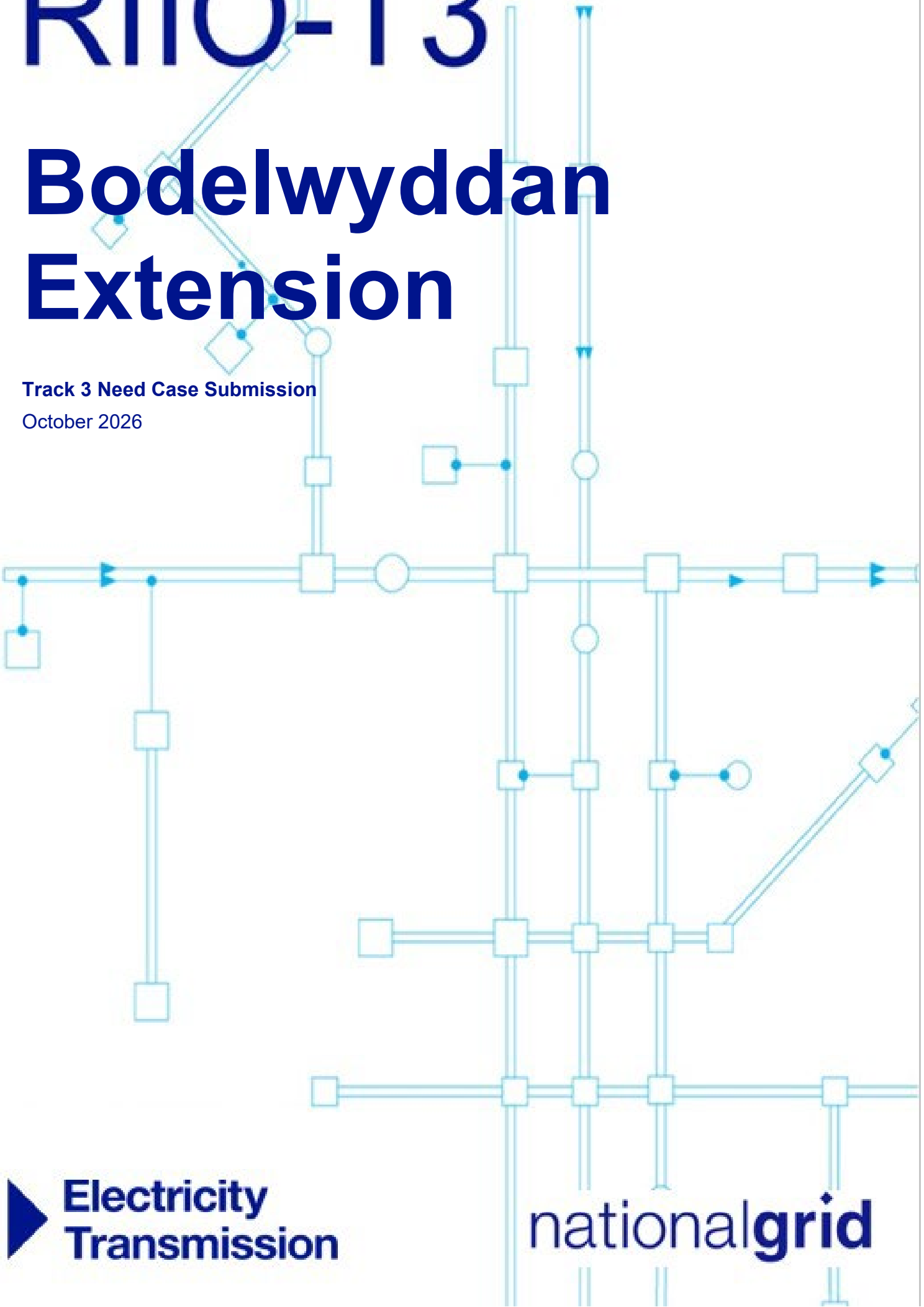
RIIO-T3

Bodelwyddan Extension

Track 3 Need Case Submission

October 2026



Electricity Transmission

nationalgrid

Contents

Reference and summary table v

Executive summary viii

1. Introduction 1

1.1 Bodelwyddan Extension 1

Project Track Statement and PASE 1

1.2 Background 1

Chronology of investment 1

Regional and network context 4

Site background 6

Historical funding 8

Early Asset Write Offs (EAWO) 8

2. Drivers and need Case 9

2.1 Customer 9

Customer information and confidence 10

Strategic significance of the connections 10

Counterfactual implications 11

2.2 Asset health 11

3. Optioneering 12

3.1 Strategic options 12

3.2 Siting 13

3.3 Longlist of options considered 13

Shortlisting rationale and influence of stakeholder considerations 20

3.4 Shortlisted options 20

Description of short-list options considered 21

3.5 Qualitative assessment of shortlisted options 28

Qualitative assessment output 32

PASE alignment 33

3.6 Quantitative assessment of shortlisted options 33

Cost estimates of shortlisted options 33

Cost Benefit Analysis (CBA) 34

3.7 Preferred solution 38

Project benefits and outputs 38

Futureproofing 39

4. Delivery 41

4.1 Delivery year and indicative timeline 41

4.2 Procurement and contracting strategy 42

4.3 Risks and risk management 42

5. Conclusion 45

Appendix A Glossary A1

Appendix B System design table B1

Appendix C Images of longlist options C1

Appendix D Customer information D1

Appendix E Land ownership maps E1

Appendix F Siting F1

Appendix G Site constraint maps G1

List of Figures

Figure 1: Chronology of project development 3
Figure 2: NGET network map highlighting the location of the investment in Wales 4
Figure 3: Future Network Picasso diagram highlighting the location of the investment in North Wales 5
Figure 4: Bodelwyddan 400kV Substation Arrangement 7
Figure 5: Overview of site constraints 8
Figure 6: Possible layout of Option E-1 based on a similar scheme (new AIS substation at Bodelwyddan) 21
Figure 7: Existing OHL arrangement 23
Figure 8: OHL arrangement for Option D-6 23
Figure 9: SLD for Option D-6, including existing assets 24
Figure 10: Layout for Option D-6 24
Figure 11: Gas pipe diversion 25
Figure 12: SLD for Option D-7 (image 1) 26
Figure 13: SLD for Option D-7 (image 2) 27
Figure 14: Layout for Option D-7 27
Figure 15: Indicative programme of work for Bodelwyddan Extension 41
Figure 16: Layout of existing Bodelwyddan 400kV substation C2
Figure 17: OHL arrangement for Option D-2 C3
Figure 18: Layout for Option D-2 C4
Figure 19: SLD for Option D-2 C5
Figure 20: OHL arrangement for Option D-3 C6
Figure 21: Layout for Option D-3 C7
Figure 22: SLD for Option D-3 C8
Figure 23: Layout for Option D-4 C9
Figure 24: SLD for Option D-4 C10

Figure 25: Layout of Option D-5 (new detached GIS substation to the west) C11
Figure 26: OHL arrangement for Option D-6 C12
Figure 27: Layout for Option D-6 C13
Figure 28: SLD for Option D-6 (image 1) C14
Figure 29: SLD for Option D-6 (image 2) C15
Figure 30: Layout for Option D-7 C16
Figure 31: SLD for Option D-7 (image 1) C17
Figure 32: SLD for Option D-7 (image 2) C18
Figure 33: Layout of Option E-1 (new AIS substation at Bodelwyddan) C19
Figure 34: Detailed land ownership map of the investment area E2
Figure 35: Land ownership map immediately surrounding Bodelwyddan substation E3



Figure 42: BP Mona planned substation in proximity to Bodelwyddan substation G4

List of tables

Table 1: Summary of options ix
Table 2: Total costs including 13.8% contingency (2023/24 prices) xi
Table 3: Investment drivers 9
Table 4: Details of customers with contracted connections 10
Table 5: Strategic direction setting 12
Table 6: Assessment of longlist options 14
Table 7: Multifactorial analysis 28
Table 8: Cost estimate breakdown (£m, 23/24 prices) 33
Table 9: Lifetime CBA (2023/2024 base prices, central carbon pricing, discounted values) 36
Table 10: Summary of all additional Capex costs (2023/2024 base prices) 37
Table 11: Summary of all benefits 37
Table 12: Summary of risks and mitigations 43
Table 13: Submission summary 45
Table 14: Table of abbreviations and definitions A1
Table 15: System Design Table B1

Reference and summary table

Field	Description
Project name	Bodelwyddan Extension
TO's preferred re-opener track	Track 3 Needs Case
RRP References	[redacted]
BPDT / Scheme Reference Number	[redacted]
Load Board Reference	[redacted]
Investment driver(s)	Generation connections, two of which are CP2030-critical OSW customers: [redacted] The project also delivers PT2030-CW1 by connecting the existing circuit between Connah's Quay and Pentir directly into Bodelwyddan.
Project outputs	[redacted] • 2.6GW of additional OSW [redacted] • Conversion of existing tee'd OHL to a full double turn in arrangement at Bodelwyddan Substation, delivering four new 400 kV circuits: • Bodelwyddan–Pentir 1 & 2 • Bodelwyddan–Connah's Quay 1 & 2 [redacted] • Diversion of Wales & West high-pressure gas main to release construction footprint

Field	Description
	• Operational Tripping Scheme (OTS) enabling secured connection of new generation
Short list of strategic options considered	Option E-1: Offline Built AIS (Hybrid) Extension + double turn-in • [redacted] • New Double turn-in of 4ZB circuits [redacted] Option D-6: Offline Built SF6-free GIS Hall adjacent to existing site + double turn-in [redacted] • Reconfiguration of the existing tee'd OHL arrangement to a double turn-in [redacted] Option D-7: Offline Built SF6-free GIS Hall + [redacted] Bay Extension of existing GIS Hall + double turn-in • Stage 1: Extension of existing GIS Hall to accommodate a [redacted] Connection Bay • [redacted] • Reconfiguration of the existing tee'd OHL arrangement to a double turn-in [redacted]
Preferred solution and explanatory narrative on the rationale	The preferred solution is a westward SF6-free GIS Substation Extension with 400 kV Double Turn In (Option D-6). The preferred option has been selected due to the demand for connections in the area. The majority of the build is offline, and the new GIS hall will allow flexibility for future connections. The option also delivers PT2030-CW1, providing operational benefits to the network in North Wales.
PASE alignment	The PASE-primary option (Option E-1) is not our preferred solution because an AIS substation requires approximately five times the land area of a GIS site, which would create significant conflicts with other planned developments in the area.

Field	Description
	Pursuing an AIS solution would result in programme risk and increased cost to consumers, including delayed CP2030 outputs. Our preferred option (D-6) is PASE-variant option (an SF6-free extension to a double bus bar substation).
Cost (23/24 prices)	The upfront capital cost estimate (23/24 prices) for the investment is: • **Substation:** [redacted] • **OHL:** [redacted] • **Cables:** [redacted] • [redacted] • **Risk ( ):** [redacted] • **Total:** [redacted]
Delivery year	[redacted]
Applicable reporting tables	BPDT 10.5 ET Pipeline log
Interactive projects	Please note the following interactive projects, which can be identified by Ofgem Scheme References (OSRs) NGT400057 and NGT500471 in the T3 BPDT, with information set out in the T3 EJP submission entitled "Major Project EJP Bodelwyddan - Deeside - Pentir OHL: • 101006 – 4ZB reconductoring Bodelwyddan to Connahs Quay • 101987 – 4ZB reconductoring Bodelwyddan to Pentir
Historical funding interaction	No historical funding relating to these customer drivers. There are no early asset write-offs (EAWOs) associated with this project.
Spend apportionment	**T2 (FY 2022- 2026)**: [redacted] **T3 (FY 2027 – FY 2031)**: [redacted] **T4+ (FY 2032 – FY 2037+):** [redacted]

Executive summary

Project Summary

The investment will reinforce the North Wales network by extending Bodelwyddan substation and delivering a new SF6-free GIS hall and double turn-in of the existing tee'd 4ZB circuits, enabling the connection of [redacted]

Submission purpose

This Needs Case and associated CBA are submitted as part of the RIIO-ET3 Load Reopener (LR) mechanism under Special Condition 3.18 (Load Re-opener and Price Control Deliverable).

This submission seeks approval of the needs case, optioneering assessment and our preferred solution to deliver the Bodelwyddan Extension project.

The project's eligibility for the Load Re-opener and associated Pre-Construction Funding was addressed through the Eligibility Letter process and is not a determination sought through this Needs Case submission.

Project need

The investment is required to meet the needs of [redacted] at Bodelwyddan substation:

[redacted]

This investment enables CP2030-critica [redacted]

[redacted] For this reason, the timely delivery of their connections has been considered essential in our optioneering.

All assets at the existing Bodelwyddan substation are assessed at present to have a low risk, meaning there is no asset health driver.

Optioneering to date

We undertook a structured, multi-factor optioneering process to identify a proportionate and deliverable solution in the interests of consumers. NESO's own CION and HND optioneering, conducted 2018-21, identified Bodelwyddan as [redacted] also included the existing location within their DCO boundaries, which has been approved. Therefore, the use of the existing Bodelwyddan site was determined to be the preferred approach from a cost and technical perspective.

For the 13 longlisted options that we considered for delivering against the drivers, we undertook a high-level assessment against the balanced scorecard criteria. From these, we shortlisted three options (see summary in Table 1).

Table 1: Summary of options

Option	Details	Drivers met?	New site?	AIS/ GIS?	Short List?	Preferred solution?
A	Do nothing counterfactual option	No	No	NA	No	No
B	Market-based solution	No	No	NA	No	No
C	Non-transmission, whole systems solutions (DNO)	No	No	NA	No	No
D-1	Extension of Bodelwyddan substation to the west, retaining the existing circuit arrangement	No	No	GIS	No	No
D-2	New GIS extension to west and reconfiguration of the existing 4ZB connection	No	No	GIS	No	No
D-3	New GIS extension to the west and 3 new OHL circuits	No	No	GIS	No	No
D-4	New GIS extension to the west and 2 new OHL circuits	No	No	GIS	No	No
D-5	New detached GIS substation to the west	No	No	GIS	No	No
D-6	Offline SF6-free GIS hall adjacent to site	Yes	No	GIS	Yes	Yes

Option	Details	Drivers met?	New site?	AIS/ GIS?	Short List?	Preferred solution?
D-7	Offline SF6-free GIS hall and [redacted]-bay extension of existing GIS hall	Yes	No	GIS	Yes	No
D-8	Offline SF6-free GIS substation and repurposing of feeder bay	No	No	GIS	No	No
E-1	New AIS substation at Bodelwyddan	Yes	No	AIS	Yes	No
E-2	New remote AIS substation near Bodelwyddan	Yes	Yes	AIS	No	No

Based on a qualitative assessment of the shortlisted options against the balanced scorecard criteria, Option D-6 is the preferred option because:

- The alternative GIS Option D-7 extends the existing SF6 GIS hall, leading to an increased risk of SF6 emissions. Preferred Option D-6 avoids building new SF6 equipment.
- AIS Option E-1 would require approximately five times the land area of a GIS site, which would create significant conflicts with other planned developments in the area [redacted]
- AIS Option E-1 is associated with substantial cost and programme risk. The earliest achievable date for first site access (FSA) for that option is estimated to be 2035. Consequently, this option would not support CP2030 targets.

Cost estimates

To assess the shortlisted options, cost estimates have been created for quantitative economic comparison (see Table 2). [redacted]

Table 2: [redacted] (2023/24 prices)

Option	Total Costs (£m)
E-1: New AIS Substation at Bodelwyddan + Double Turn In	[redacted]
D-6: Offline Built SF6-free GIS Hall Adjacent to Existing Site + Double Turn In	[redacted]
D-7: [redacted] Bay Extension of Existing GIS + Offline Built SF6-free GIS Hall Adjacent to Existing Site + Double Turn In	[redacted]

Indicative delivery programme

The target completion / energisation year is 2029–2030, which is [redacted] This factors in:

- Outage availability on the Pentir–Connah's Quay corridor
- Long-lead procurement for GIS, GIB, and OHL steelwork (24–36 months)
- Critical early milestone: Wales & West gas main diversion (must complete before main civils)
- Programme sequencing validated through FEED and PWS

1. Introduction

1.1 Bodelwyddan Extension

This Needs Case and associated CBA are submitted as part of the RIIO-ET3 Load Reopener (LR) mechanism under Special Condition 3.18 (Load Re-opener and Price Control Deliverable).

This submission seeks approval of the investment need, the optioneering undertaken and our choice of preferred solution to meet the project drivers.

Subject to Ofgem approval of the needs case and our preferred option, we will continue development and intend to submit a Project Assessment in line with the Load Re-Opener process.

Project Track Statement and PASE

We believe the project should progress through the Load Related Re-Opener because the investment is required to facilitate customer connections and the requirement did not form part of the baseline portfolio for RIIO-T3 Final Determination.

Our original proposal was for Track 2 allocation. However, in Draft Determination's for the investments submitted within the May 2026 Load Re-Opener window, Ofgem decided this project should fall within Track 3.

Within the PASE framework, the investment is a variant option (an SF6-free extension to a double bus bar substation). The track proposal has been discussed with Ofgem.

1.2 Background

Chronology of investment

[redacted]

Initial connection offers were issued [redacted] ESO undertook detailed optioneering to determine the most appropriate location through the Connection and Infrastructure Options Note (CION) process. Through this structured qualitative and

[1] Please refer to Section 3 for information on the Gate 1 and 2 status for each customer.

quantitative assessment, NESO identified Bodelwyddan Substation as the optimal and [redacted]

[redacted] further [redacted]

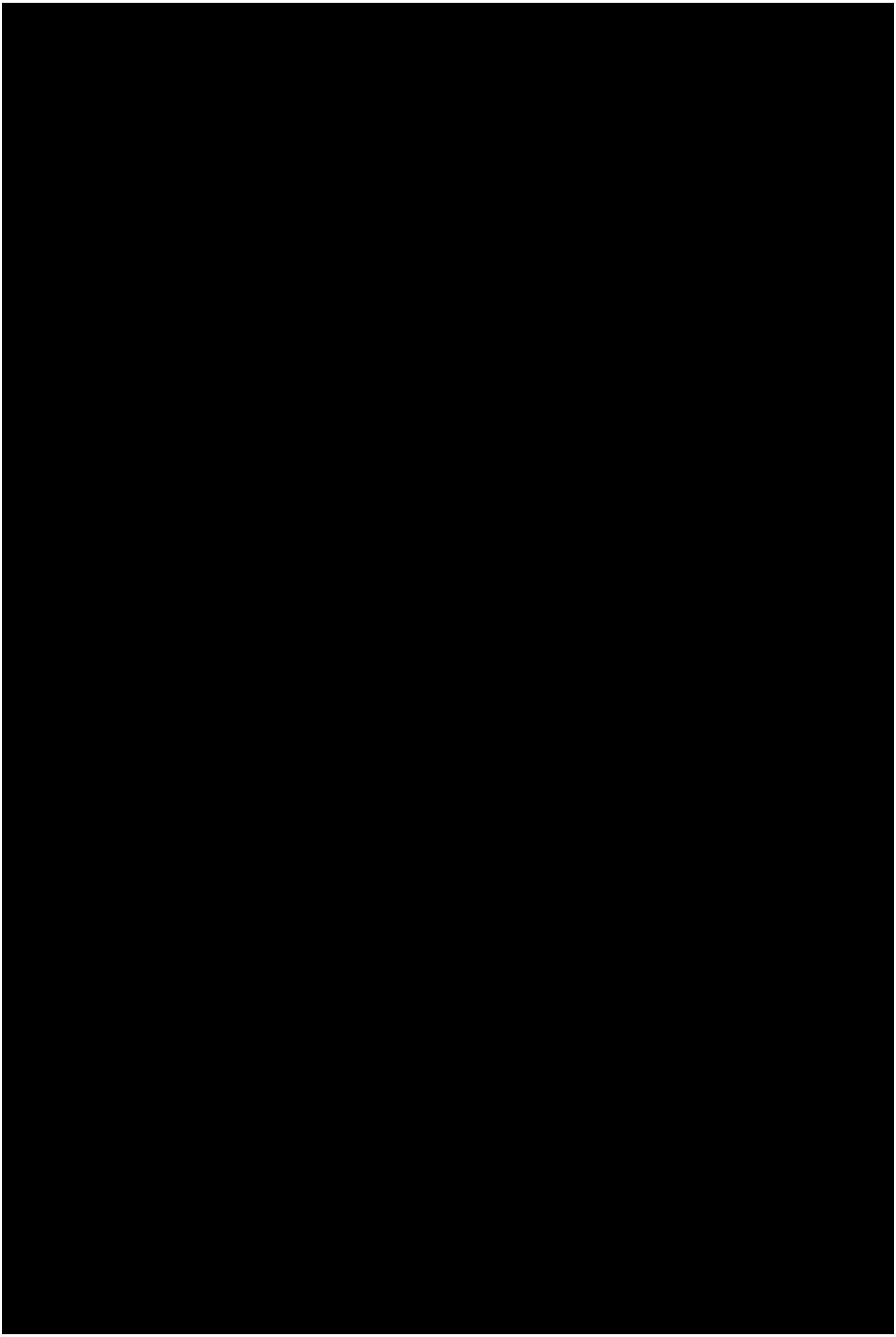
Environmental and ecological [redacted]
was held [redacted]
the surrounding areas.

It was identified in early design there would be a requirement to divert a high-pressure gas main, should the current site be extended to the west. Feasibility works for the gas main diversion [redacted] ngaged throughou [redacted]

[redacted]

[redacted]

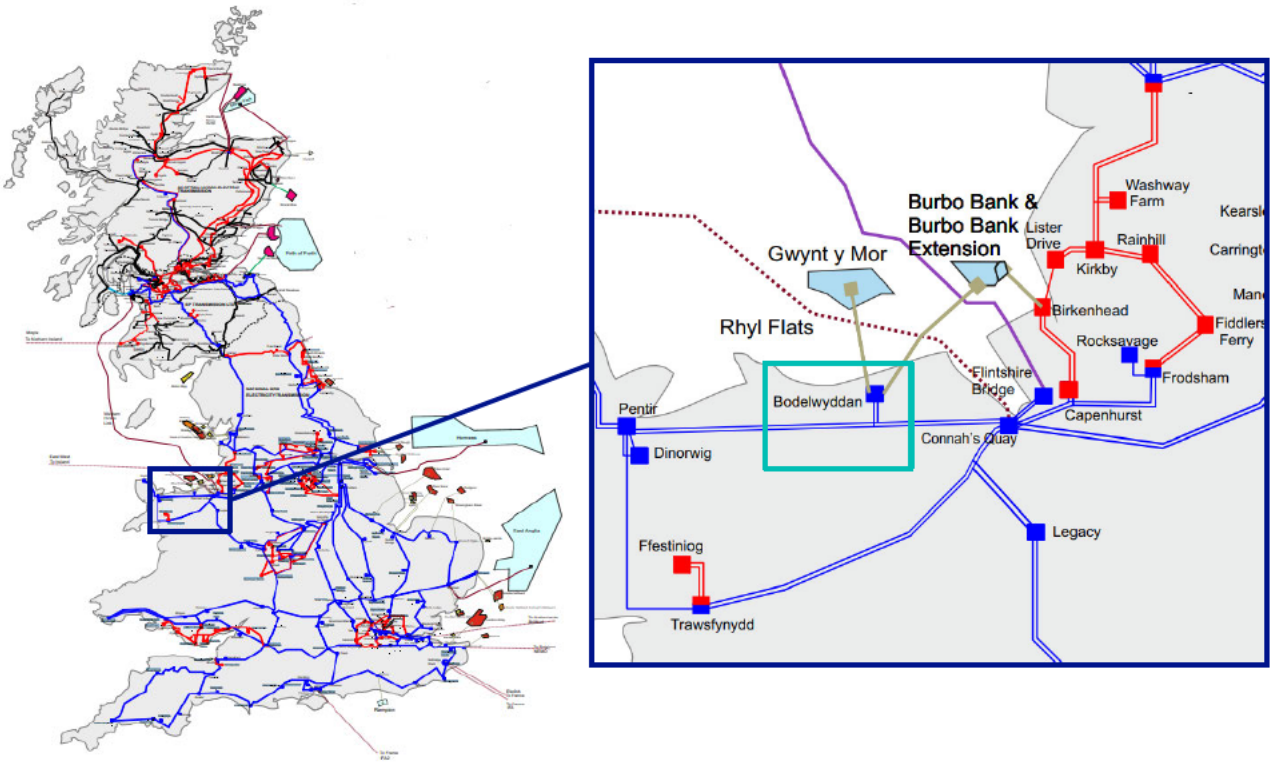
We summarise the above chronology in Figure 1, below.



Regional and network context

The proposed investment site is in Denbighshire in the north of Wales (see Figure 2 and Figure 3). The current transmission network in the north of Wales comprises a 400kV transmission route that interlinks via the Midlands to a 400kV ring configuration. North Wales is captured within the Northwest transmission region of the network for the purpose of transmission planning.

Figure 2: NGET network map highlighting the location of the investment in Wales



*Key: **Red** = 275kV assets, **Blue** = 400kV assets. Investment location shown in **green** box.*



The transmission network in North Wales was designed for moving power from older generating plants to demand centres. The region houses Dinorwig

The Northwest region is renowned for its diverse energy landscape with around 16 GW of connected generation capacity already in place comprising a variety of technology types including Combined Cycle Gas Turbines (CCGTs), offshore wind farms (such as Burbo Bank and the Walney Extension), pumped storage and interconnectors. From Connah's Quay substation, there is the East West interconnector with Ireland.

As part of Connections Reform, capacity allocations were agreed between the Government and NESO for each transmission network region for different technologies required for 2030 and 2035 to help protect the ability to connect strategically important demand.[2] For the region defined as "North Wales, the Mersey and the Humber", this was restricted to 1.2GW of capacity for solar, 300MW of capacity for onshore wind and 4.2GW of capacity for batteries for 2030.

[2] UK Government, 2026. Clean Power 2030 Action Plan: connections reform annex (updated April 2025)

The Welsh Government has set a target for Wales to meet 100% of its electricity needs from renewable sources by 2035 and achieve net zero carbon emissions by 2050, ambitions which signal a significant energy transition for the country. With abundant wind and marine resources, and scope for future nuclear development at Wylfa, North Wales could become a net exporter of low carbon electricity.

[redacted]

Interactive projects

There are two identified projects that interact with the investment set out in this Eligibility Letter:

[redacted]

- **Reconductoring of the 4ZB route:** 4ZB reconductoring Bodelwyddan to Connahs Quay and 4ZB reconductoring Bodelwyddan to Pentir.

[redacted]

Site background

Location and existing connections

Bodelwyddan 400kV Substation is located in Cefn Meiriadog, North Wales, and is an existing Gas [redacted] In Appendix E-Land ownership maps, a map of the land ownership for the site surrounding Bodelwyddan substation is provided.

Site technical information

[redacted]

[3] ESO, 2022. Pathway to 2030: Holistic Network Design

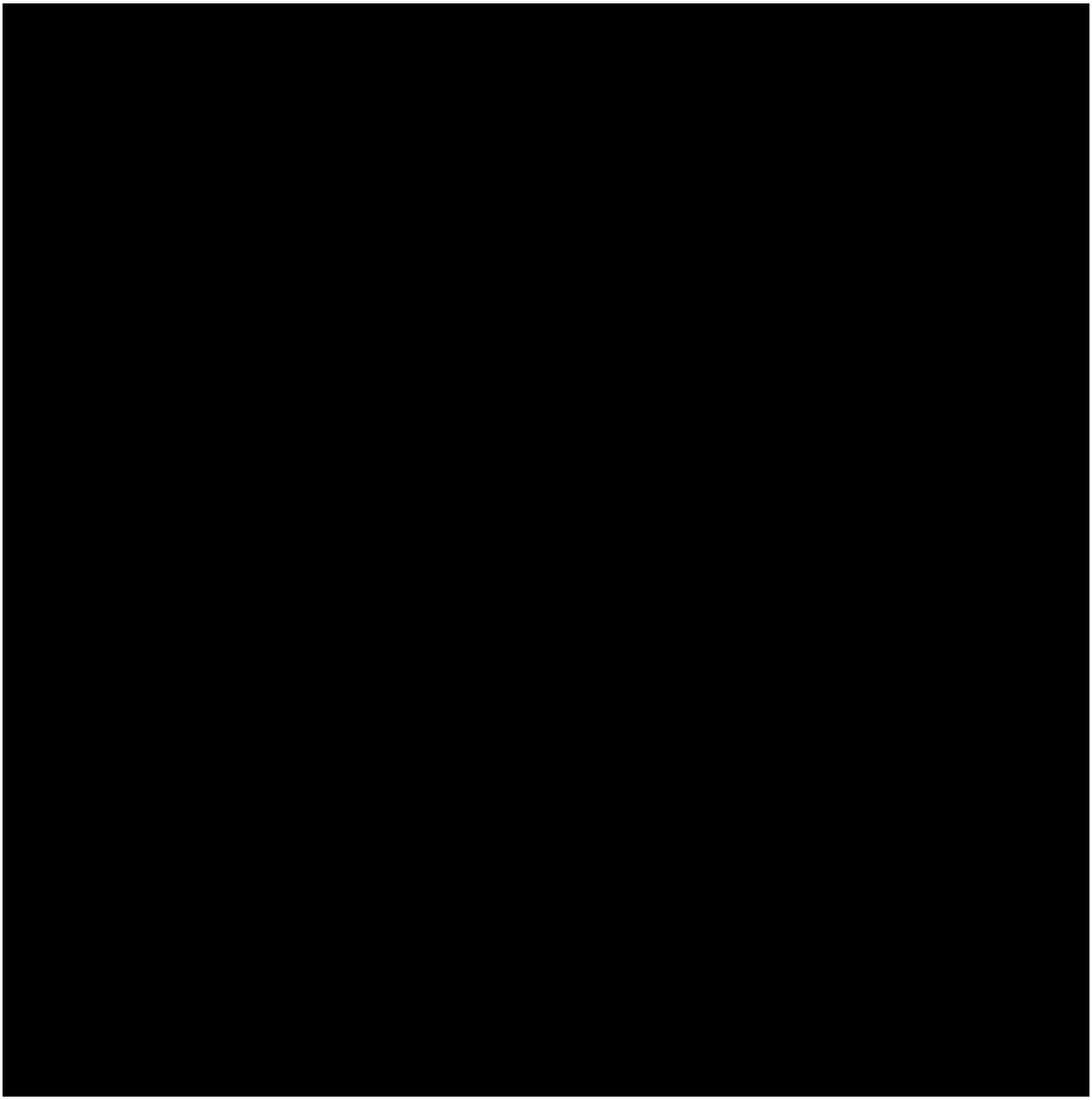


Constraints surrounding the site

The area around Bodelwyddan substation is constrained by customer development projects and utilities (summarised in Figure 5, with further figures provided in Appendix G-Site constraint maps):

- an existing customer substation [redacted] adjoins the existing National Grid site, which limits the ability to extend the site to the east (see top right of Figure 5);
- there is a development planned by [redacted] in the fields to the southwest of Bodelwyddan substation (see lower portion of Figure 5, below, and Figure 39 in Appendix G-Site constraint maps);
- [redacted] has approved DCO rights to route cabling to Bodelwyddan Substation (see lower portion of Figure 5, below, and Figure 40 and Figure 41 in Appendix G-Site constraint maps);
- [redacted] has approved DCO rights to build a substation near the existing cable sealing end at [redacted] for which cables will be routed from the south of the existing substation (see lower portion of Figure 5, below, and Figure 42 in Appendix G-Site constraint maps);
- utility constraints around the existing substation include a high-pressure gas main that runs in proximity to the south and west of the site and a high-

pressure water main that runs parallel to the north of the existing site (see top right of Figure 5, below).



Historical funding

There is no historical funding relating to these customer drivers.

Early Asset Write Offs (EAWO)

There are no early asset write-offs (EAWOs) associated with this project.

2. Drivers and need Case

[redacted] Table 3 with further information on each driver set out in the below subsections.

[redacted] hich is Project Assessment.

Table 3: Investment drivers

Type	Description	Date
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

2.1 Customer

[redacted], which are summarised in the list below. Further information is provided for each customer in Appendix D-Customer information.

[redacted]

Customer information and confidence

Information on the gate status for each connecting customer is provided in Table 4, below.

[redacted]

Table 4: Details of customers with contracted connections

Customer	Project name	Technology	MW	Voltage	ACL date	Gate 1 / Gate 2
[redacted]						

Strategic significance of the connections

The investment supports the UK Government's net zero target and CP2030 by [redacted]

Counterfactual implications

In the absence of the investment, the following consequences are foreseen:

[redacted]

2.2 Asset health

[redacted]

3. Optioneering

3.1 Strategic options

Following our standard optioneering process, we explored options within five strategic option categories (see Table 5).

Table 5: Strategic direction setting

Category	Description	Assessment
A: Do minimum	Maintaining the network its current state and not facilitating the new connections.	Compliant customer connection not delivered.
B: Market-based solution	Accommodating customer demand through the procurement and use of ancillary services only.	Compliant customer connection cannot be delivered.
C: Non-transmission, whole systems solution	The required customer connection is accommodated by a DNO instead of NGET.	Compliant customer connection cannot be delivered.
D: Making use of existing substations	Extensions of the existing Bodelwyddan substation to facilitate the new connections.	[redacted] The design for would need to account for physical constraints surrounding the existing site (see Section "Site background").
E: Building new substations	Construction of a new substation in the vicinity of Bodelwyddan substation.	A new substation would require greater footprint and subsequent siting considerations.

3.2 Siting

The selection of Bodelwyddan substation as the preferred site for the connections has been driven by NESO's own optioneering on the most economic connection point on the electricity transmission network for [redacted]



Based on these analyses, it became clear that connecting at the existing Bodelwyddan substation was the preferred approach from a cost and technical perspective. We set out the CION optioneering that was undertaken for [redacted] in Appendix F-Siting.

3.3 Longlist of options considered

Within each of the five option categories, set out in Section 3.1, we designed 13 options and assessed them based on the balanced scorecard categories.

An overview of the assessment of our longlist options is provided in the Table 6 below. Layout drawings and single line diagrams (SLDs) are provided in Appendix C-Images of longlist options to this document. Please also refer to the supplementary files for larger images that were shared alongside the Eligibility Letter submission.

Table 6: Assessment of longlist options

Option name and status (progressed/ not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
Option A: Do minimum **Not progressed**	The network is kept in its current state, and no new connections are facilitated.	**Layout:** Layout of existing substation shown in Appendix C- Images of longlist options.	N/A	**Engineering:** Compliant customer connection not delivered. Under conditions of its Transmission Licence (Licence Condition C8), NGET has a statutory duty to make offers to provide connections to signed customer agreements. Licence Condition C17, requires NGET to plan, develop and operate the transmission system, in accordance with the NETS SQSS. The Do-Nothing option was therefore discounted as it would go against NGET Licence Obligations
Option B: Market-based solution **Not progressed**	Increased customer demand is accommodated through the procurement and use of ancillary services only.	N/A	N/A	**Engineering:** Compliant customer connection not delivered. New customer connections require physical connections to the transmission network. Based on a review of grid supply facilities at existing Bodelwyddan Substation, it has been determined that there is insufficient connection headroom available to reliably accommodate any further physical customer connections. The market-based option was therefore discounted as new customer connections require a physical connection to the transmission network.

Option name and status (progressed/ not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
Option C: Non-transmission, whole systems solution **Not progressed**	The required customer connection is accommodated by a DNO instead of NGET.	N/A	N/A	**Engineering:** Compliant customer connection not delivered. The non-transmission, whole system solution was discounted as new customer connections require a physical connection to the transmission network.
Option D-1: Extension of Bodelwyddan substation to the west, retaining the existing circuit arrangement **Not progressed**	• New GIS extension to the west • Retain existing arrangement of the 4ZB Circuit [redacted]	No drawing	• Town and Country Planning Application to Denbighshire County Council • Existing gas main would require relocation	**Engineering:** New customer connections trigger a new section within the substation [redacted] would require an additional feeder circuit to be SQSS compliant, but there is insufficient headroom on the existing section.
Option D-2: New GIS extension to west and reconfiguration of the existing 4ZB connection **Not progressed**	• New GIS extension to the west • Reconfiguration of the existing 4ZB Connection to form new double turn-in arrangement	**Layout, SLD and OHL layout:** Appendix C-Images of longlist options.	• Town and Country Planning Application to Denbighshire County Council • 2 x Section 37 applications to cover OHL works required • Existing gas main would require relocation	**Environment:** Option is based on installing SF_6 equipment, given that the existing substation is SF_6 GIS. **Deliverability:** Extension would extend outside the existing operational site and extend the existing GIS hall, creating challenges for delivering the option due to constraints surrounding the site (see Section "Site background"). **Consumer value / economic performance**: New section of OHL will comprise two spans (i.e., it cannot be achieved with one span) at a cost to consumers.

Option name and status (progressed/ not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
				Engineering: Extension of the existing GIS hall would require substantial works within the operational footprint of the substation. *N.b. this was discounted as early option considering only [redacted]. The option does not cater for additional connection requirements of other customers.*
Option D-3: New GIS extension to the west and [redacted] OHL circuits **Not progressed**	• New GIS extension to the west • [redacted] OHL circuits into new bays, reuse of existing bay and cable circuit	**Layout, SLD and OHL layout:** Appendix C-Images of longlist options.	• Town and Country Planning Application to Denbighshire County Council • Section 37 application to cover OHL works required • Existing gas main would require relocation	**Environment:** Option is based on installing SF_6 equipment, given that the existing substation is SF_6 GIS. To the east of the proposed OHL, there is a section of trees that would be in close proximity to the proposed double circuit section. **Deliverability:** Extension would extend outside the existing operational site and extend the existing GIS hall, creating challenges for delivering the option due to constraints surrounding the site (see Section "Site background"). **Consumer value / economic performance (Pathway to 2030):** In addition, the new feeder circuit arrangement does not maximise capacity at the site as per 'Pathway to 2030' recommendations. **Consumer value / economic performance (spans)**: New section of OHL will comprise two spans (i.e., it cannot be achieved with one span) with additional costs to consumers. [redacted] *only as connections. The option does not cater for additional connection requirements of other customers.*

Option name and status (progressed/ not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
Option D-4: New GIS extension to the west and [redacted] OHL circuits **Not progressed**	• New GIS extension to the west • [redacted] OHL circuits (reuse of the 4ZB existing infrastructure. • Uprating of existing 4ZB cable section	**Layout and SLD:** Appendix C-Images of longlist options.	• Town and Country Planning Application to Denbighshire County Council • Section 37 application to cover OHL works required • Existing gas main would require relocation	**Environment:** Option is based on installing SF_6 equipment, given that the existing substation is SF_6 GIS. To the east of the proposed OHL, there is a section of trees that would be in close proximity to the proposed double circuit section. **Deliverability:** Extension would be built within the existing operational site and extend the existing GIS hall, creating challenges for delivering the option. **Consumer value / economic performance vs stakeholder challenges:** New section of OHL could be one span in length, providing a more economical solution or two spans in length to reduce visual impact. In addition, it does not fit with Pathway to 2030 strategy. [redacted] *only as connections. The option does not cater for additional connection requirements of other customers*
Option D-5: New detached GIS substation to the west **Not progressed**	• New detached GIS substation to the West (Connection via GIB to existing) • New Double turn-in of 4ZB circuits	**Layout:** Appendix C-Images of longlist options.	• Town and Country Planning Application to Denbighshire County Council • 2 x Section 37 applications to cover OHL works required • Existing gas main would require relocation	**Planning, consent and stakeholder challenges:** Will result in additional GIB routing and access issues for Wales and West utilities. **Land acquisition:** [redacted] **Consumer value / economic performance:** The gas pipe would require a [redacted]

Option name and status (progressed/ not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
Option D-6: Offline SF_6-free GIS hall adjacent to site **Progressed to shortlist**	Offline Built SF_6-free GIS hall adjacent to existing site + double turn-in.	**Layout, SLD and OHL layout:** Appendix C-Images of longlist options.	• Town and Country Planning Application to Denbighshire County Council • Section 37 application to cover OHL works required • Existing gas main would require relocation	Encompass all drivers into the proposed SF_6-free GIS substation and avoids extending the existing SF_6 GIS substation. This option has been produced considering the proposed SF_6-free standalone GIS on the western side of the existing GIS hall and considering all new generation & feeder bays in such a manner to minimise required modifications in the existing GIS. A gas pipe diversion [redacted]
Option D-7: Offline SF_6-free GIS hall and [redacted]-bay extension of existing GIS hall **Progressed to shortlist**	Offline Built SF_6-free GIS Hall + [redacted] Bay Extension of existing GIS Hall + double turn-in	**Layout and SLD:** Appendix C-Images of longlist options.	• Town and Country Planning Application to Denbighshire County Council • Section 37 application to cover OHL works required • Existing gas main would require relocation	Delivers against the drivers. This option has been produced considering the proposed SF_6-free standalone GIS on the western side of the existing GIS hall as well as expanding on existing substation availability for one of the generators. A gas pipe diversion of [redacted].
Option D-8: Offline SF_6-free GIS substation and repurposing of feeder bay **Not progressed**	Construction of the proposed SF_6-free GIS substation along with repurposing the existing redundant feeder bay within the existing GIS substation.	No diagrams.	• Town and Country Planning Application to Denbighshire County Council • Section 37 application to cover OHL works required • Existing gas main would require relocation	**Engineering:** This option is equivalent to D-6 but with the repurposing of the redundant feeder bay into a customer bay. However, there is not a viable customer cable route out of the substation. **Consumer value / economic performance:** The gas pipe would require [redacted]

Option name and status (progressed/ not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting Risks and Environmental Constraints	Rationale for rejecting or taking forward the option
Option E-1: New AIS substation at Bodelwyddan **Progressed to shortlist**	• New AIS Substation at Bodelwyddan • New Double turn-in of 4ZB circuits • [redacted]	**Layout:** A high-level drawing based on a similar scheme is provided in Appendix C.	• Town and Country Planning Application to Denbighshire County Council • 2 x Section 37 applications to cover OHL works required • Existing gas main would require relocation • Extensive loss of mature trees and hedgerow with little space to provide enhancement. • Potential to fracture existing land parcels causing access constraints	Encompasses the drivers and avoids any extension to the existing SF_6 GIS substation. However, the footprint required for an AIS solution would impact customer projects planned in the area [redacted] DCO land requirements, and early contracted customers have based their works on an extended GIS solution). A GIS substation is also already in operation, making consenting and community buy-in a challenge. The gas pipe would require an approx[redacted].
Option E-2: New remote AIS substation near Bodelwyddan **Not progressed**	• New remote AIS Substation near Bodelwyddan • New Double turn-in of 4ZB circuits	No diagrams.	• Town and Country Planning Application to Denbighshire County Council • 2 x Section 37 applications to cover OHL works required • Tee section of 4ZB circuit would remain without additional modifications	**Planning, consent and stakeholder challenges:** [redacted] **Consumer value / economic performance:** The tee'd section would remain in the Bode-Conn-Pent circuit, going against the 'Pathway to 2030' recommendations. While substation extensions can be scaled down based on customer need dynamics, there is less flexibility for new substations.

Shortlisting rationale and influence of stakeholder considerations

- Remote AIS option E-2 was ruled out on consumer value grounds because NESO's own CION and HND optioneering, conducted 2018-21, identified Bodelwyddan as the most economic connection point [redacted]
- Substation extension option D-1 was ruled out on engineering grounds because an additional feeder circuit would be required to be SQSS compliant and there would be insufficient headroom on the existing section to accommodate the required connections.
- Substation extension options D-2, D-3 and D-4 were ruled out on environmental grounds, given that they would require the installation of new SF6 GIS equipment, and on consumer value grounds, given that the new section of OHL would not be possible to achieve with one span.
- Substation expansion option D-5 was ruled out on land acquisition and stakeholder grounds, [redacted]
- GIS extension options D-6 and D-7 were shortlisted because they have lower risk of SF6 emissions than other GIS options and avoid the deliverability challenges associated with other options within this strategic categor [redacted], among other challenges.
- New AIS option E-1 was shortlisted for avoiding the environmental implications associated with installing SF6 equipment while avoiding challenges associated with a remote AIS option, including planning and consent risks and going against the recommendations set out in 'Pathway to 2030' to connect at Bodelwyddan.

3.4 Shortlisted options

We have shortlisted three options, which are each described in the subsections that follow:

- **E-1:** New AIS Substation at Bodelwyddan + Double Turn In
- **D-6:** Offline Built GIS Hall Adjacent to Existing Site + Double Turn In
- **D-7:** [redacted] Bay Extension of Existing GIS + Offline Built GIS Hall Adjacent to Existing Site + Double Turn In

Please refer to the system design table in Appendix B-System design table, which is provided for each shortlisted option.

Description of short-list options considered

Option E-1: New AIS Substation at Bodelwyddan + Double Turn In

Description:

[redacted]

How it delivers the project drivers:

[redacted]

Drawing:

[redacted]

Option D-6: Offline Built SF6-free GIS Hall Adjacent to Existing Site + Double Turn In

Description:

[redacted]

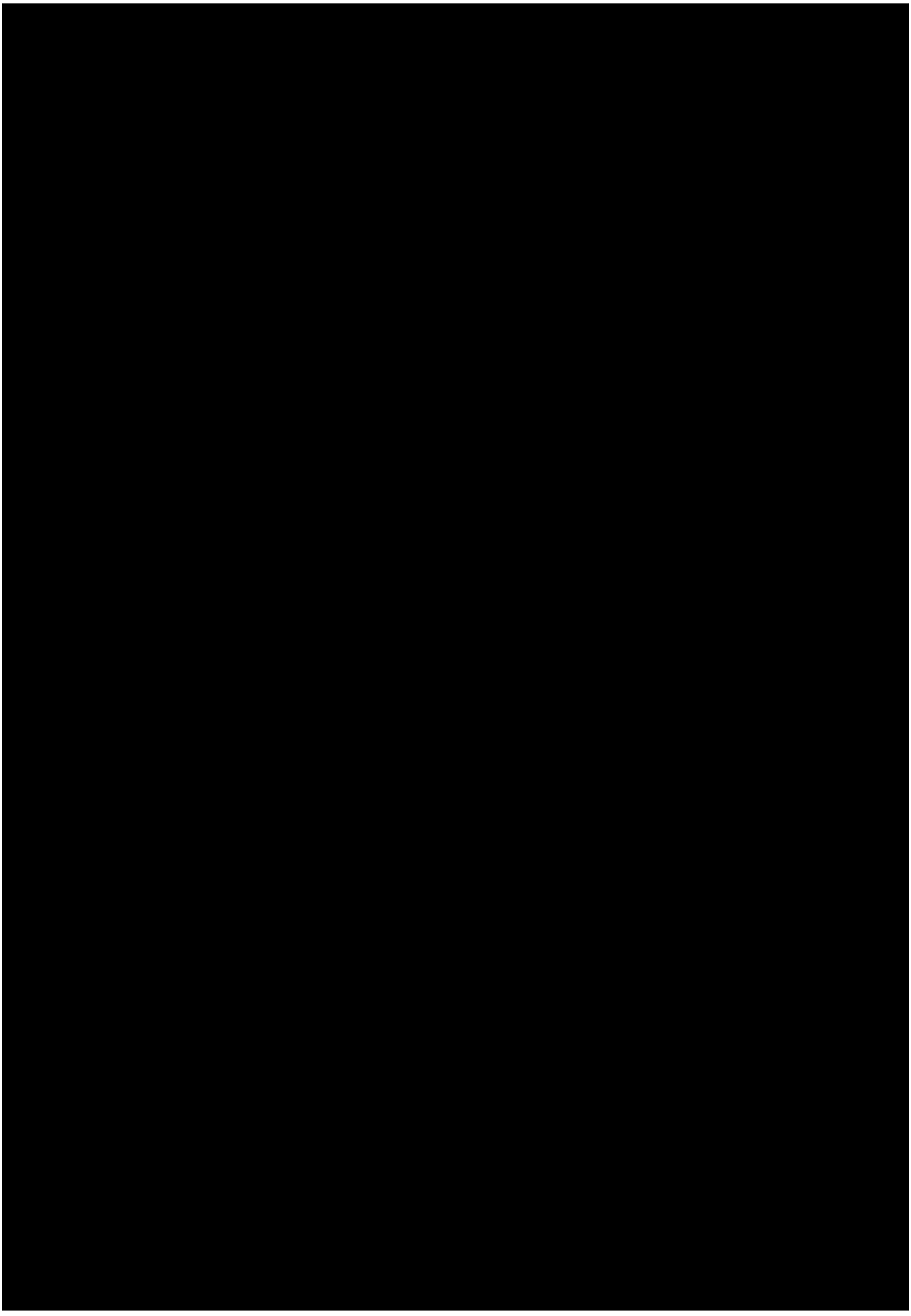
How it delivers the project drivers:

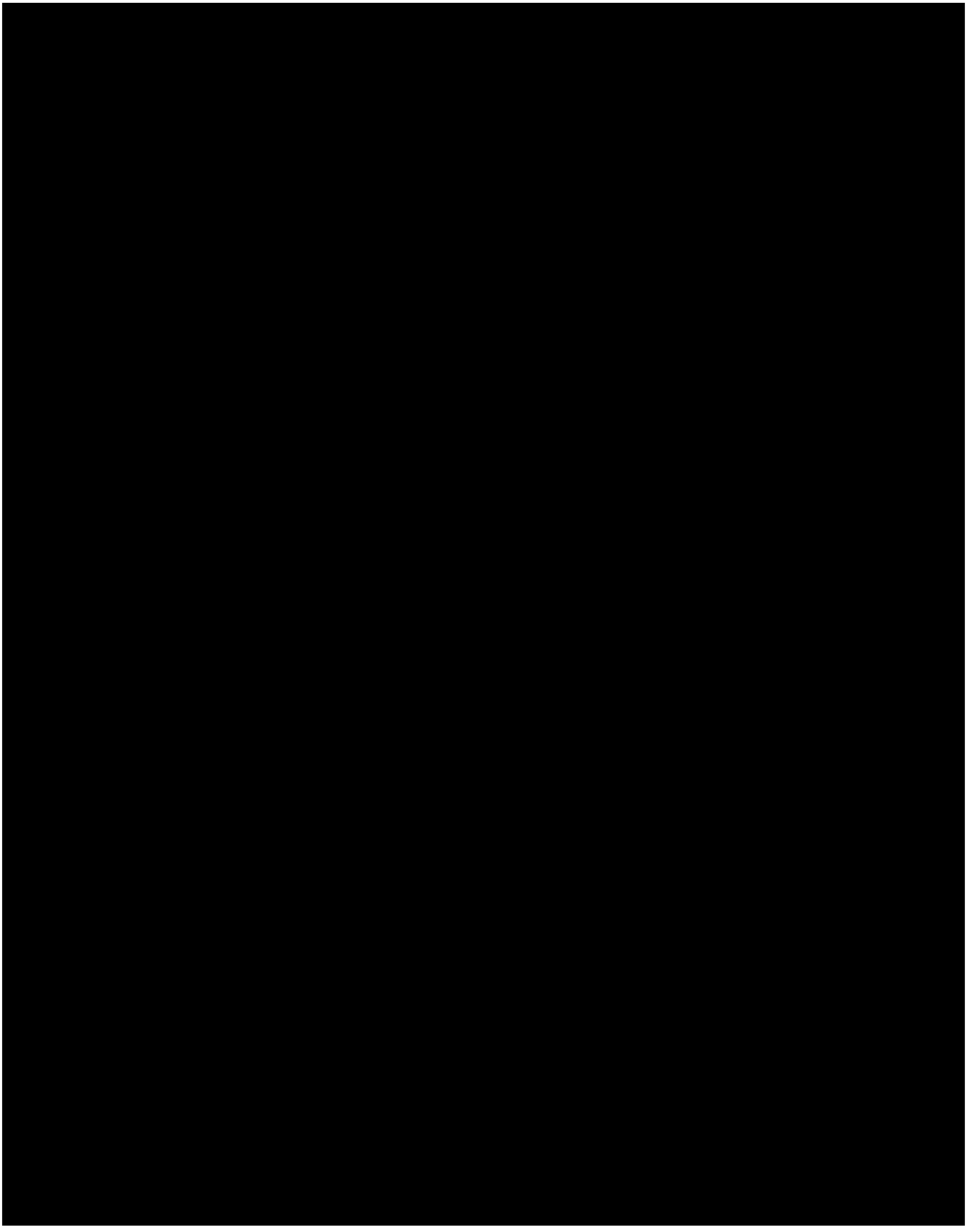
[redacted]

Drawing:

[redacted]

[4] Given that this option is determined to be our preferred option, the final layout will be presented at PA for this scheme.





[redacted]

Option D-7: [redacted] Bay Extension of Existing GIS + Offline Built SF6-free GIS Hall Adjacent to Existing Site + Double Turn In

Description:

[redacted]

How it delivers the project drivers:

The solution would enable the connection of contracted customers at Bodelwyddan and enhance operability between Pentir and Connahs Quay.

Drawing:

[redacted]







3.5 Qualitative assessment of shortlisted options

Table 7: Multifactorial analysis

	Optioneering Categories				
Option	**Engineering**	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting/Stakeholder**
Option E-1 **New AIS Substation at Bodelwyddan + Double Turn In**	• Delivers against the project drivers. • The new substation would be constructed offline, thereby avoiding disruption to the operation of the existing site.	• AIS footprint (which is typically ~[redacted] is larger than its GIS counterpart (which is typically [redacted]), increasing the land impact. • SF_6-free technology avoids building new SF_6 equipment. • Avoids the extension to the existing SF_6 GIS substation.	• Due to the typical AIS footprint size, we would be exposed to greater risk of CPO (which would require 12-24 months). • We would also need to secure TCPA consent and section 37 consent). • We would also need to undertake dentification studies to find a suitable land parcel (noting that the layouts provided in this document are indicative and based on a similar scheme). • It would also conflict with two of our connecting customers' planned developments that have DCO approval. Attempting to alter these arrangements would not be compatible with the project programme. • Due to the above, the earliest date for first site access (FSA) for this option is estimated to be ~eight years from project initiation, with completion forecast	• Delivery of the scheme would require diversion of a high-pressure gas pipeline of up to approximately [redacted] at a cost to consumers.	• AIS requires ~five times the land area of a GIS site, creating conflicts with other planned developments [redacted] These customers have based their works on an extended GIS solution. • Depending on the final siting, the development could also fragment existing land parcels [redacted]

	Optioneering Categories				
Option	**Engineering**	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting/Stakeholder**
			in 2035 (five of our six connecting customers have connection dates in 2029 and 2030), including CP2030-critical projects.		[redacted]
	Supporting Evidence: Internal analysis	**Supporting Evidence:** Environmental costs calculated as part of our CBA. Footprint size is discussed in *DNV, 2024. Substation and Switchgear Technology – Independent Assessment*	**Supporting Evidence:** Internal analysis of the required runway for the project. Please refer to assumptions set out regarding critical pathways and timelines in Appendix 7 of the Letchmore Heath LOTI FNC.	**Supporting Evidence:** Maps of utility constraints provided in Section "Site background". Layout of this option relative to gas main is provided in Section 3.4.	**Supporting Evidence:** Maps of planned developments in Appendix G-Site constraint maps. Land maps in Appendix E-Land ownership maps. Footprint size is discussed in *DNV, 2024. Substation and Switchgear Technology – Independent Assessment*. Information on stakeholder engagement in NGET's October 2025 *Pre-application Consultation Summary Report*
	Strong Benefit	Neutral	Strong Detractor	Detractor	Detractor
Option D-6 **Offline Built SF_6-free GIS Hall Adjacent**	• Delivers against the project drivers. • GIS extension would be constructed offline, minimising	• Avoids adding further GIS SF_6 equipment substation. All new equipment would be SF_6-free.	• Delivers connections in line with connection dates. • Supports connection of green energy projects in line with CP2030 targets.	• Delivery would require diversion of a high-pressure gas pipeline of approximately [redacted]	• Area west of the site has clearer planning pathway and better land availability when compared with land required for an AIS alternate.

	Optioneering Categories				
Option	**Engineering**	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting/Stakeholder**
to Existing Site + Double Turn In	disruption to operational assets. • Double turn in with the GIS extension meets thermal, resilience, and future FES/NOA export needs. • The OHL alignments ensure capacity and avoid clearance and constructability issues.	• GIS footprint is smaller than its AIS counterpart, reducing the land impact.	• Supports agreed protective provisions and side agreements with customers which manage project interactions.	at a cost to consumers. • Class 5 cost comparisons completed; western extension + double turn in gave lowest whole system cost. • Allows a single outage strategy and avoids complex works near live circuits.	• NGET would nonetheless need to secure land rights from [redacted] landowners to facilitate the scheme. • This option aligns with planned customer schemes in the area and their associated DCO rights.
	Supporting Evidence: SWOT analysis.	**Supporting Evidence:** As above.	**Supporting Evidence:** As above.	**Supporting Evidence:** As above.	**Supporting Evidence:** As above.
	Strong Benefit	Benefit	Strong Benefit	Neutral	Benefit
Option D-7 **[redacted] Bay Extension of Existing GIS + Offline Built SF_6-free**	• Delivers against the project drivers. • The second stage extension would be constructed offline, avoiding disruption to	• SF_6-free technology for the offline built GIS hall avoids building new SF_6 equipment. • Due to space constraints, the [redacted] bay extension of the existing SF_6 GIS hall during stage 1 would need	• Delivers connections in line with connection dates. • Supports connection of green energy projects in line with CP2030 targets. • Supports agreed protective provisions and side agreements	• Delivery would require diversion of a high-pressure gas pipeline of approximately [redacted] at a cost to consumers.	• Western site has clearer planning pathway and better land availability. • NGET would nonetheless need to secure land rights from [redacted] landowners to support the works.

	Optioneering Categories				
Option	**Engineering**	**Environmental**	**Deliverability**	**Economic/Consumer Value**	**Consenting/Stakeholder**
GIS Hall Adjacent to Existing Site + Double Turn In	operational assets. • Double turn in with the GIS extension meets thermal, resilience, and future FES/NOA export needs. • The OHL alignments ensure capacity and avoid clearance and constructability issues.	to be populated with SF_6 equipment, as there is insufficient room to accommodate SF_6 free technology. • GIS footprint is smaller than its AIS counterpart, reducing land impact. • Installing both SF_6 and non SF_6 technology could cause interfacing challenges and delay programme.	with customers which manage project interactions.	• Two stage outage and commissioning strategy would be required.	• This option is coordinated with planned customer schemes in the area and their associated DCO rights.
	Supporting Evidence: SWOT analysis.	**Supporting Evidence:** As above	**Supporting Evidence:** As above.	**Supporting Evidence:** As above.	**Supporting Evidence:** As above.
	Strong Benefit	Detractor	Strong Benefit	Neutral	Benefit

Qualitative assessment output

Based on the qualitative assessment, **Option D-6 is the preferred option**. This is driven primarily by the deliverability and programme benefits associated its GIS technology versus the AIS technology of Option E-1. Option D-6 also has SF_6-free benefits because it avoids extending the existing SF_6 GIS substation, which is the design of Option D-7.

In summary:

- While the layout for the shortlisted AIS Option E-1 provided in this document is indicative and based on a similar scheme, AIS geographical footprints typically require approximately five times the land area of a GIS site.5 This would inevitably create significant conflicts with other planned developments in the area, including [redacted] of our contracted customers that have DCO approval and have based their works on an extended GIS solution [redacted] Attempting to alter these arrangements would not be compatible with the project programme.

- Pursuing the shortlisted AIS Option E-1 would also be associated with substantial programme risk. Due to the size of the footprint, there would be a heightened risk of CPO, given varying level of support amongst affected landowners and other developers showing interest in land parcels that would be required for the NGET works (CPO requires an estimated 12-24 months). Based on recent experience, micro-siting identification studies would also take approximately 18 months to identify a final location. There would also be timeframes associated with TCPA and Section 37 applications. These processes could extend years to the project programme. As a result, the earliest achievable date for first site access (FSA) is estimated to be 2035, which is incompatible with connecting our CP2030-critical customers.

- Due to the size of the typical geographical footprint of AIS substation, AIS Option E-1 would require a significantly larger gas-main diversion of [redacted] at a cost to consumers. By comparison, the diversion for the preferred GIS Option D-7 would only be an estimated [redacted]

- Alternative GIS Option D-7 extends the existing SF6 GIS hall, leading to an increased risk of SF6 emissions. In contrast, our preferred Option D-6 avoids building new SF6 equipment.

[5] As stated in the analysis table, independent analysis indicates that an archetypical AIS 400kV double busbar substation has an operational footprint of 80,000m^2, relative to an operational footprint of 20,000m^2 for the GIS equivalent. Source: DNV, 2024. Substation and Switchgear Technology – Independent Assessment

PASE alignment

As set out in the preceding subsection, the PASE-compliant option (Option E-1) is not our preferred solution because an AIS substation requires approximately five times the land area of a GIS site, which would create significant challenges that are detailed in the preceding subsection, including (i) conflicts with other planned developments in the area [redacted] and (ii) a much larger gas-main conversion at a cost to consumers. Pursuing an AIS solution would involve an additional associated cost to consumers, programme risk, and a risk to CP2030 projects connecting on time.

Our preferred option (D-6) is a PASE-variant option (an SF_6-free extension to a double bus bar substation).

3.6 Quantitative assessment of shortlisted options

Cost estimates of shortlisted options

[redacted] project analysis, to account for unforeseen circumstances and mitigate risks during implementation.

Table 8: Cost estimate breakdown (£m, 23/24 prices)

[redacted]

Option E-1 is lower cost than options D-6 and D-7 because of the lower upfront capital cost of AIS relative to GIS. However, this is offset to a degree by the costs associated with a larger gas main diversion and land acquisition associated with AIS Option E-1 due to the larger footprint associated with AIS.

Cost drivers

The project's cost estimates are based on current market conditions, with ongoing work to refine requirements. The baseline funding request is supported by high cost confidence and robust EUL assessments.

Key drivers for the capex include:

- **Switchgear technology:** The choice of AIS versus GIS drives a difference between options, with AIS equipment having a lower upfront capital cost than GIS equipment.
- **High-pressure gas main diversion:** The cost of the gas main diversion is estimated to be approximately three times larger for the AIS option than for the GIS option due to the typically larger geographical footprint for AIS and the consequently larger scale of works required.



- **OHL reconfiguration & double turn in works**: The costs associated with OHL works would be largely equivalent across the three shortlisted options. These would include reconfiguring the tee'd arrangement and creating the new double turn in, which increases steelwork, tower construction, outages, and sequencing costs.
- **Design, surveys & planning:** Our capital estimates also capture early-stage concept design, surveys, planning and legal processes.

Cost Benefit Analysis (CBA)

Purpose and approach

Our Cost Benefit Analysis (CBA) evaluates the economic efficiency and consumer value of the proposed transmission investments. This analysis aligns with Ofgem's Load Re-opener Guidance and Submission Requirements.

The CBA process integrates monetised benefits such as constraint cost savings, system efficiency improvements, and consumer bill impacts, alongside a comprehensive Whole-Life Cost Analysis (WLCA) that captures capital expenditure, operational and maintenance costs, replacement cycles, carbon impacts, and future extendibility. This dual approach ensures a balanced assessment of both short-term economic benefits and long-term cost efficiency, avoiding the risk of asset stranding or future inefficiencies.

Our CBA considers:

- **Robust optioneering and sensitivity testing:** We have evaluated credible alternatives, including 'do nothing' and 'do minimum' scenarios, to confirm that the preferred solution delivers the optimal balance of technical performance, environmental impact, and economic benefit.
- **Quantification of constraint cost reductions:** Using system operator modelling outputs and historical data, we quantify expected savings from reduced system constraints, which translate into direct consumer bill benefits.
- **Assessment of delay impacts:** The financial consequences of potential project delays on constraint costs and consumer bills are modelled through risk-adjusted scenarios, providing a clear understanding of the value of timely delivery.
- **Inclusion of socio-economic benefits:** Where quantification is challenging, qualitative evidence supported by stakeholder engagement and regional development plans highlights the wider economic benefits, including job creation and inward investment.
- **Consideration of non-monetised benefits:** We explicitly identify benefits that are qualitative or not readily monetisable, such as enhanced system operability, resilience, and environmental improvements, ensuring full transparency of the value proposition.
- **Alignment with policy and government targets including Net Zero and AI Growth Zones:** The CBA reflects the influence of national and local policies, including Clean Power 2030, net zero commitments, and economic growth plans demonstrating how the investment supports the broader energy transition.

We have assessed consumer value by comparing the whole-life costs and benefits of five shortlisted connection and substation delivery options using Ofgem's RIIO-ET3 CBA template. The assessment is completed relative to a counterfactual and on a discounted basis over a 50-year appraisal period (2027–2076), consistent with the CBA methodology.

For each option considered, we have quantified:

(i) Initial CAPEX investment required

(ii) Future end of life replacement costs

The supporting CBA model quantifies the costs and benefits for this project. Using the Ofgem RIIO-ET3 CBA template spreadsheet, the CBA compares the discounted cost and benefits for consumers for the following three shortlisted options.

- E-1: New AIS Substation at Bodelwyddan + Double Turn In
- D-6: Offline Built SF6-free GIS Hall Adjacent to Existing Site + Double Turn In
- D-7: [redacted] Bay Extension of Existing GIS + Offline Built SF6-free GIS Hall Adjacent to Existing Site + Double Turn In

CBA outcome

Lifetime Cost-Benefit Analysis: The lifetime costs and benefits refer to a 50-year period starting from 2027 until 2076.

Table 9: Lifetime CBA (2023/2024 base prices, central carbon pricing, discounted values)

Option	Initial Investment (£m)	PV of Lifetime Costs (£m)	PV of Monetised Benefits (£m)	NPV (£m)
Option E-1	[redacted]	[redacted]	[redacted]	[redacted]
Option D-6	[redacted]	[redacted]	[redacted]	[redacted]
Option D-7	[redacted]	[redacted]	[redacted]	[redacted]

On the basis of the discounted lifetime CBA results (Table 9), Option E-1 delivers the highest NPV ([redacted] 2023/2024 base prices) and therefore represents the preferred option on consumer value grounds. Options D-6 and D-7 deliver NPVs that are lower than E-1 [redacted] and [redacted] respectively). This analysis is subject to confirmation through deliverability, consents/land, outage and risk considerations, and any CBA sensitivities set out in the assumptions below.

Assumptions of the CBA analysis

Core assumptions and sensitivities. The CBA results are based on the following high-level assumptions (with sensitivities used to test robustness where appropriate):

- Appraisal period of 50 years (2027–2076), with costs and benefits discounted and presented relative to the counterfactual.
- Cost base: 2023/2024 prices, aligned to the Ofgem RIIO-ET3 CBA template inputs (including treatment of replacement CAPEX and maintenance).
- Carbon: central base case carbon price applied for monetising construction carbon, SF6/alternative gas leakage and losses, with scenario testing for alternative carbon price trajectories.
- Benefits scope applied consistently across options; where option-specific benefits exist (e.g. constraints), the basis and evidence are documented and applied consistently.
- Key sensitivities considered (as applicable): timing/phasing, CAPEX uncertainty ranges, delivery/outage risk, and benefit parameter uncertainty (including losses and leakage assumptions).

Costs

Table 10: Summary of all additional Capex costs (2023/2024 base prices)

	Capex		
	Initial works (£m)	Future replacement (40yr) (£m)	Total costs (£m)
Option E-1	[redacted]	[redacted]	[redacted]
Option D-6	[redacted]	[redacted]	[redacted]
Option D-7	[redacted]	[redacted]	[redacted]

Option E-1 has the lowest total calculated costs, making it the most cost-effective option. Option D-6 has marginally higher calculated costs.

Benefits

The following benefits have been included within the CBA:

- SF6 / Alternative gas leakage reduction
- Carbon cost of construction reduction
- Constraint cost reduction
- Summary of all Benefits

Table 11 presents the summary of all (undiscounted) benefits, including environmental and non-environmental benefits, considering the central base case carbon price.

Table 11: Summary of all benefits

Option	Environmental Benefits		Non-Environmental Benefits	Total Benefits (£m)
	Carbon costs of construction (£m)	Gas leakage (£m)	Transmission loss (£m)	
Option E-1	[redacted]	[redacted]	[redacted]	[redacted]
Option D-6	[redacted]	[redacted]	[redacted]	[redacted]
Option D-7	[redacted]	[redacted]	[redacted]	[redacted]

3.7 Preferred solution

The preferred option is a Western GIS Substation Extension with 400 kV Double Turn-In (D-6). This option has the following advantages:

[redacted]

Project benefits and outputs

The following benefits can be attributed to the project:

[redacted]

We propose the following T3 PCD outputs [redacted] connecting customers and therefore enables timely generator and interconnector energisation:

[redacted]

Futureproofing

Futureproofing considerations in the proposed investment include:

- [redacted] with the rest designated as infrastructure bays) [redacted] and an existing feeder bay will become redundant following the upgrade to the site. This could be considered for any future customer connections beyond those already contracted.
- Connections Reform may affect the number of bays required by customers (with the exception of the [redacted] We have incorporated flexibility into the design to account for this by ensuring there is enough physical space and capacity to accommodate all of them should they develop further. We will reassess when the time comes to placing the GIS equipment order

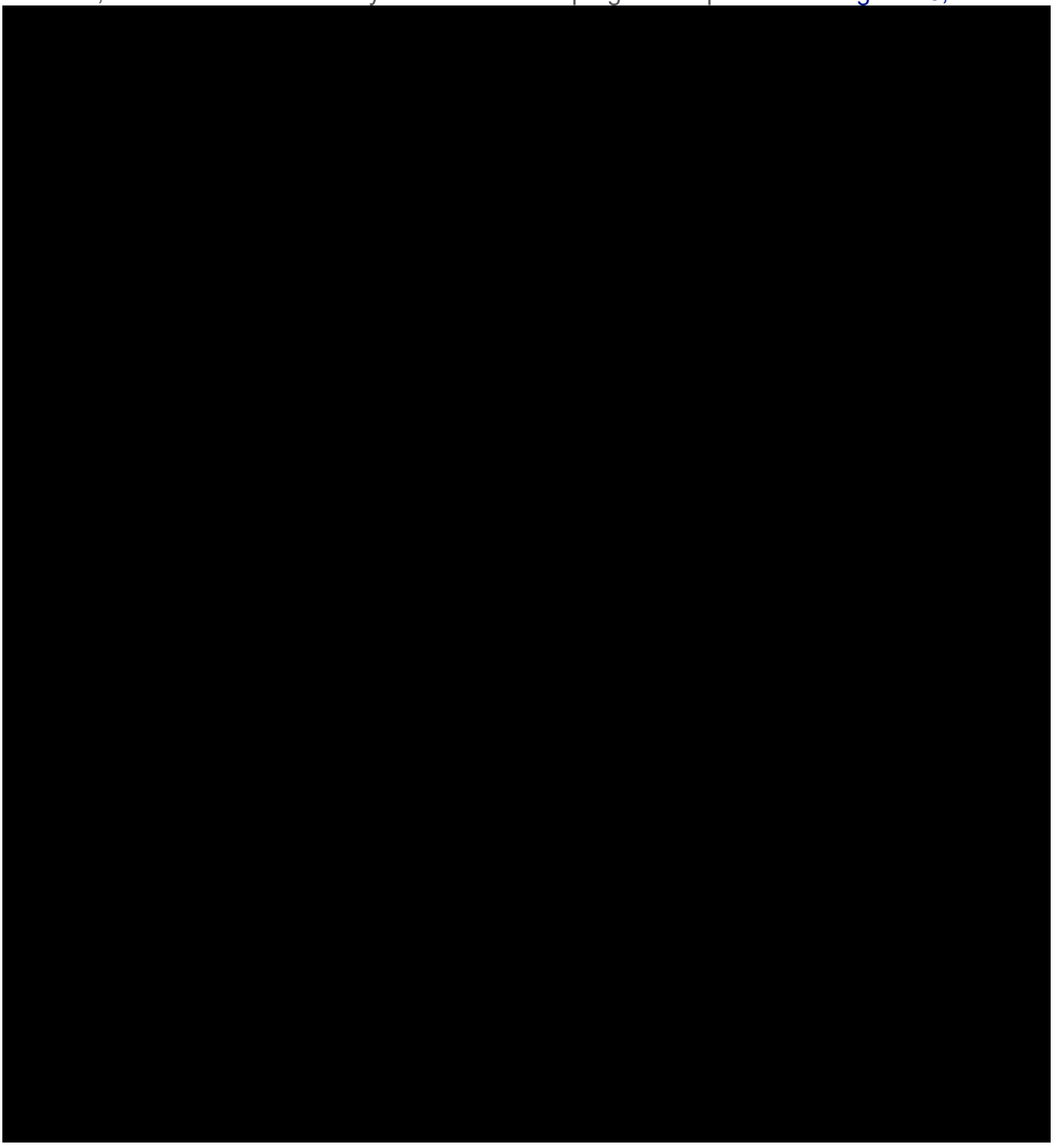


- Western expansion avoids sensitive woodland, reducing future consenting risks and removing long-term environmental blockers.
- Customer projects located close to Bodelwyddan Substation have been considered during design, to ensure a coordinated approach, and to mitigate against interactions impacting design.

4. Delivery

4.1 Delivery year and indicative timeline

This will be a staged programme that delivers customer connections by the following dates, which will be enabled by the construction programme provided in Figure 15, below.



[redacted] This is factors in:

- Outage availability on the Pentir–Connah's Quay corridor
- Long-lead procurement for GIS, GIB, and OHL steelwork (24–36 months)
- Critical early milestone: Wales & West gas main diversion (must complete before main civils)
- Programme sequencing validated through FEED and PWS

4.2 Procurement and contracting strategy

[redacted]

4.3 Risks and risk management

We have identified a range of risks to the delivery of our project (see Table 12, below). For each of these risks, we have put in place mitigations. The impact of these risks manifesting as real issues could range from adjustment to delivery schedules (covering both minor changes not affecting connection energisation or major impacts resulting in connection date delays) up to a change of preferred option.

Table 12: Summary of risks and mitigations

Risk	Mitigation
Land acquisition: Land acquisition delays for the freehold of the substation extension location and easements for new OHL arrangement. [redacted] Developers connecting into Bodelwyddan also have interest in land parcels required for the NGET works.	Early L&A engagement. [redacted]
Planning and consent: The complexity of the planning and consent process, including visual mitigation, ecology, and alignment with local plan, could create risks to the project programme.	Structured consenting strategy and environmental screening. [redacted]
Third-party interactions: For the gas main diversion, there is dependence on Wales & West Utilities for design, procurement and construction. There is a risk of programme slippage if diversion approval or material procurement delays occur.	Early design acceptance, staged payments, parallel consenting, tight interface management.
OHL outage and construction constraints: Limited outage windows on the Pentir–Connah's Quay corridor; potential NESO access constraints. Foundation works near live circuits create sequencing and safety risk.	Early NESO engagement, detailed outage planning, staged constructability reviews.

[6] View Planning Application | Denbighshire County Council

[7] View Planning Application | Denbighshire County Council; View Planning Application | Denbighshire County Council

Risk	Mitigation
Technical interfaces: Integration of non SF_6 GIS with existing SF_6 infrastructure may create design and commissioning complexity. Protection & Control (OTS) interface risk across multiple customer projects.	FEED validation, technical assurance, integrated commissioning strategy.
Equipment long lead-times: Equipment procurement long lead times could delay the project programme. This includes GIS, GIB, and towers, which are vulnerable to global supply chain delays.	[redacted] e also plan to use the Advanced Procurement Mechanism (APM) and have requested allowances for bespoke procurement as part of the APM Re-opener window in April 2026, which is subject to Ofgem pre-approval.
Resource availability: Contractor resourcing risk due to regional workload (North Wales cluster).	Schedule buffers, framework supplier engagement.
Stakeholder dependencies: [redacted]	Structured customer interface management, APM reporting, monthly alignment meetings.
Environmental and community: Potential objections on noise, construction traffic, and visual impacts. Habitat disturbance risk during OHL works.	Early consultation, construction environmental management plans (CEMPs), traffic routing plans.

5. Conclusion

This submission sets out the preferred solution to address the investment drivers for the Bodelwyddan Extension project. The submission seeks approval of the investment need as well as formal endorsement of the optioneering undertaken and our preferred solution.

The preferred solution is a westward SF6-free GIS Substation Extension with 400 kV Double Turn In (Option D-6). The preferred option has been selected due to the demand for connections in the area. The majority of the build is offline, and the new GIS hall will allow flexibility for future connections. The option also delivers PT2030-CW1, providing operational benefits to the network in North Wales

Table 13: Submission summary

Submission summary	
Main drivers	[redacted]
Preferred option	The preferred solution is a westward SF6-free GIS Substation Extension with 400 kV Double Turn In (Option D-6). The preferred option has been selected due to the demand for connections in the area. The majority of the build is offline, and the new GIS hall will allow flexibility for future connections. The option also delivers PT2030-CW1, providing operational benefits to the network in North Wales.
Estimated cost and timing	The upfront capital cost estimate (23/24 prices) for the investment is: [redacted]

Submission summary	
	[redacted]
	The ACL for each customer is: [redacted]
Outputs	[redacted]
Proposed PCD	Delivery of the outputs. Delivery date for the PCD to be confirmed at the PA stage.

Appendix A
Glossary

Table 14: Table of abbreviations and definitions

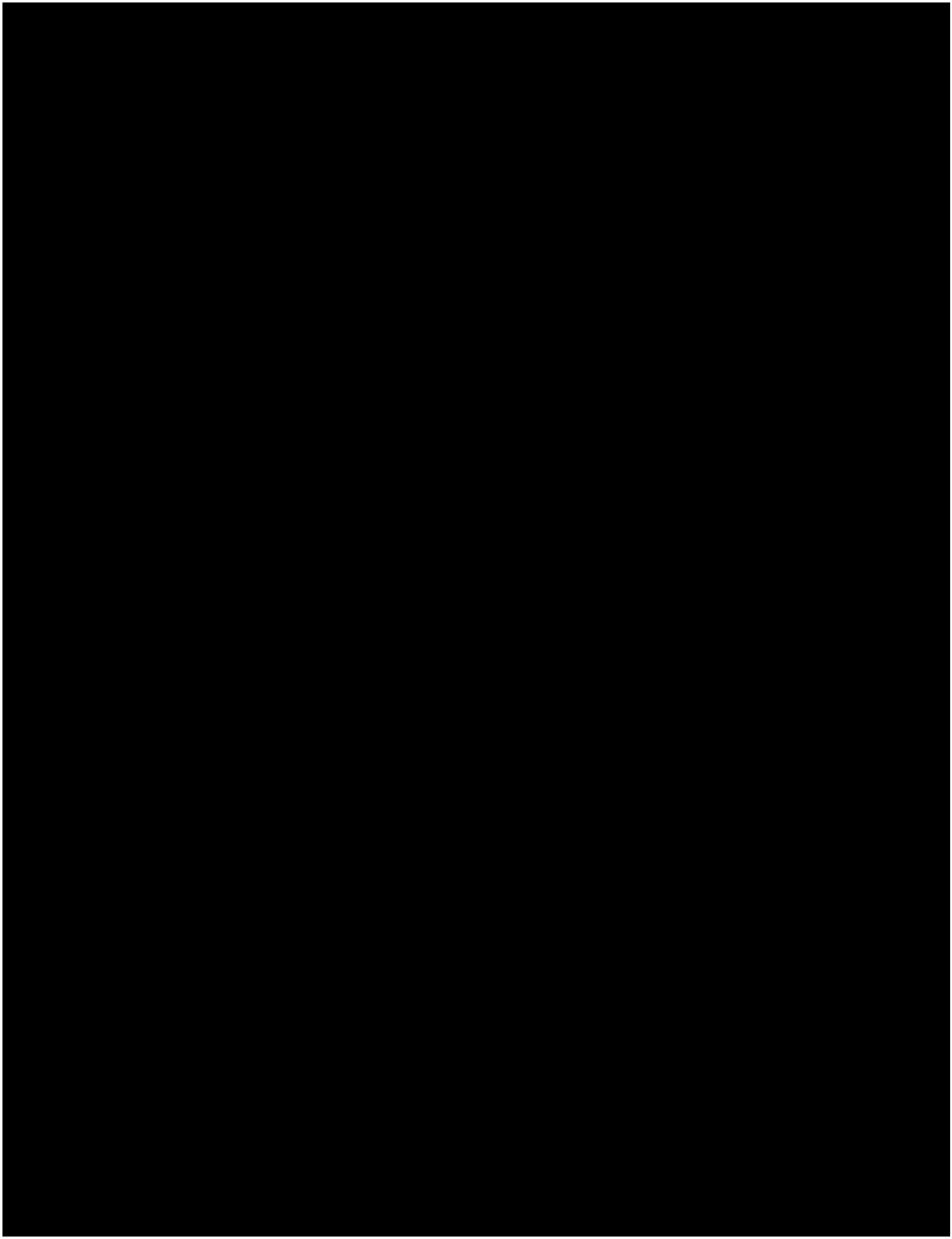
Abbreviation	Description
ACL	Available for commercial load
AIS	Air-insulated switchgear
BESS	Battery energy storage system
BPDT	Business Plan Data Template
CBA	Cost-benefit analysis
CCGT	Combined-cycle gas turbine
CION	Connection and Infrastructure Options Note
CPO	Compulsory purchase order
CP2030	Clean Power 2030
DCO	Development Consent Order
DNO	Distribution network operator
EAWO	Early asset write-off
ECI	Early contractor involvement
EEW	Early enabling works
EJP	Engineering Justification Paper
EPC	Engineering, procurement and construction
ESO	Electricity System Operator
EUL	Estimating Units Line
ET2/ET3	The names of the price control periods used by Ofgem (equivalent to RIIO-ET2/RIIO-ET3)
FEED	Front-end engineering design
FSA	First site access OR Final site acceptance
FY	Financial year
GB	Great Britain
GIB	Gas-insulated busbar
GIS	Gas-insulated switchgear

Abbreviation	Description
GW	Gigawatt
HND	Holistic Network Design
HVDC	High-voltage direct current
ISS	Integrated security system
LVAC	Low-voltage alternating current
MVA	Megavolt-ampere
MVAR	Megavolt-ampere reactive
MW	Megawatt
NGET	National Grid Electricity Transmission
NC	Needs Case
NESO	National Energy System Operator
NETS	National Electricity Transmission System
NOA	Network Options Assessment
NPV	Net present value
OHL	Overheat line
OSR	Ofgem scheme reference
OSW	Offshore wind
OTS	Operational tripping scheme
PA	Project Assessment
PASE	Pre-approval of Solutions by Engineering
PCF	Pre-Construction Funding
PWS	Pre-works sanction
RIIO-ET2/ET3	The names of the price control periods used by Ofgem (equivalent to ET2/ET3)
RRP	Regulatory Reporting Pack
SF_6	Sulphur hexafluoride
SGT	Super grid transformers
SLD	Single line diagram
SQSS	Security and Quality of Supply Standard
S/S	Substation

Abbreviation	Description
TCPA	Town and Country Planning Act
TCSNP	Transitional Centralised Strategic Network Plan
TNCC	Transmission Network Control Centre
TO	Transmission Operator
UK	United Kingdom

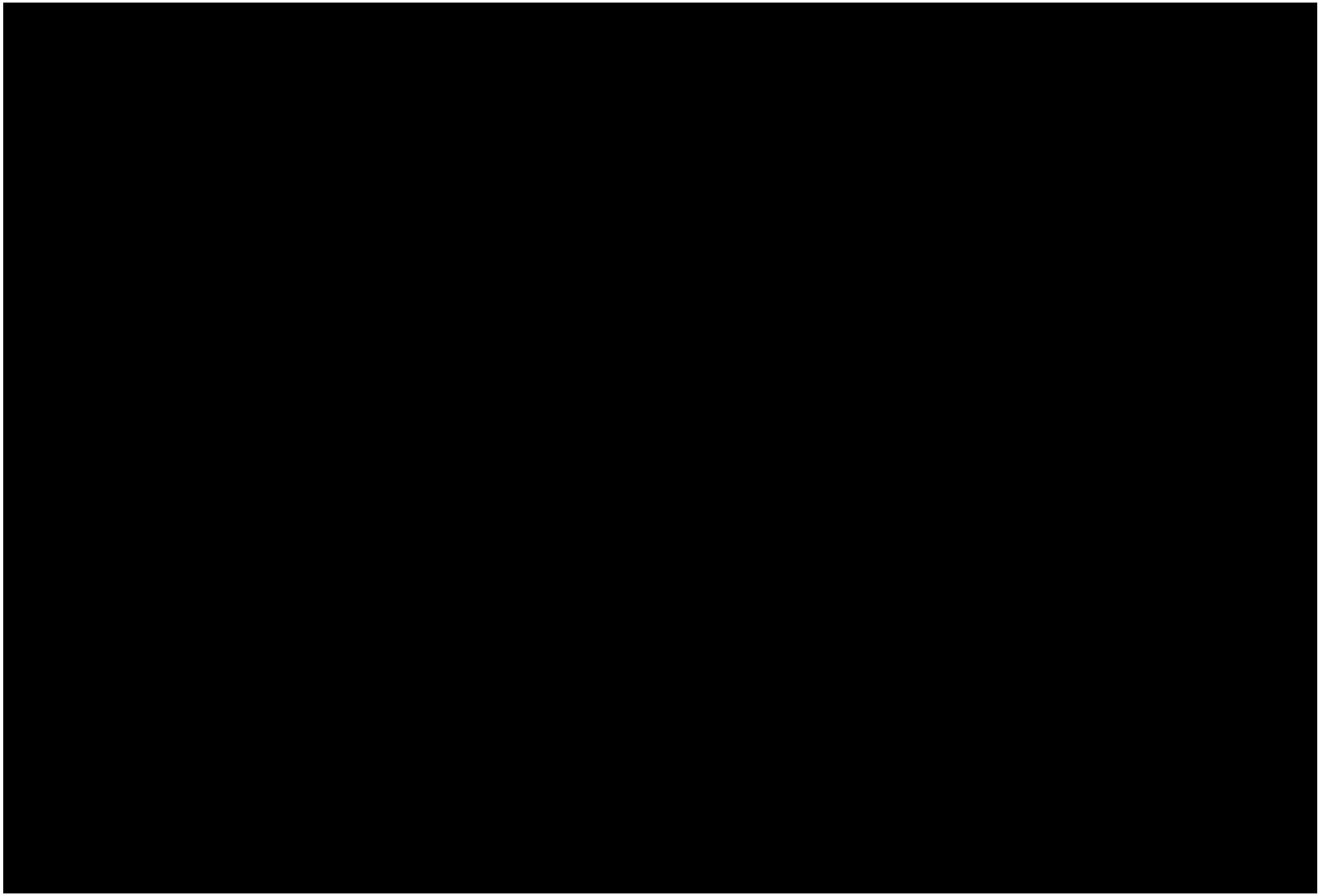
Appendix B
System design table

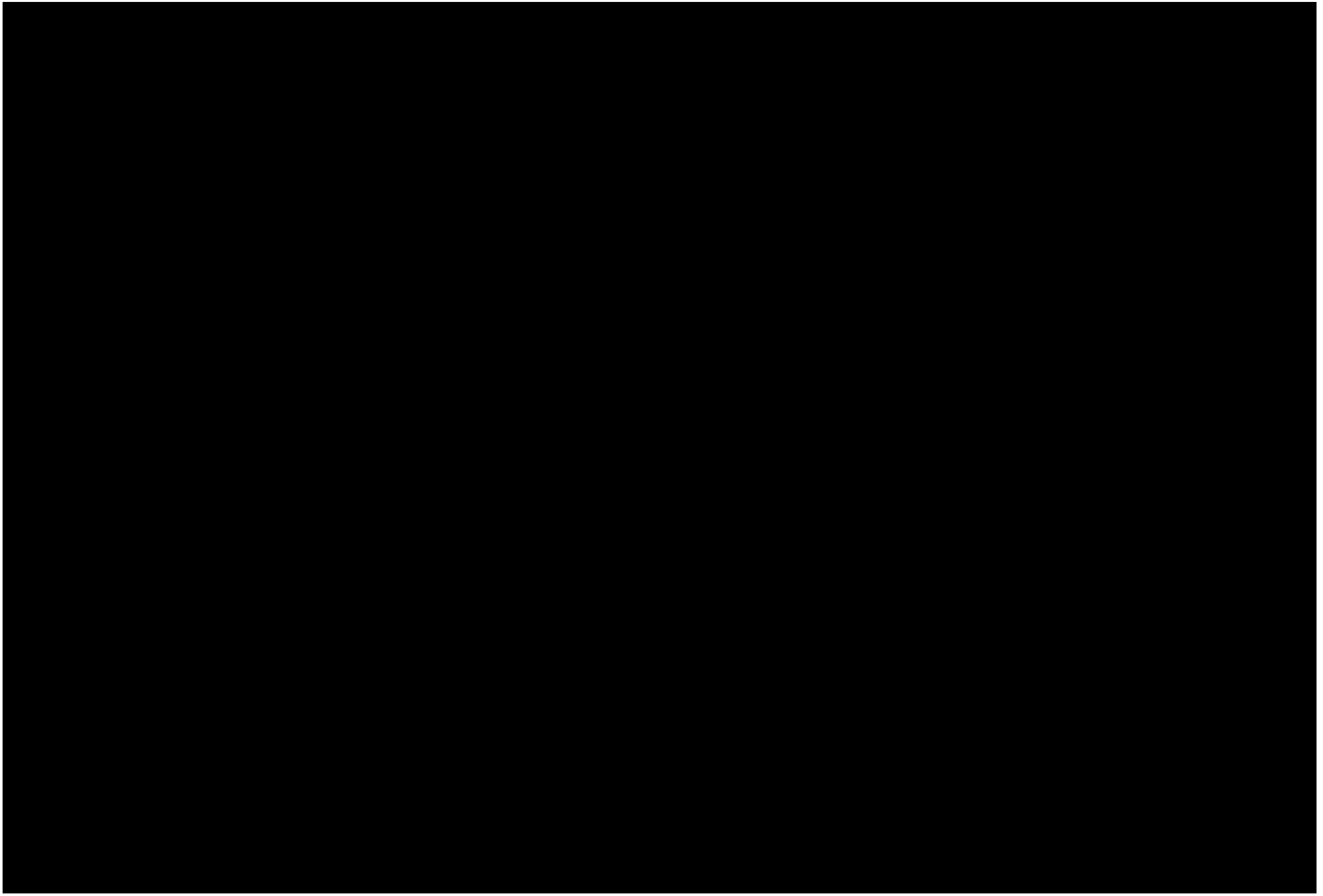
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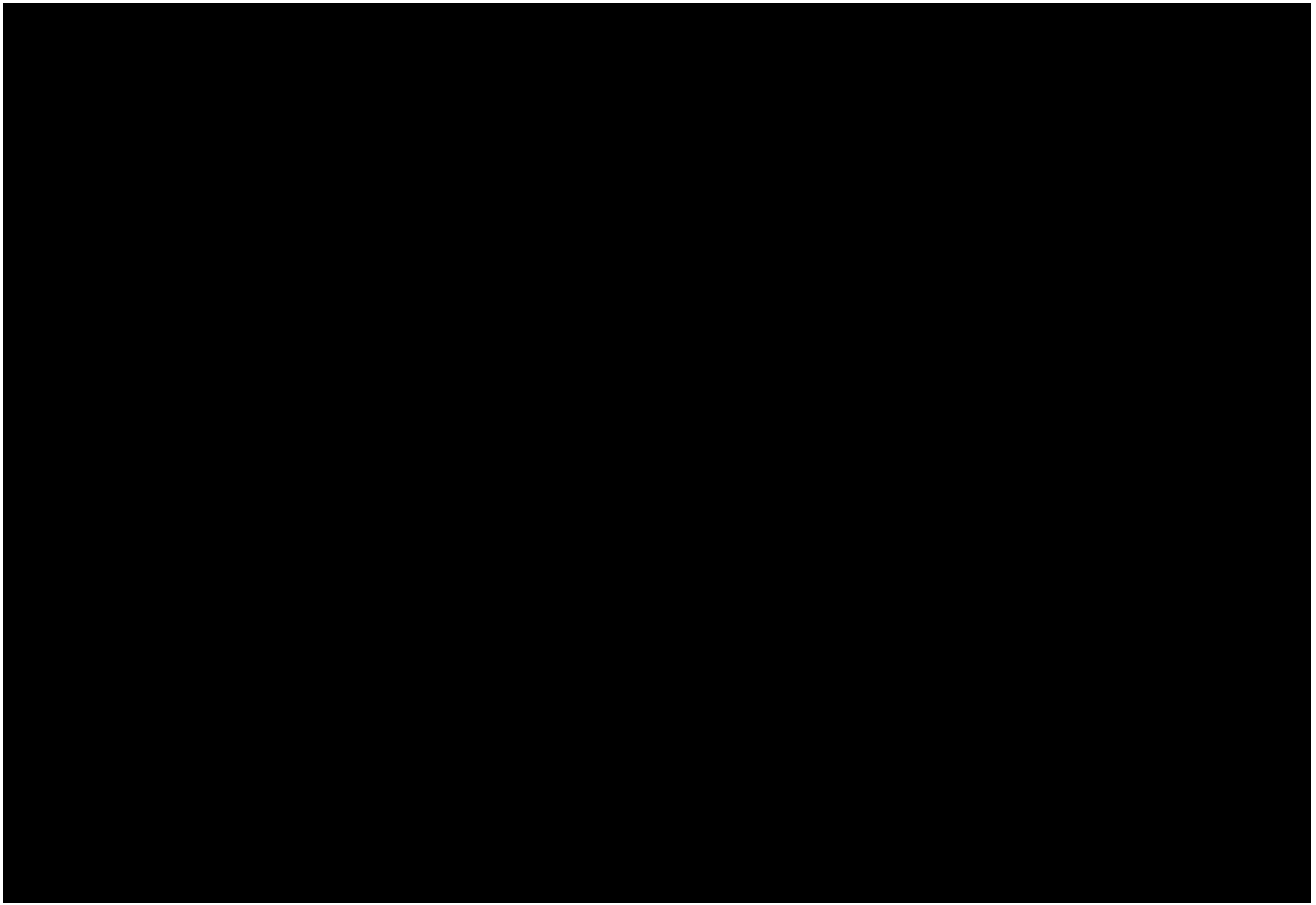


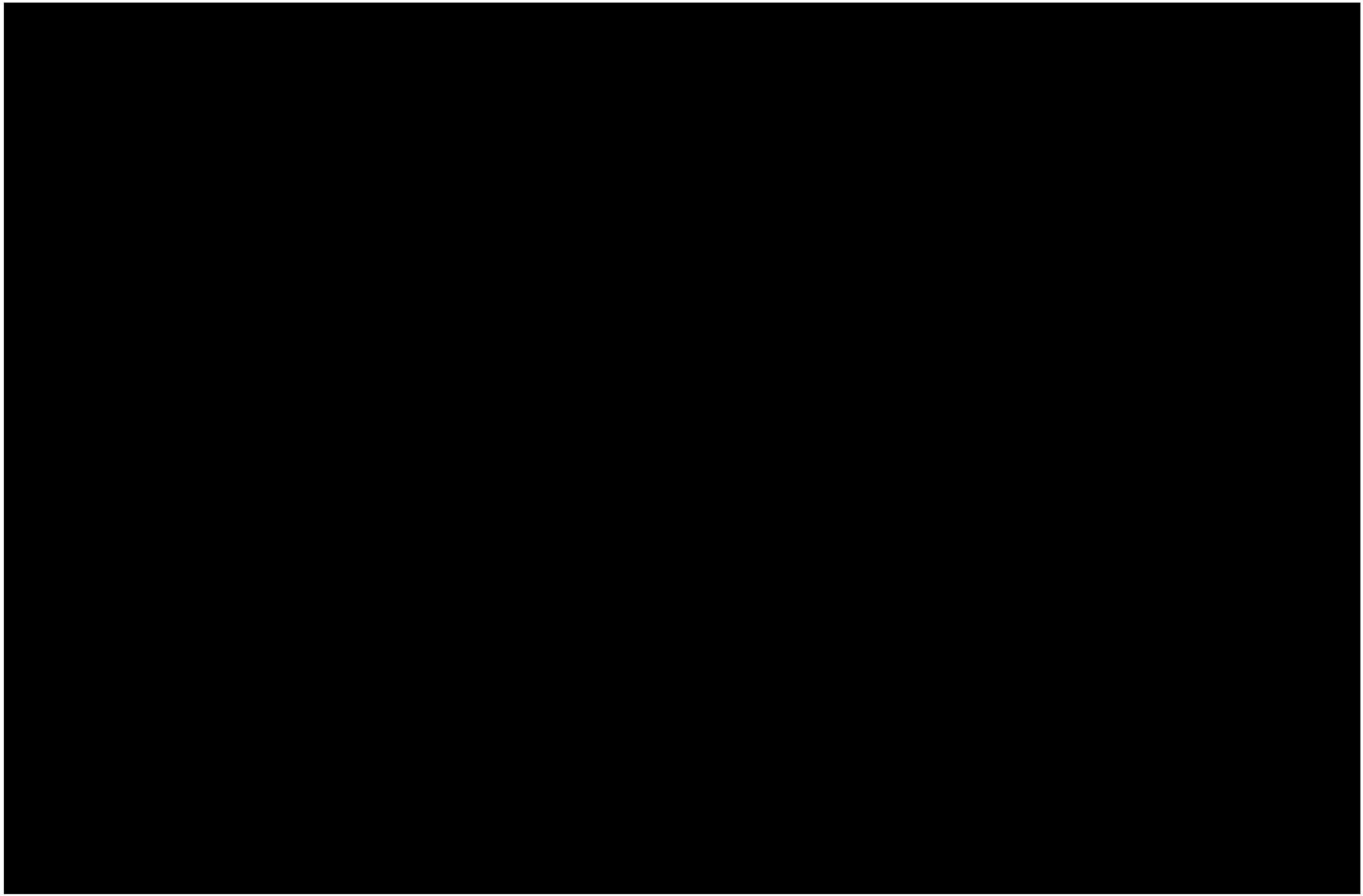


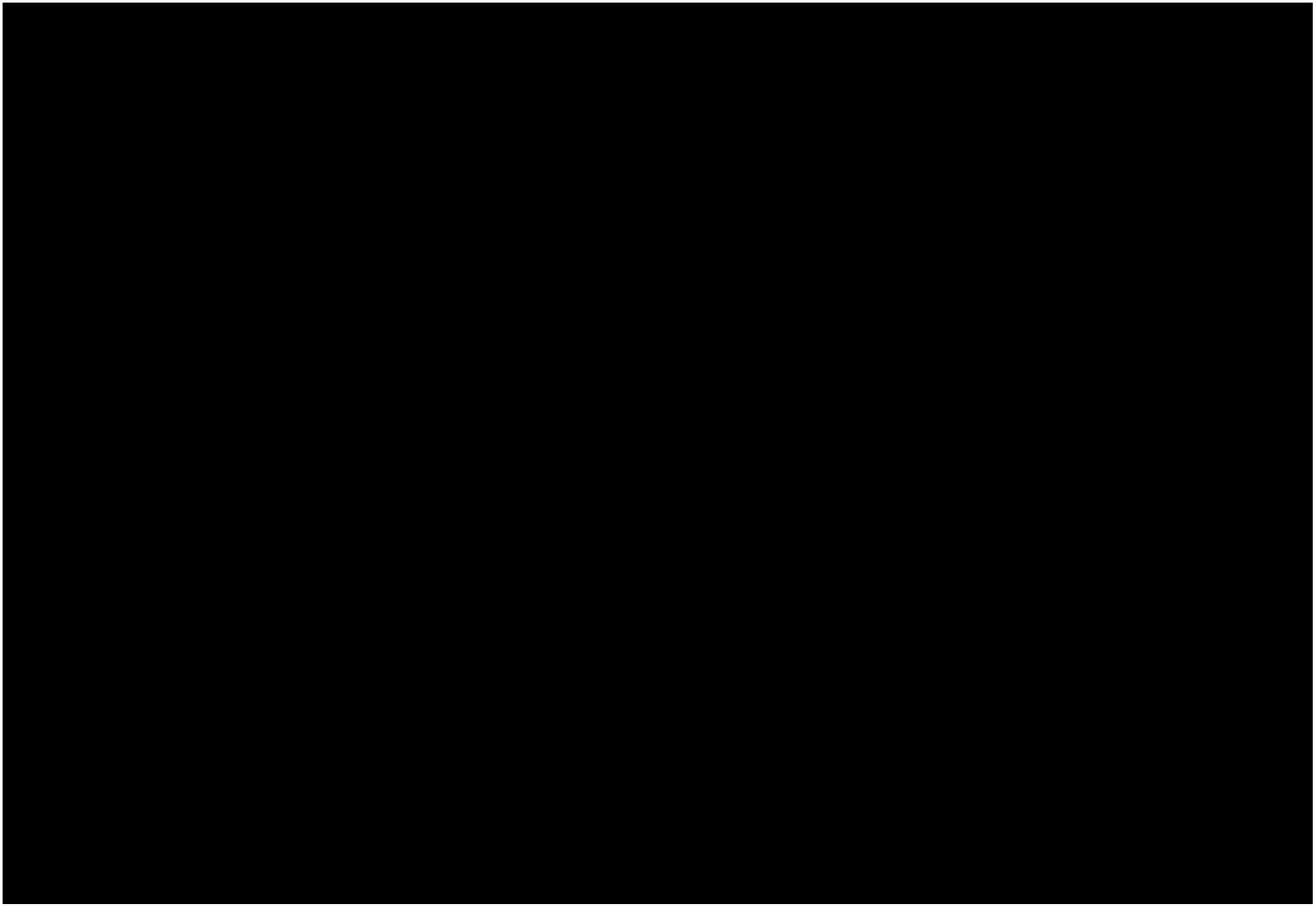


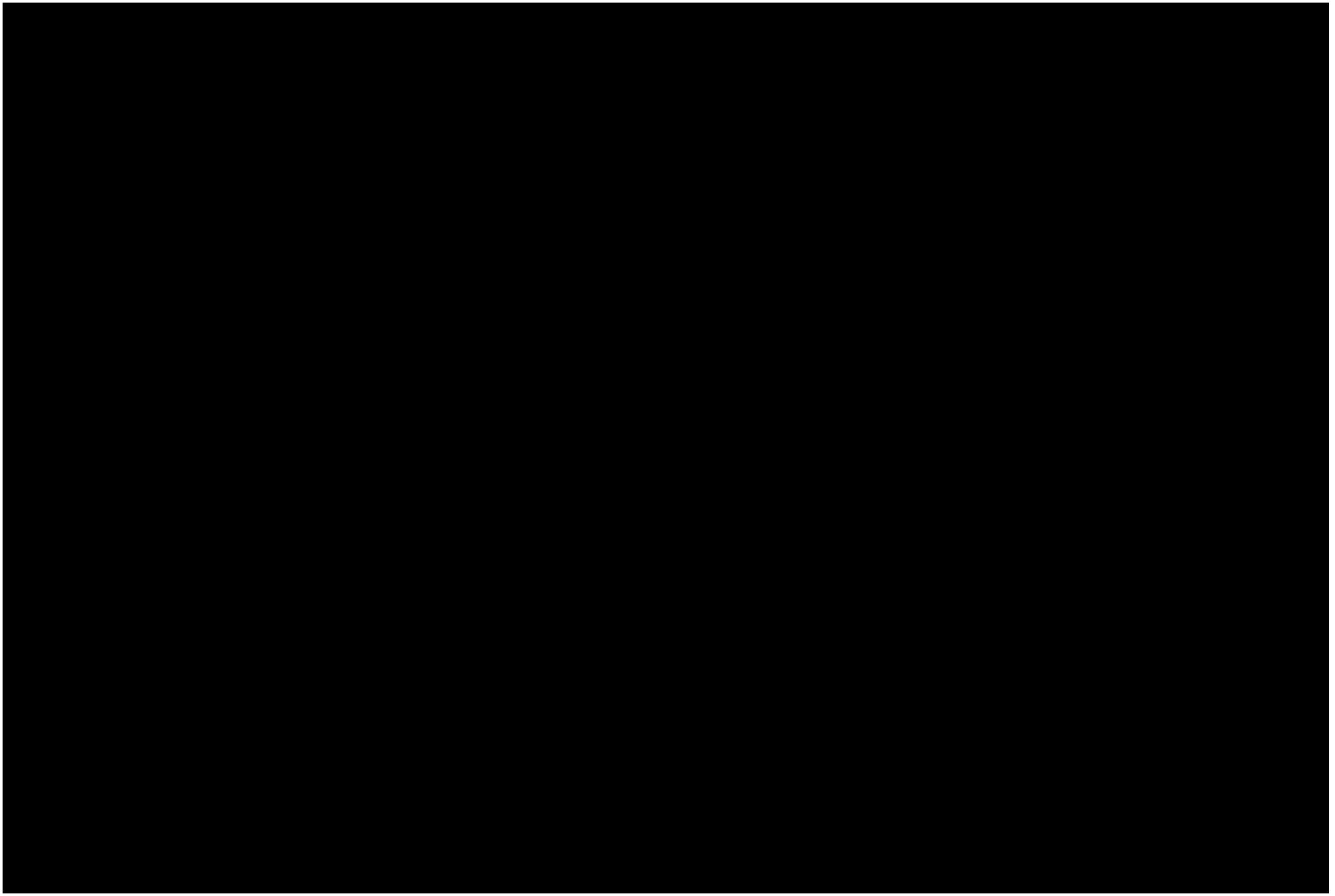


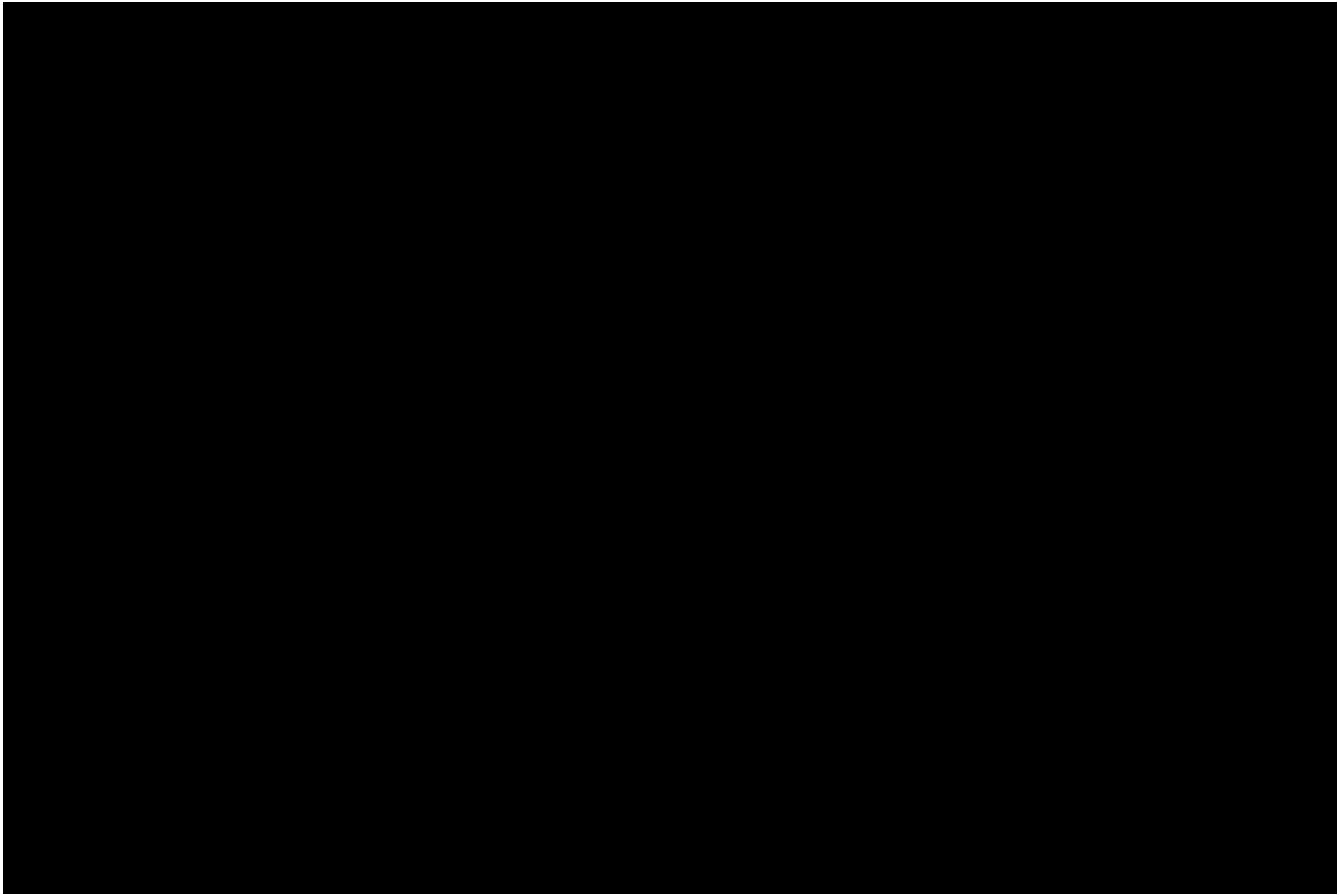


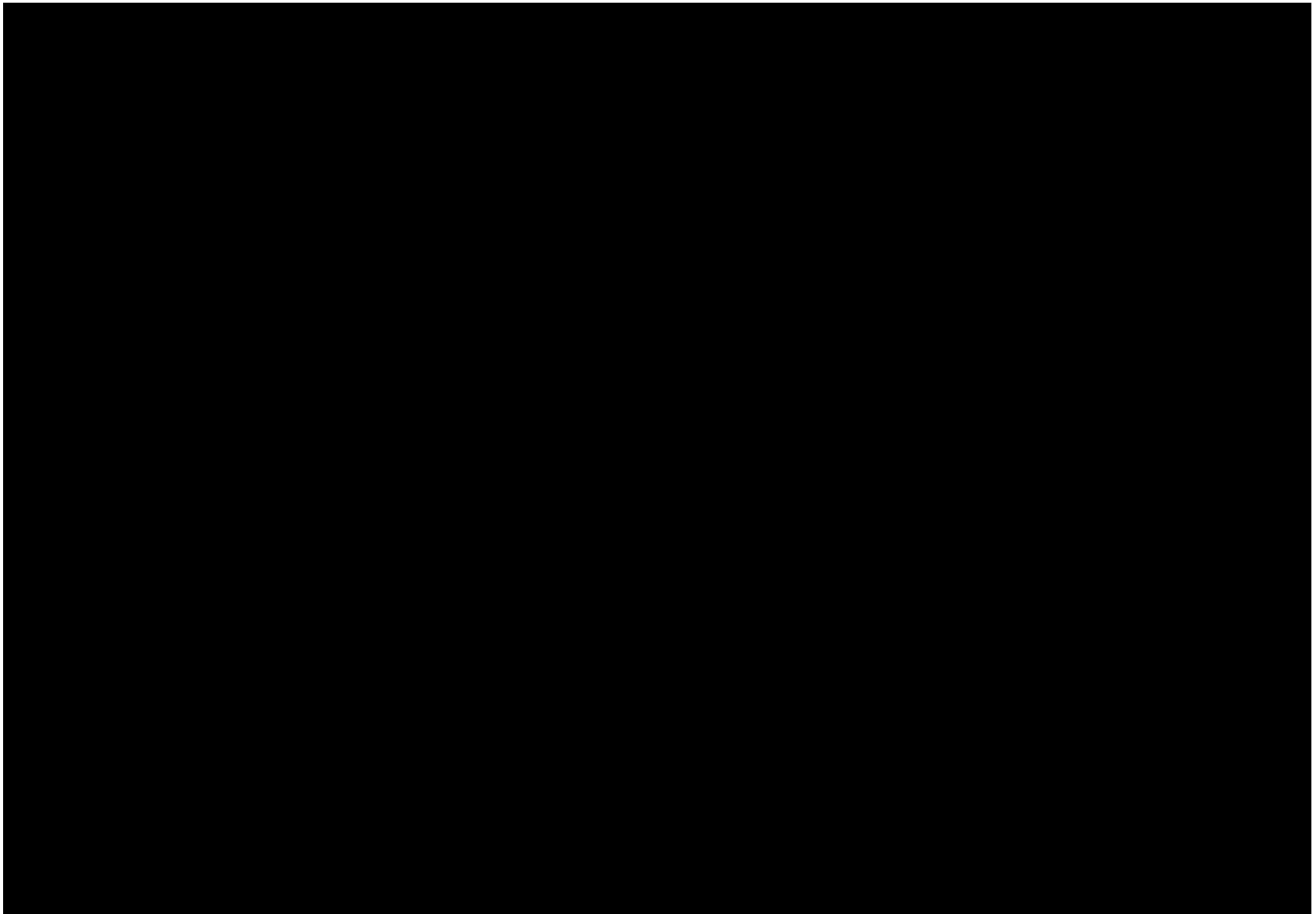


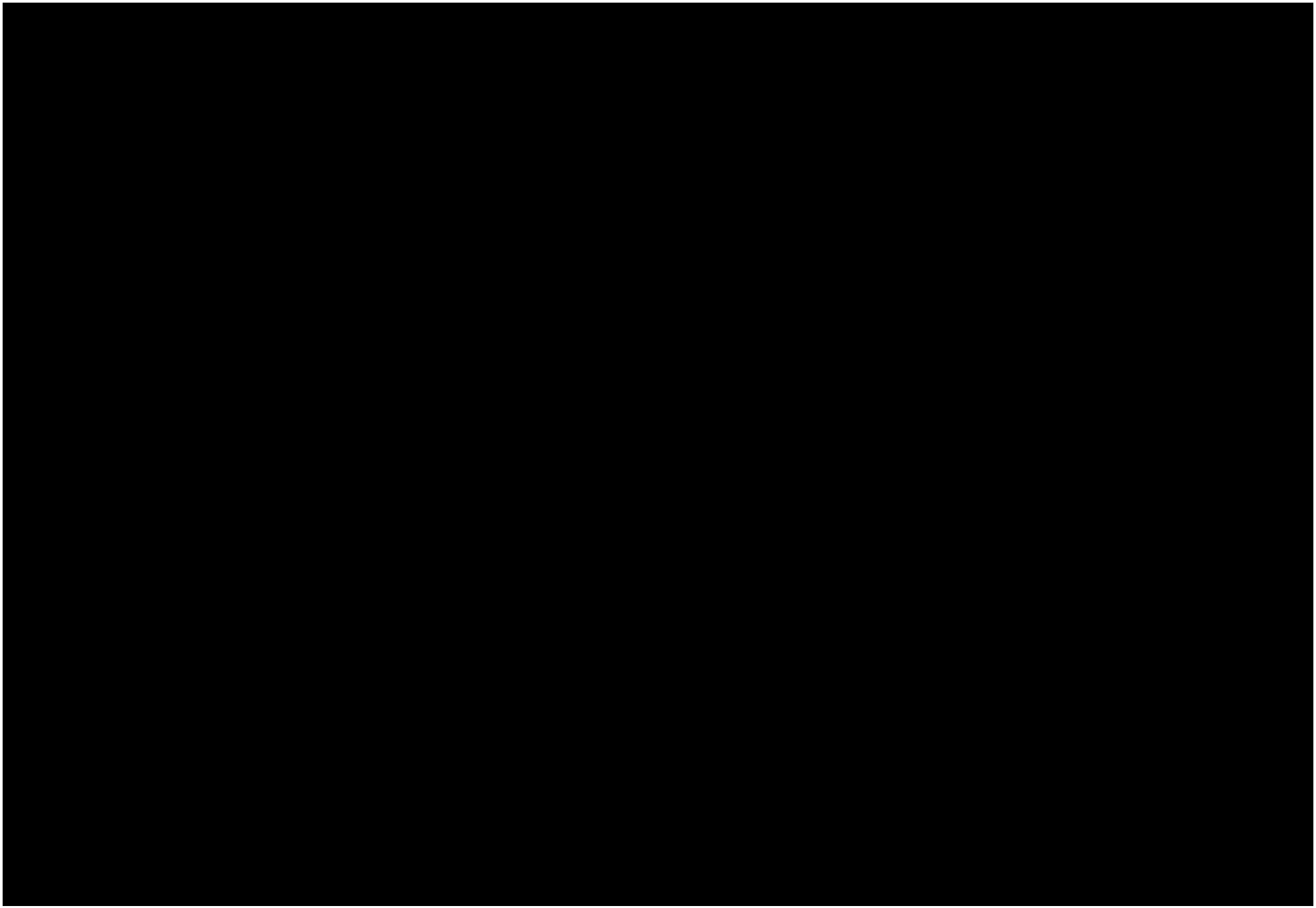


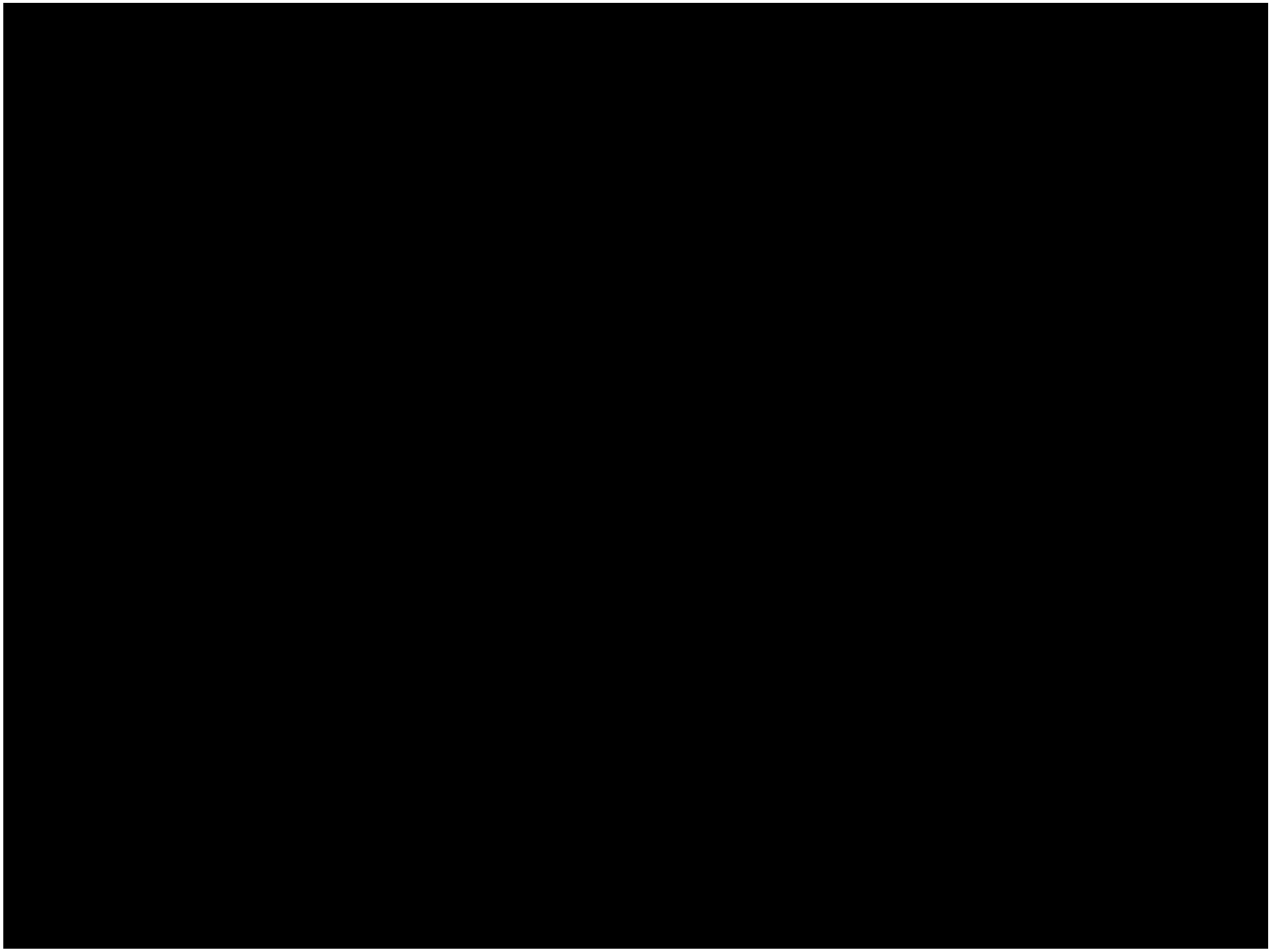


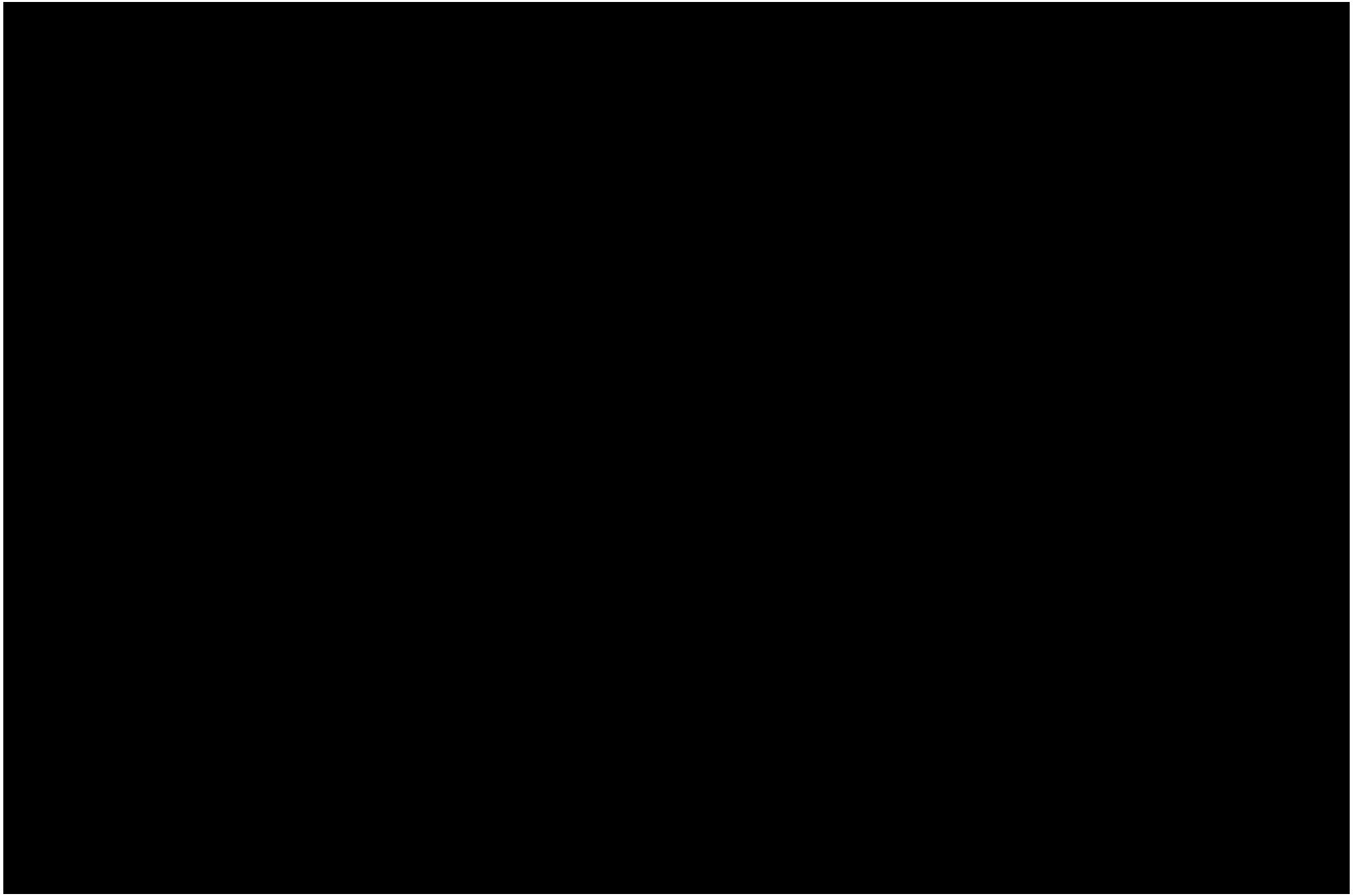


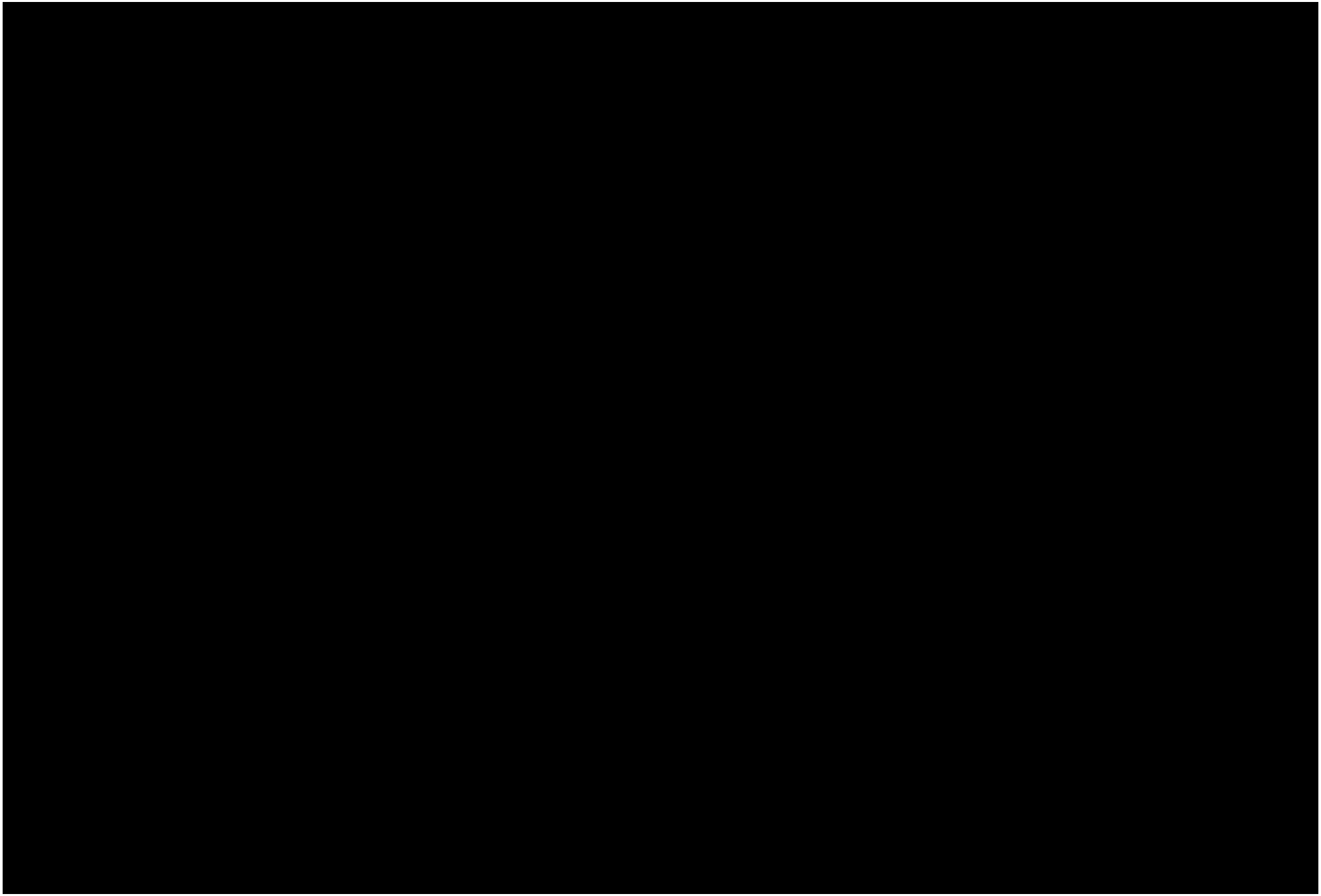


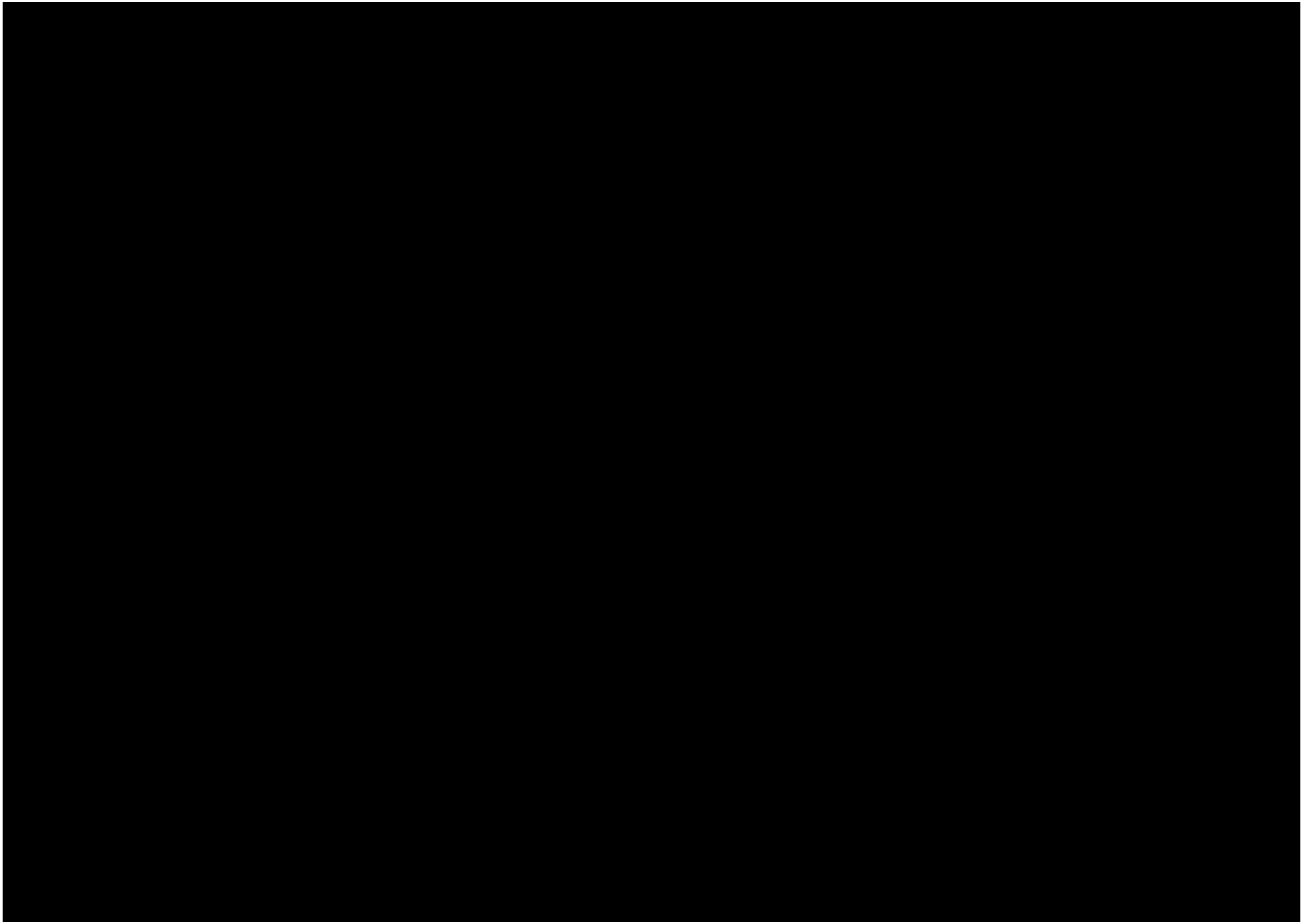


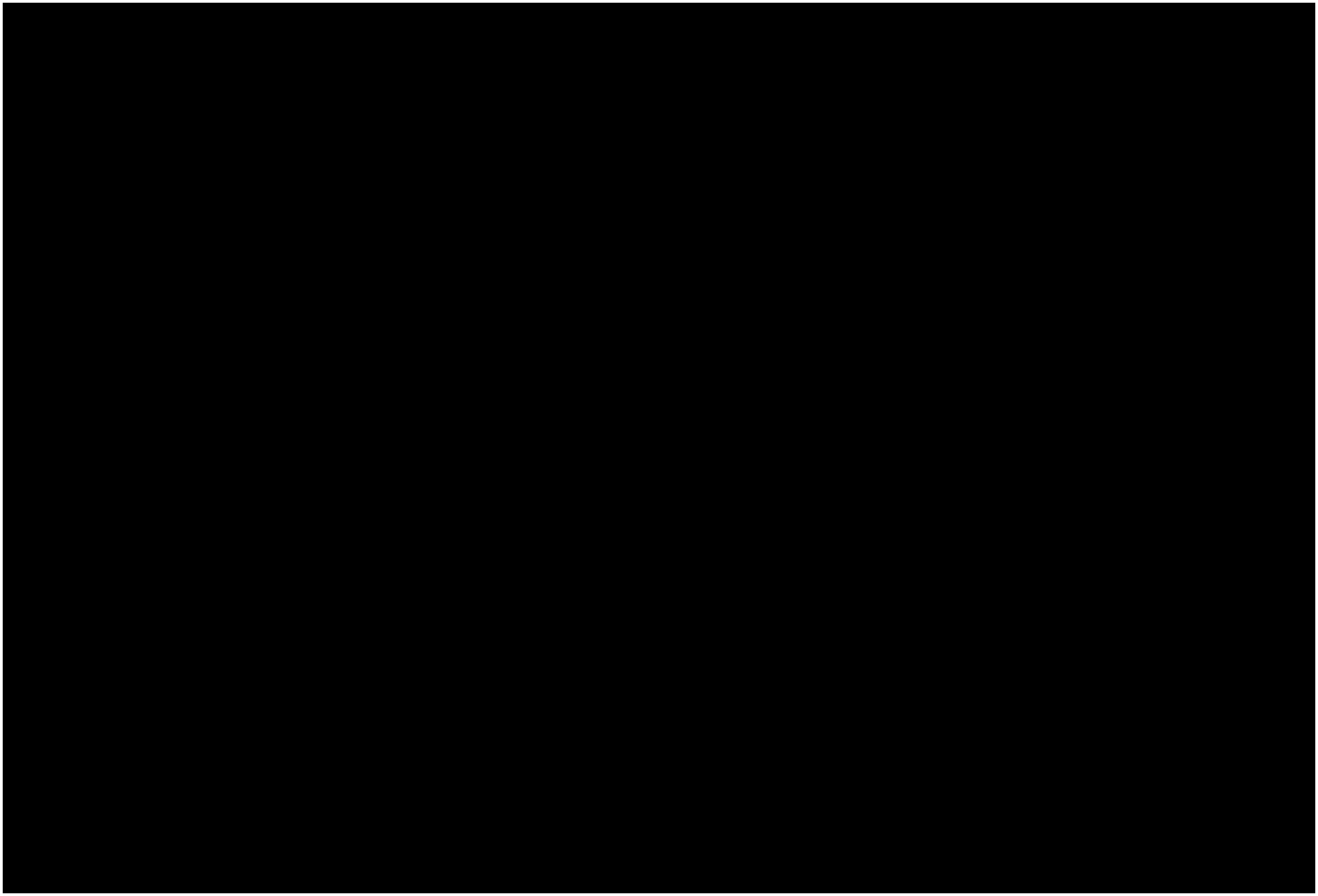


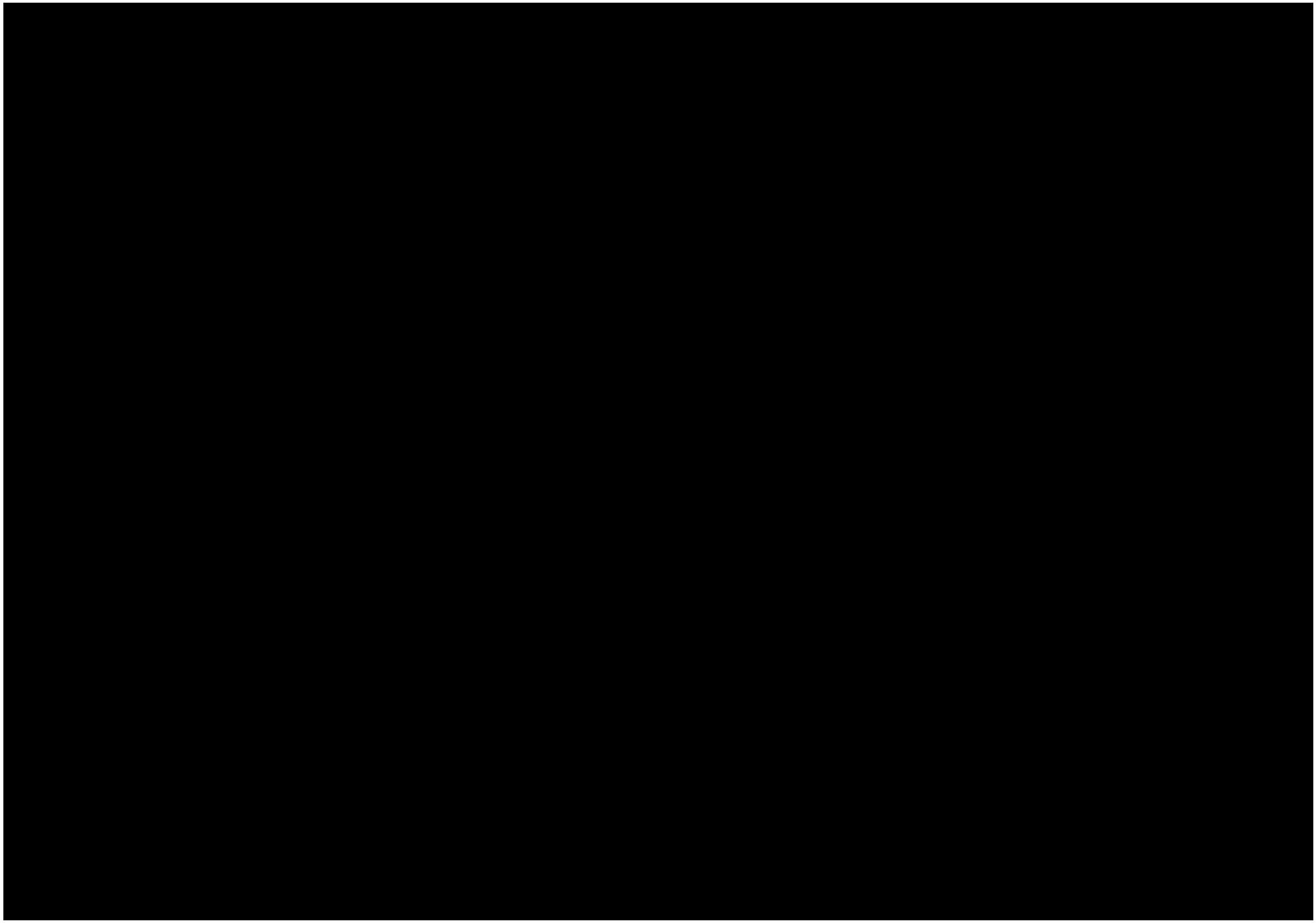


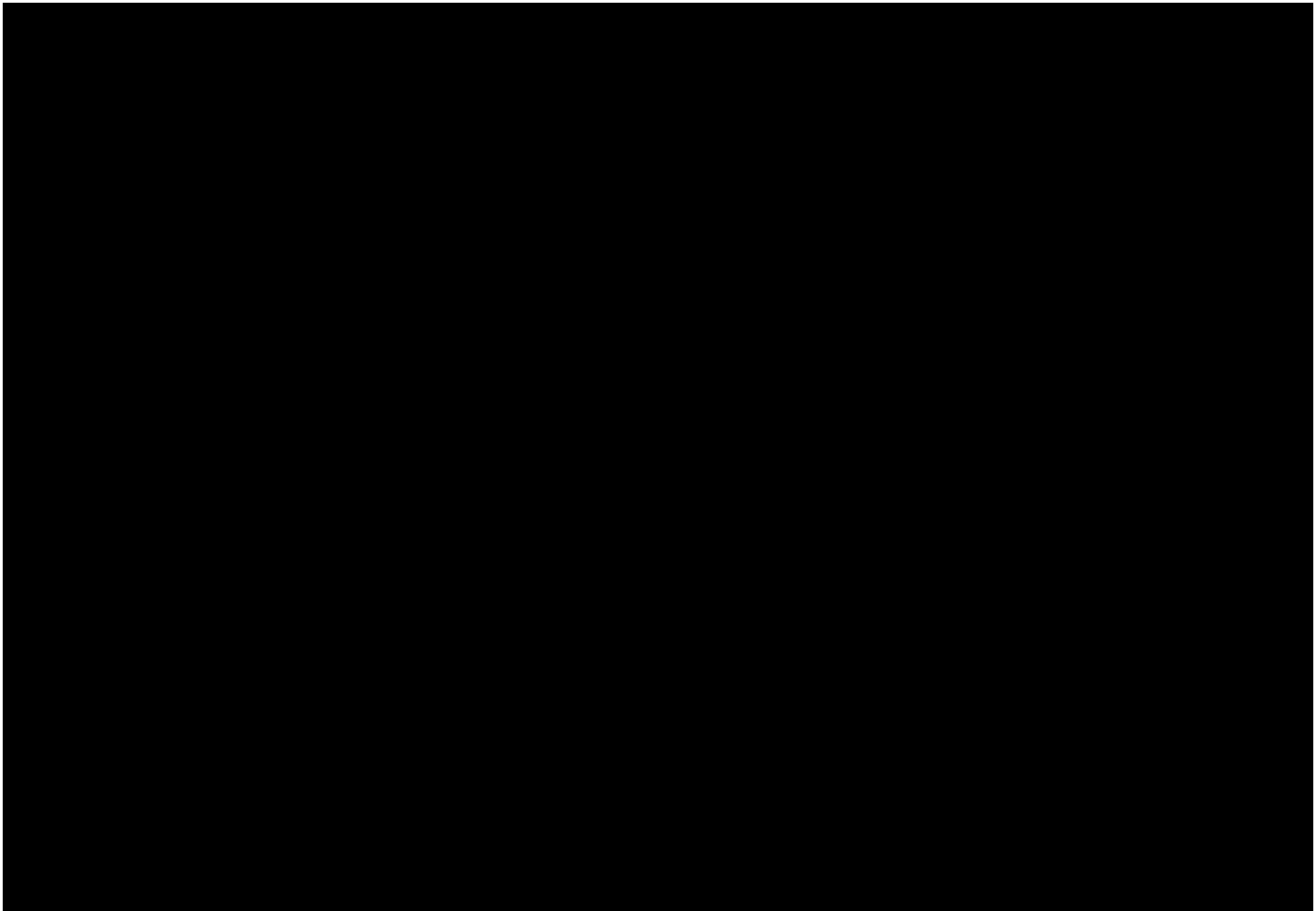


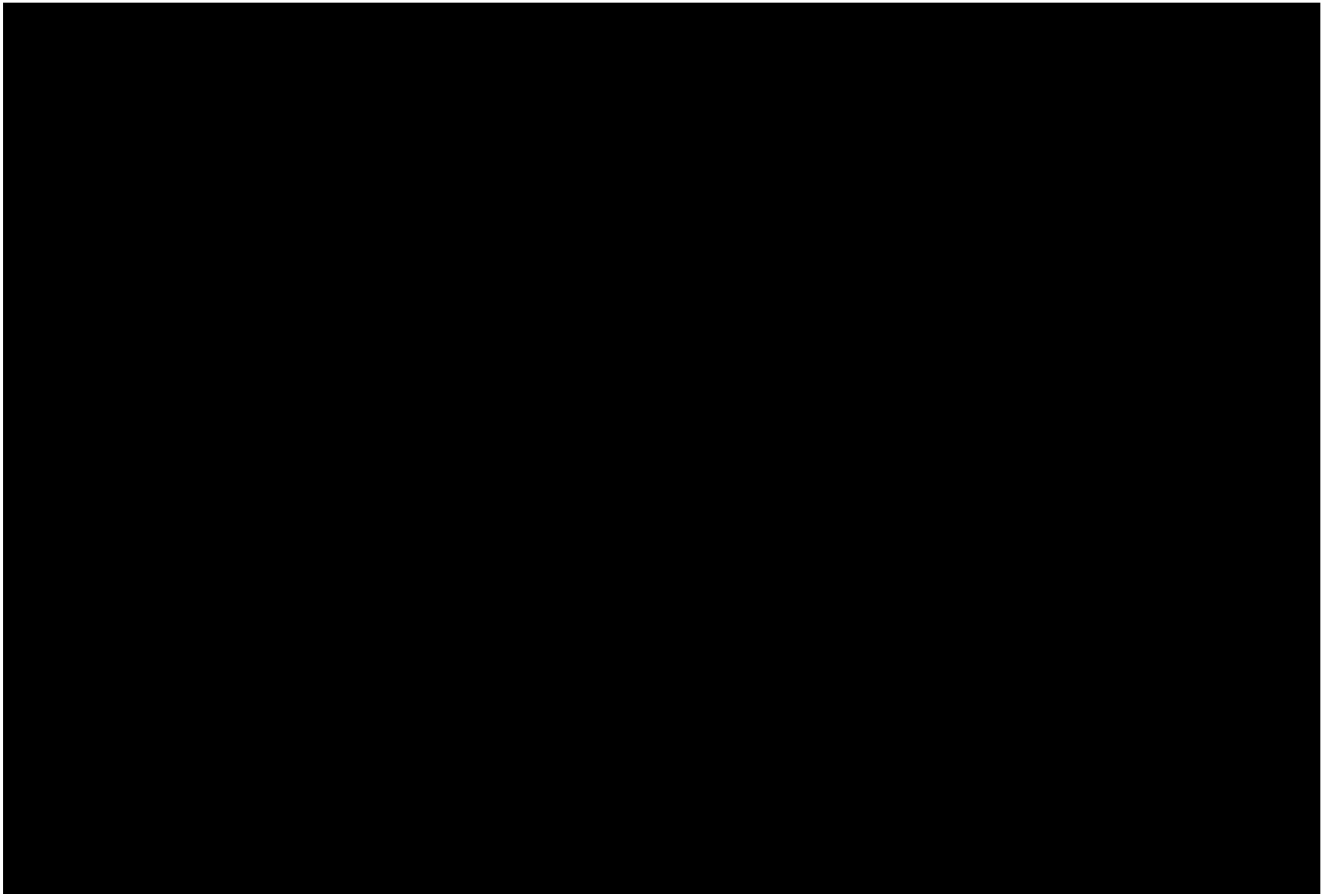


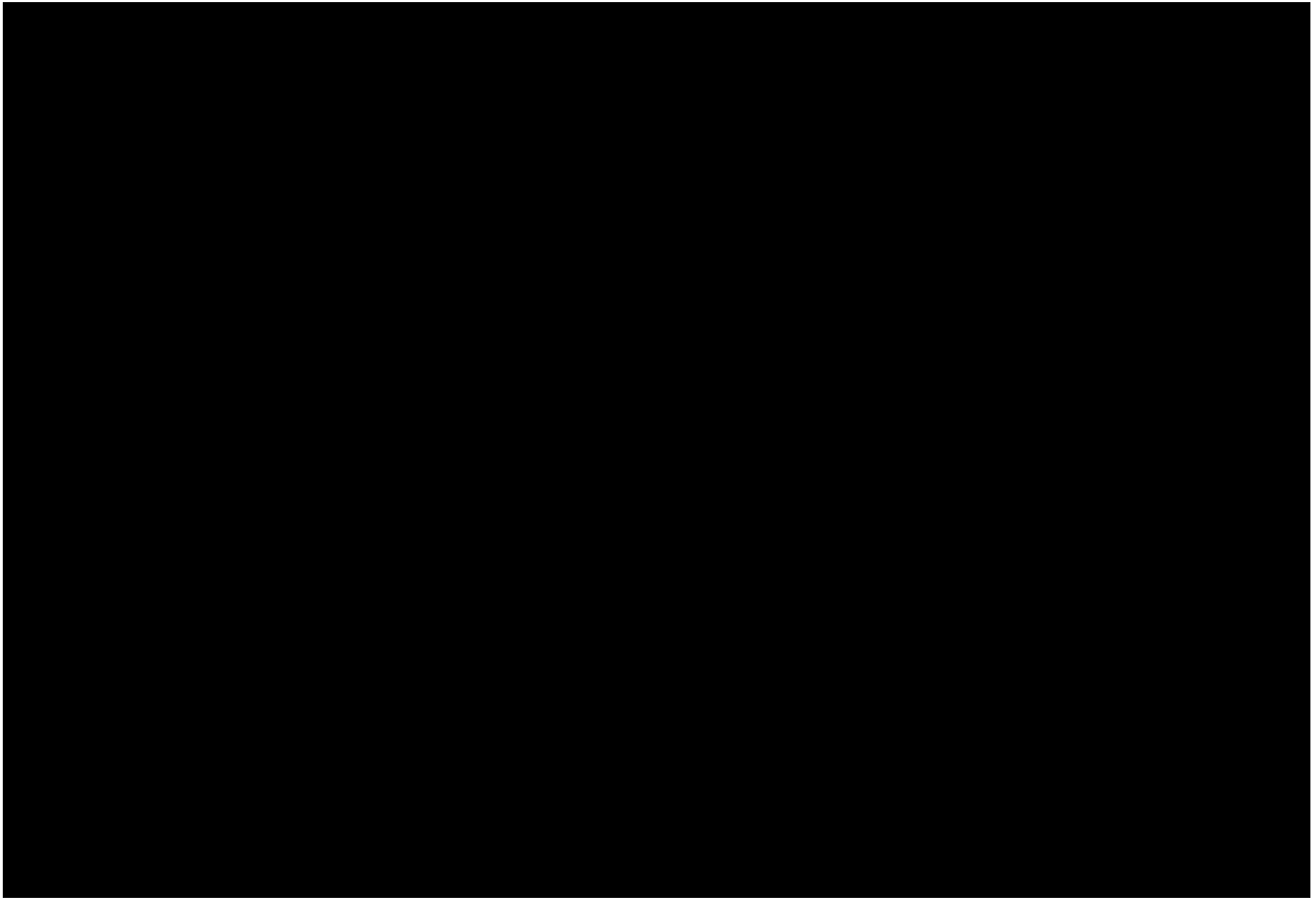


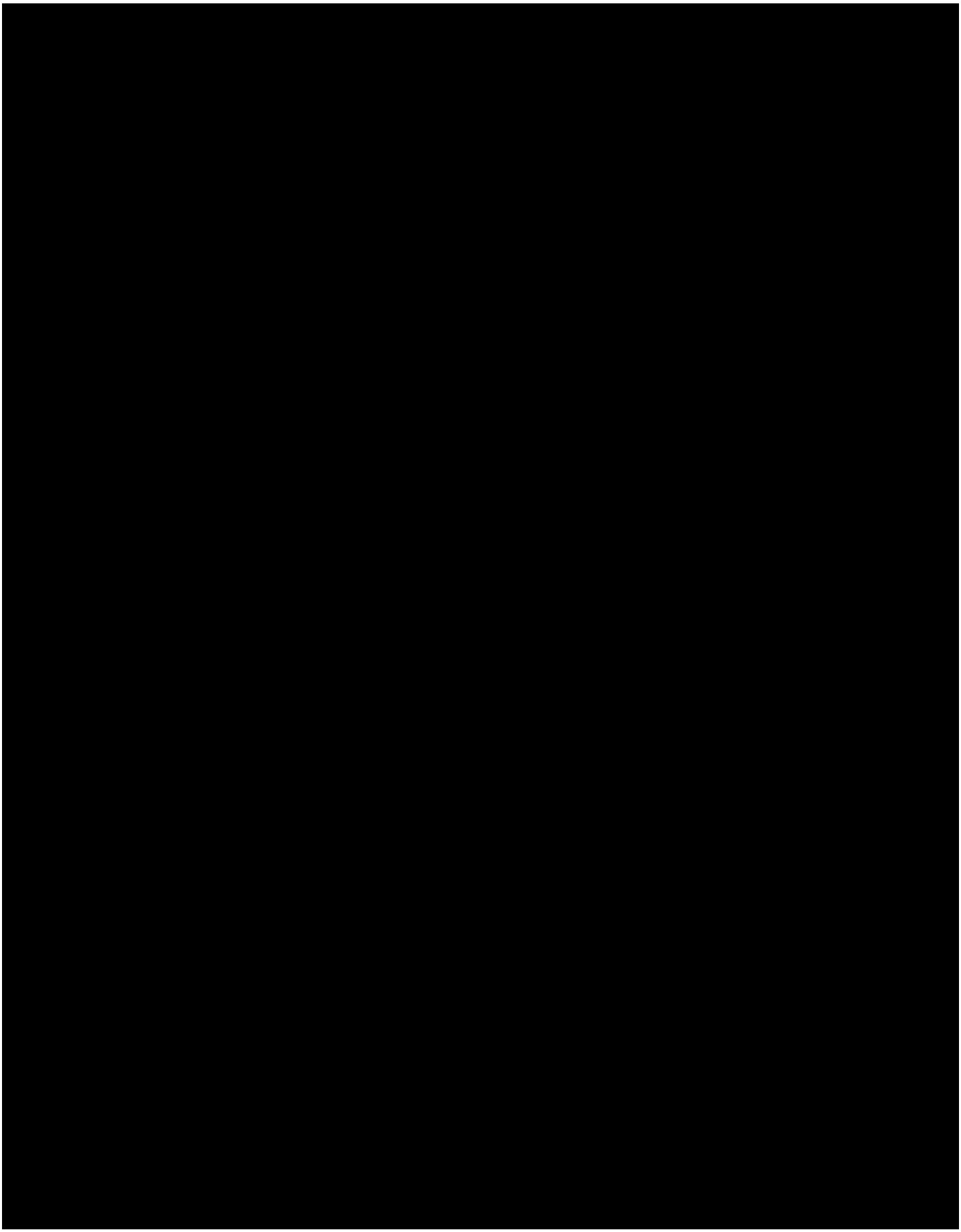


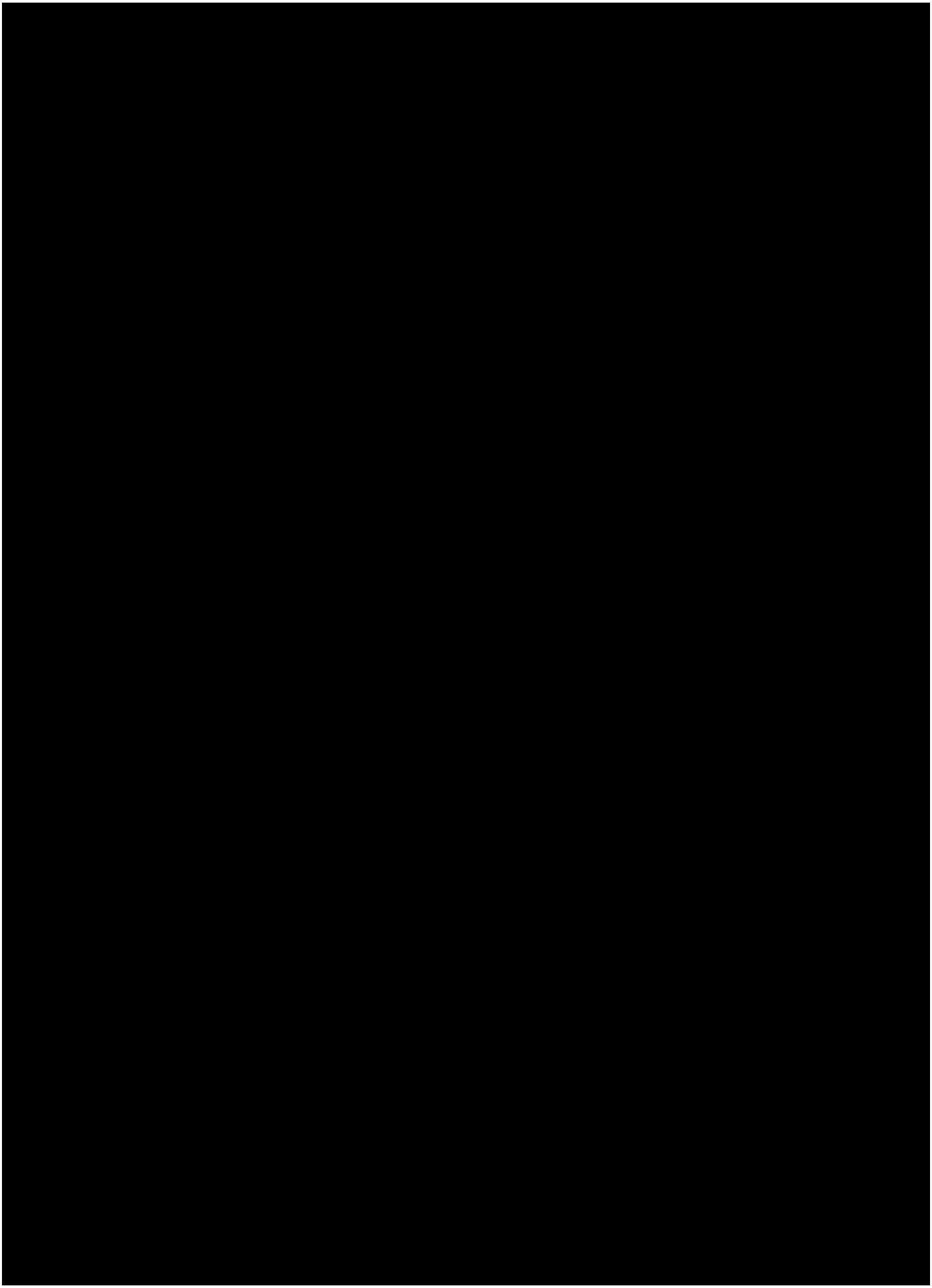










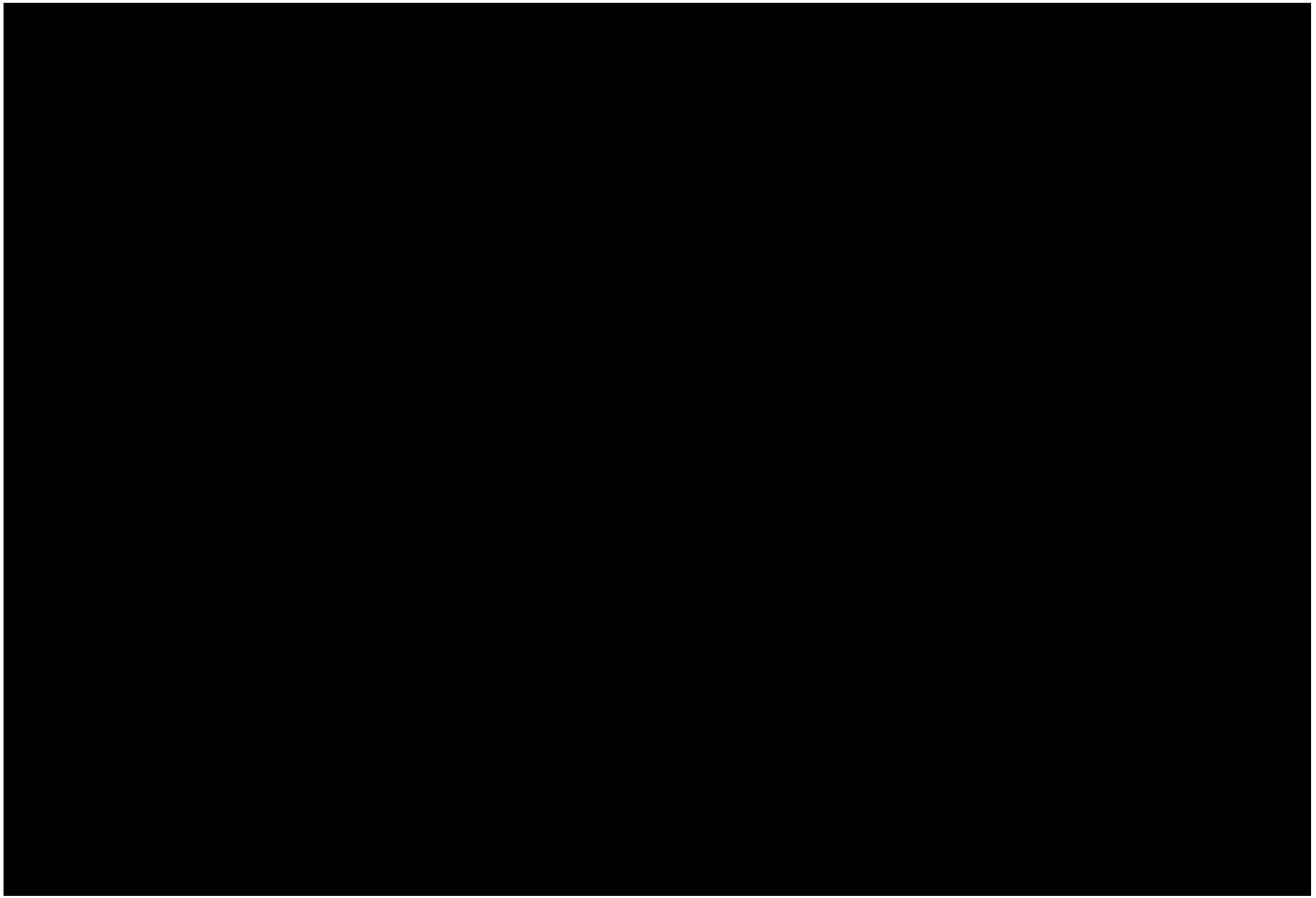


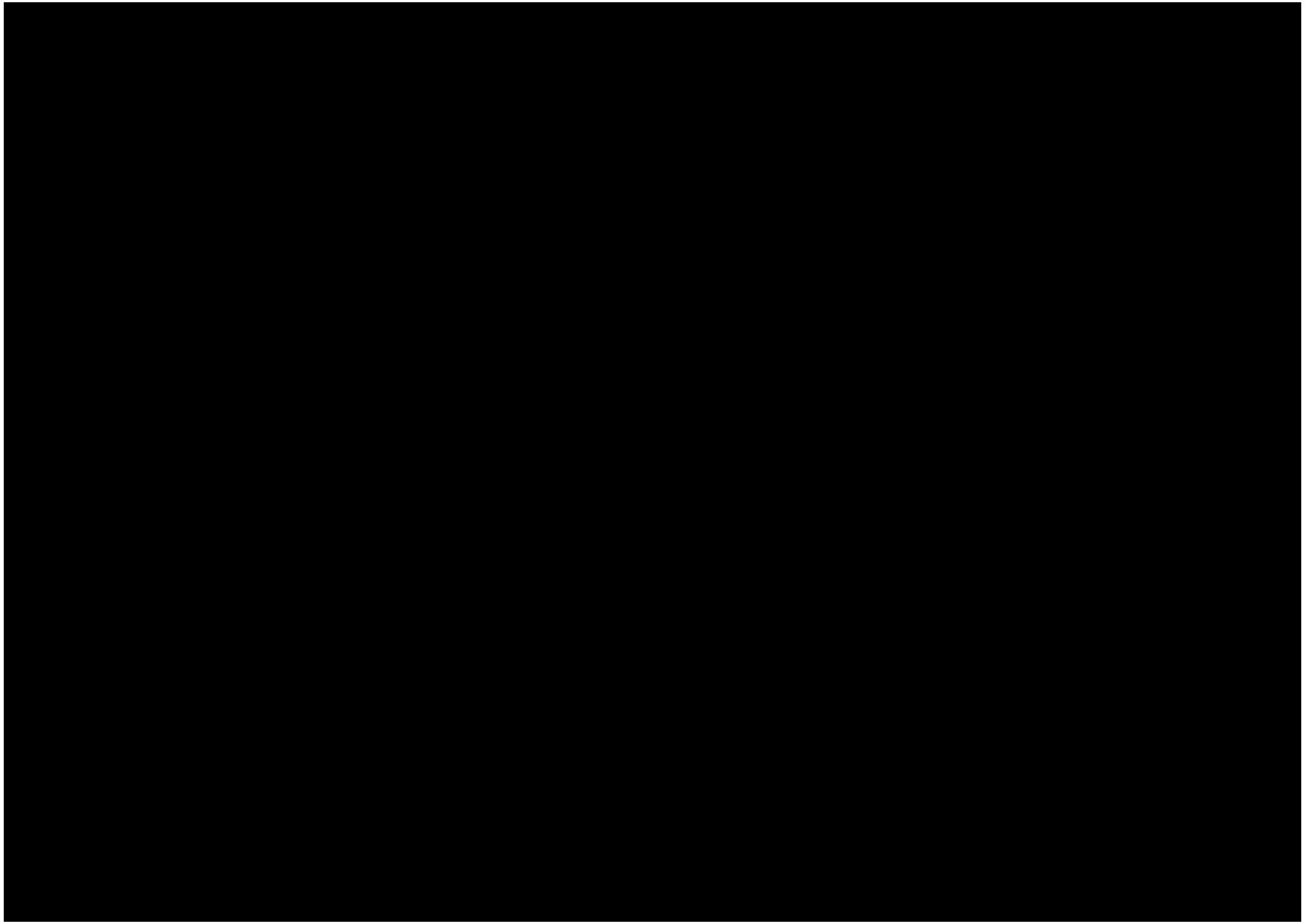


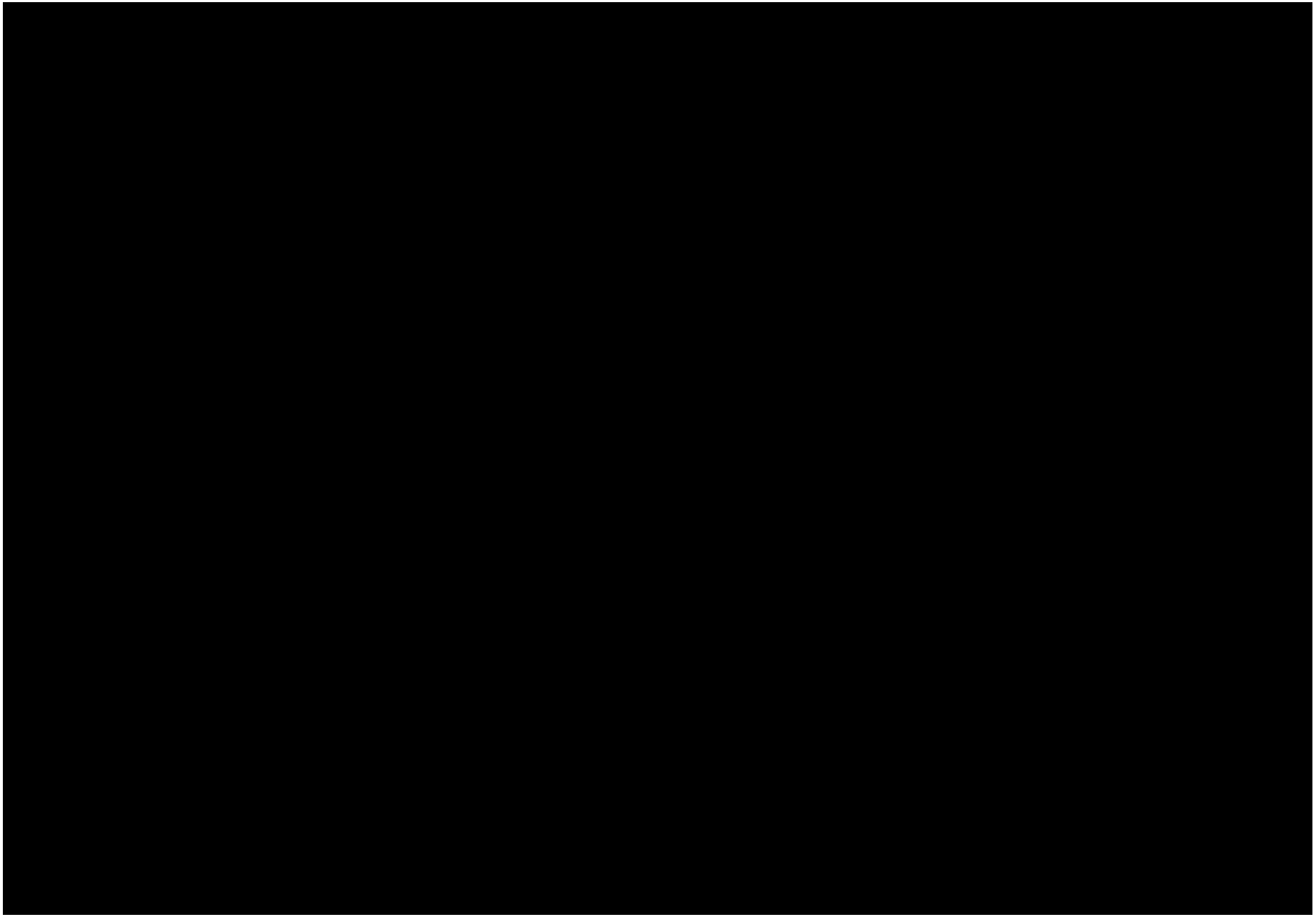
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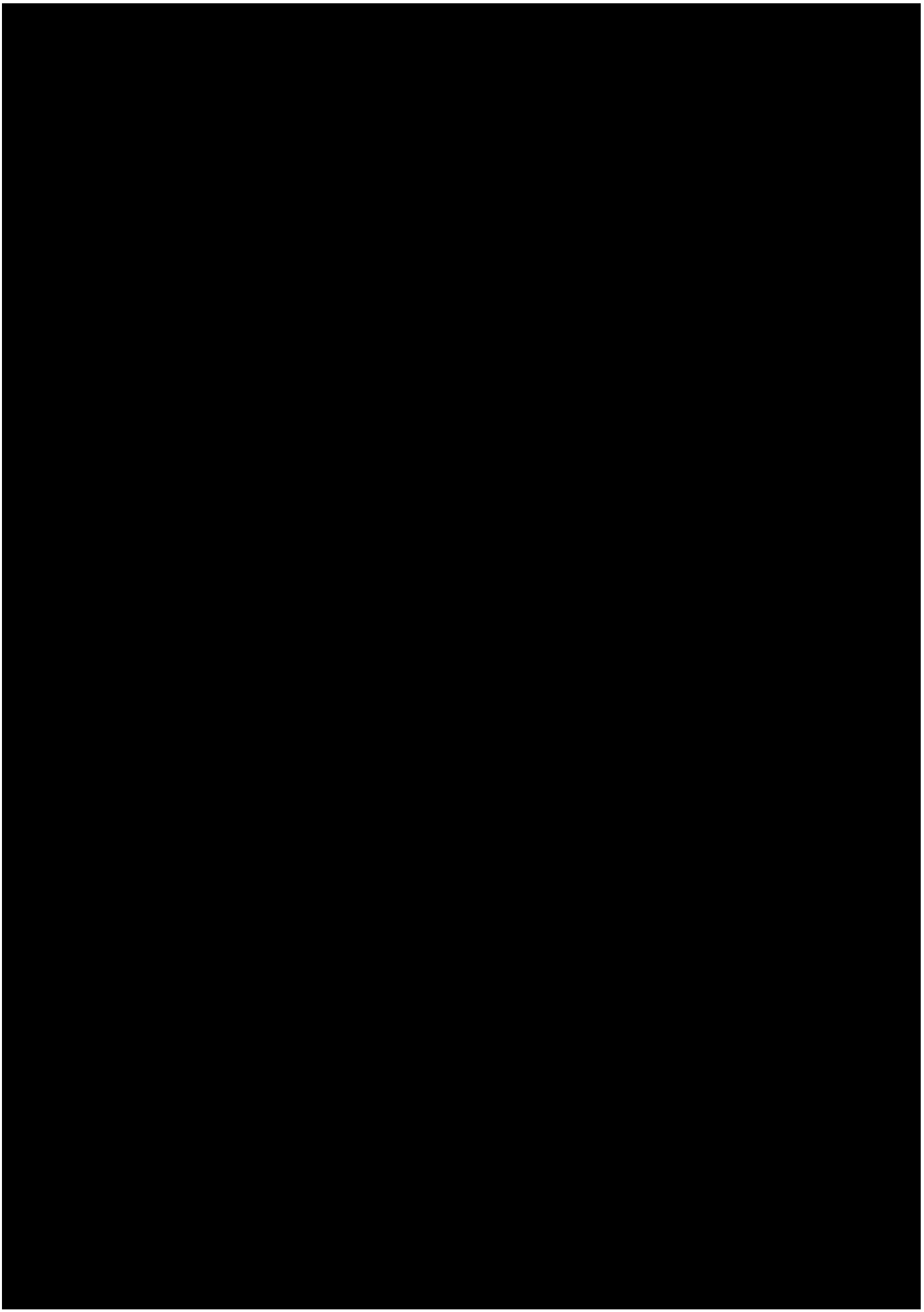
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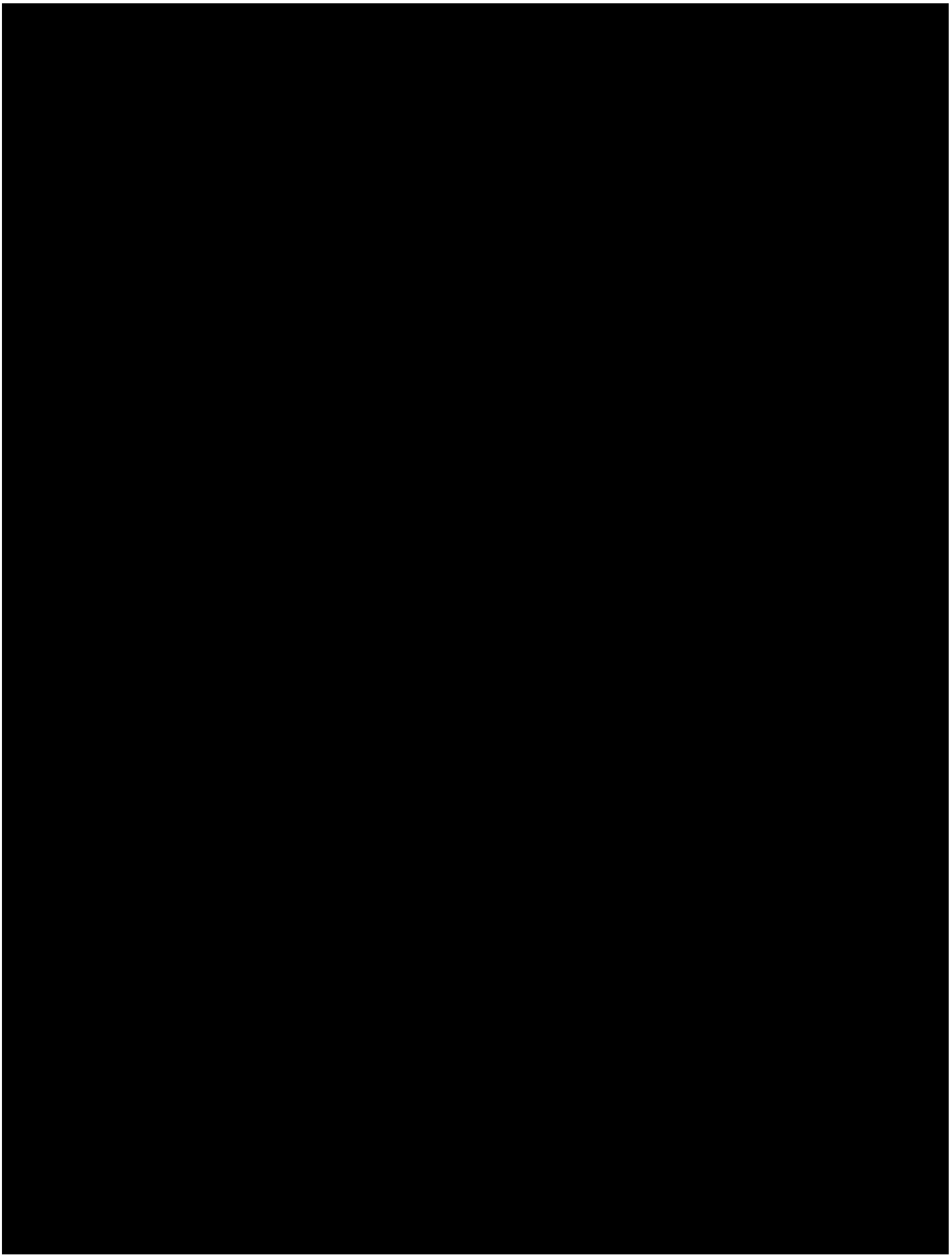
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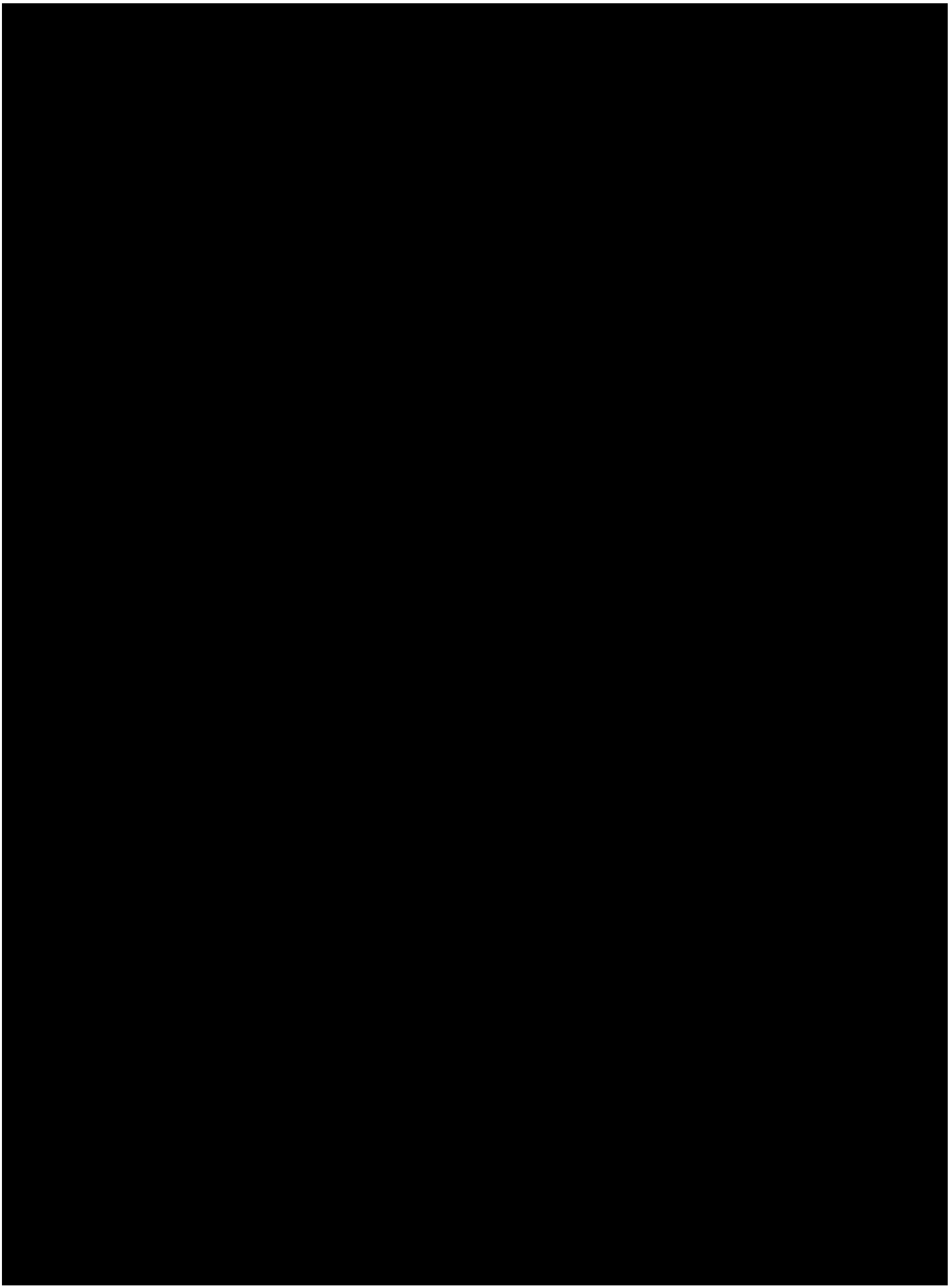


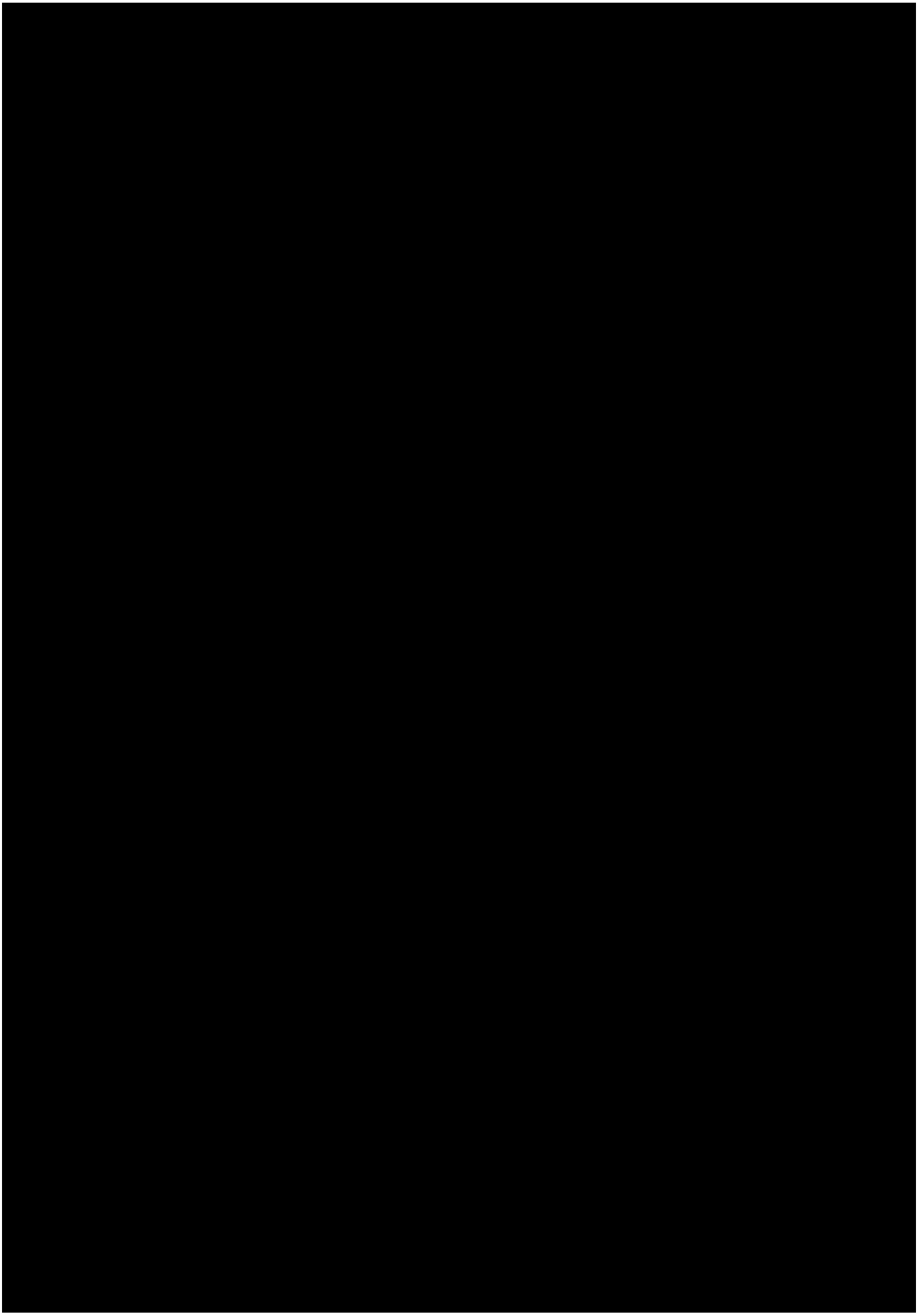


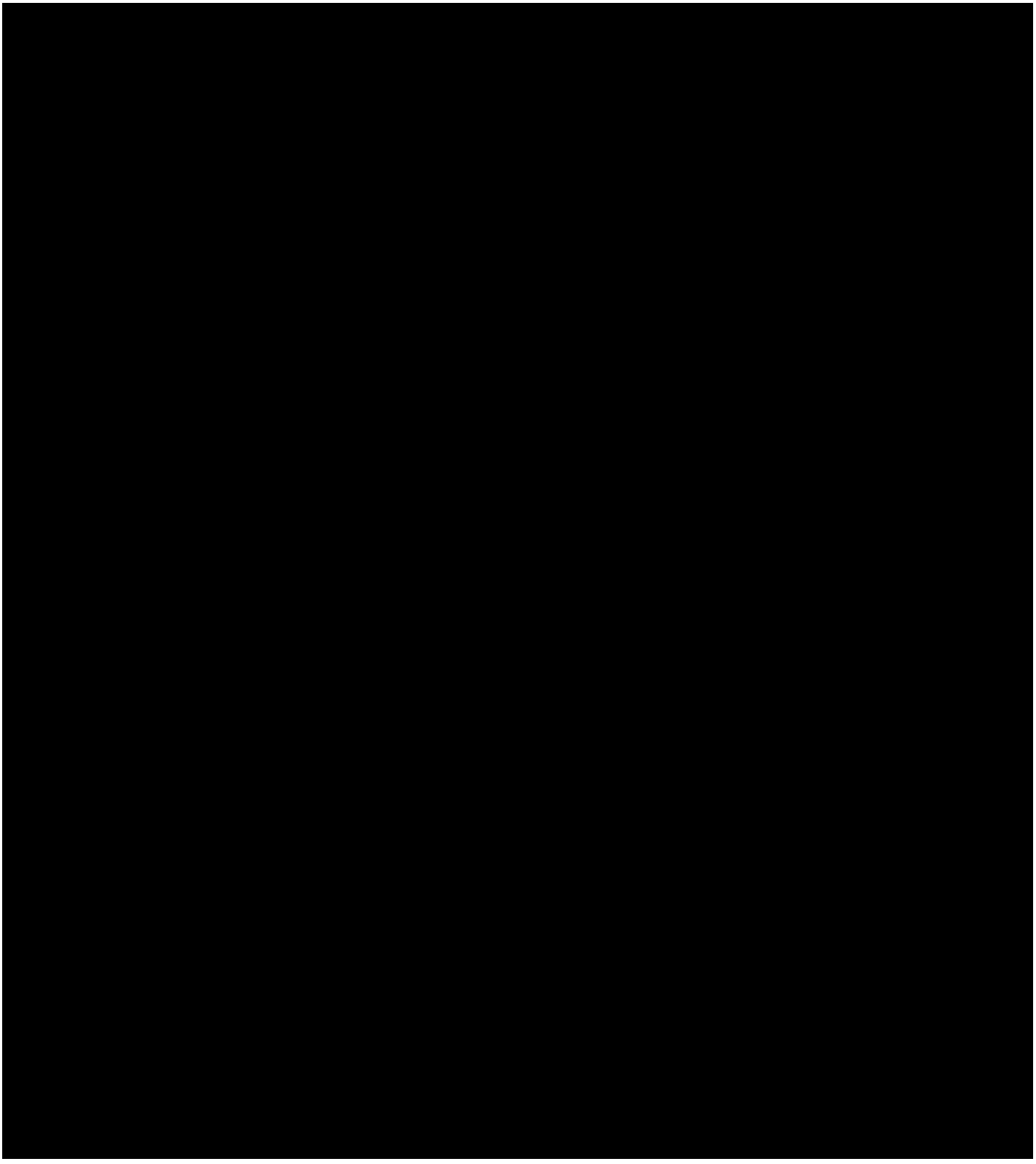




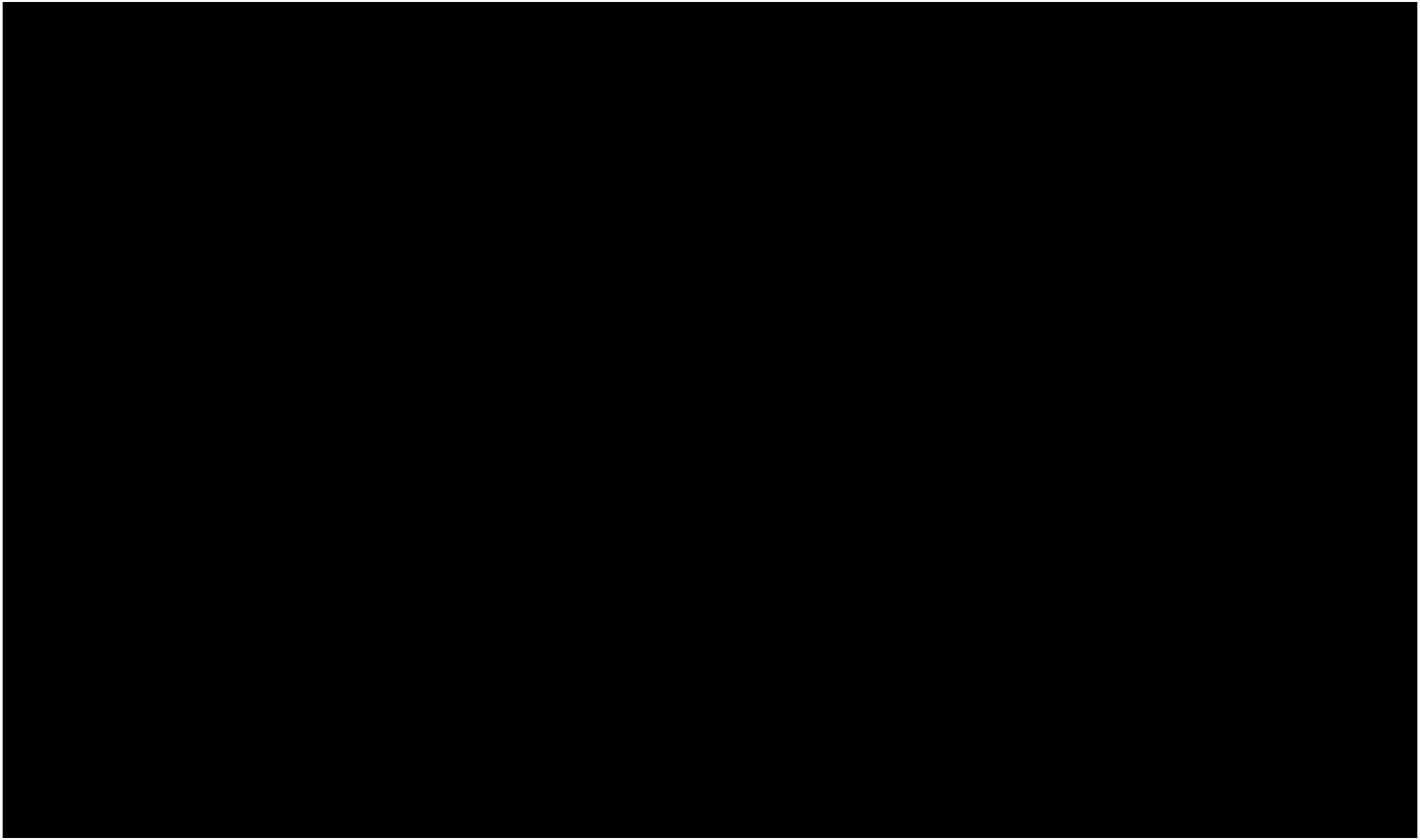














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