Crab Tiling Survey within the River Fowey 2018

Final report for the 2018 Crab Tiling Survey within the Fowey Estuary

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1 Introduction

Crab tiling, or crab potting as it is sometimes referred to locally, is a method of collecting shore crabs (*Carcinus maenas*) which are hiding underneath crab tiles so they can be used as bait for anglers. Like all other crustaceans, shore crabs moult their shells at regular intervals throughout their lives and will seek shelter when they go through this process. Bait collectors, known as 'crab tilers' exploit this behaviour by providing artificial habitats using hard, man-made structures, such as pieces of half round guttering, drain pipes, tyres and roof tiles. Examples of materials used as crab tiles within the Fowey Estuary are shown in Figure 1. The crabs are collected at low tide (preferably spring low tide) when the tiles are accessible. Crab tiling has been documented within the Fowey Estuary since the 1990s when 300 car tyres and 900 plastic drains were ordered to be removed by the Fowey Harbour Commissioners as the owners of the foreshore and fundus of the estuary (UK Marine SAC Project, 1998). Sheehan *et al.,* (2008) identified the River Fowey as a river which had very few or no crab tiles in 2004. Crab tiles have the potential to change habitat complexity, benthic infaunal diversity and abundance, as well as bird behaviour over large areas (Sheehan *et al*., 2010).

Figure 1: Crab tiles within the Fowey Estuary (Source: Fowey Estuary Partnership, 2003 & 2012).

Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA) have a responsibility to manage the exploitation of sea fisheries resources under the Marine and Coastal Access Act 2009 (MaCAA) which includes bait collection. Fowey Harbour Commissioners state bait digging should not take place within 6 metres of any mooring, pile, beacon, hard, causeway, jetty, wharf or similar structure or on the foreshore between signs indicating areas of no digging under Harbour Byelaw 102. There is also a Bait Digging Code of Conduct for the Fowey Estuary (Fowey Harbour Commissioners, n.d.). Currently no statutory or voluntary measures have been implemented for crab tiling on the Fowey Estuary. Cornwall IFCA aim to carry out crab tiling surveys within the district every four years. This is to enable the number and location of crab tiles to be assessed over time. Bait collection activities within the River Fowey have not previously been surveyed. The River Fowey falls within the Upper Fowey to Pill Point Marine Conservation Zone (MCZ) (Annex 1) and the data would help inform MCZ assessments for the site.

2 Aims and objectives

2.1 Aims

- Monitor the number of crab tiles within the Fowey Estuary.
- Detect any other forms of bait collection in intertidal areas.

2.2 Objectives

- Assess bait collection activities from aerial imagery.

3 Methodology

An Unmanned Aerial Vehicle (UAV) or drone, as they are commonly referred to, was used to collect aerial images to assess bait collection activities within the Fowey Estuary. This was operated by Duncan Hine of Vertical Horizons Media. The survey was carried out over a four hour time frame, two hours either side of low water, over two spring tides on 12th and 19th April and 15th and 17th May 2018. Site maps were provided by Cornwall IFCA which showed the areas to be surveyed based on areas believed to be subject to bait collection activities. The UAV operator programmed flight paths into the drone for each location of the survey. The drone was flown at an altitude of 40m, recording the GPS track and taking a still image every few seconds to achieve a target ground spacing distance of 0.9 cm/ pixel. The technical specification of the drone and survey particulars can be found in Annex 2. The drone could be manually overridden by the operator when necessary to avoid obstacles or during windy periods.

The images from the survey were then processed by the drone operator using the processing software; GPSBable, Geosetter, and Pix4D. The software Pix4D stitches together the imaging and creates geo-tiles.

The geo-tiles were imported and overlaid into MapInfo Pro (Version 17.0) to give the exact location of the raster images which were then used to count the crab tiles. A gridline (Lat/ Long WGS84) was overlaid onto the raster images (spacing: 0.001 degrees horizontal and 0.0005 degrees vertical) and the grid was systematically searched for signs of bait collection activities using a cartographic scale of 1 cm: 85 cm. When crab tiles were identified, a point was placed directly on top of each crab tile. Attribute data including location, tile identification, number of tiles and any other comments were recorded within the layer table in MapInfo.

4 Results

A total of 1,431 crab tiles were recorded from three locations (Figure 2) in the Fowey Estuary. Table 1 shows the numbers of crab tiles per area. Crab tiles were only found on the east side of the River Fowey (Figure 2) within the area surveyed.

Table 1: Crab tile counts in the Fowey Estuary.

Location	Number of crab tiles
North of Penpoll Creek	258
South of Penpoll Creek	415
Mixtow Pill	758

The drone flights were successful in obtaining aerial imagery of the areas which were known areas of bait collection activities, covering 0.62 km² of foreshore and river (Figure 2). The results can be seen in Figure 3 to Figure 5, which show the crab tile distribution and counts for 2018 over the aerial imagery. The majority of tiles were made of plastic drains, but 82 were car tyres Figure 6. Out of the total observed, 1,255 crab tiles (88%) had footprints leading to the tile indicating they were active. No other signs of bait collection activities e.g. bait digging were observed on the aerial imagery.

In some areas along the foreshore overhanging trees obscured the view of crab tiles and made it difficult to determine the number of tiles in these areas. Additionally some tiles were not uncovered at the time of being overflown but tiles could just be made out under the surface of the water and the majority were thought to be accounted for. Tiles extended beyond the area covered by the drone (namely into Penpoll Creek and near Cliff Pill) which results in an underestimated total count for the estuary as a whole. To enable an estimation of the total number crib tiles in the estuary a future UAV survey will cover these additional areas.

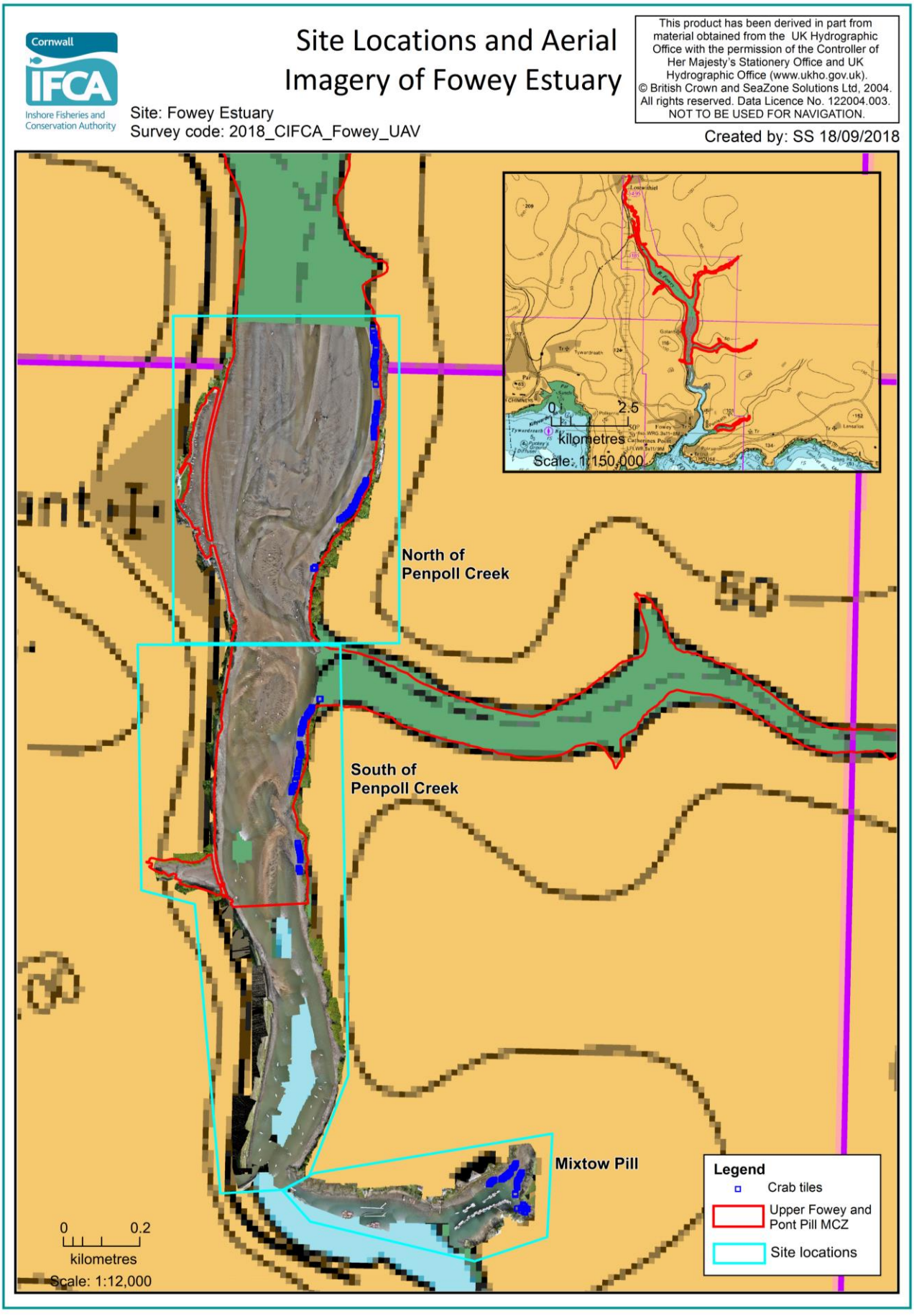

Figure 2: Aerial imagery within the Fowey Estuary.

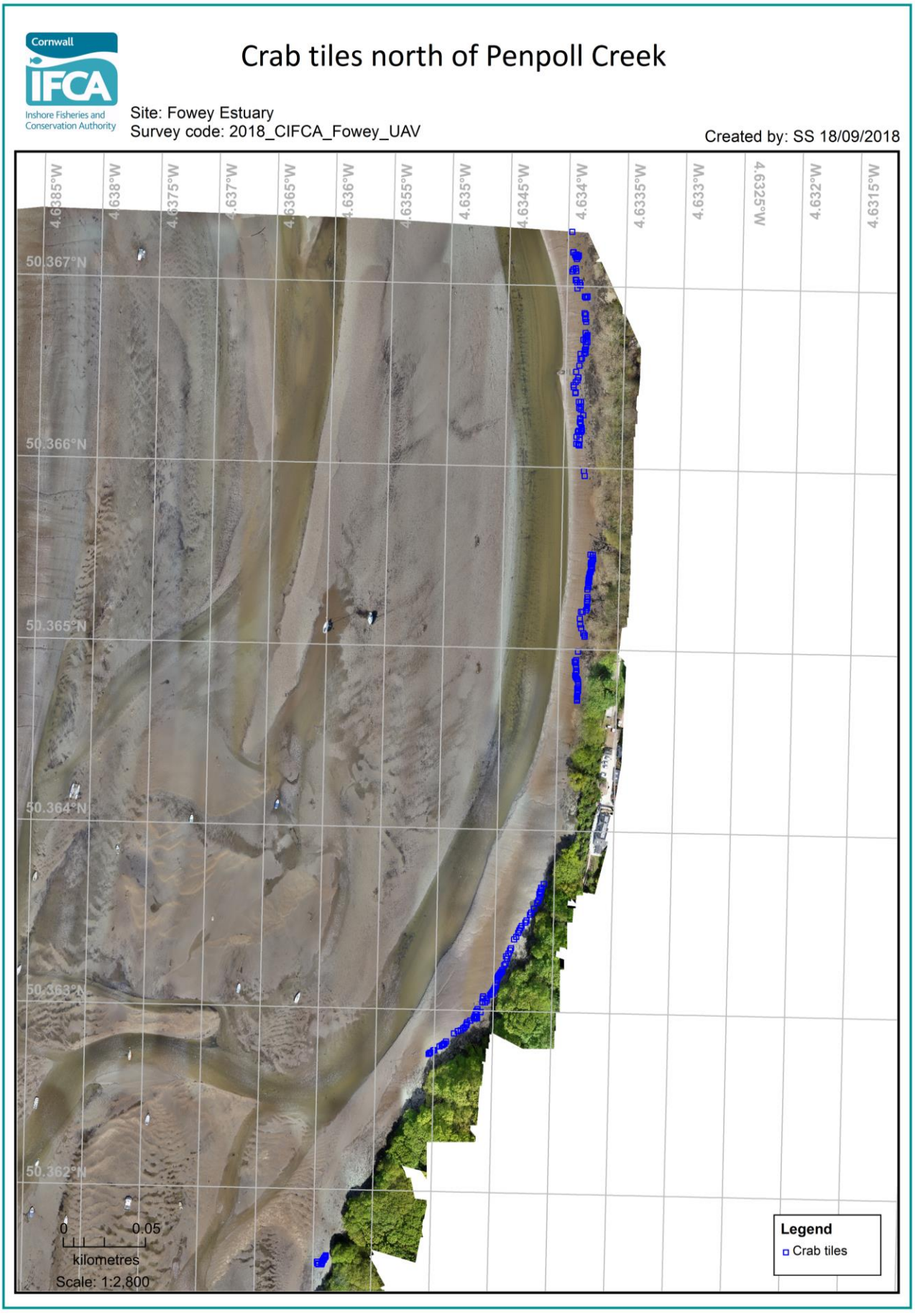

Figure 3: Crab tile locations north of Penpoll Creek within the Fowey Estuary.

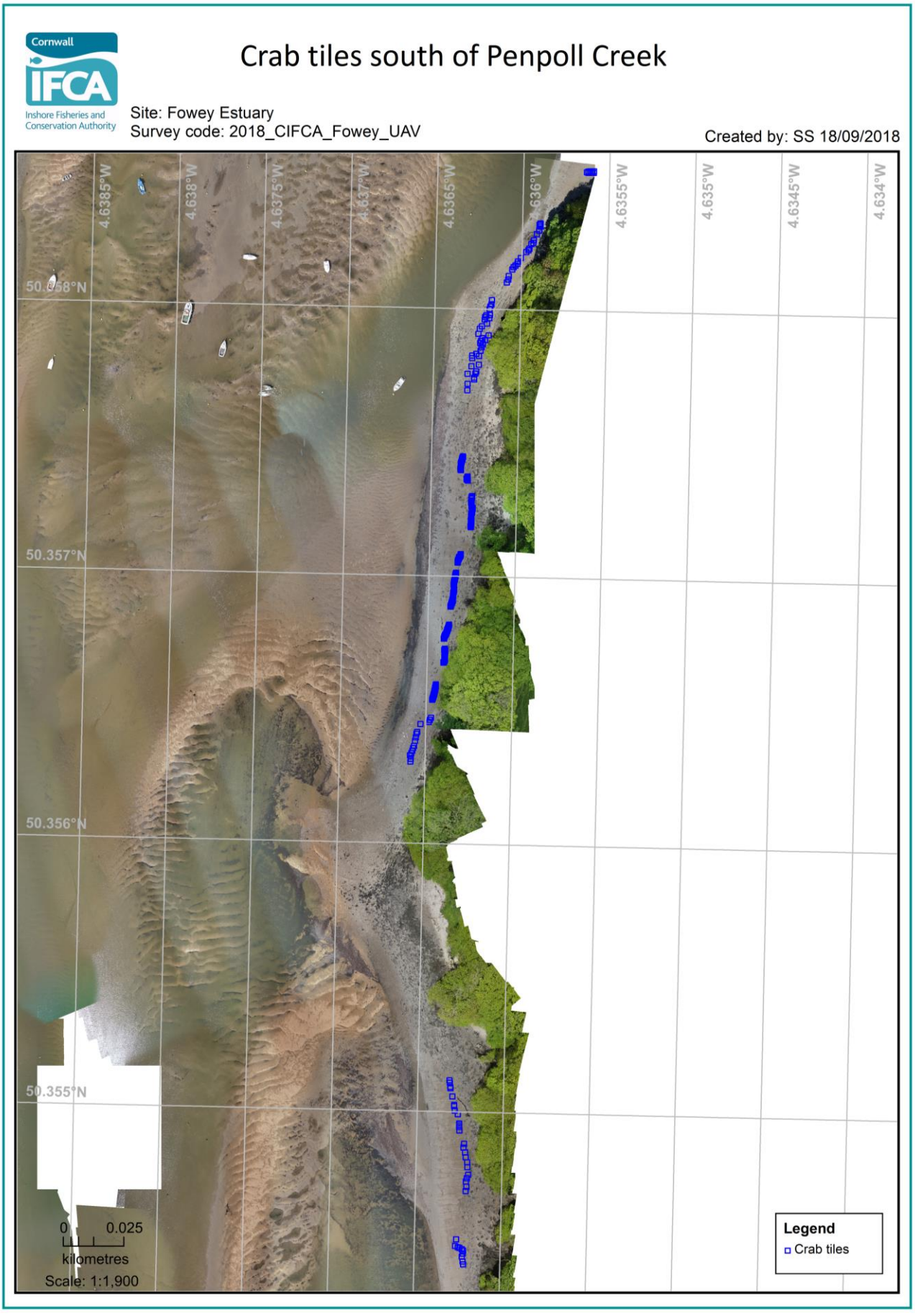

Figure 4: Crab tile locations south of Penpoll Creek within the Fowey Estuary.

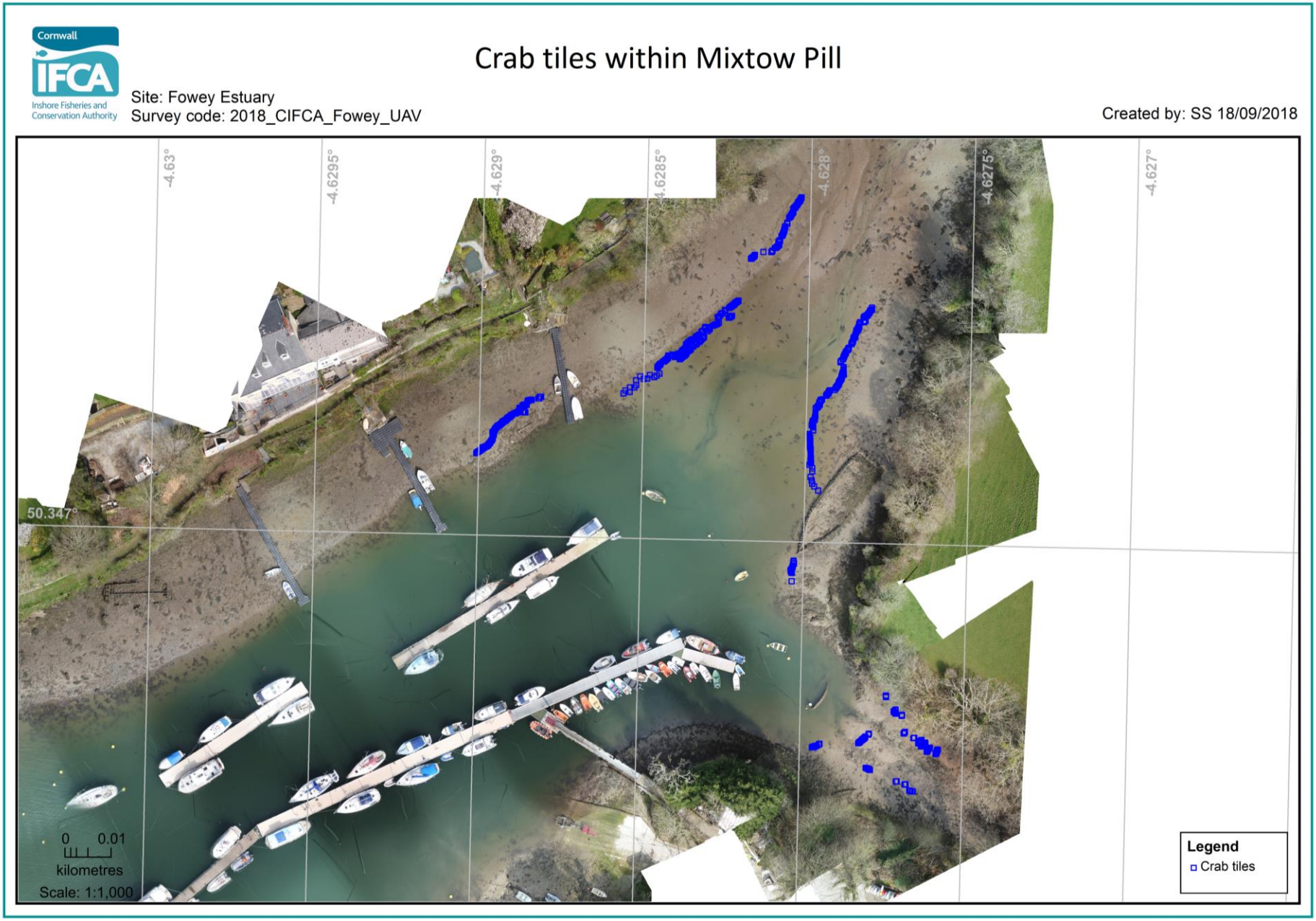

Figure 5: Crab tile locations in Mixtow Pill within the Fowey Estuary.

Figure 6: Example of crab tiles from aerial imagery within the Fowey Estuary.

5 Discussion

The aerial imagery of Fowey Estuary showed evidence of bait collection activities, with 1,431 crab tiles identified. Bait digging was not observed, but this does not mean the activity is not occurring in the estuary as the aerial imagery is only a snapshot of time and only covered a small part of the MCZ.

Within the area of the survey crab tiles were only found on the east foreshore from Mixtow Pill to south of Cliff Pill. Usually crab tiles are laid in rows with one metre spacing between each tile (Sheehan *et al.,* 2010) but many of the plastic drain tiles seen in the Fowey Estuary were laid directly next to each other forming long chains (Figure 6). A lot of these chains appeared to be held together with planks and rocks. From the aerial imagery, usage could be observed and the majority of tiles had footprints to and around the tiles (Figure 6).

It should be noted that crab tiles appeared to extend out of the areas where aerial imagery had been gathered and therefore this survey is not a comprehensive account of crab tiles within the Fowey Estuary. However, with the continued use of aerial images in the future, it can demonstrate more detailed changes of crab tile numbers and distribution over time.

5.1 Data limitations

While every effort was made to ensure high accuracy during data collection, there are some limitations in the survey which may affect the overall counts and distribution. When analysing the aerial imagery from the drone it was subject to personal judgement. In some areas it was difficult to determine the difference between crab tiles and rocks. Additionally, when crab tiles have not been worked for a while, they sink into the sediment and can be hard to identify. Also, areas of crab tiles may have been overlooked as the drone flight path did not cover the whole estuary. Finally, there were differences between two of the raster images in projection of 2.7 m which results in slight discrepancies between the exact location of crab tiles north and south of Penpoll Creek.

5.2 Recommendations for future work

It is necessary that the crab tiling survey is continued so that the monitoring of crab tile numbers and distribution in the Fowey Estuary is continual. The data collected helps inform MCZ assessments for the Upper Fowey and Pont Pill MCZ. It is important to monitor the activity and determine whether levels are environmentally sustainable. Another method of surveying bait digging activity may be suitable as aerial imagery would have to be recorded regularly (weekly) in order to observe and monitor the activity.

This survey did not cover the whole of the Fowey Estuary and it is therefore recommended that for future surveys the entire foreshore of the River Fowey is surveyed to ensure the total counts of crab tiles for the estuary are accurate.

6 References

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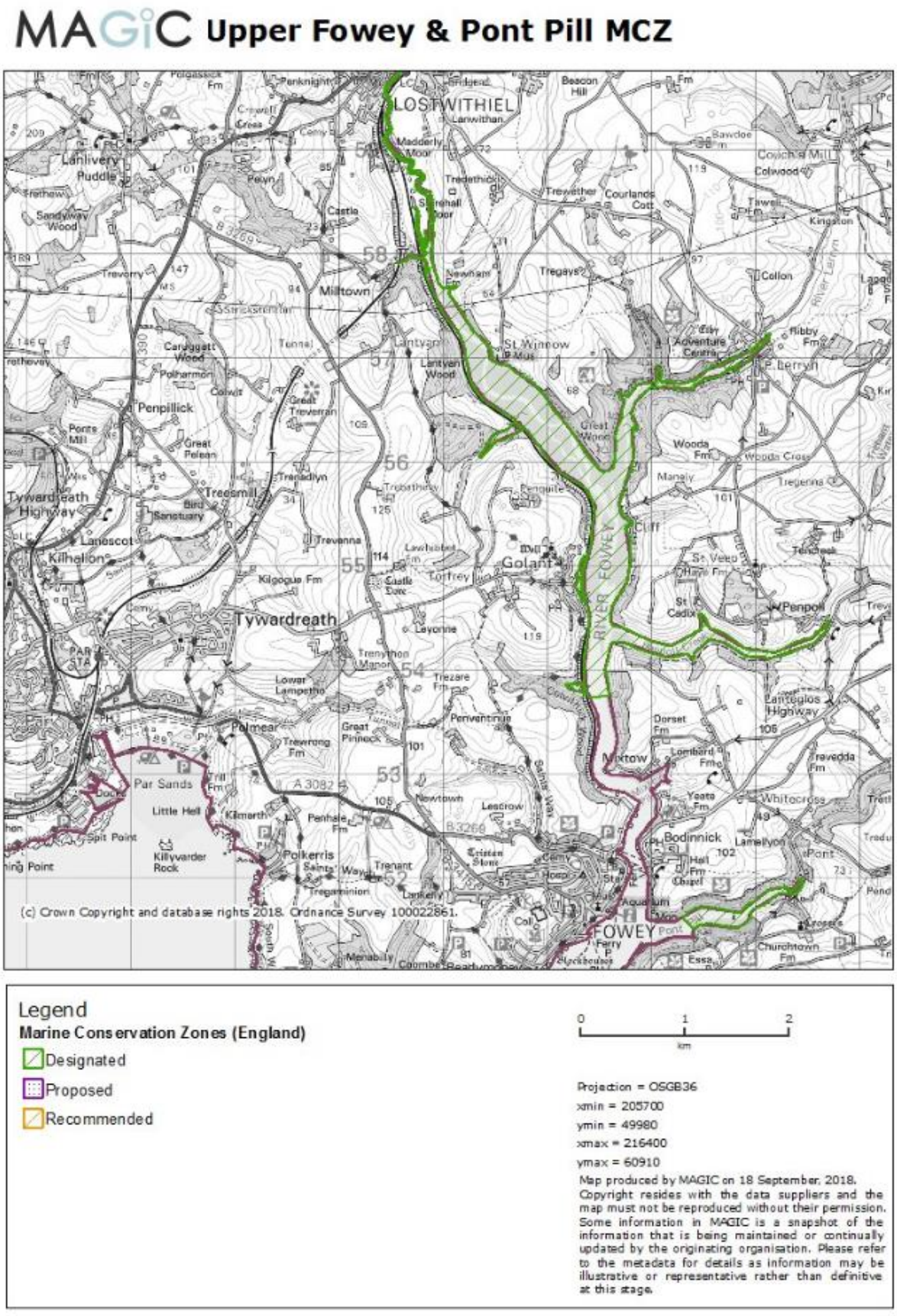
7 Appendices

Annex 1 – Upper Fowey and Pont Pill Marine Conservation Zone (MCZ)



Source: http://magic.gov.uk/MagicMap.aspx [Accessed: 18/09/2018]

Annex 2 - Aerial Surveying Technical Specification for Vertical Horizons Media

Survey vehicle:

- Airframe- Bespoke carbon fibre quad-copter
- Endurance – 35mins @10m/s
- Avionics –Pixhawk cube running Ardupilot with a 800mz command and control datalink
- Sensors – Real time kinematic GPS altitude and position, barometric pressure altitude, laser altitude, digital magnetometer, ultrasonic forward collision sensors, 2 solid state accelerometers.
- Autopilot- Fully autonomous, infinite way-points with internal track logging and real time flight telemetry.
- Imaging – Sony RX100 21mp camera with IR filter removed.

Operator details:

- Operator – Duncan Hine T/A Vertical Horizons media
- Insurance - £5 million public liability underwritten by Lloyds.
- License – Permitted by the CAA to conduct aerial works.

Survey parameters:

- Target Ground Spacing Distance (GSD) – 0.9cm/pixel
- Airspeed – 10 m/s
- Survey altitude – 40m AGL
- Approx. area covered by each image to obtain a GSD of 0.9@40m AGL – 50x34m
- Target frontal overlap – 75%
- Target lateral overlap- 60%
- Approximate track spacing – 25m
- Track generation – semi automated based on survey area and wind direction

Post processing software:

- Mission planner – Image geotagging
- Pix4D –Photogrammetry image stitching and geo-tile creation.

Images of the UAV used during the survey are shown in Figure 7.

Figure 7: Images of the UAV used by Vertical Horizons Media (©Duncan Hine)