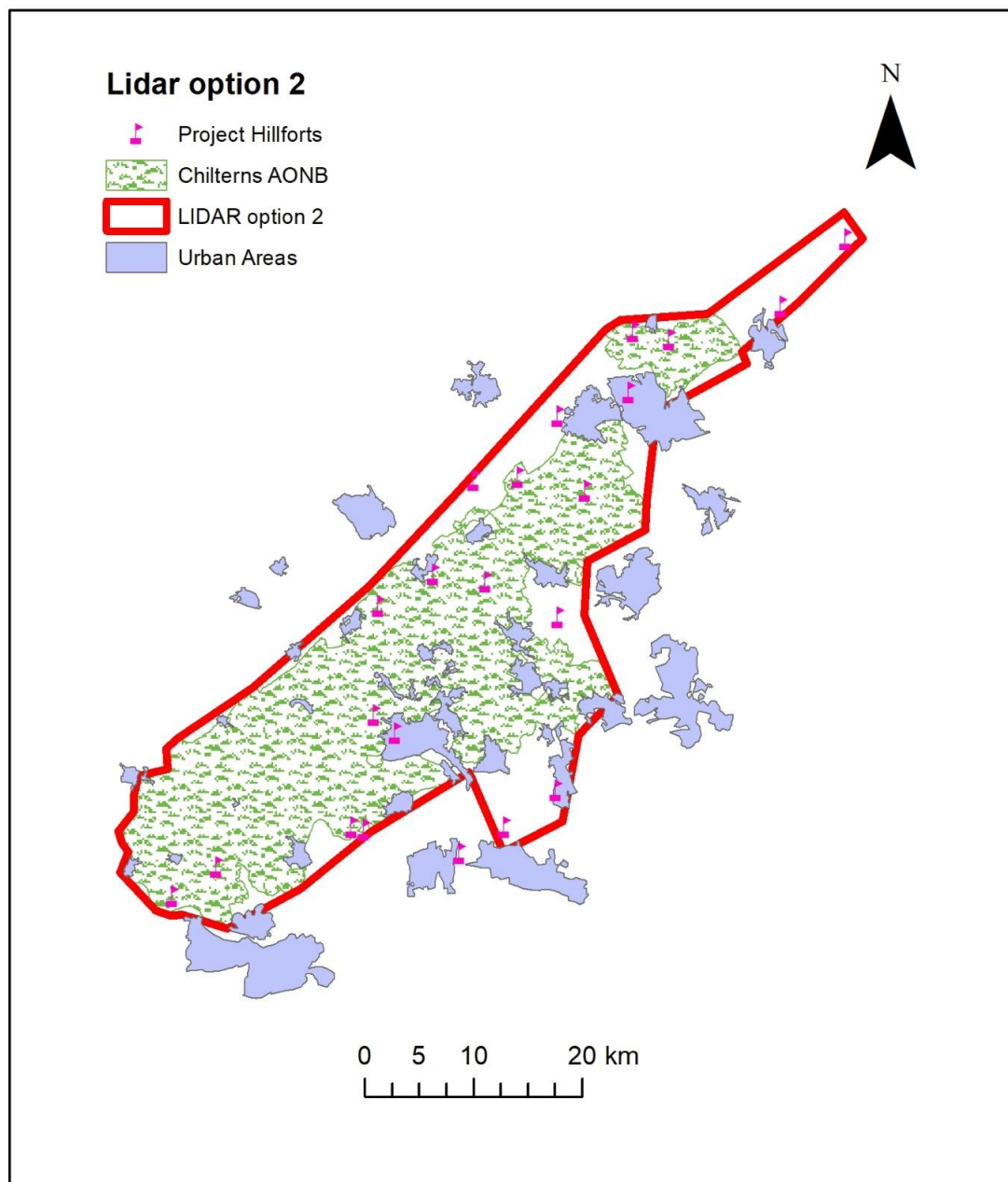
In order to achieve our goals, all Intellectual Property Rights in the data, both raw and processed, should be transferred exclusively to CCB; CCB to have full ownership of the data.

A free, exclusive licence to use the LiDAR data in perpetuity and all derivatives, for any purpose that CCB and partners see fit. Copyright is owned solely by CCB and any specific partners, as determined by the project partnership.

Please include any explanatory comments or observations regarding IPR that will assist us making our final decision.



LiDAR option 1 is approximately 1150 km² coverage



LIDAR option 2 is approximately 1300 km² coverage