



Department  
for Environment  
Food & Rural Affairs

# Satellite Imagery Proof of Concept for Agri- Environmental Monitoring Conditions of Contract **Short Form – Services** **Contract Number: ecm\_63428**

October 2019

**Annex 1**  
**Terms and Conditions of Contract for Services**

**1 Interpretation**

1. In these terms and conditions:

“Agreement”	means the contract between (i) the Customer acting as part of the Crown and (ii) the Supplier constituted by the Supplier’s countersignature of the Award Letter and includes the Award Letter and Annexes;
“Award Letter”	means the letter from the Customer to the Supplier printed above these terms and conditions;
“Central Government Body”	<p>means a body listed in one of the following sub-categories of the Central Government classification of the Public Sector Classification Guide, as published and amended from time to time by the Office for National Statistics:</p> <ul style="list-style-type: none"><li>(a) Government Department;</li><li>(b) Non-Departmental Public Body or Assembly Sponsored Public Body (advisory, executive, or tribunal);</li><li>(c) Non-Ministerial Department; or</li><li>(d) Executive Agency;</li></ul>
“Charges”	means the charges for the Services as specified in the Award Letter;
“Confidential Information”	means all information, whether written or oral (however recorded), provided by the disclosing Party to the receiving Party and which (i) is known by the receiving Party to be confidential; (ii) is marked as or stated to be confidential; or (iii) ought reasonably to be considered by the receiving Party to be confidential;
“Customer”	means the person named as Customer in the Award Letter;
“DPA”	means the Data Protection Act 1998;

“Expiry Date”	means the date for expiry of the Agreement as set out in the Award Letter;
“FOIA”	means the Freedom of Information Act 2000;
“Information”	has the meaning given under section 84 of the FOIA;
“Key Personnel”	means any persons specified as such in the Award Letter or otherwise notified as such by the Customer to the Supplier in writing;
“Party”	means the Supplier or the Customer (as appropriate) and “Parties” shall mean both of them;
“Personal Data”	means personal data (as defined in the DPA) which is processed by the Supplier or any Staff on behalf of the Customer pursuant to or in connection with this Agreement;
“Purchase Order Number”	means the Customer’s unique number relating to the supply of the Services;
“Request for Information”	has the meaning set out in the FOIA or the Environmental Information Regulations 2004 as relevant (where the meaning set out for the term “request” shall apply);
“Services”	means the services to be supplied by the Supplier to the Customer under the Agreement;
“Specification”	means the specification for the Services (including as to quantity, description and quality) as specified in the Award Letter;
“Staff”	means all directors, officers, employees, agents, consultants and contractors of the Supplier and/or of any sub-contractor of the Supplier engaged in the performance of the Supplier’s obligations under the Agreement;
“Staff Vetting Procedures”	means vetting procedures that accord with good industry practice or, where requested by the Customer, the Customer’s procedures for the vetting of personnel as provided to the Supplier from time to time;
“Supplier”	means the person named as Supplier in the Award Letter;

- “Term” means the period from the start date of the Agreement set out in the Award Letter to the Expiry Date as such period may be extended in accordance with clause 4.2 or terminated in accordance with the terms and conditions of the Agreement;
- “VAT” means value added tax in accordance with the provisions of the Value Added Tax Act 1994; and
- “Working Day” means a day (other than a Saturday or Sunday) on which banks are open for business in the City of London.

2. In these terms and conditions, unless the context otherwise requires:

1.2.1 references to numbered clauses are references to the relevant clause in these terms and conditions;

1.2.2 any obligation on any Party not to do or omit to do anything shall include an obligation not to allow that thing to be done or omitted to be done;

1.2.3 the headings to the clauses of these terms and conditions are for information only and do not affect the interpretation of the Agreement;

1.2.4 any reference to an enactment includes reference to that enactment as amended or replaced from time to time and to any subordinate legislation or byelaw made under that enactment; and

1.2.5 the word ‘including’ shall be understood as meaning ‘including without limitation’.

## **2 Basis of Agreement**

1. The Award Letter constitutes an offer by the Customer to purchase the Services subject to and in accordance with the terms and conditions of the Agreement.

2. The offer comprised in the Award Letter shall be deemed to be accepted by the Supplier on receipt by the Customer of a copy of the Award Letter countersigned by the Supplier within [7] days of the date of the Award Letter.

## **3 Supply of Services**

1. In consideration of the Customer’s agreement to pay the Charges, the Supplier shall supply the Services to the Customer for the Term subject to and in accordance with the terms and conditions of the Agreement.

2. In supplying the Services, the Supplier shall:

- 3.2.1 co-operate with the Customer in all matters relating to the Services and comply with all the Customer's instructions;
- 3.2.2 perform the Services with all reasonable care, skill and diligence in accordance with good industry practice in the Supplier's industry, profession or trade;
- 3.2.3 use Staff who are suitably skilled and experienced to perform tasks assigned to them, and in sufficient number to ensure that the Supplier's obligations are fulfilled in accordance with the Agreement;
- 3.2.4 ensure that the Services shall conform with all descriptions and specifications set out in the Specification;
- 3.2.5 comply with all applicable laws; and
- 3.2.6 provide all equipment, tools and vehicles and other items as are required to provide the Services.

3. The Customer may by written notice to the Supplier at any time request a variation to the scope of the Services. In the event that the Supplier agrees to any variation to the scope of the Services, the Charges shall be subject to fair and reasonable adjustment to be agreed in writing between the Customer and the Supplier.

#### **4 Term**

- 1. The Agreement shall take effect on the date specified in Award Letter (the "Effective Date") and shall expire on the Expiry Date, unless it is otherwise extended in accordance with clause 4.2 or terminated in accordance with the terms and conditions of the Agreement.
- 2. Omitted.

#### **5 Charges, Payment and Recovery of Sums Due**

- 1. The Charges for the Services shall be as set out in the Award Letter and shall be the full and exclusive remuneration of the Supplier in respect of the supply of the Services. Unless otherwise agreed in writing by the Customer, the Charges shall include every cost and expense of the Supplier directly or indirectly incurred in connection with the performance of the Services.
- 2. All amounts stated are exclusive of VAT which shall be charged at the prevailing rate. The Customer shall, following the receipt of a valid VAT invoice, pay to the Supplier a sum equal to the VAT chargeable in respect of the Services.

3. The Supplier shall invoice the Customer as specified in the Agreement. Each invoice shall include such supporting information required by the Customer to verify the accuracy of the invoice, including the relevant Purchase Order Number and a breakdown of the Services supplied in the invoice period.
4. In consideration of the supply of the Services by the Supplier, the Customer shall pay the Supplier the invoiced amounts no later than 30 days after verifying that the invoice is valid and undisputed and includes a valid Purchase Order Number. The Customer may, without prejudice to any other rights and remedies under the Agreement, withhold or reduce payments in the event of unsatisfactory performance.
5. If the Customer fails to consider and verify an invoice in a timely fashion the invoice shall be regarded as valid and undisputed for the purpose of paragraph 5.4 after a reasonable time has passed.
6. If there is a dispute between the Parties as to the amount invoiced, the Customer shall pay the undisputed amount. The Supplier shall not suspend the supply of the Services unless the Supplier is entitled to terminate the Agreement for a failure to pay undisputed sums in accordance with clause 16.4. Any disputed amounts shall be resolved through the dispute resolution procedure detailed in clause 19.
7. If a payment of an undisputed amount is not made by the Customer by the due date, then the Customer shall pay the Supplier interest at the interest rate specified in the Late Payment of Commercial Debts (Interest) Act 1998.
8. Where the Supplier enters into a sub-contract, the Supplier shall include in that sub-contract:
  - 5.8.1 provisions having the same effects as clauses 5.3 to 5.7 of this Agreement; and
  - 5.8.2 a provision requiring the counterparty to that sub-contract to include in any sub-contract which it awards provisions having the same effect as 5.3 to 5.8 of this Agreement.
  - 5.8.3 In this clause 5.8, “sub-contract” means a contract between two or more suppliers, at any stage of remoteness from the Authority in a subcontracting chain, made wholly or substantially for the purpose of performing (or contributing to the performance of) the whole or any part of this Agreement.
9. Omitted.

## **6 Premises and equipment**

1. If necessary, the Customer shall provide the Supplier with reasonable access at reasonable times to its premises for the purpose of supplying the Services. All equipment, tools and vehicles brought onto the Customer's premises by the Supplier or the Staff shall be at the Supplier's risk.
2. If the Supplier supplies all or any of the Services at or from the Customer's premises, on completion of the Services or termination or expiry of the Agreement (whichever is the earlier) the Supplier shall vacate the Customer's premises, remove the Supplier's plant, equipment and unused materials and all rubbish arising out of the provision of the Services and leave the Customer's premises in a clean, safe and tidy condition. The Supplier shall be solely responsible for making good any damage to the Customer's premises or any objects contained on the Customer's premises which is caused by the Supplier or any Staff, other than fair wear and tear.
3. If the Supplier supplies all or any of the Services at or from its premises or the premises of a third party, the Customer may, during normal business hours and on reasonable notice, inspect and examine the manner in which the relevant Services are supplied at or from the relevant premises.
4. The Customer shall be responsible for maintaining the security of its premises in accordance with its standard security requirements. While on the Customer's premises the Supplier shall, and shall procure that all Staff shall, comply with all the Customer's security requirements.
5. Omitted.
6. Without prejudice to clause 3.2.6, any equipment provided by the Customer for the purposes of the Agreement shall remain the property of the Customer and shall be used by the Supplier and the Staff only for the purpose of carrying out the Agreement. Such equipment shall be returned promptly to the Customer on expiry or termination of the Agreement.
7. The Supplier shall reimburse the Customer for any loss or damage to the equipment (other than deterioration resulting from normal and proper use) caused by the Supplier or any Staff. Equipment supplied by the Customer shall be deemed to be in a good condition when received by the Supplier or relevant Staff unless the Customer is notified otherwise in writing within 5 Working Days.

## **7 Staff and Key Personnel**

1. If the Customer reasonably believes that any of the Staff are unsuitable to undertake work in respect of the Agreement, it may, by giving 90 days written notice to the Supplier:

7.1.1 refuse admission to the relevant person(s) to the Customer's premises;

7.1.2 request the Supplier to end the involvement in the provision of the Services of the relevant person(s); and/or

7.1.3 request that the Supplier replace any person removed under this clause with another suitably qualified person and procure that any security pass issued by the Customer to the person removed is surrendered,

and the Supplier shall use reasonable commercial efforts to comply with any such notice.

2. The Supplier shall:

7.2.1 ensure that all Staff are vetted in accordance with the Staff Vetting Procedures;

7.2.2 if requested, provide the Customer with a list of the names and business addresses (and any other relevant information) of all persons who may require admission to the Customer's premises in connection with the Agreement; and

7.2.3 procure that all Staff comply with any rules, regulations and requirements reasonably specified by the Customer.

3. Omitted.

4. Any replacements to the Key Personnel shall be of at least equal status or of equivalent experience and skills to the Key Personnel being replaced and be suitable for the responsibilities of that person in relation to the Services.

## **8 Assignment and sub-contracting**

1. The Supplier shall not without the written consent of the Customer assign, novate or in any way dispose of the benefit and/ or the burden of the Agreement or any part of the Agreement. Supplier may sub-contract in its ordinary course of business (e.g., consultants who work on-site at Supplier's offices). The Customer may, in the granting of such consent, provide for additional terms and conditions relating to such assignment, sub-contract, novation or disposal. The Supplier shall be responsible for the acts and omissions of its sub-contractors as though those acts and omissions were its own.

2. Omitted.

3. The Customer may assign, novate, or otherwise dispose of its rights and obligations under



the Agreement without the consent of the Supplier provided that such assignment, novation or disposal shall not increase the burden of the Supplier's obligations under the Agreement; provided however that if any successor in interest to Customer must pass Supplier's compliance check.

## **9 Intellectual Property Rights**

1. All intellectual property rights in any materials provided by the Customer to the Supplier for the purposes of this Agreement shall remain the property of the Customer but the Customer hereby grants the Supplier a royalty-free, non-exclusive and non-transferable licence to use such materials as required until termination or expiry of the Agreement for the sole purpose of enabling the Supplier to perform its obligations under the Agreement.

2. All intellectual property rights in any materials created or developed by the Supplier pursuant to the Agreement or arising as a result of the provision of the Services shall vest in the Supplier. If, and to the extent, that any intellectual property rights in such materials vest in the Customer by operation of law, the Customer hereby assigns to the Supplier by way of a present assignment of future rights that shall take place immediately on the coming into existence of any such intellectual property rights all its intellectual property rights in such materials (with full title guarantee and free from all third party rights).

3. The Supplier hereby grants the Customer the rights set forth in Supplier's Master Content License Agreement ("MCLA"), which is attached hereto as Exhibit **B**. In the event of any discrepancy between the Agreement and the MCLA, the MCLA shall control. The MCLA. Without limiting the foregoing, Customer's use of Supplier's (1) Licensed Materials (as defined in the MCLA) shall be subject to Supplier's Order Schedule (attached as Exhibit A), and (2) SkySat shall be subject to Supplier's SkySat Terms and Conditions (attached as Exhibit D), and Professional Services shall be subject to Supplier's Services Terms (attached as Exhibit C). Each Exhibit is incorporated herein by reference.

## **10 Governance and Records**

10.1 The Supplier shall:

10.1.1 attend progress meetings with the Customer at the frequency and times mutually agreed by the parties and shall ensure that its representatives are suitably qualified to attend such meetings; and

10.1.2 submit progress reports to the Customer at the times and in the format mutually agreed by the parties .

10.2 The Supplier shall keep and maintain until 6 years after the end of the Agreement, or as long a period as may be agreed between the Parties, full and accurate records of the

Agreement including the Services supplied under it and all payments made by the Customer. The Supplier shall on request afford the Customer or the Customer's representatives such access to those records as may be reasonably requested by the Customer in connection with the Agreement.

## **11 Confidentiality, Transparency and Publicity**

11.1 Subject to clause 11.2, each Party shall:

11.1.1 treat all Confidential Information it receives as confidential, safeguard it accordingly and not disclose it to any other person without the prior written permission of the disclosing Party; and

11.1.2 not use or exploit the disclosing Party's Confidential Information in any way except for the purposes anticipated under the Agreement.

11.2 Notwithstanding clause 11.1, a Party may disclose Confidential Information which it receives from the other Party:

11.2.1 where disclosure is required by applicable law or by a court of competent jurisdiction;

11.2.2 to its auditors or for the purposes of regulatory requirements;

11.2.3 on a confidential basis, to its professional advisers;

11.2.4 to the Serious Fraud Office where the Party has reasonable grounds to believe that the other Party is involved in activity that may constitute a criminal offence under the Bribery Act 2010;

11.2.5 where the receiving Party is the Supplier, to the Staff on a need to know basis to enable performance of the Supplier's obligations under the Agreement provided that the Supplier shall procure that any Staff to whom it discloses Confidential Information pursuant to this clause 11.2.5 shall observe the Supplier's confidentiality obligations under the Agreement; and

11.2.6 where the receiving Party is the Customer:

11.2.6.1.1 on a confidential basis to the employees, agents, consultants and contractors of the Customer;

11.2.6.1.2 on a confidential basis to any other Central Government Body, any successor body to a Central Government Body or any company to which the Customer transfers or proposes to transfer all or any part of its business;

11.2.6.1.3 to the extent that the Customer (acting reasonably) deems disclosure necessary or appropriate in the course of carrying out its public functions; or

11.2.6.1.4 in accordance with clause 12.

and for the purposes of the foregoing, references to disclosure on a confidential basis shall mean disclosure subject to a confidentiality agreement or arrangement containing terms no less stringent than those placed on the Customer under this clause 11.

11.3 The Parties acknowledge that, except for any information which is exempt from disclosure in accordance with the provisions of the FOIA, the content of the Agreement is not Confidential Information and the Supplier hereby gives its consent for the Customer to publish this Agreement in its entirety to the general public (but with any information that is exempt from disclosure in accordance with the FOIA redacted) including any changes to the Agreement agreed from time to time. The Customer may consult with the Supplier to inform its decision regarding any redactions but shall have the final decision in its absolute discretion whether any of the content of the Agreement is exempt from disclosure in accordance with the provisions of the FOIA; provided however, that Supplier's Confidential Information constitutes a trade secret.

11.4 The Supplier shall not, and shall take reasonable steps to ensure that the Staff shall not, make any press announcement or publicise the Agreement or any part of the Agreement in any way, except with the prior written consent of the Customer.

## **12 Freedom of Information**

12.1 The Customer is committed to open government and to meeting its responsibilities under the Freedom of Information Act 2000 (as amended) ('Act') and the Environmental Information Regulations 2004 (as amended) (Regulations').

12.2 Subject to Section 11 of the MCLA, the Supplier agrees that:

12.2.1 All information submitted to the Customer may need to be disclosed by the Customer in response to a request under the Act or the Regulations; and

12.2.2 The Customer may include information submitted (in whole or in part) in the publication scheme which it maintains under the Act or publish the Contract, including from time to time agreed changes to the Contract, to the public.

12.3 The information included in Supplier's tender, or that Supplier has submitted to the Customer or that is otherwise contained in the Contract, is commercially sensitive, and if disclosed, may cause commercial harm which cannot be measured. The Supplier acknowledges

that if it has indicated that information is commercially sensitive, such information may still be required to be disclosed by the Customer under the Act or the Regulations. The receipt of any material marked 'confidential' or equivalent by the Customer shall not be deemed to infer that the Customer agrees any duty of confidentiality by virtue of that marking.

### **13 Protection of Personal Data and Security of Data**

13.1 Where applicable, the Supplier shall, and shall procure that all Staff shall, comply with any notification requirements under the DPA and both Parties shall duly observe all their obligations under the DPA which arise in connection with the Agreement.

13.2 Notwithstanding the general obligation in clause 13.1, where the Supplier is processing Personal Data for the Customer as a data processor (as defined by the DPA) the Supplier shall:

13.2.1 ensure that it has in place appropriate technical and organisational measures to ensure the security of the Personal Data (and to guard against unauthorised or unlawful processing of the Personal Data and against accidental loss or destruction of, or damage to, the Personal Data), as required under the Seventh Data Protection Principle in Schedule 1 to the DPA;

13.2.2 provide the Customer with such information as the Customer may reasonably request to satisfy itself that the Supplier is complying with its obligations under the DPA;

13.2.3 promptly notify the Customer of:

13.2.3.1.1 any breach of the security requirements of the Customer as referred to in clause 13.3; and

13.2.3.1.2 any request for personal data; and

13.2.4 ensure that it does not knowingly or negligently do or omit to do anything which places the Customer in breach of the Customer's obligations under the DPA.

13.3 When handling Customer data (whether or not Personal Data), the Supplier shall ensure the security of the data is maintained in line with the security requirements of the Customer as notified to the Supplier from time to time. Notwithstanding anything to the contrary in this Agreement, Customer shall not disclose Personal Data to Supplier except as required to fulfill the obligations of the Agreement (e.g., providing user names for provisioning).

### **14 Liability**

14.1 The Supplier shall not be responsible for any injury, loss, damage, cost or expense suffered

by the Customer if and to the extent that it is caused by the negligence or wilful misconduct of the Customer or by breach by the Customer of its obligations under the Agreement.

14.2 Subject always to clauses 14.3 and 14.4:

14.2.1 the aggregate liability of the Supplier in respect of all defaults, claims, losses or damages howsoever caused, whether arising from breach of the Agreement, the supply or failure to supply of the Services, misrepresentation (whether tortious or statutory), tort (including negligence), breach of statutory duty or otherwise shall in no event exceed a sum equal to [REDACTED] of the Charges paid or payable to the Supplier in the 12 months preceding the claim; and

14.2.2 except in the case of claims arising under clauses 9.4 and 18.3, in no event shall the Supplier be liable to the Customer for any:

14.2.2.1.1 loss of profits;

14.2.2.1.2 loss of business;

14.2.2.1.3 loss of revenue;

14.2.2.1.4 loss of or damage to goodwill;

14.2.2.1.5 loss of savings (whether anticipated or otherwise); and/or

14.2.2.1.6 any indirect, special or consequential loss or damage.

14.3 Nothing in the Agreement shall be construed to limit or exclude either Party's liability for:

14.3.1 death or personal injury caused by its negligence or that of its Staff;

14.3.2 fraud or fraudulent misrepresentation by it or that of its Staff; or

14.3.3 any other matter which, by law, may not be excluded or limited.

14.4 The Supplier's liability under the indemnity in clause 9.4 and 18.3 shall be unlimited.

14.5 Customer's liability and indemnification obligations shall be as set forth in the MCLA.

## **15 Force Majeure**

Neither Party shall have any liability under or be deemed to be in breach of the Agreement for any delays or failures in performance of the Agreement which result from circumstances beyond the reasonable control of the Party affected. Each Party shall promptly notify the other Party in writing when such circumstances cause a delay or failure in performance and when they cease to do so. If such circumstances continue for a continuous period of more than two months, either

Party may terminate the Agreement by written notice to the other Party.

## **16 Termination**

16.1 The Customer may terminate the Agreement at any time by notice in writing to the Supplier to take effect on any date falling at least 1 month (or, if the Agreement is less than 3 months in duration, at least 10 Working Days) later than the date of service of the relevant notice, subject to the payment of any fees due under any Order Schedule (as defined in the MCLA).

16.2 Without prejudice to any other right or remedy it might have, the Customer may terminate the Agreement by written notice to the Supplier with immediate effect if the Supplier:

16.2.1 (without prejudice to clause 16.2.5), is in material breach of any obligation under the Agreement which is not capable of remedy;

16.2.2 repeatedly breaches any of the terms and conditions of the Agreement in such a manner as to reasonably justify the opinion that its conduct is inconsistent with it having the intention or ability to give effect to the terms and conditions of the Agreement;

16.2.3 is in material breach of any obligation which is capable of remedy, and that breach is not remedied within 30 days of the Supplier receiving notice specifying the breach and requiring it to be remedied;

16.2.4 undergoes a change of control within the meaning of section 416 of the Income and Corporation Taxes Act 1988;

16.2.5 breaches any of the provisions of clauses 7.2, 11, 12, 13 and 17 and that breach is not remedied within 30 days of the Supplier receiving notice specifying the breach and requiring it to be remedied;

16.2.6 becomes insolvent, or if an order is made or a resolution is passed for the winding up of the Supplier (other than voluntarily for the purpose of solvent amalgamation or reconstruction), or if an administrator or administrative receiver is appointed in respect of the whole or any part of the Supplier's assets or business, or if the Supplier makes any composition with its creditors or takes or suffers any similar or analogous action (to any of the actions detailed in this clause 16.2.6) in consequence of debt in any jurisdiction; or

16.2.7 is found by a court of competent jurisdiction to be in violation of the applicable legal obligations in the fields of environmental, social or labour law.

16.3 The Supplier shall notify the Customer as soon as practicable of any change of control as referred to in clause 16.2.4 or any potential such change of control.

16.4 The Supplier may terminate the Agreement by written notice to the Customer if the Customer has not paid any undisputed amounts within 30 days of them falling due.

16.5 Termination or expiry of the Agreement shall be without prejudice to the rights of either Party accrued prior to termination or expiry and shall not affect the continuing rights of the Parties under this clause and clauses 2, 3.2, 6.1, 6.2, 6.6, 6.7, 7, 9, 10.2, 11, 12, 13, 14, 16.6, 17.4, 18.3, 19 and 20.7 or any other provision of the Agreement that either expressly or by implication has effect after termination.

16.6 Upon termination or expiry of the Agreement, the Supplier shall:

16.6.1 omitted.

16.6.2 return or destroy all requested documents, information and data to the Customer as soon as reasonably practicable.

## **17 Compliance**

17.1 The Supplier shall promptly notify the Customer of any health and safety hazards which may arise in connection with the performance of its obligations under the Agreement. The Customer shall promptly notify the Supplier of any health and safety hazards which may exist or arise at the Customer's premises and which may affect the Supplier in the performance of its obligations under the Agreement.

17.2 The Supplier shall:

17.2.1 comply with all the Customer's health and safety measures while on the Customer's premises; and

17.2.2 notify the Customer immediately in the event of any incident occurring in the performance of its obligations under the Agreement on the Customer's premises where that incident causes any personal injury or damage to property which could give rise to personal injury.

17.3 The Supplier shall:

17.3.1 perform its obligations under the Agreement in accordance with all applicable equality Law and the Customer's equality and diversity policy as provided to the Supplier from time to time; and

17.3.2 take all reasonable steps to secure the observance of clause 17.3.1 by all Staff.

17.4 The Supplier shall supply the Services in accordance with the Customer's environmental policy as provided to the Supplier from time to time.



17.5 The Supplier shall comply with, and shall ensure that its Staff shall comply with, the provisions of:

17.5.1 the Official Secrets Acts 1911 to 1989; and

17.5.2 section 182 of the Finance Act 1989.

## **18 Prevention of Fraud and Corruption**

18.1 The Supplier shall not offer, give, or agree to give anything, to any person an inducement or reward for doing, refraining from doing, or for having done or refrained from doing, any act in relation to the obtaining or execution of the Agreement or for showing or refraining from showing favour or disfavour to any person in relation to the Agreement.

18.2 The Supplier shall take all reasonable steps, in accordance with good industry practice, to prevent fraud by the Staff and the Supplier (including its shareholders, members and directors) in connection with the Agreement and shall notify the Customer immediately if it has reason to suspect that any fraud has occurred or is occurring or is likely to occur.

18.3 If the Supplier or the Staff engages in conduct prohibited by clause 18.1 or commits fraud in relation to the Agreement or any other contract with the Crown (including the Customer) the Customer may:

18.3.1 terminate the Agreement and recover from the Supplier the amount of any loss suffered by the Customer resulting from the termination, including the cost reasonably incurred by the Customer of making other arrangements for the supply of the Services and any additional expenditure incurred by the Customer throughout the remainder of the Agreement; or

18.3.2 recover in full from the Supplier any other loss sustained by the Customer in consequence of any breach of this clause.

## **19 Dispute Resolution**

19.1 The Parties shall attempt in good faith to negotiate a settlement to any dispute between them arising out of or in connection with the Agreement and such efforts shall involve the escalation of the dispute to an appropriately senior representative of each Party.

19.2 If the dispute cannot be resolved by the Parties within one month of being escalated as referred to in clause 19.1, the dispute may by agreement between the Parties be referred to a neutral adviser or mediator (the “**Mediator**”) chosen by agreement between the Parties. All negotiations connected with the dispute shall be conducted in confidence and without prejudice



to the rights of the Parties in any further proceedings.

19.3 If the Parties fail to appoint a Mediator within one month, or fail to enter into a written agreement resolving the dispute within one month of the Mediator being appointed, either Party may exercise any remedy it has under applicable law.

## **20 General**

20.1 Each of the Parties represents and warrants to the other that it has full capacity and authority, and as of the Effective Date, all necessary consents, licences and permissions to enter into and perform its obligations under the Agreement, and that the Agreement is executed by its duly authorised representative.

20.2 A person who is not a party to the Agreement shall have no right to enforce any of its provisions which, expressly or by implication, confer a benefit on him, without the prior written agreement of the Parties.

20.3 The Agreement cannot be varied except in writing signed by a duly authorised representative of both the Parties.

20.4 The Agreement and its Exhibits contains the whole agreement between the Parties and supersedes and replaces any prior written or oral agreements, representations or understandings between them. The Parties confirm that they have not entered into the Agreement on the basis of any representation that is not expressly incorporated into the Agreement. Nothing in this clause shall exclude liability for fraud or fraudulent misrepresentation.

20.5 Any waiver or relaxation either partly, or wholly of any of the terms and conditions of the Agreement shall be valid only if it is communicated to the other Party in writing and expressly stated to be a waiver. A waiver of any right or remedy arising from a breach of contract shall not constitute a waiver of any right or remedy arising from any other breach of the Agreement.

20.6 The Agreement shall not constitute or imply any partnership, joint venture, agency, fiduciary relationship or other relationship between the Parties other than the contractual relationship expressly provided for in the Agreement. Neither Party shall have, nor represent that it has, any authority to make any commitments on the other Party's behalf.

20.7 Except as otherwise expressly provided by the Agreement, all remedies available to either Party for breach of the Agreement (whether under the Agreement, statute or common law) are cumulative and may be exercised concurrently or separately, and the exercise of one remedy

shall not be deemed an election of such remedy to the exclusion of other remedies.

20.8 If any provision of the Agreement is prohibited by law or judged by a court to be unlawful, void or unenforceable, the provision shall, to the extent required, be severed from the Agreement and rendered ineffective as far as possible without modifying the remaining provisions of the Agreement, and shall not in any way affect any other circumstances of or the validity or enforcement of the Agreement.

## **21 Notices**

21.1 Any notice to be given under the Agreement shall be in writing and may be served by personal delivery, first class recorded or, subject to clause 21.3, e-mail to the address of the relevant Party set out in the Award Letter, or such other address as that Party may from time to time notify to the other Party in accordance with this clause:

21.2 Notices served as above shall be deemed served on the Working Day of delivery provided delivery is before 5.00pm on a Working Day. Otherwise delivery shall be deemed to occur on the next Working Day. An email shall be deemed delivered when sent unless an error message is received.

21.3 Notices under clauses 15 (Force Majeure) and 16 (Termination) may be served by email only if the original notice is then sent to the recipient by personal delivery or recorded delivery in the manner set out in clause 21.1.

## **22 Governing Law and Jurisdiction**

Notwithstanding the language as set forth in Exhibit B (MCLA), Section 13.b, the Parties hereby agree that the validity, construction and performance of the Agreement, and all contractual and non-contractual matters arising out of it, shall be governed by English law .

## Annex 2 – Charges

Milestones:	Title	Delivery Date	Price (£ ex-VAT)	% of total tender price
Milestone 1	<p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p>	Promptly upon full execution of the Agreement	[REDACTED]	[REDACTED]
Milestone 2 (SOW Task 1)	<p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p>	Estimated 30 days from Start Date	[REDACTED]	[REDACTED]
Milestone 3 (SOW Task 2)	<p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p> <p>[REDACTED]</p>	Estimated 60 days from Start Date	[REDACTED]	[REDACTED]

[REDACTED]

<p>Milestone 4 (SOW Task 3)</p>	<div></div> <div></div> <div></div> <div></div> <div></div> <div></div>	<p>Estimated 90 days from Start Date</p>	<div></div>	<div></div> <div></div>
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## Annex 3 – Specification

### Summary

We have a requirement for very high- and high-resolution satellite imaging services for a pilot agricultural monitoring and remote inspection project covering multiple areas of England for 3 months.

### Summary of Team

The land operations and geospatial team provide geospatial expertise, operational delivery and maintenance of the RPA's land register. We support everything related to land – including mapping queries, job loading, analysis and reporting, supporting the physical and remote inspections processes, data management and geospatial innovation. We are also involved in the modelling and spatial prioritisation work in the ELM scheme.

### Specific Objectives/Deliverables

The Supplier shall provide streaming satellite imagery within 48 hours of data acquisition. Daily routine coverage at a resolution of 4m GSD or better is required for the whole of England with the ability to stream images in a GIS software such as ArcGIS and/or QGIS.

The Supplier shall provide Analysis-Ready daily, cloud-free/gap-filled satellite imagery at 4m GSD or better for multiple sites in England for 1-year worth of archive data covering the period of September 2020 to September 2021 and 6 months of new data acquired over the project period or a combination of 3 months archive data and 3 months new data covering the period of October 2021 to March 2022.

The Supplier shall assess the utility of using the required data for the monitoring of Sustainable Farming Incentive (SFI) standards as set out in the SFI pilot website [Sustainable Farming Incentive pilot - GOV.UK](https://www.gov.uk/guidance/sustainable-farming-incentive-pilot) ([www.gov.uk](https://www.gov.uk/guidance/sustainable-farming-incentive-pilot) and [SIF Arable and horticultural soils standard 2022](https://www.gov.uk/guidance/sustainable-farming-incentive-pilot)). An initial report with recommendations needs to be delivered after 2 weeks of contract award.

The Supplier shall develop a proof of concept assessing the usability of Very-High-Resolution (VHR) and Very-High-Frequency High Resolution Imagery to monitor selected SFI Standards and actions. A report summarising the result and providing recommendations, the data and code base (preferably open-source software such as Python or R) should be delivered as a result of this.

The Supplier shall produce a land cover map showing crop types as in the Crop Map of England (CROME) (see CROME specification document in Appendix A) and provide recommendations on how to integrate the data into the current CROME workflow to produce an early/in-season

crop map using the Analysis-Ready daily cloud-free archive data. The code (preferably open-source software such as Python or R) and data produced in the process must also be delivered alongside the report with the recommendations.

The Customer shall be able to share the outputs / results throughout DEFRA and be able to share screenshot (not georeferenced) images of the data with relevant stakeholders. Ideally, the data should be accessible via OGC services such as WMS.

The Supplier must make all data available to download for further in-house analysis.

The Supplier shall also provide customer support service - accessible Monday-Friday 9am - 5pm, subject to Supplier's Standard Support terms (<https://www.planet.com/solutions/technical-support/>).

The Supplier shall provide access to stream within 48 hours of data acquisition and make all data available for download during the project period.

The Supplier shall be able to schedule at short notice satellite data capture at better than 1m GSD that will be made available to visualise and analyse within 48 hrs of acquisition. It is anticipated that approximately 20 collects, each of approximately 25sq. km will be required throughout the Term .

The Supplier will update and discuss progress as well as any issues at weekly meetings, or as otherwise mutually agreed, with the RPA's Geospatial Team.

### **Timescales/Deadlines**

The proof of concept will be broken down into three tasks. After each task the specific deliverable shall be delivered. The estimated timescales for the individual tasks are as follows:

Task name:	Estimated Duration:	Deliverable:
SOW Task 1: Assessment of use cases of the VHR and HR imagery for SFI standards monitoring.	2-3 weeks	Initial report describing the utility of the VHR and HR products to monitor SFI standards, including recommendations for operational uses.
SOW Task 2: Determine the utility of daily cloud-free (gap-filled) HR imagery for the use in the Crop Map of England	4-6 weeks	Final report describing the results and the utility of daily, cloud-free (gap-filled) data for the CROME workflow,

(CROME) crop classification methodology.		including recommendations for operational use.
SOW Task 3: Develop proof of concept applications for using the requested VHR and HR data to monitor SFI standards and identify on-farm management practices and their timings.	4-6 weeks	Final report describing PoC results and the utility of different satellite products with respect to the SFI standards, the code base as well as recommendations for operational use.

### **Contract Management**

Contract performance shall be managed via monthly project review meetings.

The Authority shall raise Purchase Orders against the key milestones listed at Annex 2 – Charges.

The Supplier shall invoice against these Purchase Orders upon completion and acceptance of the milestone, and provide any supporting evidence of completion to the Authority.

Appendix A

## Crop Map of England

## Product Specification- v.2020.2

**Non-Sensitive  
Information**



## Contents

### Abbreviations

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Annex A – Land Cover Codes

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## Abbreviations

CROME – Crop Map of England

ESA – European Space Agency

GRD – Ground Range Detected

LUCODE – Land Use Code

RGBNIR – Red, Green, Blue, Near-Infrared

SNAP – Sentinel Application Platform

VH – Vertical-Horizontal Polarisation

VV – Vertical-Vertical Polarisation

VV/VH – Vertical-Vertical/Vertical-Horizontal dual Polarisation



## 1 Introduction

### 1.1 Document Control

## 2 Revision History

Date	Author	Version	Change reference

## 3 Reviewers and Contributors

Name	Role	Team

██████	██████	██████
██████	██████	██████

### 3.1 Purpose Scope

This document defines the product specification for the Crop Map of England (CROME) layer delivered by the Rural Payments Agency (RPA).

CROME is a tessellated multi-temporal visualisation of the type and distribution of land covers identified using remote sensing techniques. The purpose of this specification is to define that representation and the technical details for the reference dataset structure, data format and delivery. This document includes the technical specification and a general overview of the methodology used to produce the CROME layer.

The CROME layer covers most of the land in England (including some small isles) into approximately 32 million hexagon cells. The CROME Layer is expected to be revised once a year during September-October, and then released shortly afterwards.

It is important to note here that CROME is basically a scientific product and not a conventional cartographic product. Therefore, minimal efforts have been taken to:

- generalise the thematic variation of crop and land cover types;
- revise the land use types to homogenise land cover over an area;
- improve the cosmetic appearance of the layer.

### 3.2 Document Ownership and Distribution

This document is owned by the GI Technical Team within the RPA Operational Delivery Directorate. The document is for use by RPA staff, its third-party suppliers and end user organisations. There are no restrictions on internal Defra Organisation employee access to this document, or to contractors/consultants, third parties and any other agency or body with access to Defra Organisation assets or data handling facilities.

### 3.3 Assumptions, Dependencies and Constraints

The document describes the derivation of a technical geospatial data product. It is not written for the layman and thus assumes that users of this document are knowledgeable in:

- Geographic Information Systems
- Earth Observation concepts

The product is released under the Open Government Licence. This requires a reference as follows:

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## 4 Data Creation

### 4.1 Feature Classification

The main sources for the crop classification are satellite images from the Sentinel constellation together with Ground Truth data for land cover types. A combination of radar and multispectral imagery from Sentinel sensors was used for automatic classification. Sentinel-1 with its C-band sensor transmits and receives microwave radiation in the horizontal (H) and vertical (V) polarisation. Sentinel-2 captures multispectral imagery in 13 spectral bands at varying spatial resolutions. More information regarding the specification of each satellite can be found on the following ESA websites: [Sentinel-1](#) and [Sentinel-2](#).

### 4.2 Geometry

Unlike conventional land cover classification maps, the classification of crops and land cover in CROME is represented as hexagonal cells. Traditional thematic visualisation of geospatial information (e.g. distribution of crop types and other land use types) partitions the land into either a regular grid (e.g. [CropScape-Cropland Data layer](#)) or an agricultural/administrative polygonal representation of the land use extent (e.g. [CEH Land Cover plus –Crops 2015; onesoil.ai](#)). However, the CROME layer is based on the hexagonal grid, which provides a superior opportunity to model and visualise the arbitrary arrangement of land use forms and locations in comparison to a regular grid. Furthermore, it avoids using third party vector products (with any associated licence constraints) that represent agricultural/administrative polygons.

Each hexagon cell covers an area of 4156 sq. m., or 0.41 hectares. The hexagon cells in the CROME layer are spatially distinct units and the CROME layer does not provide any spatial adjacency information. The vertices of adjacent cells are mostly coincident; therefore, the CROME layer provides a continuous representation of the land use. The hexagon cells are not constrained by any topographic features, except the extent of the land.



**Figure 1. Example of CROME hexagonal classification cells**

## 4.3 Attributes

In the creation of the CROME layer, attribution is generated from the associated imagery and the feature classification process.

## 5 Reference Layer Features

## 5.1 Representation

The classification is provided as hexagonal polygon cells, with each cell being attributed a land cover classification, according to the classification in Annex A. An example of the landscape and the classification cells, labelled with the land cover code in Annex A, is shown in Figure 1. Unlike previous versions, CROME 2018 (and onwards) data production did not involve any climate zones, as internal experiments revealed that Random Forest Classification performed with equivalent accuracy with or without regional labelling. The distribution has also been revised to be now based on ceremonial counties because user feedback have suggested that zones used in previous versions were too large. The ceremonial county boundaries are based on the boundary

line product by the OS ([link](#)). CROME 2020 is distributed on 46 ceremonial counties. Table 1 lists the number of counties and their respective codes and Figure 2 shows the map of the counties.

Ceremonial County	County Code
Bedfordshire	BED
Berkshire	BER
Bristol and Somerset	BRS
Buckinghamshire	BUC
Cambridgeshire	CAM
Cheshire	CHE
Cumbria	CMB
Cornwall	COR
Derbyshire	DER
Devon	DEV
Dorset	DOR
Durham	DUR
East Riding of Yorkshire	ERY
Essex	ESS
East Sussex	ESX
Gloucestershire	GLO
Greater Manchester	GMN
Hampshire	HAM

Ceremonial County	County Code
Leicestershire	LEI
Lincolnshire	LIN
City and Greater London	LON
Merseyside	MER
Norfolk	NOR
Nottinghamshire	NOT
Northamptonshire	NRM
Northumberland	NRT
North Yorkshire	NYO
Oxfordshire	OXF
Rutland	RUT
Shropshire	SHR
Staffordshire	STF
Suffolk	SUF
Surrey	SUR
South Yorkshire	SYO
Tyne & Wear	TAW
Warwickshire	WAR

Herefordshire	HER	Wiltshire	WIL
Hertfordshire	HRT	West Midlands	WMD
Isle of Wight	IOW	Worcestershire	WOR
Kent	KEN	West Sussex	WSX
Lancashire	LAN	West Yorkshire	WYR

**Table 1. CROME data distribution zones with their zone codes and cell counts respectively.**



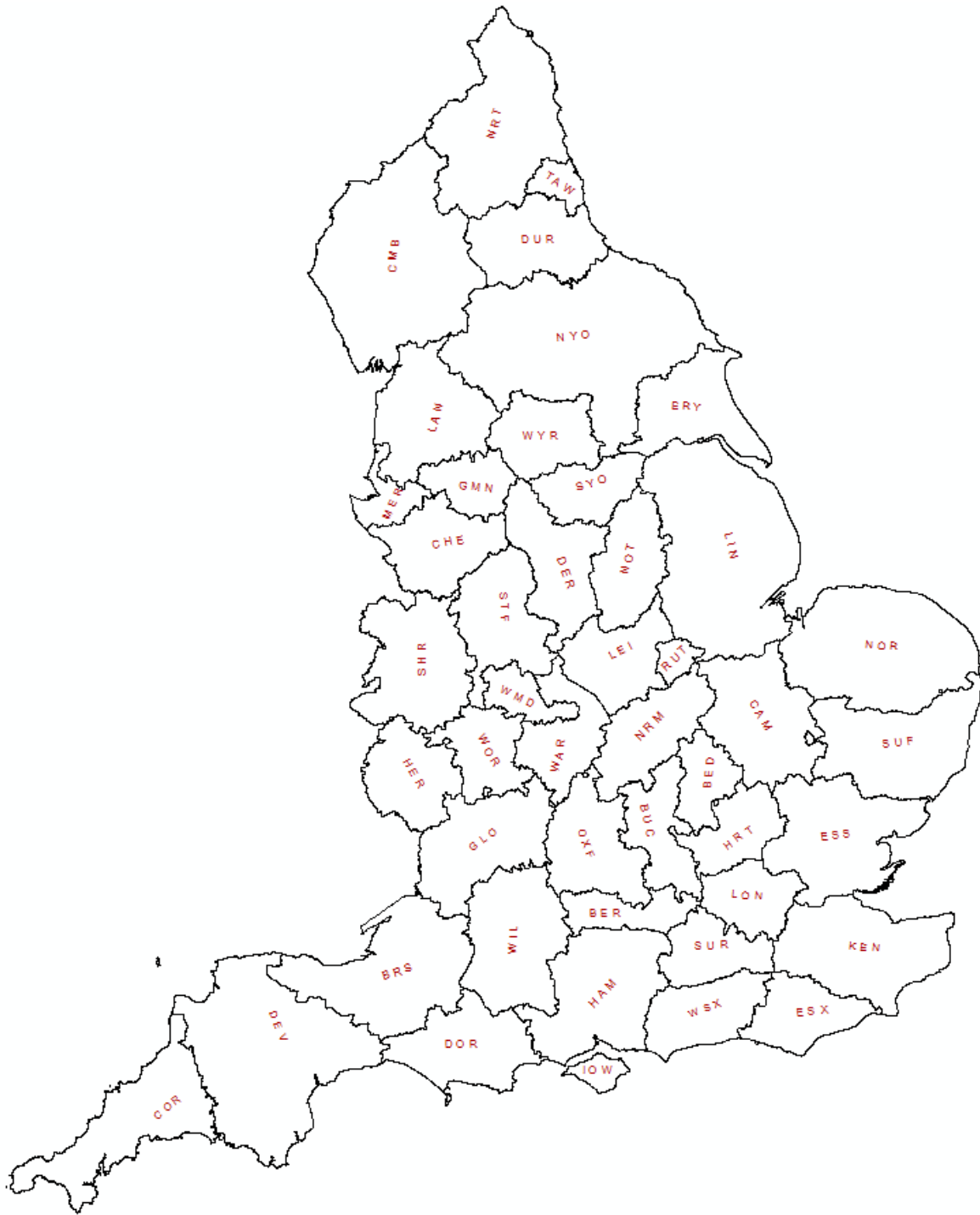


Figure 2. Ordnance Survey Ceremonial Counties in England (source: Ordnance Survey). See Table 1 for full names for each county codes.

## 6 CROME Classification

The classification of the topography was performed using the Random Forest classifier, a supervised machine learning approach. More information on Random Forest Classification can be found on the authors' [homepage](#). The approach learns the classification of specific crop types by associating backscatter characteristics of each radar polarisation (VV, VH, VV/VH) and

multispectral (RGBNIR) signatures at 10m spatial resolution to known land covers, previously collected by field inspectors. The ground truth points, radar and multispectral images were fed into the workflow, outlined in Figure 3, making up the four main work packages described below in further detail.

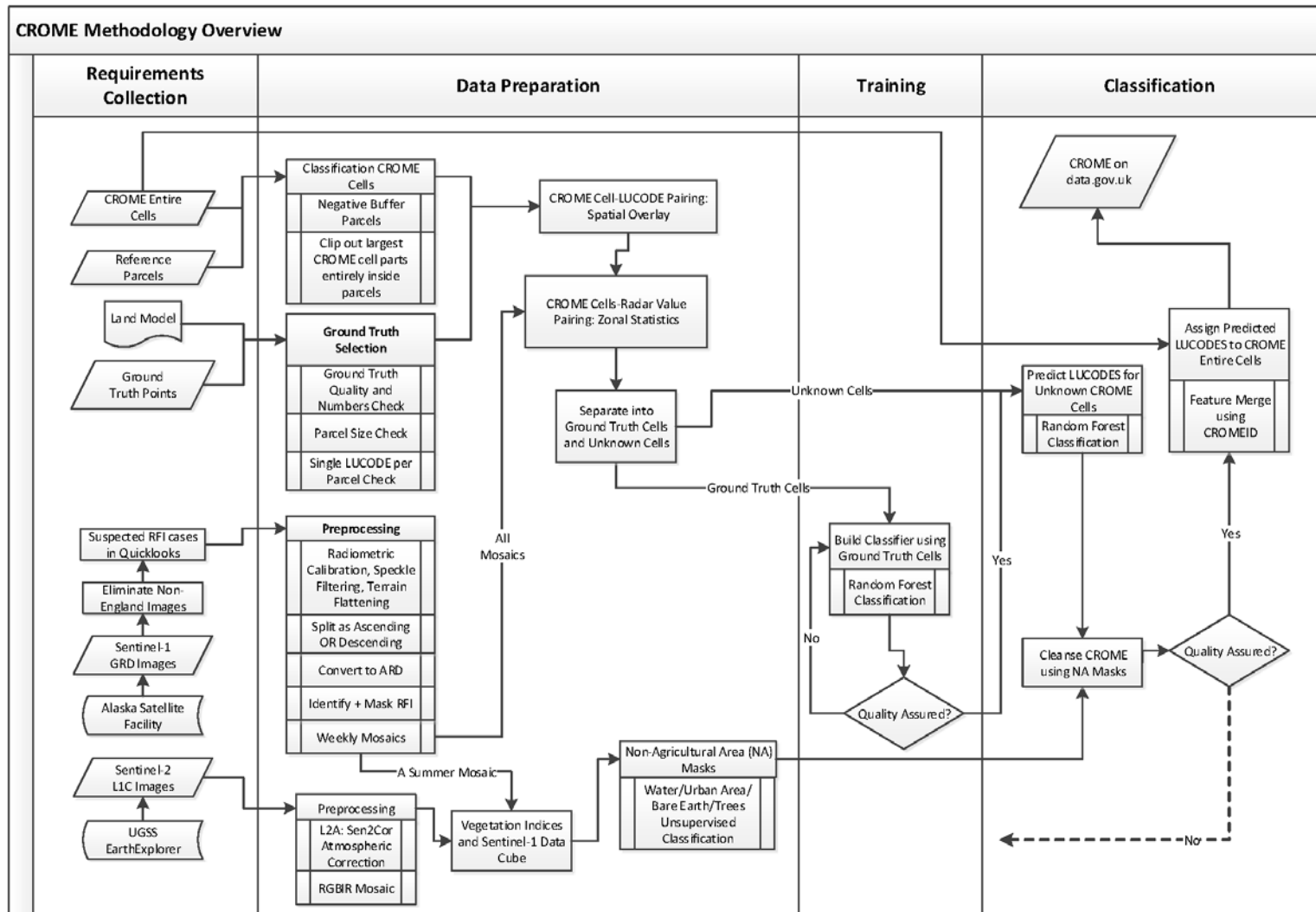


Figure 3. Workflow for CROME classification

## 6.1 Requirements Collection

This step involves the creation and collection of the input datasets and specifications required to perform the classification. The step involves five main inputs:

- a) CROME Cells: These are hexagon cells that form the spatial framework of the CROME layer. These are essentially Voronoi polygons and were created using a combination of ESRI ArcMap and FME applications.
- b) Land Model (current version 1.7.1): This is an internal RPA document that contains a list and specification of the relevant land cover and crop types which are eventually assigned to the CROME cells.
- c) Ground Truth Points (GTP): These are a record of the spatial location and type of crop and land use found by the RPA field inspectors and Cyient during late-spring and summer period of 2020. The ground truth collection process involves verification and, where required, correction of the crop and other land cover types declared by the farmers against each parcel registered under their name. In order to minimise classification errors, only the ground truth data and parcels that matched the following conditions were used:
  - a. Parcels only contained a single GTP crop/land use type.
  - b. Parcel area after applying a negative buffer of 20 m (to exclude contamination from hedges and other boundary features) was greater than 0.32 ha (i.e. it would cover 80% of a CROME cell area).
  - c. The crop/land use type was present in at least 10 ground truth parcels.

In addition, the numbers and varieties for non-agricultural areas were boosted by collecting additional ground truth information, such as man-made surfaces and structures, from other RPA datasets e.g. inspections.

- d) Sentinel-1 GRD images: These are Sentinel-1 Radar Ground Range Detected (GRD) dual polarisation (VV, VH) images for the period of January till September 2020, covering the main land masses of England. These can be downloaded from the [Copernicus Open Access Hub](#) or the [Alaska Satellite Data Facility](#).
- e) Sentinel-2 Level2A images: These are a collection of Sentinel-2 RGBNIR images, mosaiced to a cloud-free product for the period of March till June 2020. These can be downloaded from the [Copernicus Open Access Hub](#).

## 6.2 Data Preparation

The objective of this step is to attribute the CROME Cells with the required LUCODE (only for cells used during supervised training) and radar backscatter and multispectral surface reflectance values for the purposes of classification. It involves the following main processes:

- a) Ground truth data points are filtered by applying a combination of simple attribute and spatial filtering using farm field polygons.

- b) The Sentinel-1 GRD images are processed using the Sentinel Application Platform (more information available on [SNAP](#) homepage) software to transform the raw images into georeferenced and radiometrically corrected Sigma-0 (backscattering coefficient) images.
- c) The Sentinel-2 L2A images are downloaded and mosaiced to cloud free composite.
- d) Zonal Statistics analysis is performed to calculate the weekly mean of VV, VH and VV/VH-ratio image values for the area covered by each CROME cell. Each CROME cell (32 million in total) is assigned a pair of triplet values i.e. mean VV, VH and VV/VH, based on an England-wide weekly composite of scenes. Statistics were calculated of each polarization combinations (VV, VH and VV/VH) from suitable weekly mosaic radar scenes captured from January to September 2020. Weekly statistics allowed a common temporal reference axis for all cells because although satellite pass dates over cells are broadly predictable as per ESA guidance, i.e. within 5-10 days revisit, these still varied considerably across England thereby creating data gaps.
- e) Zonal statistics (mean) for Sentinel-2 L2A RGBNIR 10m are extracted only from one cloud-free mosaic due to persistent cloud cover.
- f) Spatial overlap is tested between the selected ground truth subset points and all the CROME cell polygons to assign the known LUCODES to the training-CROME cell polygons.

Classification rules were formulated based on the known LUCODES, established in step (f), and the weekly radar backscattering coefficient values derived in step (d) and the surface reflectance values derived in step (e) from the training CROME cells.

## 6.3 Training

The objective of this step is to automatically build the classification rules that can be used to predict the LUCODE of a CROME cell, given its associated weekly radar backscatter coefficient values and the multispectral values.

This work uses the Random Forest classification technique, a supervised machine learning approach, available in the R application. The unique advantage of Random Forest classification is that given a large number of ground truth points, it is able to perform robust cross-validation internally by generating numerous decision trees using a subsample of the training data for each tree using a technique called bagging (bootstrap aggregation). Furthermore, the Random Forest classifier estimates the variable importance and calculates the probability of each feature (e.g. hexagon cell) belonging to a specific class / LUCODE by taking advantage of the majority voting strategy.

The training process involves randomly combining input variables and deriving a permutation of input variables that provides the most instances of accurate match between the known LUCODE and a predicted LUCODE. The software internally uses 2/3rds of the input variables for developing and training the ruleset, and the remaining 1/3rd for testing the classification, using the out-of-bag (OOB) error.

## 6.4 Classification

Each CROME cell is then applied a LUCODE from the Random Forest classification ruleset. A random visual check using 2020 Sentinel-2 images was performed to detect obvious misclassifications. Simple cases of misclassifications (e.g. slightly rough areas of manmade surfaces conflicted with grass, water, urban areas misclassified as trees, and vice versa) are reduced by using the 10m RGBNIR Sentinel-2 mosaic.

## 7 Features Types and Attribution

### 7.1 Attribution

Table 2 shows the attribute for each CROME cell:

Name	Type	Properties	Comments
CROMEID	TEXT	Primary Key	Unique across all supply years
REFDATE	NUMBER	Not Null	The date of the classification was performed.
LUCODE	TEXT	Not Null	The land use code. See Annex A for lookup tables.
SHAPE	GEOMETRY	Not Null	Polygon representing the extent of the classified land use object.
SHAPE_area	FLOAT	Not Null	Area of the hexagon cell in sq. m
SHAPE_length	FLOAT	Not Null	Circumference of the hexagon cell in m
PROB	FLOAT	Not Null	Random Forest derived probability of a hexagon cell belonging to a specific class (majority voting) with a range from 0 to 1

Table 2. Attribute Schema of CROME layer

## 8 CROMEID

The CROMEID is the unique identifier assigned to each cell, consisting of the letters 'RPA' and a twelve-digit number, which are the Easting and Northing coordinates of the centroid of the cell.

## 9 REFDATE

The REFDATE is the date when the classification was performed. The date format used is YYYYMMDD e.g. 20181121. The value is expected to remain constant for each cell in a CROME release.

## 10 LUCODE

The Land Use Code is alphanumeric code of up to 5 characters long and is intended to record land use information. At present, all non-agricultural areas will be assigned a generic non-agricultural land use code. These land use codes are based on the land model used by the RPA as part of the claim purpose. The table in Annex A contains the valid Land Use Code (Column 3) that will be used in the current release of the CROME.

## 11 PROB

Random Forest derived probability of a hexagon cell belonging to a specific class. This probability is derived from the majority voting process used when using the Random Forest classifier i.e. the actual numbers of trees that resulted in the final class/LUCODE compared to the total number of trees.

### 11.1 Data Format and Naming

The dataset is supplied in the ESRI shapefile format, together with a projection file (\*.prj) that defines the coordinate system as British National Grid. The data for a given year shall be supplied either as a single shapefile or as a series of shapefiles that collectively cover all CROME zones.

The dataset format shall be consistent with the specification in Section 5.1, with all fields whose source is marked as shapefile being included in the supplied dataset.

The shapefile name shall be as follows:

CROME\_<YYYYMMDD>\_<ZONECODE>.shp

where:

<YYYYMMDD> is the release date of the dataset

<ZONECODE> is the mnemonic for each ceremonial county data distribution zone covered by the shapefile (see Table 1).

Each shapefile will be accompanied by a metadata xml file in the accordance to the UK GEMINI v 2.2 standard.

**Please note that the final packaged filenames (see Table 1) may be different due to other requirements.**



## 12 Thematic Accuracy

Thematic accuracy is concerned with the degree to which the classification and attribution of features correctly match the real-world features that are being modelled within the dataset.

The quality of CROME land code classification was assessed by comparing the crop/land use types predicted by the Random Forest Classification against the ground truth data collated by the field inspectors from Rural Payments Agency. The comparison is reported in the form of a confusion matrix, with the overall accuracy and Kappa Coefficient presented in Table 3 below. The confusion matrix was measured on the majority of CROME cells within each RPA land parcel. CROME v2020.2 has an overall accuracy of 70.5% and a Kappa coefficient of 0.66.

The Ground Truth data did not provide information on non-agricultural land covers such as woodland, water bodies and general non-agricultural areas (e.g. manmade surfaces) therefore the confusion matrix does not provide accuracy numbers for each land use. Samples for these land uses were collected from other reliable sources e.g. non-Remote Sensing inspections and were only used during the training to minimise confusion with similar classes.

### 12.1 Known Accuracy Challenges

Due to strong correspondence in the physical morphology of Permanent Crops ground truths and other trees, TC01 cells also cover areas of other trees e.g. along parcel boundaries, roads. Due to lack of any definitive morphological definition for fallow land ground truth in general, FA01 cells also cover areas that are mostly bare soil to partially grass. Similarly, due to variability in growth of grass, PG01 cells cover areas that are declared as fallow land by the customers. The seasonality of the suitable Sentinel-2 image used for cleansing can also influence the attribution of otherwise vegetated parcels to NA01 if the usable image was taken when the field had been harvested or still bare soil.

## 13 Dataset Specification

### 13.1 Format

The CROME datasets are in ESRI shapefile format.

### 13.2 Topological Consistency

No topological consistency errors are known to exist with CROME, i.e. each feature is valid according to the OGC specification.

### **13.3 Horizontal Positional Accuracy**

Not applicable

### **13.4 Currency**

The map is to be updated annually, after August to coincide approximately with end of harvesting and cropping season.

### **13.5 Format Consistency**

N/A

### **13.6 Domain Consistency**

N/A

### **13.7 Temporal Consistency**

There are no known temporal consistency issues with CROME.

### **13.8 Temporal Validity**

There are no known temporal validity issues with CROME.

### **13.9 Attribute Completeness**

The version of the dataset has 100% attribute completeness.

### **13.10 Spatial Completeness**

The version of the dataset has 100% spatial completeness, as verified by visual inspection.

### **13.11 Lineage**

Crop types were derived by using Random Forest Classification on Sentinel-1 radar data and refined using surface reflectance images from Sentinel-2 optical data.

### **13.12 CROME Layer Metadata**

A metadata file will be supplied with each product supply. Metadata will conform to ISO 19115 and be UK GEMINI discovery level metadata.

		Ground Truth													
		AC01	AC03	AC16	AC17	AC19	AC20	AC32	AC44	AC63	AC65	AC66	AC67	FA01	LG03
CROME	AC01	227	1		15			6	1	2		9		2	4
	AC03	3	17		2				1			2			
	AC16			8								2			
	AC17	4			41							2		3	4
	AC19	1		1		24					1	2			
	AC20						2								
	AC32	3			3	3		36				21		1	1

	AC44	4				1			30	1		1		1	1
	AC63	1	2		3			1	2	76		5	1	1	
	AC65					2					4	1	1		
	AC66	18			10			3	1	8	2	184	3	3	
	AC67	9			4			1		2	3	6	102		2
	FA01				4									4	2
	LG03	1			3			2				2		5	60
	LG07				2									1	
	LG11											1		1	
	LG14										1				
	LG20	1			5	1				1		4	1		2

	PG01				1									6	
	Total	272	20	9	93	31	2	49	35	90	11	242	108	28	76

Table 3. Confusion Matrix of CROME v 2019.2

Land Cover	LUCODE	Accuracy	
		User	Producer
<b>Barley - Spring</b>	AC01	80%	83%
<b>Beet</b>	AC03	68%	85%
<b>Linseed -Spring</b>	AC16	80%	89%
<b>Maize</b>	AC17	55%	44%
<b>Oats - Spring</b>	AC19	80%	77%
<b>Onions</b>	AC20	100%	100%
<b>Wheat - Spring</b>	AC32	49%	73%
<b>Potato</b>	AC44	75%	86%
<b>Barley - Winter</b>	AC63	72%	84%
<b>Oats - Winter</b>	AC65	36%	36%
<b>Wheat - Winter</b>	AC66	72%	76%
<b>Oilseed - Winter</b>	AC67	78%	94%
<b>Fallow</b>	FA01	24%	14%
<b>Field beans - Spring</b>	LG03	71%	79%
<b>Peas - Spring</b>	LG07	85%	67%

<b>Lucerne</b>	LG11	41%	88%
<b>Clover</b>	LG14	25%	14%
<b>Field beans - Winter</b>	LG20	46%	52%
<b>Permanent grassland</b>	PG01	68%	18%

**Table 4. User and Producer accuracies of land cover.**

## Annex A – Land Cover Codes

Land Cover Description	LUCODE	Land Use Description
Cereal Crops	AC01	Spring Barley
	AC03	Beet
	AC04	Borage
	AC05	Buckwheat
	AC06	Canary Seed
	AC07	Carrot
	AC09	Chicory
	AC10	Daffodil
	AC14	Hemp
	AC15	Lettuce
	AC16	Spring Linseed
	AC17	Maize
	AC18	Millet
	AC19	Spring Oats
	AC20	Onions
	AC22	Parsley
	AC23	Parsnips
	AC24	Spring Rye
	AC26	Spinach
	AC27	Strawberry
	AC30	Spring Triticale
	AC32	Spring Wheat
	AC34	Spring Cabbage
	AC35	Turnip
	AC36	Spring Oilseed



	AC37	Brown Mustard
	AC38	Mustard
	AC41	Radish
	AC44	Potato
	AC45	Tomato
	AC50	Squash
	AC52	Siam Pumpkin
	AC58	Mixed Crop-Group 1
	AC59	Mixed Crop-Group 2
	AC60	Mixed Crop-Group 3
	AC61	Mixed Crop-Group 4
	AC62	Mixed Crop-Group 5
	AC63	Winter Barley
	AC64	Winter Linseed
	AC65	Winter Oats
	AC66	Winter Wheat
	AC67	Winter Oilseed
	AC68	Winter Rye
	AC69	Winter Triticale
	AC70	Winter Cabbage
	AC71	Coriander
	AC72	Corn gromwell
	AC74	Phacelia
	AC81	Poppy
	AC88	Sunflower
	AC90	Gladioli
	AC92	Sorghum

	AC94	Sweet William
	AC100	Italian Ryegrass
	CA02	Cover Crop
Leguminous Crops	LG01	Chickpea
	LG02	Fenugreek
	LG03	Spring Field beans
	LG04	Green Beans
	LG06	Lupins
	LG07	Spring Peas
	LG09	Cowpea
	LG08	Soya
	LG11	Lucerne
	LG13	Sainfoin
	LG14	Clover
	LG15	Mixed Crops–Group 1 Leguminous
	LG16	Mixed Crops–Group 2 Leguminous
	LG20	Winter Field beans
	LG21	Winter Peas
Energy Crop	SR01	Short Rotation Coppice
Grassland	FA01	Fallow Land
	HE02	Heathland and Bracken
	PG01	Grass
Non–Agricultural Land	NA01	Non-vegetated or sparsely vegetated Land
Water	WA00	Water
Trees	TC01	Perennial Crops and Isolated Trees
	NU01	Nursery Crops
	WO12	Trees and Scrubs, short Woody plants, hedgerows

Unknown Vegetation Or Mixed Vegetation	AC00	Unknown or Mixed Vegetation
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Note that the variety of land cover codes may change during releases of CROME due to variability in ground truth however the LUCODE will remain same.

## Acknowledgements

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- ESA's Scihub and Alaska Satellite Facility for download access to the Sentinel-1 Data;
- Guido Lemoine (Joint Research Centre, Italy) and Andrea Minchella (previously at Satellite Applications Catapult, UK) for pointers on how to batch process large number of Sentinel-1 images.
- SNAP Discussion forum members on very helpful tips on improving the performance of batch processing and issues surround Sentinel-1 radar data.
- Asger Petersen and Gregers Petersen (Septima.dk, Denmark) for advice on how to use GDAL and parallel processing of large amount of geospatial data.

# Annex 4 - Order Form

<b>1. Contract Reference</b>	ecm_63428
<b>2. Date</b>	10/01/2022 – 09/04/2022
<b>3. Authority</b>	GOV Rural Payments Agency UK
<b>4. Supplier</b>	Planet Labs Germany GmbH
<b>5. The Contract</b>	<p>The Supplier shall supply the Deliverables described in Contract documents [REDACTED]</p> <p>Unless the context otherwise requires, capitalised expressions used in this Order Form have the same meanings as in Conditions.</p>
<b>6. Specification</b>	The specification of the Deliverables is as set out in Annex 3.

<b>7. Term</b>	<p>The Term shall commence on</p> <p>10/01/2022 (the <b>Start Date</b>)</p> <p>and the Expiry Date shall be</p> <p>09/04/2022, unless it is otherwise extended or terminated in accordance with the terms and conditions of the Contract.</p>
<b>8. Charges</b>	<p>The Charges for the Deliverables shall be as set out in Annex 2.</p>
<b>9. Payment</b>	<p>The Authority's preference is for all invoices to be sent electronically, quoting a valid Purchase Order Number (PO Number), to:</p> <p><a href="mailto:RPACIOD.servicemanagement@rpa.gov.uk">RPACIOD.servicemanagement@rpa.gov.uk</a></p> <p>Alternatively, you may post to:</p> <p>Shared Services Connected Ltd</p> <p>DEF Procure to Pay</p> <p>PO Box 790</p> <p>Newport</p> <p>Gwent</p> <p>NP10 8FZ</p> <p>Within <b>10</b> Working Days of receipt of your countersigned copy of this Order Form, we will send you a unique PO Number. You must be in receipt of a valid PO Number before submitting an invoice.</p> <p>To avoid delay in payment it is important that the invoice is compliant with Annex 2. Non-compliant invoices will be sent back to you, which may lead to a delay in payment.</p> <p>If you have a query regarding an outstanding payment please contact the Authority's Authorised Representative(s).</p>

<b>10. Authority Authorised Representative(s)</b>	<p>For general liaison your contact will continue to be</p> <p>[Redacted]</p> <p>or, in their absence,</p> <p>[Redacted]</p>	
<b>Signed for and on behalf of the Supplier</b>	<b>Signed for and on behalf of the Authority</b>	
[Redacted]		
[Redacted]		

