Cost Proposal for Tender Reference: Bravo Project 36416

Use of biomolecular technology in DUS testing (RDE Framework)

2.0 Proposal

2.1 The following document is to be used as a Call-Off template to be sent to all Contractors on a sub-lot for completion and return in accordance with the Call-Off procedures detailed in the Form of Agreement.

Research, Development and Evidence Framework 2 **PROPOSAL**
To be completed by the Contractor
Contractor's Name: NIAB **Call off Reference: Defra RDE Framework** **Sub-Lot Number: 8.2** **Date: 14 February 2023**
Note: Your proposal must not exceed 6 sides of A4 plus the Costs Proposal in Section 4 (unless otherwise indicated in project client's specification above). Attachments must not be included unless requested except for a programme diagram and full cost schedule if you consider these would support your proposal. Do not make or append Caveats and Assumptions in your proposal – any points of uncertainty must be raised as a clarification point prior to submitting the proposal. Where assumptions are to be made, these will be stated by the Authority's Project Manager.
1. Approach & Methodology
1.1 Brief project description. Awarding of Plant Breeders' Rights is underpinned by UPOV guidelines including Distinctness, Uniformity and Stability (DUS) testing. For spring barley, UK candidate varieties are assessed over 2-3 years using a suite of 29 DUS 'characteristics' (phenotypic traits) by NIAB. Key to this process, barley candidate varieties must be shown to be Distinct (D) from all varieties in the Reference Collection (RC). The use of molecular markers provides opportunities to streamline the DUS process - predominantly by shortening

maximum assessment timelines from 3 years to 2 years via marker-informed selection of appropriate RC subsets for growth and assessment alongside candidates in year-1. Recent research shows that for barley, the number of genetic markers available in the current state-of-the-art 50,000 feature genotyping array is not the limiting factor towards this goal - indeed marker numbers are an order of magnitude higher than required. Thus, rather than additional capacity to identify and genotype molecular markers via application of ever more sequencing efforts, efficient implementation of molecular marker approaches within DUS requires optimization of analysis methodologies to best exploit the huge genotyping capacities that current, and reasonably affordable, array-based technologies afford. In this project, we will use the barley 50,000 feature array to genotype ~70% of the barley 'Technical Reference Collection' (the subset in common active use) and create a database to store this alongside existing DUS trait data and associated meta-data. Using this powerful data-matrix, we will apply combinations of new analysis techniques to optimise molecularmarker based selection of appropriate RC subsets soon after receipt of Candidate variety seed. These approaches include (1) use of 'haplotypes' generated from combined genotype scores from 2 or more markers at a time, (2) use of machine learning genomic prediction approaches, and (3) differential weighting of marker data across these methods (based on how diagnostic they are for known genetic loci controlling DUS traits. The ability to use markers to select and grow appropriate RC subsets alongside candidates in year-1 trials should allow DUS timelines to be reduced to a maximum of 2 years. Further, we will optimise selection of smaller subsets of ~100 molecular markers that, based on marker data from the RC, will robustly allow barley variety identification. Such marker sets will provide 'molecular fingerprints' to complement DUS trait-based descriptions, and for cross validation of DUS and VCU (Value for Cultivation and Use) seed samples within the UK National Listing system.

1.2 Methodology

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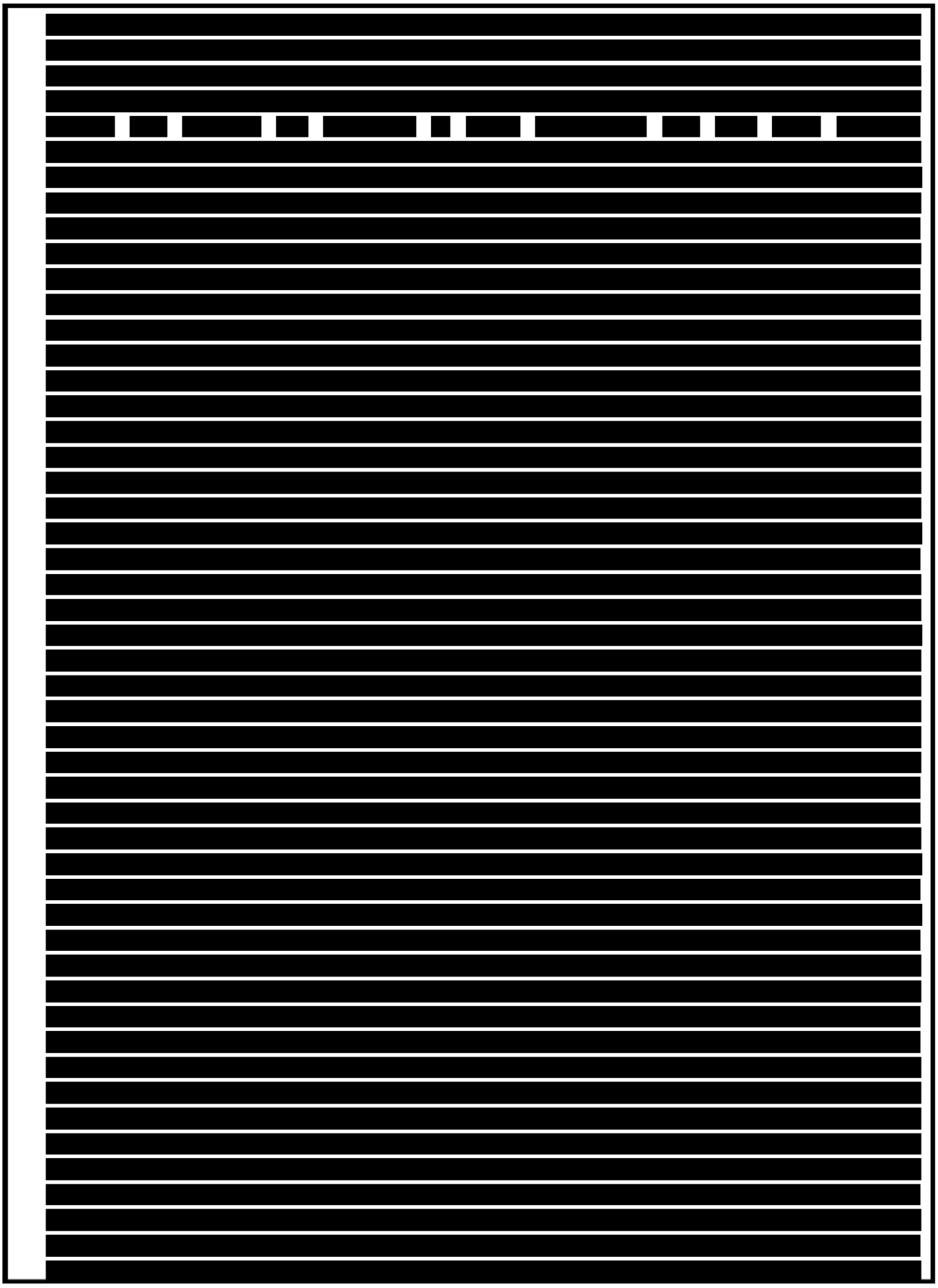

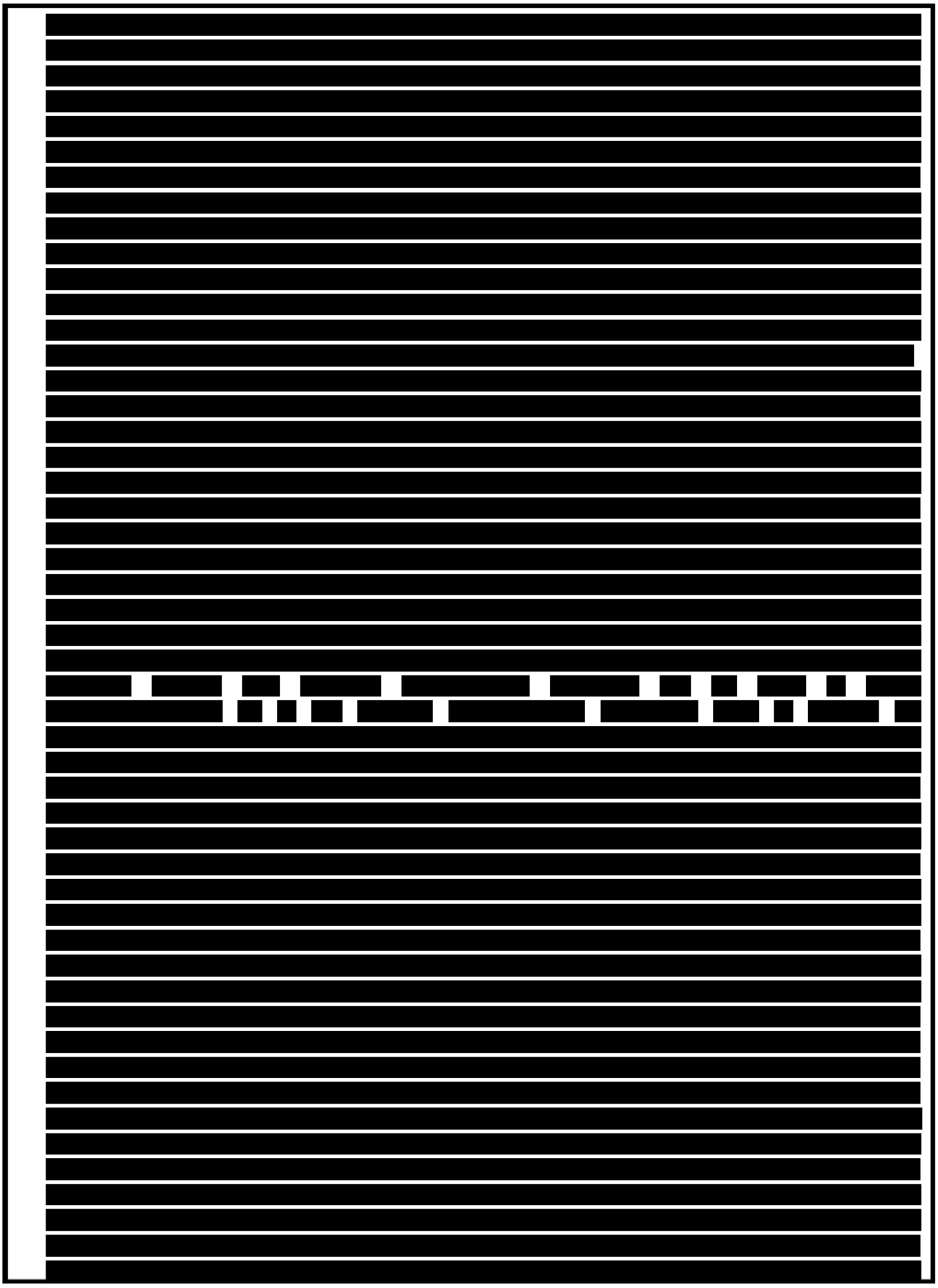

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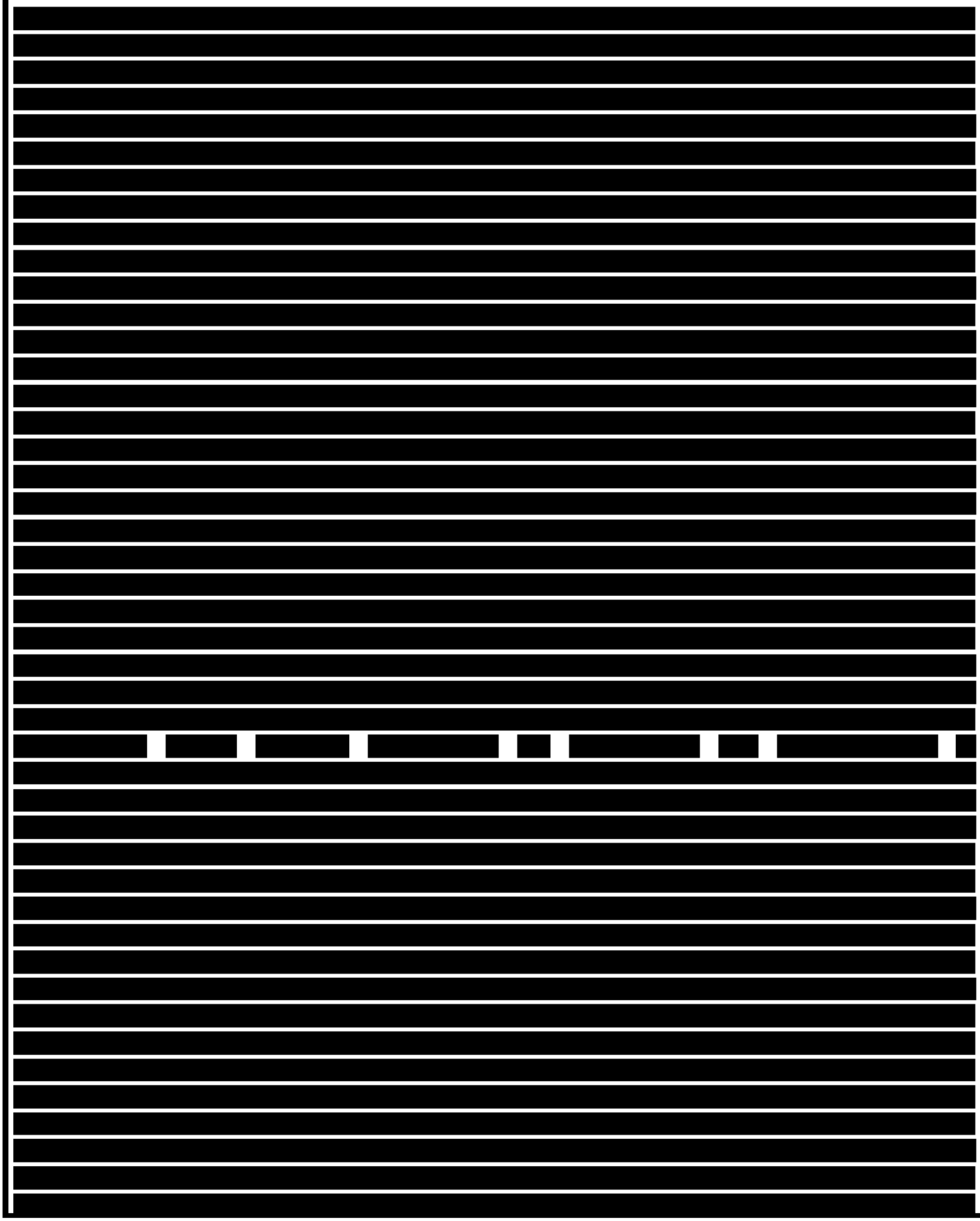
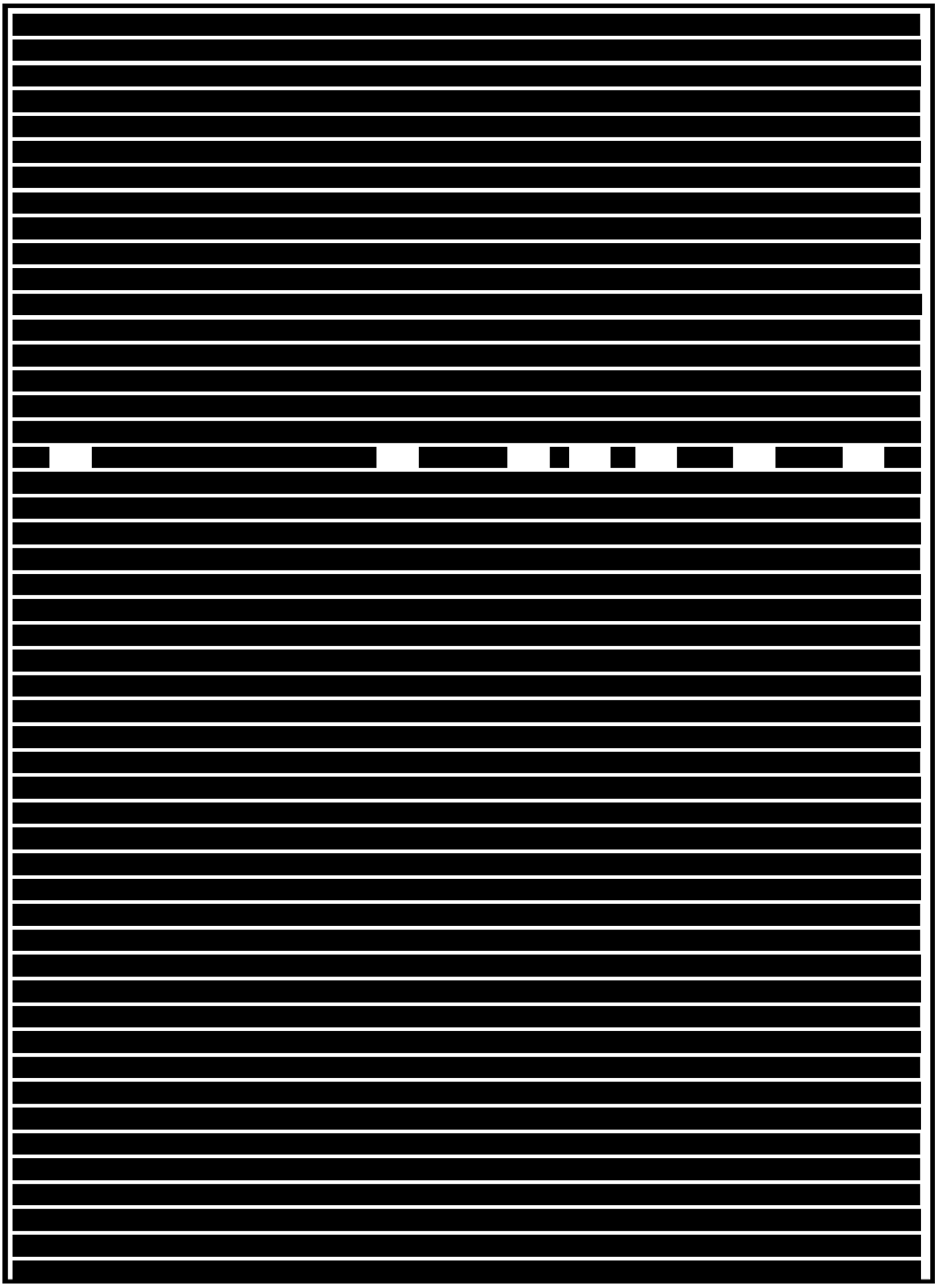
2. Proposed Staff who will do the work and briefly state previous relevant qualification/experience. Contractors experience of undertaking similar projects and accreditations (if requested).





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3. Project Management (inc Project plan). A project plan may be provided as an attachment with your reply (delete if not required)

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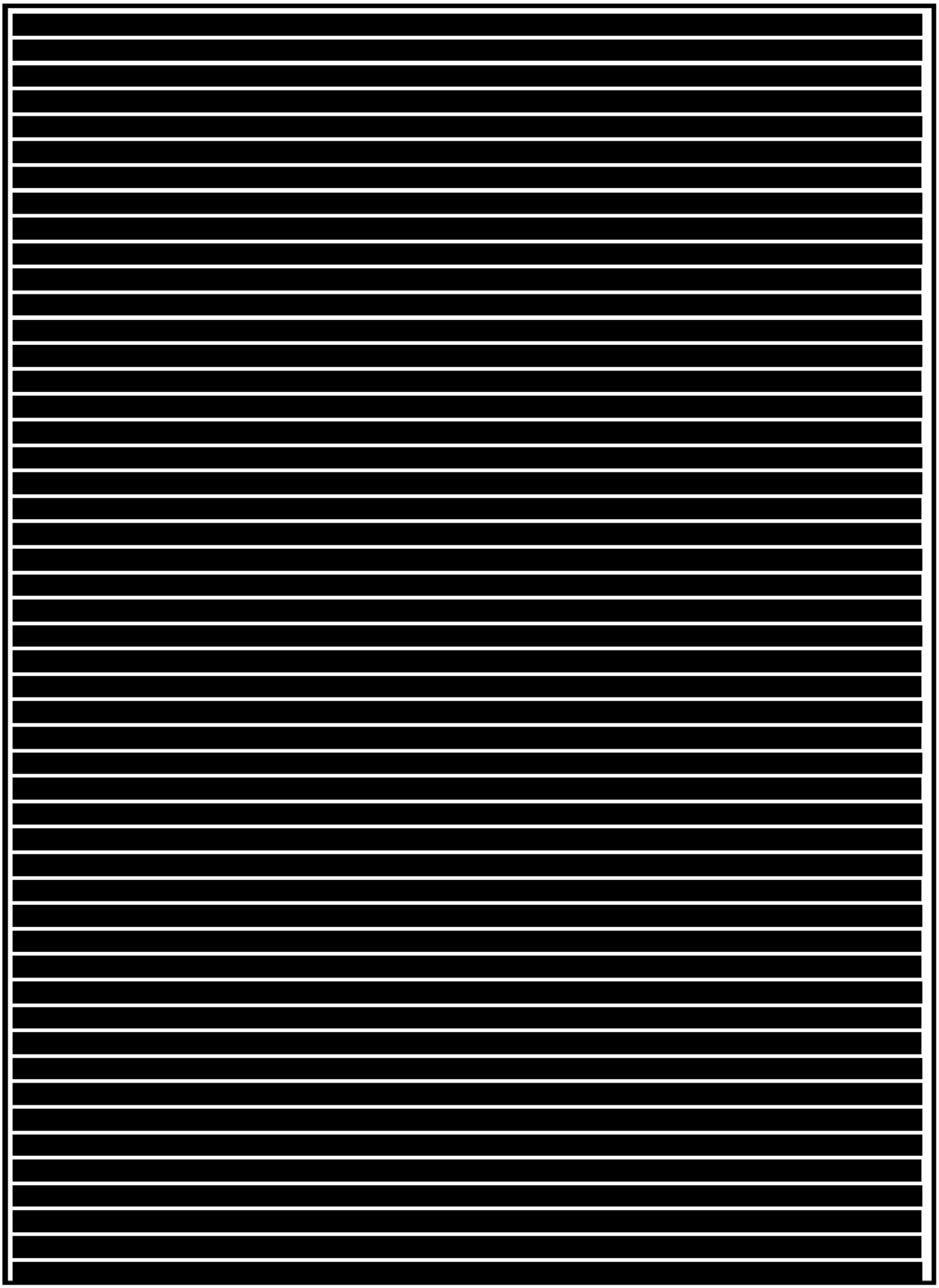

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Work Packages, Milestones (M) and Deliverables (D)		Target Date
	Description	
WP1	Database design and data curation	
M1.1	DUS data curation	28-Feb-23
M1.2	Database structure finalised	31-Mar-23
D1	DUS trait-genotype database structure	31 March 2023
WP2	Additional 50k marker array genotyping	
M2.1	DNA extracted from 500 varieties	31-Mar-23
M2.2	50k molecular marker array genotyping	31-May-23
D2	Spring barley DUS trait-genotyping data matrix	31 May 2023
WP3	Optimising methods for molecular marker-based discrimination of barley lines	
M3.1	Baseline marker vs trait correlations established	31-Aug-23
M3.2	Haplotype-based marker vs trait correlations	31-Dec-23
M3.3	Machine Learning-based marker vs trait correlations	
M3.3a	Phase 1: Development and initial testing	31-Mar-24
M3.3b	Phase 2: Validation and refinement	31-May-24
M3.4	Implementation of diagnostic marker weighting	31-Aug-24
M3.5	Accuracy of best method vs real DUS testing decisions	30-Sep-24
D3	Optimised marker + methodology for Reference Collection subsets	30 September 2024
WP4	Development of smaller molecular marker subsets for the molecular profiling	
M4.1	Subset of 100 'molecular profiling' markers determined	31-Aug-23
M4.2	Validation of KASP assays for the 100 markers in M4.1	31-Mar-24
D4	Validated 'molecular profiling' molecular markers	31 March 2024
WP5	Recommendations for implementation	
D5	Recommendations for implementation in DUS	31 December 2024
	Final Reporting	
	Draft Final Report preparation and submission	
	Presentation of results and receipt of comments	
	Final Report preparation and submission	31 January 2025

KPI1: Milestones and Deliverables completed by target date (90%) to ensure the project is effectively delivered in a timely and financially sound manner with appropriate flexibility and responsiveness

KPI2: communication with DEFRA:

- monthly written reports provided on time (date to be agreed once project start date is decided)
- periodic reports shared with DEFRA five working days before NIAB internal project meetings
- quarterly progress meetings with DEFRA, APHA and NIAB (date to be agreed once project start date is decided)

KPI3: Accurate and timely invoicing according to the agreed payment schedule. Payments to be released on completion of Milestones and Deliverables

KPI4: Sub-contractor reviewed prior to commissioning to ensure quality of work and value for money. DEFRA to see the report on subcontractor no less than four weeks prior to the commission of the work.

KPI5: Three working day response time to queries received from DEFRA Project Officer.

KPI6: NIAB to consult with DEFRA prior to any engagement with current major research project cohorts and to give DEFRA three working days' notice before engagement with other projects. Evidence of interactions with other relevant projects e.g. INVITE, INNOVAR, included in monthly written reports and discussions.

KPI7: Draft Final Report submitted 10 working days before presentation of results

KPI8: Final Report submitted by 31st January 2025

4. Risk

Note: *This section is to be used to detail any risks relevant to the project i.e. Programme deliverable dates, data, consultees etc.*

Additional information supplied by NIAB regarding Risk Register

The risk register will be loaded on NIAB SharePoint, and access granted to Defra and APHA PVS teams.

NIAB would inform Defra and APHA of any emerging risks and issues as soon as possible in a manner most appropriate to the circumstance, likely to be in writing via email, but could be by telephone or by arranging a meeting of all relevant people. The risk register would be updated and reviewed regularly to include the new item and any mitigations. The risk or issue would be included in the regular reporting structure and also in NIAB's quality assurance system (QAS). The QAS documents the issue and any actions taken. The entry could be made available to Defra and APHA as required. This is in keeping with our Technical Services contract with Defra and APHA.

5. Sustainability (only complete if requested in defined evaluation criteria)

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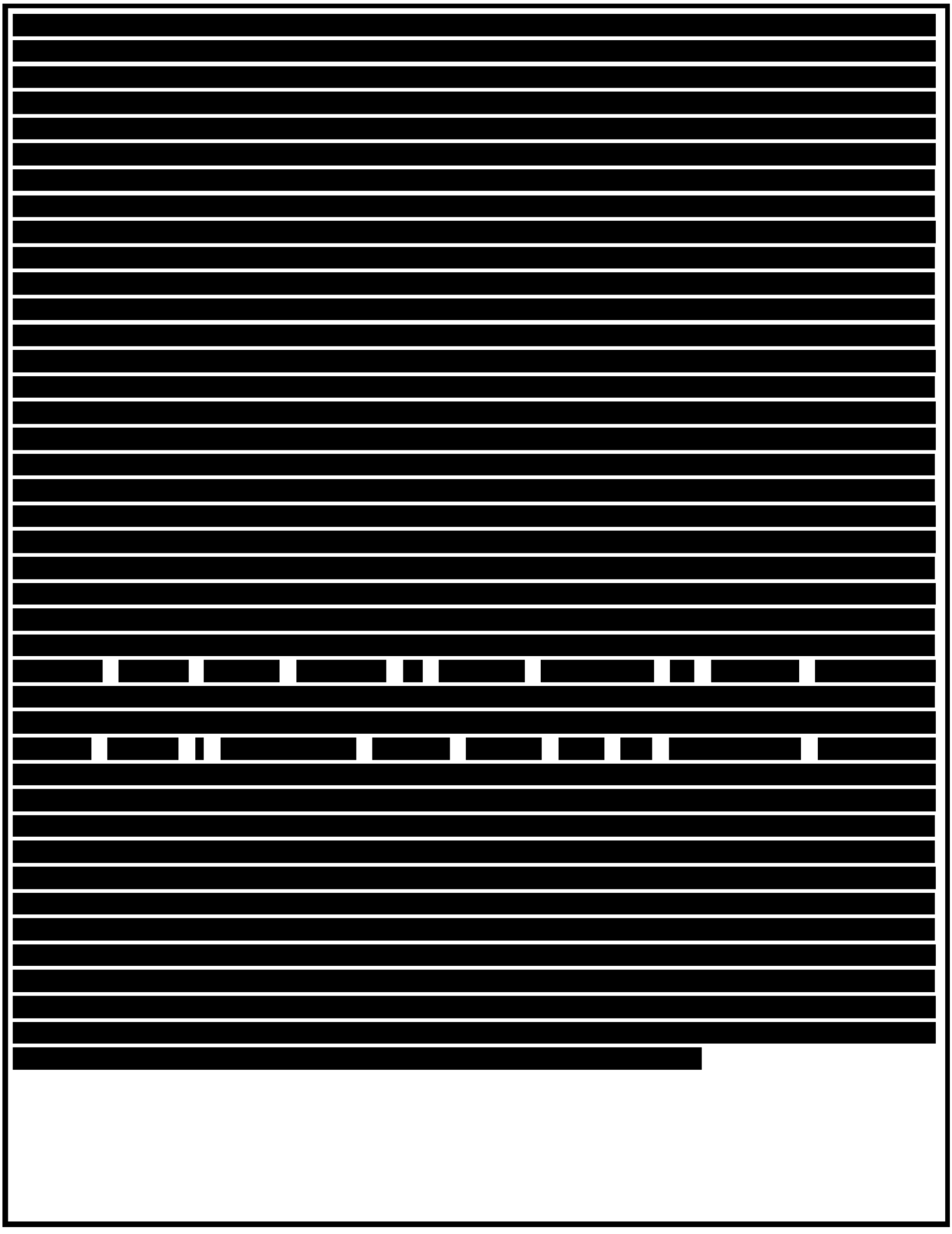

Gantt Chart

Work Packages, milestones (M) and Deliverables (D)		2023												2024												2025
	Description	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
WP1	Database design and data curation																									
M1.1	DUS data curation		M1.1																							
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	Draft report preparation and submission																									
	Presentation of results and receipt of comments																									
	Final report prepartaion and submission																									

Revised Cost Proposal

The original submission included a wide skill set across the facets of the proposed work. Each member of the consortium was included to contribute their specific expertise. The "consultants" (as termed by the framework guidelines) will either directly deliver on the project or significantly contribute expertise towards the direction of the work.

With that in mind, we reviewed the staff inputs and have been able to reduce the overall number of staff days by 6%, and have reduced the number of staff involved by one. The revised costings reflect these changes: £196,616 (£11,305 lower than our original costing).

The updated spreadsheet below now also includes details of the spread of our revised costs over the financial years, assuming the project starts

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3.0 Order Form

3.1 The following document is to be completed by the Contracting Authority and sent to the Contractor for counter signature to form a Call-Off contract.

Research, Development and Evidence Framework 2 **ORDER FORM**
To be completed by Contracting Authority Project Manager and sent to Contractor for countersignature
Project title: Use of biomolecular technology in DUS testing (RDE Framework) **Call off Reference: P-31057** **Atamis project ref (if applicable): P-31057** **Date: 14 February 2023**

THE Contracting Authority: Defra Group Commercial (DGC),
APHA Weybridge
Woodham Lane
Addlestone
Surrey KT15 3NB

THE CONTRACTOR: NIAB
93 Lawrence Weaver Road
Cambridge
Cambs
CB3 0LE

This Order Form, when completed and executed by both Parties, forms a Call-Off Contract. A Call-Off Contract can be completed and executed using an equivalent document or electronic purchase order system.

APPLICABLE FRAMEWORK CONTRACT

This Order Form is for the provision of the Call-Off Deliverables and dated [Insert date of issue]. It's issued under the Research Development & Evidence Framework Agreement reference 30210 for the provision of [Insert name of project].

CALL-OFF SUB-LOT: Defra RDE Framework, sub-lot 8.1

CALL-OFF INCORPORATED TERMS The following documents are incorporated into this Call-Off Contract. Where numbers are missing we are not using those schedules. If the documents conflict, the following order of precedence applies:

1. Defra Framework Terms and Conditions;
2. Request for Proposal;
3. Proposal;

No other Supplier terms are part of the Call-Off Contract. That includes any terms written on the back of, added to this Order Form, or presented at the time of delivery.

CALL-OFF START DATE: 13/02/2023

CALL-OFF EXPIRY DATE:12/02/2025

CALL-OFF INITIAL PERIOD: 2 Years

For and on behalf of the Supplier:

For and on behalf of the Authority: