FINAL NOTICE

To: **Citigroup Global Markets Limited (FRN 124384)**

Date: 17 May 2024

1. Action

1.1. For the reasons set out in this Final Notice, the Prudential Regulation Authority (PRA) imposes a financial penalty on Citigroup Global Markets Limited (the "Firm") of **£33,880,000** for breaches of:

1.1.1. PRA Fundamental Rule 2 (a firm must conduct its business with due skill, care and diligence);

1.1.2. PRA Fundamental Rule 5 (a firm must have effective risk strategies and risk management systems);

1.1.3. PRA Fundamental Rule 6 (a firm must organise and control its affairs responsibly and effectively);

1.1.4. Rule 2.1 Algorithmic Trading of the PRA Rulebook (a firm must have in place effective systems and risk controls, suitable to the business it operates, to ensure that its trading systems are subject to appropriate trading thresholds and limits and prevent the sending of erroneous orders, or the systems otherwise functioning in a way that may create or contribute to a disorderly market); and

1.1.5. Rule 2.2(2) Algorithmic Trading of the PRA Rulebook (a firm must ensure that its systems are fully tested and properly monitored to ensure they meet the requirements of Rule 2.1 Algorithmic Trading of the PRA Rulebook),

between 1 April 2018 and 31 May 2022 (the "Relevant Period").

1.2. The Firm agreed to settle during the Discount Stage of the PRA's investigation. As a result, the Firm qualified for a 30% settlement discount under the PRA Settlement Policy. Were it not for this discount, the PRA would have imposed a financial penalty of **£48,400,000**.

2. Summary of reasons for the action

The Firm

2.1. The Firm is a wholly-owned indirect subsidiary of Citigroup Inc. (Citi). The Firm is a Category 1 investment firm, meaning it has the capacity to cause significant disruption to the UK financial system if it were to fail or by carrying on its business in an unsafe manner. During the Relevant Period the Firm was regulated by the PRA and by the Financial Conduct Authority (FCA).

2.2. The Firm operates as a market maker in equity, fixed income and commodity products across cash, over the counter derivatives and exchange-traded markets. The Firm also provides investment banking, capital markets and advisory services. Consequently, the Firm is involved in trading a range of products across a number of markets. The Firm's activities serviced Citi's Institutional Clients Group (ICG), which was primarily wholesale in nature and encompassed corporates, financial institutions, and institutional and other investors.

2.3. Further information about the Firm and its regulated activities (to the extent relevant to this Final Notice) are set out in **Annex A**.

The PRA and its expectations

2.4. As the prudential regulator for PRA-designated investment firms, such as the Firm, the PRA's role is to promote the safety and soundness of those firms, which is advanced by ensuring – amongst other things – that the business of those firms is carried out in a way that avoids any adverse effect on the stability of the UK financial system.

2.5. The PRA expects firms to manage risk in a way commensurate with the nature of the firm's business, and the scale and type of potential risk. The implementation of appropriate and effective trading controls is an essential element of risk management for firms engaged in trading activities. The PRA expects trade entry systems, including internal order management systems that have the capability to send instructions to create orders in algorithmic trading systems, to have all necessary and appropriate preventative controls to block erroneous manual input errors and to ensure trading activities are undertaken so as not to threaten the safety and soundness of a firm.

2.6. The PRA has defined expectations concerning a firm's risk management and governance of Algorithmic Trading. In setting these expectations, the PRA considers a firm's risk controls to be critical for ensuring appropriate governance arrangements are in place when engaging in algorithmic trading. The PRA expects regulated firms to comply with the provisions of the PRA Rulebook concerned with algorithmic trading. This includes not creating or contributing to a disorderly market.

2.7. The PRA expects firms to promptly remediate identified issues and, where the PRA highlights concerns to a firm, to address such concerns in a full and timely manner. The PRA expects firms to proactively take all necessary steps to identify and mitigate, or remove, risks arising from trading controls. Firms should not wait for risks to crystallise before taking appropriate action.

The Breaches

2.8. While a number of matters contributed to the PRA's view that the Firm breached the Fundamental Rules set out above, as detailed in Annexes A and B, the PRA considers the following matters which occurred during the Relevant Period to be particularly serious:

2.8.1. On 2 May 2022, a trading incident occurred whereby an erroneously inputted basket of equities with a notional size of US$444bn, was processed by the Firm's trading systems. The intended notional was US$58mm. A total notional of US$1.4bn "sells" were executed on European exchanges, coinciding with a material short term movement in several European indices, before the trade was cancelled. The immediate cause of the trading error was an input mistake by a trader, but as a result of primary control failings, erroneous orders with a notional size of US$196bn were generated in the Firm's electronic trading system, CitiSmart, for execution and were not subsequently cancelled in their entirety, such that in total, US$1.4bn of sell orders were executed across various European exchanges.

2.8.2. The order management system used by the Delta One desk (known as "PTE") used "hard" and "soft" blocks (i.e. limits) as controls within its first line of defence and risk management processes. A "hard" block is a block which prevents a trade from proceeding once a control threshold is hit, and this block cannot be overridden by an individual trader. A "soft" block is triggered when a control threshold is hit, but may be overridden by an individual trader, allowing the trade to proceed. PTE displayed alerts for both hard and soft blocks together in a single "pop up" alert, which was configured such that only the first 18 lines of alerts were visible without scrolling and only 18 alerts could be reviewed at a time. Traders were able to override soft block limits without needing to review all of the alerts. The 2 May 2022 order generated 711 alerts, 65 of which were hard blocks and the remainder soft blocks. The alert was by-passed, with the soft blocks overridden. The effectiveness of the "pop ups" as a trading control was, accordingly, limited by the fact they could be "clicked through" with ease.

2.8.3. The scope of the hard blocks in PTE was insufficient. In particular, there was no hard block for orders by their total notional value, which would have prevented the entire basket of equities of US$444bn notional being processed by the Firm on 2 May 2022. That is despite the Firm's Delta One desk in New York having such a hard block in place. This is the primary preventive control for ‘fat finger’ errors, that is, erroneous manual input errors in basket size entry. There were also no hard blocks which prevented orders based on comparison of the order size with the average daily volume of the stock to be traded, and no hard blocks which related to price tolerance. Further, certain of the hard blocks which did exist were not calibrated appropriately. For example, there was a hard limit notional threshold for individual underlying stocks within a basket, which was set at US$2bn. This was revised to US$250mm subsequent to the 2 May 2022 Incident. Therefore, the scope and calibration of hard block thresholds compromised their effectiveness as controls.

2.8.4. The Firm’s risk management functions failed to provide effective real-time monitoring of those trades which generated suspensions and information alerts. The first line of defence risk function which monitored for disorderly markets received suspension alerts from the Firm’s algorithmic system (CitiSmart). On 2 May 2022, their system filtered out 226 of the 234 generated suspension alerts and therefore, their escalation missed the vast majority of the notional value. A separate team, monitoring for Firm trades to be executed on external venues, was not resourced on 2 May 2022 due to scheduled leave and therefore arranged a scheduled handover to another team to provide cover. The team providing cover failed to react to 284 real-time information alerts generated by CitiSmart, relating to 284 orders each in excess of the maximum notional value of US$25mm. Consequently, neither of these two risk functions alerted the trader to their error on 2 May 2022. It was in fact the trader who discovered the error and cancelled the order, approximately 15 minutes after they had entered the order. Consequently, the risk management function providing real-time monitoring of the Firm’s trades was ineffective.

2.8.5. The testing of algorithms at the Firm was insufficient. Testing was at a system-by-system level and did not test trading “flow” across multiple systems. Such testing could have identified any gaps in the control environment, investigated whether data flow across systems was consistent, and could have exposed any unexpected errors or issues. Further, such testing is necessary to understand the impact of erroneous trades moving through different systems and on to an external venue.

2.8.6. The above matters were all the more egregious because, during the Relevant Period, the PRA repeatedly gave supervisory feedback to the Firm regarding the poor state of its trading controls, and the Firm’s internal risk and compliance functions also repeatedly identified weaknesses in those controls, and there was a series of trading incidents which highlighted deficiencies in the Firm’s trading controls, as set out in Annex A.

2.8.7. The Firm took steps to remediate the issues identified in the Internal Audit Reports and ICRM Reports as set out in this Annex A, and a significant majority of these were rectified during the Relevant Period. The Firm intends to remediate the remaining issues before the end of 2025. Throughout the Relevant Period, the Firm was keeping the PRA updated as to the actions it was carrying out to remediate identified issues.

3. Annexes/appendices and procedural matters

3.1. The structure of this Notice is as follows:

3.1.1. **Annex A** - full particulars of the facts and matters relied on by the PRA in its decision-making process regarding the Firm.

3.1.2. **Annex B** - the relevant regulatory requirements and the breaches.

3.1.3. **Annex C** - the basis for the sanction the PRA has imposed.

3.1.4. **Annex D** - important procedural matters.

3.1.5. **Appendix 1** - the definitions used in this Notice.

3.1.6. **Appendix 2** - relevant statutory, regulatory and policy provisions applicable during the Relevant Period.

Oliver Dearie

Head of Legal, Enforcement and Litigation Division
for and on behalf of the PRA

ANNEX A: FACTS AND MATTERS RELIED UPON

1. BACKGROUND

The Firm

1.1 The Firm is a Category 1 investment firm, meaning it has the capacity to cause significant disruption to the UK financial system if it were to fail, or by carrying on its business in an unsafe manner. During the Relevant Period the Firm was regulated by the PRA and the FCA.

1.2 CGML is headquartered in London and operates globally, generating the majority of its business from the Europe, Middle East and Africa (EMEA) region with the remainder coming from Asia and the Americas. The Firm operates as a market maker in equity, fixed income and commodity products across cash, over the counter (OTC) derivatives and exchange-traded markets. The Firm also provides investment banking, capital markets and advisory services. The Firm's activities serviced Citi's Institutional Clients Group (ICG), which was primarily wholesale in nature and encompassed corporates, financial institutions, and institutional and other investors.

1.3 The Firm is involved in trading a range of products across a number of markets. Its principal business areas are: Banking, Capital Markets and Advisory; Commodities; Equities; Global Spread Products; and Rates. Equities is comprised of the following business lines: Equity Markets; Multi Asset Group; Prime Finance; Delta One; and Futures and OTC Clearing. Equities is supported by a number of technology systems, as detailed in this Annex A. A range of trading controls are required to ensure the Equities business operates within the Firm's operational risk tolerances, and further, to satisfy the PRA's expectations. These trading controls, and the PRA's expectations in respect of these, are explained further in this Annex A and in Annex B.

1.4 The Delta One trading desk are a part of the Equities business. They provide access, financing and investment solutions to a broad spectrum of clients (institutional, corporates and hedge funds) via synthetic products such as derivatives, swaps and exchange-traded funds. A Delta One product gives the investor the same exposure as if the investor were to own the underlying asset. An equity swap can provide an investor with exposure to many stocks without the operational burden and expense of having to transact each stock themselves. The price of these products closely tracks that of the underlying stocks and therefore, Delta One traders can hedge their exposure to clients by taking opposing positions in the underlying stocks.

RELEVANT FACTS: 2018

PRA Feedback

1.5 On 23 April 2018, the PRA provided Periodic Summary Meeting ("PSM") feedback to the Firm's supervised UK group, raising booking model controls as a key risk. The PRA feedback articulated a concern with inconsistent and inadequate implementation of controls across the different product lines booked into UK entities, noting the regulatory focus on controls supporting the booking model. From late 2018, the Firm communicated its plans to the PRA on development of booking model controls and on 26 November 2018, the Firm provided an update to the PRA on their progress against this feedback, reporting they were focussed on delivering adequate systems and controls, both preventative and detective, to ensure the booking control arrangements were adhered to.

Equity Trading Incident (May 2018)

1.5 In May 2018 an Equities trading desk at the Firm received an order from a client wanting to cross a basket of 3 equities - Equity A, Equity B, and Equity C. These stocks were all traded on a European exchange. The cross required the Firm to book a purchase order and a corresponding sell order, at the day's closing price, for the equities composing the basket. The aim of the transaction was to transfer the client's position from a competitor bank to the client's Firm account. The client's position in Equity C was 3,516,027 shares. Therefore, on the price at which Equity C shares closed, the Firm would simultaneously buy and sell 3,516,027 shares.

1.6 The client's position in Equity C was relatively large. It represented 1.5 times the Average Daily Volume ("ADV") of Equity C shares traded in the market and amounted to a notional in excess of the exchange's single order limit of €20mm. ADV refers to the number of shares of a particular stock which, on average, change hands during a single trading day. The exchange's single order limit required consideration as the trade executions would need to be split into smaller tranches, to prevent the orders being rejected for exceeding the €20mm size limit.

1.7 The basket was input into PTE, the order management system, by the trader with the execution field set to "At Market Price" and was subsequently processed through the CitiSmart algorithm to be executed on the market close. "At Market Price" creates an unpriced order to buy or sell a security at the best available price. As such, it is guaranteed to receive an execution, but it does not guarantee a specified price. An "At Market Price" order in large volume might cause a significant price movement as it absorbs liquidity in execution.

1.8 The Firm's rejected trades are registered in GENIE, which monitors orders, including alerts, rejections and suspensions from exchanges. The Electronic Execution ("EE") desk were responsible, at this time, for monitoring and responding to any alerts in GENIE.

1.9 The EE desk received a rejection notification of an order to purchase 3,516,027 shares of Equity C; the rejection notice for the corresponding order to sell the same quantity of shares would not be identified until later. The rejection was due to the order being in in excess of the exchange's

€20mm single order limit. Therefore, EE split the order into two smaller tranches which would not exceed the single order limit, i.e., a purchase of 2,000,000 shares and a further purchase of 1,516,027 shares. These two tranches were sent back to the exchange for execution.

1.10 The first tranche, to buy 2,000,000 shares with no limit on price, was transmitted to the auction before it closed. The second tranche, with the remaining 1,516,027 shares to buy, was not sent before the auction had closed. The alert for the rejected sell order was not seen in GENIE, by the EE team, until after the auction had closed. The impact of buying 2,000,000 shares with no limit price in the auction, and with no corresponding sell order, was to create a price movement in Equity C. When the market opened the following morning, the inflated closing price reverted. This crystallised a loss to the Firm of US$2.7mm.

1.11 CitiSmart at that time lacked functionality to check the notional size of trades against exchange limits. In the absence of a notional size check, the Equity C trades were transmitted in sizes which were in breach of the exchange's single order limits. Therefore, the exchange rejected the orders and sent them back to the Firm. Subsequent to this event CitiSmart was enhanced to perform notional checks, based on notional limits imposed by each exchange, and to include functionality to avoid limit size breaches.

1.12 GENIE did not link or identify related orders, such as the offsetting crosses described above. Further, the trader had not informed the EE desk of the cross trades being executed on the close. Consequently, the EE desk were not aware of the trades, nor of them being linked, from either the trader or from their monitoring system GENIE. Further, GENIE did not rank alerts by any metric such as notional or execution priority. Instead, alerts and notifications were reviewed and actioned sequentially by the EE desk. Thus, risk considerations, such as notional size, did not drive the sequencing and response to alerts, and EE were not assisted by GENIE (or any other system) in recognising orders which might be crossing (buy and sell in the same instrument and the same size).

1.13 In an internal review of the incident, the Firm acknowledged functionality should have existed to split trades into smaller transaction sizes to avoid limit size rejections from the exchange. The Firm further recognised a need to improve "fill vs book" functionality in PTE. This would enable PTE to recognise offsetting positions within the Firm's trading book, crossing them internally without requiring orders be sent to cross on an exchange. The Firm also identified a need to enhance monitoring of trades within GENIE, so that alerts would be ranked ordered by notional weighting and a risk prioritisation mechanism to determine alerts requiring resolution for the auction window. This would add a layer of risk consideration to alert response which had hitherto been absent.

1.14 The Firm notified the PRA, on 25 June 2018, that it was undertaking a review of its pre-trade controls, including an immediate action to remove the instruction to trade "At Market Price", with no price limit, without pre-approval from a senior trading desk head. In addition, the Firm committed to educating both trading desks, EE and Program Trading ("PT"), of the need to improve communications when dealing with large order sizes with the potential for market impact.

The Firm updated the PRA, on 20 November 2018, on the remediation progress of issues identified following the May 2018 Incident identifying the remediation that had already taken place and that the remaining steps were due to be completed by end of Q1 2019.

Internal Audit Reports

1.15 On 25 May 2018, the Firm's internal audit function ("IA") issued a report into Equities (global market risk), finding there was "Room for Improvement" in the design and operating effectiveness of key controls to mitigate the inherent risks relating to the Global Equities business. The Firm defined "Room for Improvement" as, "Audit results indicate that while assurances can be placed on the design and operating effectiveness of internal controls to mitigate and/or manage one or more of the key inherent risks to which the activities being audited are exposed, attention to the adequacy of certain control(s) is required for a number of area(s)." The report noted that the overall trend of the control environment was "stable" and that the issues raised did not affect the approved risk appetite of the Firm or other Citi entities. The majority of the controls within the scope of the audit were found to be "designed and operating effectively" and IA's rating of the "Overall Control Effectiveness" was 88%.

1.16 On 1 June 2018, IA issued a report into Delta One Sales and Trading. The audit found "Room for Improvement" in the design and operating effectiveness of key controls to mitigate the inherent risks relating to the Delta One business. Internal audit tested 19 controls, of which nine were preventative and 10 were detective. Further, of those controls tested, 16 were manual and three automated. Four controls were deemed by IA not to be designed effectively and all controls were deemed to be operating effectively. IA noted issues were caused by lack of awareness of Citi policy requirements, insufficient management oversight, and over reliance on partially mitigating controls. It was recorded that management had committed to an appropriate Corrective Action Plan ("CAP"), with a target completion date of 1 April 2019. The report noted that "[t]he overall trend of the control environment is improving compared to the prior audits". IA's rating of the "Overall Control Effectiveness" was 79%.

1.17 On 29 June 2018, IA issued a report on Equities' Electronic Trading ("e-Trading") system processes. The e-Trading business enables clients and internal trading desks to send Cash Equity orders directly to market venues. The audit results indicated "Limited Assurance" could be placed on the design and operating effectiveness of key controls to mitigate inherent risks relating to e-Trading activities. The Firm defined "Limited Assurance" as, "Audit results indicate that limited assurance can be placed on the design and operating effectiveness of internal controls to mitigate and/or manage one or more of the key inherent risks to which the activities being audited are exposed. The existence of repeat issues is also considered in assigning this overall assessment." The report found the identified issues were caused by a lack of management oversight, poorly designed operational and trade booking processes, and misinterpretation of the Low Touch e-Trading Activities policy requirements. The report further articulated that, unaddressed, these issues could result in orders being executed in contravention of client instructions, unauthorised modification of transaction data, and an inability to effectively monitor kill switch activation and business resumption. The report stated management had initiated CAPs, and these were expected to complete by 8 February 2019. IA's rating of the "Overall Control Effectiveness" was 78%.

RELEVANT FACTS: 2019

PRA Feedback & Correspondence

1.18 During the course of 2019, the PRA provided substantive feedback to the Firm, including on new product approval and booking model controls. The PRA acknowledged the Firm had taken the PRA's findings seriously. However, significant work was necessary to deliver the strategic outcomes required. Further, the PRA requested detailed plans to be fully developed and shared to assist in taking forward the substantial body of work identified.

1.19 In relation to booking model controls, the PRA found notable deficiencies in applicable systems and controls, and a lack of preventative controls to avoid transactions being mis-booked by the Firm. The PRA noted the Firm relied on different systems for different processes, and that different levels of trading controls did not appear to have been linked together in the trade capture and risk system. Further, it was observed that running multiple systems and processes could create an operational burden, resulting in control gaps. On 12 July 2019, the Firm responded, fully acknowledging the value and benefit of addressing the findings raised by the PRA in a timely manner, committing to improve the booking model control framework and controls design through the trade lifecycle. The Firm acknowledged a robust preventative control framework and effective detection controls were critical to avoid incorrect bookings, and set proposed steps to improve these controls. The PRA noted the approach the Firm was taking to remediate the identified deficiencies was broadly in line with the PRA's expectations, but observed the significant challenge in effectively delivering such a programme of work. The Firm instructed an external consultant to validate the remediation activities undertaken. This external consultant identified positive developments, including the strengthening of the control environment. However, they also pointed to residual risks, including the effectiveness of recently implemented controls had yet to be fully tested but that this testing was due to be undertaken in the following month.

1.20 In October 2019, the Firm provided a programme plan and scope for its booking model controls remediation work. This included detailed schedules of CAPs of remedial action that had already been completed, and in respect of the remaining actions, target timeframes. On 22 November 2019, the PRA provided PSM feedback to the Firm stating the effectiveness of the Firm's control environment was a key risk. Further, the targeted supervisory reviews undertaken, in addition to the specific incidents observed by the PRA, highlighted deficiencies across all three lines of defence. The PRA advised the breadth and significance of issues indicated a substantial weaknesses in the control environment across the Firm, which fell below the PRA's expectations. The Firm was instructed to remediate the identified issues in a timely and effective manner and to look across the whole Firm to ensure similar issues did not persist in other areas.

RELEVANT FACTS: 2020

Independent Compliance Risk Management

1.21 ICRM issued a compliance assurance report into UK Delta One Sales and Trading on 8 October 2020, covering a review period of 01 June 2019 to 31 May 2020, concluding there was "Room for Improvement" in the design and operating effectiveness of the key controls to mitigate conduct risks within the Delta One Sales and Trading Business in the UK. The overall assessment was driven, primarily, by the existence of open issues, including the absence of real-time reconciliations of e-Trade execution logs with those provided by relevant venues, and concerns with the control framework, specifically the detection and monitoring of unusual and unauthorised activities.

1.22 On 28 October 2020, ICRM issued a conduct risk desk review into Equity Cash sales and trading. This was again rated "Room for Improvement." Of particular note, ICRM reported that Cash Equities management did not monitor traders' overrides of pre-trade soft block limits, did not always verify limit changes, and did not implement pre-trade limits in trading system.

Internal Audit

1.23 On 3 August 2020, IA issued a report into the design and operating effectiveness of key controls to mitigate the inherent risks relating to the High Touch and Program Trading desks in the US and the UK, including their Middle Office and technology support functions. The assessment was primarily driven by the aggregate impact of various issues, including open IA issues and regulatory issues. One issue considered by this report was that EMEA Cash Equities management did not monitor overrides of pre-trade soft block limits, did not always verify limit changes, and did not implement pre-trade limits in the Total Touch system. A potential consequence of this issue identified in the report was that "erroneous orders may be executed which may lead to transactions in excess of risk appetite and potentially cause market disruption". One specific issue identified by the report was that "In EMEA, override of soft block notional, limit price deviation and % ADV [average daily volume] pre trade limits in COMET [a trading system] and PTE systems are not monitored for appropriateness". Another was that "In EMEA, one limit change, identified during the Q4 2019 quarterly limit review process was not implemented by Technology six months after the change was requested." The report was rated "Limited Assurance" reflecting that only 66% of the controls tested within the review were assessed as effective, and that none of the issues raised were reflected in the Management Control

Assessment. ("Limited Assurance" has the same definition in this context as referenced in relation to the earlier IA report from June 2018).

1.24 On 10 November 2020, IA issued a report into Equities Electronic Execution ("EE") focussed on the design and operating effectiveness of internal controls. The report was rated "Limited Assurance" with only 67% of the reviewed controls deemed effective. Further, IA observed omissions from required algorithmic testing carried out in 2019. IA noted progress had been made in remediating issues. However, continued effort was required to implement a significant volume of work, necessary to provide compliance with the Low Touch e-Trading Activity Policy, which had been in effect since October 2019. The audit also assessed that key controls, including the automated pre trade validation checks (MMCs) and related front office monitoring of breach alerts, were designed and operating effectively.

1.25 On 19 November 2020, IA issued a report into Delta One Sales and Trading rated "Limited Assurance". The audit covered the activities of the Front Office, Product Compliance, Middle Office, Operations and Technology. The focus was on the design and effectiveness of key controls to mitigate the inherent risks relating to the Delta One business. The audit found the Delta One Sales and Trading Desk relied heavily on manual processes and workarounds. This included 87 End-User Computing ("EUCs") used globally for key processes including trade pricing, booking, and rebalances. EUCs describes activities conducted manually, predominantly, in Excel spreadsheets. Manual processes were flagged as resulting in increased operational risk. The audit tested 31 controls. Eight of these were preventative and 23 detective, 28 were manual and three automated. Of these controls only 61% were assessed as effective.

PRA Feedback

1.26 On 13 August 2020, the PRA wrote to regulated firms, including the Firm, providing feedback on common market wide observations and lack of industry progress relating to issues emerging from the PRA's review of Trading Controls, and the PRA's expectations to address them. The PRA highlighted the importance of automated preventative controls, "hard / soft blocks" on large trades, and specifically referred to algorithmic trading as an area in which they could improve controls. Regulated firms were required to provide a detailed self-assessment against the issues identified in this letter, and to reply to the PRA by 31 March 2021.

1.27 On 19 November 2020, the PRA provided PSM feedback to the Firm. The PRA determined progress against feedback in the previous PSM letter, dated 22 November 2019, had been mixed and in some important areas, had lagged PRA expectations. The PRA communicated that an effective control environment continued to be a key risk for the Firm. On the effectiveness of the control environment; the PRA recognised progress in delivering the significant remediation work necessary to meet regulatory expectations, however, the PRA described the Firm as continuing to fall below the PRA's expectations. The PRA specifically pointed to insufficient preventative controls, including pre-trade checks. Further, the PRA noted trading related incidents which demonstrated control failures. The Firm responded to this feedback on 18 December 2020, acknowledging certain areas required enhanced focus and committing to operate an effective risk and control environment as a strategic priority.

Equity Trading Incident (November 2020)

1.28 In November 2020, an operational risk event occurred on the Delta One trading desk. A client sold a US$12.5mm basket of equities to the Firm. The Delta One trader generated a hedging basket in PTE, fixing a strike price for the execution, and routed to CitiSmart for execution. At this point the trader received a pop-up alert with a limit price warning, "Some Orders have Client Limit Price and will be sent as Limit orders downstream." PTE presented all triggering of soft limit and hard block breaches in a single pop-up, entitled "trade warning limits." The trader closed the popup, confirming the instruction to send the orders to CitiSmart. The trader indicated that traders frequently received the pop-up due to market data and limit price issues.

1.29 The trader became conscious of an issue due to the protracted execution of the orders. After reviewing with a colleague, it was realised limits on child orders, based on parent order limits, were being applied to the risk trading basket. Parent and child orders are a feature of algorithmic trading strategies. A large block of shares, the parent order, can be sliced into smaller lots, the child orders. A volume-weighted average price ("VWAP") algorithm divides the parent order into child orders with varying sizes based on the historical average volume of trading of shares at a given time. Having identified the problem, the limit was removed and the stocks were executed without further issue.

1.30 The issue was later determined to have been caused by an IT release in PTE, which applied the parent order strike price to child order stock baskets. This change was introduced to ensure adherence to client limit prices. The change was supposed to apply to client orders only. However, it had also been made, inadvertently, effective on risk principal baskets, where the Firm was trading on its own account (rather than on behalf of a client). Further, the trading desk had not been informed of this change and therefore, the trader was not aware at the time of the trade. The Firm suffered a minor loss. The application of the limit to principal baskets was promptly removed.

RELEVANT FACTS: 2021

Trading Controls

1.31 CitiQuote is an automated 'Request for Quote system' ("RFQ"). It is used to generate and provide electronic quotes to clients for Equity Derivatives products. The system is classified as an e-Trading application and therefore, has MMCs as per the Firm's e-Trading Policy. MMCs are a set of specific execution and conduct controls, required for all e-Trading activities and which initiate a blocking activity upon breach. Changes to CitiQuote MMC limits required approval from the e-Trading Risk and Compliance Council ("RCC"), as per the e-Trading Material Change procedure.

1.32 In the period January 2020 to February 2021, Equity Derivative traders made approximately 985 changes to the CitiQuote Max Notional MMC, including 31 notional increases, without obtaining RCC approval. Furthermore, traders were unaware they required the approval of RCC to make such changes to MMC limits. An internal Firm document, on issues within the EMEA Markets division to be corrected by the end of 2021, described the consequences of these unauthorised material changes applied to CitiQuote MMCs, "Inappropriate changes to MMC limits may not be identified which may lead to the publication of incorrect price quotes resulting in operational losses and reputational damage."

1.33 On 31 March 2021, the Firm delivered the outcome of its completed self-assessment following the PRA's request on 13 August 2020 having carefully considered findings in the PRA's feedback. The Firm acknowledged effective trading controls to be an essential requirement of risk management. Additionally, the Firm committed to undertake further actions to enhance the trading control framework. Identified enhancements included establishing a holistic inventory of trading controls and MI across the control framework. This control framework included: defining perimeters for permissible activities; pre-trade, trade-date, and post-trade controls; ongoing monitoring of MI; and holistic control testing. The Firm's self-assessment confirmed further development was required to align the Firm with regulatory expectations and industry practices; identifying weaknesses against all 11 issues in the PRA's feedback, resulting in 59 remediation actions. The Firm proceeded with the remediation work it had identified.

1.34 On 15 November 2021, the PRA wrote to the Firm with PSM feedback. The PRA recognised the Firm had made considerable progress in certain areas of concern to the PRA. However, the PRA expressed significant regulatory concern with the Firm's control environment which, having been identified as a consistent shortcoming in the PRA's PSM feedback letters in both 2019 and 2020, continued to fall short of the PRA's expectations. Additionally, the PRA review on trading controls, and the Firm's subsequent self-assessment, revealed the Firm continued to fall below the PRA's expectations respect of the scale and scope of required enhancements. The PRA instructed the Firm to commission a section 166 Financial Services and Markets Act 2000 (the "Act") skilled persons review of the technology and systems supporting high frequency trading.

1.35 The PRA provided feedback, on 31 January 2022, to the Firm's 13 August 2020 self-assessment. The PRA articulated the general expectation that firms take trading controls seriously and expedite plans to remediate issues. Specific to the Firm, the PRA listed 11 issues. Preventive controls was one such issue. The PRA noted the Firm's self-assessment made no reference to items explicitly referenced in the original PRA letter, including; measuring and monitoring the extent of preventive trading controls relative to manual controls, on a front to back basis, and prioritising those in need of automation by reference to internal history of real operational risk events and near misses. The PRA further highlighted the importance of implementing the plan to reduce manual processes, which had been due in December 2021. This was of particular concern to the PRA in light of the references to trade capture and booking errors made by the Firm in their self-assessment. The Firm subsequently reviewed its commitments to the PRA and incorporated enhancements into its planned programme of work to address the feedback provided. The Firm thereafter provided quarterly updates to the PRA in respect of the programme for the remainder of the Relevant Period.

Equity Trading Incident (May 2021)

1.36 In May 2021, a client sent an order for Equity D to the Firm for algorithmic execution. At 14:27 on the date of the incident the external exchange discovered abnormal behaviour in relation to an order that was being sent to the exchange. Multiple Equity D orders were being generated sequentially by the Firm at a rate of approximately 600 per second.

1.37 Cash Equity Production Support, an IT team, sought EE desk approval and executed a manual cancel action on the XSOR parent order. This terminated all subsequent child orders. This action was completed by 14:45, by which time 1,066,493 child orders had been generated on Equity D.

1.38 The Firm's subsequent internal investigation discovered the root cause of the incident and within two days, the Firm had implemented corrective measures. It found that the root cause was that in January 2021, the business had requested the Technology team to disable duplicative risk control checks in XSOR which were already being performed upstream by CitiSmart. Due to a software bug, deactivating this duplicative parent-order level control also inadvertently deactivated the duplicate order control (DUP1) at child level in XSOR. DUP1 was an MMC as per the Firm's e-Trading Policy. The Firm's internal investigation discovered additional controls had also been inadvertently deactivated. These were the Volume Check Control and the Price Check Control.

1.39 Risk functions monitoring behaviour of the algorithm did not identify the issue because the software bug had disabled the control and therefore it did not trigger any notifications.

Equity e-Trading Audits & Issues

1.40 On 10 May 2021, the Firm's E-Trading Risk & Controls ("ETRC") function identified a first line of defence issue. The specification of requirements, and subsequent development, of the e-Trading documentation and workflow tool had not kept pace with the development of the e-Trading Risk Management ("ETRM") framework and an increasing population of e-Trading applications, strategies, and material change activity. ETRC noted inaction on the development, or replacement, of the inventory could lead to flaws in the ETRM framework and expose the business to increased operational and regulatory risk.

1.41 In a September response to an information request from the PRA regarding e-Trading, the Firm submitted certain self-identified issues. The Firm identified that certain Equity trading desks engaged in e-Trading activity, or with access to e-Trading functionality, were not fully compliant with the applicable e-Trading policy requirements. Further, Equities management had not imposed adequate governance structures to ensure all e-Trading activity, including strategies and applications, were identified and in adherence to the e-Trading policy. This was flagged as having potential to result in an inadequate control environment, leading to risk outside of business appetite. ETRM, through its second line oversight responsibilities and processes, discovered multiple incidents under the following themes: failure to include applications or strategies in e-Trading inventory; failure to manage e-Trading policy obligations applicable to identified e-Trading applications or strategies; and, failure to adequately manage MMC limit thresholds and to adequately ensure the proper functioning of MMCs.

1.42 MMC threshold values were reviewed annually by the Business to ensure threshold values remained appropriate. Integral to the review, the owner was required to justify each threshold value, or to propose a change to the existing threshold value. Additionally, the review established whether MMC threshold values recorded in the MMC inventory corresponded to threshold values implemented in the relevant application. Following completion of the review, ETRM performed a second line of defence challenge on the Business review. In 2022 an independent external review identified weaknesses with the review of MMCs performed in 2021. The Business review had not identified the threshold for the 'Maximum Open Order Size' control in XSOR EMEA was documented incorrectly. Further, evidence of challenge by ETRM to the Business on their rationale for thresholds did not always exist. Additionally, the external review found the documentation of control names in the MMC control inventory documentation was inconsistent with the control names within the relevant system where the control threshold resided. Further, MMCs which were identified in PTE (Average Daily Volume and Price Controls), were not documented at all.

1.43 On 8 September 2021, IA issued a report into e-Trading first line, compliance, and technology independent testing. This was rated "Considerable Improvements Needed." In this context, "Considerable Improvements Needed" is defined as, "audit results indicate that considerable deficiencies exist in the design and/or operating effectiveness of controls relative to the size and complexity of the activities within the scope of the audit. These deficiencies prevent inherent risks from being adequately mitigated." The audit covered e-Trading control activities across the first line of defence managed by ETRC, ICRM, and the technology function. The audit found, whilst independent real-time monitoring existed in some areas, it needed to be extended to effectively oversee and promptly address potential issues arising from e-Trading activities. The audit also found evidence of certain e-Trading compliance monitoring being executed using incomplete trading data. Further, the report found that the testing teams were unable to demonstrate adequate testing had been performed for annual testing of trading controls, or for material changes to e-Trading applications and strategies.

1.44 On 28 September 2021, IA reported on second line of defence governance and monitoring of e-Trading risk at the Firm. The audit was rated "Considerable Improvements Needed." The audit summary specified considerable improvements were required in the design and operating effectiveness of key controls to mitigate the inherent risks relating to governance of e-Trading activities globally. Further, the audit highlighted issues relating to Management Control Assessments, MMCs, management reporting, and market risk. These issues were related to the inclusion of e-Trading controls in the second line risk functions' Management Control Assessments, the lack of consistent review of MMC breach alerts by the relevant governance body, the absence of a central repository for market risk e-Trading triggers and associated breach details, and the lack of key risk indicators specific to e-Trading activity being reported by relevant second line risk functions.

RELEVANT FACTS: 2022

Equity Trading Incident (2 May 2022)

1.45 On the morning of 2 May 2022 (a UK Bank Holiday), CGML received a request to sell 24,800 lots of the MSCI World Index futures (a stock index which tracks stocks worldwide), primarily priced on an agency basis. Between 08:47 and 08:54, a trader on the Delta One desk set about booking a basket of equities to hedge a proportion of CGML's European exposure to the MSCI World Index. This required a decomposition of the Index, detailing the constituents of the Index and their relative weighting within it. Having done this, the notional value for each component stock could be calculated. There were at least two methods available to the trader to do this, either using PTE directly or using a decomposition tool called SOLA. However, at this moment the SOLA tool was unavailable, meaning the trader was unable to use this tool to construct the constituents of the Index. Therefore, at 08:54 the trader manually entered the European element of the trade directly into PTE by selecting a pre-loaded index, the MSCI Europe (ex UK).

1.46 In the PTE order management system, a trader is required to enter either the US$ 'Notional' of the index, or else the 'Quantity' of index units, to be bought or sold. Either of these fields can be populated to determine the size of the trade. The trader at that time was dealing only with the European stock portion of the MSCI World Index (i.e. excluding the UK, US, and Japan) and planned to enter an order for US$58mm notional. However, rather than entering 58 million into the 'Notional' field, which would have created a basket of equities with notional of US$58mm, 58 million was entered into the 'Quantity' field. This had the effect of creating a basket equivalent to 58 million units of the MSCI Europe (ex UK) index ("the Index"), which equated to creating a basket of 349 stocks, across 13 European countries, with a total notional size of US$444bn. At this point, the erroneous basket was not visible to the market.

1.47 In the course of entering an order into the PTE order management system, it displayed a 'Value at Bench Mark' field ("ValAtBM"). Ordinarily, the ValAtBM showed the notional value of an order at a specified benchmark and is used where traders need to track the value against a reference price. In this case, PTE defaulted to the option "Strike". The default "Strike" option was programmed to determine the price of the Index at the prior day's close, by reference to an external data feed. However, as data from that external feed was unavailable, the price of the value of the Index instead defaulted to -1 rather than the benchmark price which was US$7684.40. The quantity of units was therefore multiplied by -1. There were a number of other fields on the PTE screen in which the total notional value of the basket was correctly displayed. However, the trader only checked the ValAtBM on PTE to confirm the size of the basket. When the trader checked the value of the inputted basket, they were presented with a figure of negative 58 million for the value of the basket. The trader saw a ValAtBM of 58 million, which was the number they expected to see, and thus they clicked "Execute". Had the data feed been available, "ValAtBM" would have shown US$444bn (58 million multiplied by 7684.40 (the actual MSCI Europe (ex UK) index value)), i.e. the true notional of the basket.

1.48 At 08:56 a 'Trade Limit Warning' pop-up appeared within PTE. This presented 711 warning messages, listed in a single alert. The first 18 lines of messages were visible in the pop-up without scrolling. The trader needed to scroll down the list to view the remaining 693 warning messages, in batches of 18 at a time.

1.49 PTE displayed alerts for both hard and soft blocks together in the single "pop up" alert referred to above. Traders did not need to review all of the alerts before proceeding. The effectiveness of the "pop ups" as a trading control was accordingly limited by the fact that they could be "clicked through" with ease.

1.50 The scope of the hard blocks in PTE was inadequate. In particular, there was no hard block for baskets of equities by their notional value or 'wave notional'. A wave notional is the total value of all the individual stocks within a 'basket'. The 'basket' in this context, refers to all the orders to be transacted on that occasion taken together. The wave notional of the erroneous basket on 2 May 2022 was US$444bn. The EMEA Delta One Trading Desk had no wave notional hard block at this time. A control of this nature had been present in the US for some nine years.

1.51 A basket-level monetary value hard-limit of this nature would have been the primary preventive control for erroneous trade-size entry. Such a hard block would have prevented the basket of US$444bn notional being processed by the Firm on 2 May 2022. Furthermore, there was no maximum order ADV hard block set within PTE for DSA flow, and no hard blocks which related to price tolerance. Price Tolerance is a control which protects against the negative consequences of executing orders in volatile markets, where prices can move quickly. The control works by setting a threshold on the price change away from the desired target level at which a trader is willing to buy or sell.

1.52 Further, certain of the hard blocks which did exist were not calibrated appropriately. For example, there was a hard limit notional threshold for orders on underlying stocks within a basket, which was set at US$2bn. This was revised to US$250mm after the 2 May 2022 Incident. Therefore, the scope and calibration of hard block thresholds compromised their effectiveness as controls.

1.53 The EMEA Delta One Trading Desk did have a US$100mm wave notional soft block. The orders in the basket triggered this soft block, however, due to the lack of market data with which to calculate the index value, the wave notional soft block warning stated, "Due to lack of market data, Wave notional cannot be found.” The trader would, furthermore, have needed to scroll down to the bottom of the list of 711 messages to read this alert.

1.54 The 2 May 2022 basket was entered in PTE, and subsequently orders with a notional size of US$196bn were generated in CGML's electronic trading system, CitiSmart, for execution, and were not subsequently cancelled in their entirety, such that in total US$1.4bn of sell orders were executed across various European exchanges. Orders which are booked in PTE flow to CitiSmart, where trade execution strategies are applied. A ‘parent’ basket of orders is then sliced into ‘child orders’ by CitiSmart, which are then passed to the smart order router ‘XSOR’ for transmission to external venues, such as exchanges. One way in which a parent order can be sliced is using a volume-weighted average price (“VWAP”) algorithm, which divides the parent order into child orders with varying sizes based on the historical average volume of trading of shares at a given time.

1.55 An order which enters the algorithms within CitiSmart is referred to as Direct Strategy Access (“DSA”). Flows which route to external exchanges and brokers via XSOR, and do not go through CitiSmart algorithms, are referred to as Direct Market Access (“DMA”). A maximum order ADV limit of 30% was set as a soft block in PTE for DSA flow (orders which would go to CitiSmart). However, DMA (orders which would not be sent to CitiSmart) also had a maximum order ADV limit of 95% set as a hard block. There was no order ADV hard block set within PTE for DSA flow.

1.56 Between 08:56:40 and 08:56:46, 284 information alerts were generated that stated that 284 individual orders were incoming to CitiSmart which were each in excess of the maximum notional of US$25mm. These information alerts did not block or suspend the orders from going into the CitiSmart Algorithm for execution. Instead, these alerts appeared on the GENIE / DNA Viewer to be checked by the Algorithmic Service Desk and were presented in the monitoring system so that their linkage to a single desk and trader was visible. There was a general understanding that, when the Equities Algorithmic Service Desk was not staffed, the responsibility for that desk would pass to the Electronic Execution (“EE”) Desk. On 2 May 2022, the Algorithmic Service Desk was on scheduled vacation and following a scheduled handover, from 08:48 onwards, a member of the EE Desk was instead responsible for monitoring the GENIE / DNA Viewer. The EE Desk member did not escalate the 284 information alerts in GENIE / DNA Viewer.

1.57 Between 08:56:40 and 09:10:30, the algorithm in CitiSmart was processing and executing the 284 orders. Four separate controls within CitiSmart operated as designed and led to the suspension of 242 orders with a total notional value of US$163bn One of the controls, ‘price move on arrival’, suspended 8 orders to a value of US$2.4bn. The control works by suspending any executions of a particular stock when the price of that stock has moved a defined percentage from the price at which the order was initially placed. On 2 May 2022, the percentage was calibrated at 15%. Therefore, when the price of a particular stock within the trader’s basket had moved 15% from the point at which the order had initially been placed, all further executions were suspended until resumed by the EE desk.

1.58 The control had been recalibrated from 5% to 15% in March 2020 by the EE Desk in response to increased market volatility caused by the outbreak of COVID. Following the increase of the limit to 15% in March 2020, there were no subsequent reviews or monitoring of the threshold until after the 2 May 2022 trading incident.

1.59 The remaining 42 orders were available to be executed with no suspension triggers until 09:10:30, when the trader cancelled the unsuspended erroneous orders. By this time, US$1.4bn of notional had been executed in multiple stocks across multiple exchanges. A material short term movement in several European indices coincided with the placement of the trader's sell orders. During this period the EE Desk made internal inquiries and consulted newswires to try and ascertain what had caused the price movement. The EE Desk only became aware of the Firm's involvement subsequent to cancellation of the trade by the trader who was the first to recognise the error.

1.60 In addition to the Algorithmic Service Desk, covered by EE Desk that morning, additional real-time monitoring was provided by ETRC, who monitor all assets though their HALO system. HALO filtered out all but eight of the information alerts relating to the erroneous basket. Consequently, their escalation missed 226 message rate suspensions and accordingly missed the vast majority of notional value. ETRC escalated the incident to the EE desk, via email, at 09:31, 30 minutes after the orders started executing and 20 minutes after the trader had already cancelled the order. Having received no response to their email, ETRC followed up four hours later.

1.61 At 09:07, the trader reviewed the Equity Risk Management System, being a first line real-time market risk exposure measurement system used by traders to understand the positions, and associated risk, on their trading books, to ensure their colleague, a junior trader, had correctly booked a placeholder for the client trade. The trader was expecting to see a long US$1.075bn notional delta, reflecting the risk exposure from the trade with the client. However, the trader saw a short delta of US$800mm, which was rapidly increasing, concentrated in European stocks. Recognising something was wrong, the trader returned to PTE and discovered the error. After several attempts, the trader cancelled the erroneous Index order at 09:10:30. At the point of cancellation, 283 of the remaining 284 orders in the basket had been partially executed, with US$1.4bn of notional being filled on European exchanges.

1.62 The immediate cause of the trading error was a manual input error by the trader, however the Firm's trading controls should have, but did not, prevent the basket of equities being transmitted to the market in entirety. While parts of CGML's trading control framework operated as the Firm expected, some primary controls were absent or deficient. The error was then not identified by either of the Firm's risk functions dedicated to real-time monitoring of the Firm's trades, but by the trader some 15 minutes after the trade was entered into the Firm's systems.

Skilled Person Review

1.63 On 14 July 2022 the PRA issued a Final Requirement Notice for a section 166 Skilled Person Review under the Act. The appointed Skilled Person was required to perform a review of three specific areas:

i. Detailed analysis of events leading up to and following the 2 May 2022 Incident;

ii. Review of the Firm's equities trading controls including, but not limited to, an assessment of the weakness in the Firm's existing pre- and post-trade controls; and

iii. Review of the Firm's alignment with PRA expectations in the Supervisory Statement.

1.64 The PRA has had regard to the Skilled Person's findings in the course of its investigation.

1.65 The Skilled Person found that the Firm had tactically remediated controls which it identified as immediately relevant to the 2 May 2022 Incident and, as a result, the Skilled Person considered that the Firm had taken positive actions to prevent a similar incident occurring. The Skilled Person also noted that the post-incident escalation to and the involvement of senior trading and risk management staff was both timely and appropriate for the scale and nature of the incident. However, the Skilled Person also identified a number of issues, including that the testing of algorithms at the Firm was inadequate. Testing was at a system-by-system level and did not test trading "flow" across multiple systems. Additionally, the Skilled Person identified missing controls which would have prevented the 2 May 2022 Incident. Further, there were controls which could, if they had been designed more appropriately or operated more effectively, have further mitigated, and potentially prevented the incident from occurring. In some cases, there were controls which operated in other lines of business which did not apply in the business line where the incident occurred. In addition, some of the controls did not follow applicable Firm policies and procedures or expected market practices.

ANNEX B: BREACHES AND FAILINGS

1. Breaches

1.1. During the Relevant Period, as a result of the facts and matters set out at Annex A, the Firm breached relevant requirements of the PRA Rulebook. In particular, between the period of 01 April 2018 and 31 May 2022, the Firm breached:

a) Fundamental Rule 2 because the Firm failed to conduct its business with due skill, care and diligence;

b) Fundamental Rule 5 because the Firm did not have effective risk management strategies and risk management systems;

c) Fundamental Rule 6 because the Firm failed to organise and control its affairs responsibly and effectively;

d) Algorithmic Trading Rule 2.1 of the PRA Rulebook because the Firm did not have in place effective systems and risk controls, suitable to the business it operates to ensure that its trading systems are subject to appropriate trading thresholds and limits, and prevent the sending of erroneous orders or the systems otherwise functioning in a way that may create or contribute to a disorderly market; and

e) Algorithmic Trading Rule 2.2(2) of the PRA Rulebook because the Firm did not ensure that its systems were fully tested and properly monitored to meet the requirements of Algorithmic Trading Rule 2.1 of the PRA Rulebook.

1.2. These rules are included at **Appendix 2**.

2. The PRA's expectations

2.1. The management of risk through effective controls and oversight is a key expectation of the PRA. The PRA expects firms to manage risk in a way commensurate with the nature of the firm's business, and the scale and type of potential risk. The implementation of appropriate and effective trading controls is an essential element of risk management for firms engaged in trading activities. The PRA expects firms to manage their operations with due skill, care and diligence. This includes ensuring trading controls operate effectively.

2.2. The PRA has set out its expectations concerning a firm's risk management and governance of algorithmic trading in the Supervisory Statement. In setting these expectations, the PRA considers a firm's risk controls to be critical for ensuring appropriate governance arrangements are in place when engaging in algorithmic trading. The PRA sets expectations in respect of a firm's algorithmic trading activities over the following areas:

i. Governance;
ii. Algorithmic approval process (by the firm);
iii. Testing and deployment;
iv. Inventories and documentation; and
v. Risk management and other systems and controls functions.

2.3. The PRA expects all regulated firms engaged in algorithmic trading to comply with the relevant provisions of the PRA Rulebook. This includes ensuring that systems function in such a way that does not create or contribute to a disorderly market.

2.4. Testing and reporting of controls are a necessary component of an effective risk management system. The PRA expects all algorithms and risk controls to be tested prior to deployment. Testing should assess design and implementation. A firm should periodically revalidate algorithms and risk controls. Where deficiencies or errors are identified during the testing process, the firm should take remedial action. The firm should have in place a process for managing identified issues, including the tracking and documentation of outstanding issues to an auditable standard. The PRA expects a firm, when connecting to a trading venue, to assess the operational arrangements at the trading venue and determine whether actions should be taken to ensure the algorithmic trading system operates as intended.

2.5. The PRA expects trade entry systems to have all necessary and appropriate preventative controls to block erroneous manual input errors. This requires apposite hard blocks and appropriately calibrated threshold limits.

2.6. Firms are expected to construct and implement a robust preventative and detective control framework to avoid and arrest mis-booked transactions. This includes effective real-time monitoring of algorithmic systems and disorderly markets. Additionally, where firms rely on different systems within the trade pricing, booking, and risk management process, these systems should be effectively linked to avoid control gaps.

2.7. Repeated trading incidents, from within the same business area, which include analogous features, are demonstrative of a firm failing to organise and control its affairs responsibly and effectively and of failing to conduct its business with due skill, care and diligence. Firms should proactively take all proper steps to identify and mitigate, or remove, risks arising from trading controls and booking models and should not wait for risks to crystallise before taking appropriate action. However, where risks have presented, the PRA expects firms to take all necessary steps to prevent future repetition of such recognised failings.

2.8. The PRA expects firms to promptly remediate identified issues and, where the PRA highlights concerns to a firm, to address such concerns in a full and timely manner. The PRA expects firms to take a holistic approach to remediation, proactively considering whether identified remedial activities could be usefully deployed to address the same similar risks elsewhere in the firm, and if relevant across its group entities. The PRA expects firms to proactively take all necessary steps to identify and mitigate, or remove, risks arising from trading activity.

3. Failings

3.1. During the Relevant Period, the Firm breached PRA Fundamental Rules 2, 5 and 6. Further, the Firm breached certain provisions of the PRA Rulebook concerned with algorithmic trading, namely Algorithmic Trading Rule 2.1 and Algorithmic Trading Rule 2.2(2).

PRA Fundamental Rule 2

3.2. During the Relevant Period, the Firm breached PRA Fundamental Rule 2 (*A firm must conduct its business with due skill, care and diligence*) for the following reasons:

a) There were material and continuing deficiencies in the Firm's trading controls.

b) The Firm failed to remediate identified issues with trading controls, and to respond to concerns raised by the PRA, in a timely manner. That the PRA repeatedly highlighted deficiencies in trading controls, combined with the operational incidents which occurred throughout the Relevant Period, in particular the 2 May 2022 Incident, are evidence of the Firm not conducting its business with due skill, care and diligence.

c) The Firm failed to implement effective and appropriate hard blocks to limit, or prevent, inappropriate trading activity. Crucially, the primary preventative control for erroneous size basket entry, wave notional hard block, was not in place for the EMEA Delta One desk. In addition, there was no hard block for maximum order ADV for Direct Strategy Access

("DSA") flow (i.e. orders which entered the algorithms within CitiSmart). However, a maximum order ADV limit of 95% was set as a hard block for Direct Market Access ("DMA") flow (i.e. flows which route to external exchanges and brokers without going through CitiSmart algorithms). Had either of the hard blocks, for wave notional or maximum order ADV, applied to the EMEA Delta One desk, the 2 May 2022 Incident could have been prevented.

d) Soft limits within PTE were quickly and easily overridden. All threshold breaches (ADV, Order Notional, Quantity, and Price) were presented in the single pop-up, as were both hard blocks and soft block warnings. Additionally, the pop-up screen contained only 18 rows of alerts without scrolling. Consequently, it was necessary to scroll through the pop-up to see further alerts. However, traders were able to click through pop-ups without necessarily scrolling down or reading the pop-ups.

e) Real-time monitoring of internal desk orders was inadequate to fully identify risks and remediate all issues arising from suspensions and alerts. On 02 May 2022, ETRC's system filtered out 226 of the 234 primary message rate suspension alerts from CitiSmart. Consequently, their escalation missed 226 message rate suspensions and the vast majority of notional value. ETRC escalated the incident 20 minutes after the trader had already cancelled the order. Having received no response, ETRC followed up 4 hours later, indicating serious failings in the Firm's monitoring controls.

f) Equities desks which engaged in e-Trading activity, or had access to e-Trading functionality, were not fully compliant with the Firm's e-Trading Policy ("the Policy") requirements. The 985 changes made by Equity Derivative traders to the CitiQuote Max Notional MMC, in the period January 2020 to February 2021, without obtaining RCC approval, is a clear example.

g) Equities management did not impose adequate governance structures to ensure all e-Trading activity was identified and adhered to the Policy. There was a failure to adequately manage MMC limit thresholds and to adequately ensure the proper functioning of MMCs. Further, there was a failure to manage Policy obligations applicable to identified e-Trading applications or strategies.

h) The Firm were over reliant on manual processes and workarounds. This included EUCs for key processes, including trade pricing, trade booking, and rebalances. An internal audit in 2020 found the Delta One Sales and Trading Desk relied heavily on manual processes and workarounds. This same audit described manual processes as increasing operational risk.

PRA Fundamental Rule 5

3.3. During the Relevant Period, the Firm breached PRA Fundamental Rule 5 (*A firm must have effective risk strategies and risk management systems*) for the following reasons:

a) Real-time monitoring of internal desk orders was inadequate to fully identify risks and remediate all issues arising from suspensions and alerts. On 2 May 2022, the EE Desk, who were covering for the Algorithmic Service Desk, did not escalate the 284 information alerts notifying of 284 individual orders incoming to CitiSmart which were each in excess of the maximum notional of US$25mm. These alerts were presented in the monitoring system so that their linkage to a single desk and trader was visible. Had these alerts been escalated, the trader could have been notified and the trade immediately cancelled.

b) Operational procedures and processes actioned by first line of defence functions, including alert protocols and messaging to risk owners, were not timely and did not represent effective risk management. On 2 May 2022, ETRC's system filtered out 226 of the 234 primary message rate suspension alerts from CitiSmart. Consequently, their escalation missed 226 message rate suspensions and the vast majority of notional value. ETRC escalated the incident 20 minutes after the trader had already cancelled the order, and having received no response, followed up 4 hours later. The EE Desk only became aware of the erroneous trade when informed by a senior manager, subsequent to the cancellation of the trade.

c) The Firm failed to implement effective and appropriate hard blocks to limit, or prevent, inappropriate trading activity. Crucially, the primary preventative control for erroneous size basket entry, wave notional hard block, was not in place for the EMEA Delta One desk. In addition, there was no hard block for maximum order ADV for DSA flow. However, a maximum order ADV limit of 95% was set as a hard block for DMA flow. Had either of the hard blocks, for wave notional or maximum order ADV, applied to the EMEA Delta One desk, the 2 May 2022 Incident could have been prevented.

d) There was no Price Tolerance hard block set within PTE for DSA flow as of 2 May 2022. This control is particularly important during periods of heightened volatility, such as the low liquidity environment characteristic of public holidays. Price Tolerance controls also protect against erroneous manual input errors ('fat finger') input errors by cancelling orders from executing outside of a chosen percentage range. This not only protects the trader placing the order, but also other users from the unexpected price movements which may be associated with a 'fat finger' input error and the insufficiencies of the Firm in this regard demonstrates weaknesses in the Firm's risk management systems and strategies.

e) The calibration of threshold limits in PTE were not designed appropriately to mitigate the risk of an erroneous order being entered for DSA Delta One flow. As an example, on 2 May 2022 the hard limit threshold for Order Notional was set at US$2bn. This meant underlying securities within a basket were only blocked if their individual notional was in excess of US$2bn. The hard limit threshold for Order Notional in PTE applicable to DSA Delta One flow has subsequently been changed from US$2bn to US$250mm. The magnitude of change emphasises the previous threshold was too high and the failure of the Firm's risk management systems in this regard.

f) On 2 May 2022, the price move on arrival control within CitiSmart was inappropriately calibrated at 15%. This had originally been calibrated, in January 2015, at 5%. It was subsequently increased to 15%, by the business in March 2020, in response to the market volatility caused by COVID. The control threshold was subsequently unchanged until 5 May 2022, when it was returned to 5%. Had this control been calibrated at 5% on the 2 May 2022, the size of the erroneous trade executed in the market would have been significantly reduced.

g) Alerts for limit breaches within PTE presented as a single pop-up. Consequently, soft limit and hard limit breaches were detailed in the same pop-up. Control threshold breaches (ADV, Order Notional, Quantity, and Price) were amalgamated within the single pop-up. Further, the pop-up only presented 18 lines concomitantly. Therefore, it was necessary to scroll through the pop-up to view all alerts if there were more than 18. However, traders did not need to scroll through all alerts before overriding the pop-up. Consequently, the pop-up was poorly designed and did not operate effectively as a risk management tool. Soft limits within PTE were quickly and easily overridden.

h) The Firm failed to effectively risk manage MMCs, essential to the Firm's risk management strategy. There was no consistent review of MMC breach alerts, there was a failure to adequately manage MMC limit thresholds and to adequately ensure the proper functioning of MMCs. Equity Derivative traders made 985 changes to the CitiQuote Max Notional MMC, in the period January 2020 to February 2021, without obtaining RCC approval. Additionally, the XSOR – LSE incident in May 2021 revealed MMCs could be inadvertently deactivated and remain undetected for months.

i) Equities management did not impose adequate governance structures to ensure all e-Trading activity was identified and adhered to the Policy. There was a failure to adequately manage MMC limit thresholds and to adequately ensure the proper functioning of MMCs. Further, there was a failure to manage Policy obligations applicable to identified e-Trading applications or strategies.

j) The Firm were over reliant on manual processes and workarounds. This included EUCs for key processes, including trade pricing, trade booking, and rebalances. An internal audit in 2020 found the Delta One Sales and Trading Desk relied heavily on manual processes and workarounds. This same audit described manual processes as increasing operational risk.

k) The Firm failed to maintain and operate adequate control testing. Control testing for MMCs were at a system level, by which controls were tested for their operational effectiveness only within that system. No scenario testing of a trading "flow" across multiple systems, from order capture through to booking in ledgers and trading books, was undertaken. Such testing could have explored whether data flow across systems was consistent, identified any gaps in the control environment, and exposed any unexpected errors or bugs. The result of such testing would be to reduce the volume and criticality of any errors reaching external venues.

l) During the Relevant Period, the Firm received regular supervisory feedback regarding the weaknesses in its trading controls, the Firm's internal resources identified similar and further such weaknesses, and there were repeated trading control failures, each as set out above. Trading controls are a critical part of risk management and, as such, the failure by the Firm to rectify identified issues indicates a significant weakness in the Firm's risk management strategy and systems.

PRA Fundamental Rule 6

3.4. During the Relevant Period, the Firm breached PRA Fundamental Rule 6 (*A firm must organise and control its affairs responsibly and effectively)* for the following reasons*:*

a) Real-time monitoring of internal desk orders was inadequate to fully identify risks and remediate all issues arising from suspensions and alerts. On 2 May 2022, the EE Desk, who were covering for the Algorithmic Service Desk, did not escalate the 284 information alerts notifying of 284 individual orders incoming to CitiSmart which were each in excess of the maximum notional of US$25mm. These alerts were presented in the monitoring system so that their linkage to a single desk and trader was visible. Had these alerts been escalated, the trader could have been notified and the trade immediately cancelled.

b) Operational procedures and processes actioned by first line of defence functions, including alert protocols and messaging to risk owners, were not timely and did not enable the Firm to organise and control its affairs responsibly and effectively. On 2 May 2022, ETRC's system filtered out 226 of the 234 primary message rate suspension alerts from CitiSmart. Consequently, their escalation missed 226 message rate suspensions and the vast majority of notional value. ETRC escalated the incident 20 minutes after the Trader had already cancelled the order, and having received no response, followed up 4 hours later. The EE Desk only became aware of the erroneous trade when informed by a senior manager, after the cancellation of the trade.

c) The Firm failed to maintain and operate adequate control testing. Control testing for MMCs were at a system level, by which controls were tested for their operational effectiveness only within that system. No scenario testing of a trading "flow" across multiple systems, from order capture through to booking in ledgers and trading books, was undertaken. Such testing could have explored whether data flow across systems was consistent, identified any gaps in the control environment, and exposed any unexpected errors or bugs. The result of such testing would be to reduce the volume and criticality of any errors reaching external venues and would have better enabled the Firm to organise and manage its affairs effectively and responsibly.

d) The Firm failed to effectively risk manage MMCs, essential to the Firm's risk management strategy. There was no consistent review of MMC breach alerts, there was a failure to adequately manage MMC limit thresholds and to adequately ensure the proper functioning of MMCs. Equity Derivative traders made 985 changes to the CitiQuote Max Notional MMC, in the period January 2020 to February 2021, without obtaining RCC approval. Additionally, the XSOR – LSE incident in May 2021 revealed MMCs could be inadvertently deactivated and remain undetected for months.

e) Equities management did not impose adequate governance structures to ensure all e-Trading activity was identified and adhered to the Policy. There was a failure to adequately manage MMC limit thresholds and to adequately ensure the proper functioning of MMCs. Further, there was a failure to manage Policy obligations applicable to identified e-Trading applications or strategies.

f) Alerts for limit breaches within PTE presented as a single pop-up. Consequently, soft limit and hard limit breaches were detailed in the same pop-up. Control threshold breaches (ADV, Order Notional, Quantity, and Price) were amalgamated within the single pop-up. Further, the pop-up only presented 18 lines concomitantly without scrolling. Therefore, it was necessary to scroll through the pop-up to view all alerts if there were more than 18. Consequently, the pop-up was poorly designed and did not operate effectively as a risk management tool. Soft limits within PTE were quickly and easily overridden. Downstream from PTE, CitiSmart was inadequate to fully identify risks, through limit-based quantity controls, and remediate

g) The Firm failed to remediate identified issues with trading controls, and to respond to concerns raised by the PRA, in a timely manner. The PRA's 2020 PSM letter flagged trading controls in the front, middle, and back office as a continuing weakness; and in 2021, the PSM letter identified the Firm as falling below the PRA's expectations in relation to trading controls. That the PRA repeatedly highlighted deficiencies in trading controls, combined with the operational incidents which occurred throughout the Relevant Period, in particular the 2 May 2022 Incident, are a failure by the Firm to organise and control its affairs responsibly and effectively.

h) The Firm failed to implement effective and appropriate hard blocks to limit, or prevent, inappropriate trading activity. Crucially, the primary preventative control for erroneous size basket entry, wave notional hard block, was not in place for the EMEA Delta One desk. In addition, there was no hard block for maximum order ADV for DSA flow, which applied to Delta One, in PTE in EMEA. However, a maximum order ADV limit of 95% was set as a hard block for DMA flow. Had either of the hard blocks, for wave notional or maximum order ADV, applied to the EMEA Delta One desk, the 2 May 2022 Incident could have been prevented.

i) There was no Price Tolerance hard block set within PTE for DSA flow as of 2 May 2022. This control is particularly important during periods of heightened volatility, such as the low liquidity environment characteristic of public holidays. Price Tolerance controls also protect against erroneous manual input errors ('fat finger') input errors by cancelling orders from executing outside of a chosen percentage range. This not only protects the trader placing the order, but also other users from unexpected price movements which may be associated with a 'fat finger' input error.

j) The calibration of threshold limits in PTE were not designed appropriately to mitigate the risk of an erroneous order being entered for DSA flow. As an example, on 2 May 2022 the hard limit threshold for Order Notional was set at US$2bn. This meant underlying securities within a basket were only blocked if their individual notional was in excess of US$2bn. The hard limit threshold for Order Notional in PTE applicable to DSA flow has subsequently been changed from US$2bn to US$250mm. The magnitude of change emphasises the inappropriateness of the previous threshold.

k) On 2 May 2022, the price move on arrival control within CitiSmart was inappropriately calibrated at 15%. This had originally been calibrated, in January 2015, at 5%. It was subsequently increased to 15%, by the business in March 2020, in response to the market volatility caused by COVID. The control threshold was subsequently unchanged until 5 May 2022, when it was returned to 5%. Had this control been calibrated at 5% on the 2 May 2022, the total volume of the executed orders would have been significantly reduced.

l) The Firm were over reliant on manual processes and workarounds. This included EUCs for key processes, including trade pricing, trade booking, and rebalances. An internal audit found the Delta One Sales and Trading Desk relied heavily on manual processes and workarounds. This same audit, from 2020, described manual processes as increasing operational risk.

PRA Rulebook Algorithmic Trading Rules

3.5. During the Relevant Period, the Firm breached PRA Rulebook Algorithmic Trading Rule 2.1(2) (*a firm must have in place effective systems and risks controls, suitable to the business it operates, to ensure that its trading systems are subject to appropriate trading thresholds and limits*), for the following reasons:

a) There was no wave notional hard block set within PTE in EMEA for DSA flow on 2 May 2022. Therefore, there was no basket-level monetary value hard-limit in EMEA, which is the primary preventative control for erroneous basket size entry. However, at the time of the incident, such a control was present for PTE in the U.S.

b) There was no order ADV hard block set within PTE in EMEA for DSA flow. However, an ADV limit was set at 95% (hard block) for DMA activity. Had this ADV hard block been additionally calibrated for DSA flow, it would have blocked all orders within the 2 May 2022 erroneous trade from leaving PTE and thus, entirely prevented the incident.

c) On 2 May 2022, there was no Price Tolerance hard block set within PTE in EMEA for DSA flow. This control is particularly important during periods of heightened volatility, such as the low liquidity environment characteristic of public holidays. Price Tolerance controls also protect against erroneous manual input errors ('fat finger') input errors by cancelling orders from executing outside of a chosen percentage range. This not only protects the trader placing the order, but also other users from unexpected price movements which may be associated with a 'fat finger' input error.

d) The calibration of threshold limits in PTE were not designed appropriately to mitigate the risk of an erroneous order being entered for DSA flow. On 2 May 2022 the hard limit threshold for Order Notional was set at US$2bn. This meant underlying securities within a basket were only blocked if their individual notional was in excess of US$2bn. The hard limit threshold for Order Notional in PTE applicable to DSA flow has subsequently been changed from US$2bn to US$250mm. The magnitude of change emphasises the inappropriateness of the previous threshold.

e) On 2 May 2022, the price move on arrival control within CitiSmart was not calibrated effectively as it was set at 15%. This had originally been calibrated, in January 2015, at 5%. It was subsequently increased to 15%, by the business in March 2020, in response to the market volatility caused by COVID. The control threshold was subsequently unchanged until 5 May 2022, when it was returned to 5%. Had this control been calibrated at 5% on the 2 May 2022, the total volume of the executed orders would have been significantly reduced.

f) The Firm failed to effectively risk manage MMCs, essential to the Firm's risk management strategy. There was no consistent review of MMC breach alerts, there was a failure to adequately manage MMC limit thresholds and to adequately ensure the proper functioning of MMCs. Equity Derivative traders made 985 changes to the CitiQuote Max Notional MMC, in the period January 2020 to February 2021, without obtaining RCC approval. Additionally, the XSOR – LSE incident in May 2021 revealed MMCs could be inadvertently deactivated and remain undetected for months.

g) Alerts for limit breaches within PTE presented as a single pop-up. Consequently, soft limit and hard limit breaches were detailed in the same pop-up. Control threshold breaches (ADV, Order Notional, Quantity, and Price) were amalgamated within the single pop-up. Further, the pop-up only presented 18 lines concomitantly. Therefore, it was necessary to scroll through the pop-up to view all alerts if there were more than 18. Consequently, the pop-up was poorly designed and did not operate effectively as a risk management tool. Soft limits within PTE were quickly and easily overridden. Downstream from PTE, CitiSmart was inadequate to fully identify risks, through limit-based quantity controls, and remediate.

3.6. During the Relevant Period, the Firm breached PRA Rulebook Algorithmic Trading Rule 2.1(3) (*a firm must have in place effective systems and risks controls, suitable to the business it operates, to prevent the sending of erroneous orders, or the system otherwise functioning in a way that may create or contribute to a disorderly market*), for the following reasons:

a) The 2 May 2022 Incident was a serious example of an erroneous order being sent to the market; and was one which might have created or contributed to a disorderly market. The

Firm’s systems and risk controls were not effective to prevent the 2 May 2022 Incident from occurring for all the reasons set out above.

b) A trading incident in May 2018 highlighted a lack of functionality in CitiSmart as it did not perform notional checks on market-on-close trades based on notional limits imposed by corresponding exchanges. Such functionality would have enabled CitiSmart to recognise trades exceeding exchange single order size limits and split them into smaller, acceptable tranches. Consequently, had this functionality existed at the time, the trades in ‘Equity C’ would not have been initially rejected by the exchange. The rejection by the exchange resulted in the trades being registered in GENIE, where they were not linked, listed together, or identified as related. This resulted in only the purchase leg of the trade being sent back to the exchange before the auction window closed. This created an impact on the closing price.

c) In May 2021, a software defect in the Firm’s smart order router, XSOR, resulted in improper interaction with an exchange. The software defect, which had gone undetected for four months, resulted in the deactivation of an MMC within XSOR. The absence of this control resulted in XSOR generating 600 orders per second, for a total of 1,066,493, in the half hour before a manual cancellation was executed by the Firm. This created abnormal behaviour within the order books of the exchange, who spotted the issue and notified the Firm.

d) Real-time monitoring of internal desk orders was inadequate to fully identify risks and remediate all issues arising from suspensions and alerts. Suspensions triggered by pre-trade controls in CitiSmart were presented real-time in a dedicated monitoring application, DNA Viewer. In addition to suspension of orders, the application provided information alerts designed to allow further monitoring of specific data, such as large orders as they entered CitiSmart. Immediately following the erroneous trade booking on the morning of 2 May 2022, 284 information alerts were generated in DNA Viewer, highlighting 284 separate orders entering CitiSmart, each exceeding the maximum notional value of US$25mm. However, the team responsible for monitoring DNA Viewer on 2 May 2022 did not escalate these alerts. These alerts were presented in the monitoring system so that their linkage to a single desk and trader was visible. Had these alerts been escalated, the trader could have been notified and the trade cancelled. On 2 May 2022 this manual risk control failed, resulting in US$1.4bn notional of erroneous selling being executed in the market.

h) Operational procedures and processes actioned by first line of defence functions, including alert protocols and messaging to risk owners, were not timely and did not represent effective risk management. On 2 May 2022, ETRC’s system filtered out 226 of the 234 primary message rate suspension alerts from CitiSmart. Consequently, their escalation missed 226 message rate suspensions and the vast majority of notional value. ETRC escalated the incident 20 minutes after the trader had already cancelled the order, and having received no response, followed up 4 hours later. The EE Desk only became aware of the erroneous trade when informed by a senior manager, after the cancellation of the trade.

3.7. During the Relevant Period, the Firm breached PRA Rulebook Algorithmic Trading Rule 2.2(2) (*a firm must ensure that its systems are fully tested and properly monitored*), for the following reasons:

a) During the Relevant Period, control testing for MMCs was at a system level, meaning controls were tested for their operational effectiveness only within that system. No scenario testing of a trading "flow" across multiple systems, from order capture through to booking in ledgers and trading books, was undertaken. Consequently, if a soft trigger was overridden in testing, to mirror an inadvertent erroneous override in production, and proceeded to the Firm's downstream systems, there was no testing on the behaviour of the order flow to other systems and external venues. Such testing is necessary to reduce the volume and criticality of errors reaching external venues.

ANNEX C: SANCTION

1. Financial penalty

1.1. On 30 January 2024, the Bank of England published a revised approach to Enforcement which included a revised PRA penalty policy. However, when setting a fine, the PRA is required to have reference to the relevant penalty policy in place during the Relevant Period. In accordance with the PRA's penalty policy which was in place during the Relevant Period (the "Penalty Policy"), the PRA applies a five-step framework, which operates as follows, to determine the appropriate level of financial penalty.

2. Step 1: Disgorgement

2.1. The PRA seeks to deprive a person of any economic benefits derived from or attributable to the breach of its regulatory requirements, where it is practicable to ascertain and quantify them.

2.2. The PRA has not identified any economic benefit, including any profit made or loss avoided, which it would be practicable to ascertain or quantify.

2.3. The Step 1 figure is therefore **£0**.

3. Step 2: The seriousness of the breach

3.1. The PRA determines a starting point figure for a financial penalty having regard to the seriousness of the breach by the firm – including any threat it posed or continues to pose to the advancement of the PRA's statutory objectives – and the size and financial position of the firm.

3.2. A suitable indicator of the size and financial position of the firm may include, but is not limited to, the revenue in respect of one or more areas of its business.

3.3. Given that the significant trading incidents during the Relevant Period occurred in Delta One, the revenues generated by this business are an appropriate starting point. The PRA consider the revenues for the financial year preceding the 2 May 2022 Incident, 1 January 2021 to 31 December 2021, to be appropriate. The revenue for EMEA Delta One for the financial year 2021 was **£242,000,000**.

3.4. The PRA then applies an appropriate percentage rate (the "**Seriousness Percentage**") to the starting point figure that properly reflects the nature, extent, scale and gravity of the breaches.

3.5. The PRA has taken the following factors into account to determine the Step 2 Seriousness Percentage:

a) The integrity of a firm's trading controls are fundamental to the PRA's assessment of a firm's safety and soundness. The failure to adequately develop and monitor trading controls, including internal order management systems that have the capability to send instructions to create orders in algorithmic trading systems, suitable to the scale and complexity of a firm's business, can have a significantly adverse impact on a firm's safety and soundness.

b) The duration of the Firm's breaches persisted over a period of 4 years.

c) Throughout the relevant period, the Firm received repeated supervisory communication from the PRA on the need to strengthen trading controls. Further, Internal Audit within the Firm flagged the multiple, and significant, control issues to be addressed. In some areas, the Firm communicated its intention to remediate identified issues to the PRA and, after completing some remediation activities, the Firm obtained validation both from an external consultant and from its Internal Audit function that the remediation work had removed or mitigated the identified control issues. However, notwithstanding these remediation works, certain weaknesses in internal controls at the Firm during the relevant period were not addressed completely or quickly enough.

d) Trading incidents throughout the Relevant Period shared repeated themes, namely trade entry systems susceptible to trader input errors, algorithms which lacked appropriate controls, inadequate communication between internal trading desks, deficient notification alerts, and insufficient monitoring. These incidents repeatedly demonstrated the weaknesses in the Firm's trading controls.

e) The EMEA Delta One desk lacked the primary and explicit preventative control for erroneous manual input errors in basket trade entry, a wave notional hard block. Such a control would have terminated the erroneous order on 2 May 2022, before it left the Firm's environment and impacted external exchanges. This was a conspicuous failing. The North American Delta One desk did have such a wave notional hard block.

f) The Firm failed to conduct end-to-end testing of a trading "flow" through the various applicable systems. Such testing is necessary to ensure strategies and systems do not behave in an unintended manner which might contribute to a disorderly market.

g) The Firm failed to ensure its trading systems prevented the sending of erroneous orders, or its systems otherwise functioning in a manner which may create or contribute to a disorderly market.

3.6. The PRA has also had regard to the matters set out at Annexes A and B to this Notice.

3.7. Taking these factors into account, the PRA considers that the seriousness of the conduct to be such that the appropriate **Seriousness Percentage is 25%**.

3.8. Therefore, the Step 2 figure is **£60,500,000**.

4. Step 3: Adjustment for any aggravating, mitigating or other relevant factors

4.1. Pursuant to paragraph 24 of the PRA's Penalty Policy, the PRA may increase or decrease the Step 2 figure to take account of any factors which may aggravate or mitigate the breaches. Any such adjustment will normally be made by way of a percentage adjustment to the figure determined at Step 2.

4.2. In deciding whether any adjustment for aggravating or mitigating factors is warranted, the PRA has considered the following factors:

a) In November 2019, the PRA imposed a financial penalty on several Citi entities, including the Firm, of £43,890,000 for a breach of FR6 (a firm must organise and control its affairs responsibly and effectively). This was the result of systems and controls failings which had persisted over a relevant period of 19 June 2014 to 31 December 2018.

b) In August 2022, the Firm were fined in excess of £12.5 million by the Financial Conduct Authority ("**FCA**") for breaches of Principle 2 (failing to act with due skill, care and diligence) and Article 16(2) of the Market Abuse Regulation ("MAR"), Regulation (EU) No. 596/2014 during the period between 2 November 2015 and 18 January 2018. By failing to properly implement the MAR trade surveillance requirements, the Firm could not effectively monitor certain of its trading activities, and the Firm failed to identify significant gaps in its arrangements, systems and procedures in respect of its compliance with Article 16(2) MAR. These failings correspond with those identified by the PRA in this Final Notice.

c) The effectiveness of the Firm's control environment was highlighted as a key risk, repeatedly over the course of the Relevant Period, by the PRA to the Firm. The PRA flagged, amongst other issues, the lack of preventative controls in 2019, trading related incidents demonstrating control failures in 2020, and the Firm's control environment falling short of expectations in 2021. In this regard, the Firm failed to respond to supervisory interventions made by the PRA in an adequate or timely manner.

d) In assessing aggravating factors, the PRA may have regard to the implications or potential implications of the breach. The Firm's failure to have in place trading controls which were appropriate to its business had potential to cause or contribute to the creation of a disorderly market. The occurrence of trading incidents during the Relevant Period and, in particular, the trading incident on the 2 May 2022, illustrates the implications or potential implications of the Firm's failings in this regard.

e) During the Relevant Period and since, the Firm has undertaken significant remediation in respect of trading controls and booking model controls. During the Relevant Period, the Firm also obtained validation of its progress from an external consultant and from its Internal Audit function. The PRA considers, however, the Firm were aware of potential weaknesses and deficiencies in their booking model controls from the beginning of the Relevant Period, and so greater immediate priority should have been given to ensuring the adequacy of the Firm's trading controls and booking model controls.

f) The Firm took immediate steps in the days following the trading incident on 2 May 2022 to make tactical adjustments to its controls to prevent a similar incident occurring.

g) The Firm has cooperated with the PRA during the course of the investigation, however instances of incomplete production of documents by the Firm impacted on the PRA's ability to conclude its enforcement process promptly and efficiently and fell short of the PRA's expectations in this regard.

h) The enforcement action taken against the Firm by the FCA in relation to the trading incident on the 2 May 2022 is a relevant factor.

4.3. Considering the countervailing nature of the above factors, and taking them as a whole, the PRA conclude the impact of aggravating factors is offset by mitigation awarded for the FCA penalty.

4.4. Accordingly, a reduction of 20% is made at Step 3. Therefore, the Step 3 figure is **£48,400,000**.

5. Step 4: Adjustment for deterrence

5.1. The PRA does not consider it necessary to adjust the Step 3 figure for deterrence.

6. Step 5: Application of any applicable reductions for early settlement or serious financial hardship

6.1. If the PRA and the firm upon whom a financial penalty is to be imposed agree the amount of the financial penalty and any other appropriate settlement terms, the PRA's settlement policy provides that the amount of the penalty which would otherwise have been payable may be reduced.

6.2. The PRA and the Firm reached an agreement to settle during the Discount Stage and so a 30% settlement discount applies to the Step 4 figure.

6.3. Therefore, the Step 5 figure is **£33,880,000**.

ANNEX D: PROCEDURAL MATTERS

Decision maker

1. The settlement decision makers made the decision which gave rise to the obligation to give this Final Notice.

2. This Final Notice is given under and in accordance with section 390 of the Act.

Manner and time for payment

3. The Firm must pay the financial penalty in full to the PRA by no later than 7 June 2024. If all or any of the financial penalty is outstanding on 8 June 2024 – the day after the due date for payment – the PRA may recover the outstanding amount as a debt owed by the Firm and due to the PRA.

Publicity

4. Sections 391(4), 391(6A) and 391(7) of the Act apply to the publication of information about the matter to which this Final Notice relates. Under those provisions, the PRA must publish such information about the matter to which this Final Notice relates as the PRA considers appropriate. However, the PRA may not publish information if such publication would, in the opinion of the PRA, be unfair to the persons with respect to whom the action was taken or prejudicial to securing an appropriate degree of protection to policyholders.

PRA contacts

5. For more information concerning this matter generally, please contact Press Office (**Press@BankofEngland.co.uk**).

APPENDIX 1: DEFINITIONS

THE DEFINITIONS BELOW ARE USED IN THIS FINAL NOTICE:

"2 May 2022 Incident"	The incident occurring on 2 May 2022 whereby a basket of equities of notional $444bn was erroneously inputted into the Firm's trading systems, with a total of $1.4bn of "sells" being filled by the market before the trade was cancelled.
"Act"	The Financial Services and Markets Act 2000 (as amended).
"ADV"	Average Daily Volume, number of shares of a particular stock which, on average, changed hands during a single trading day.
"Algorithmic Trading"	As defined in **Article 4(1)(39) of MifID II**: *'algorithmic trading' means trading in financial instruments where a computer algorithm automatically determines individual parameters of orders such as whether to initiate the order, the timing, price or quantity of the order or how to manage the order after its submission, with limited or no human intervention, and does not include any system that is only used for the purpose of routing orders to one or more trading venues or for the processing of orders involving no determination of any trading parameters or for the confirmation of orders or the post-trade processing of executed transactions.*
"Banking, Capital Markets and Advisory"	Provide structuring and syndication of securities and financing transactions in the bond capital markets and deliver equity and equity-linked solutions in financing acquisitions, funding capital expenditures, managing liabilities, monetising assets, and hedging exposures. Additionally, provide advisory services to clients in relation to mergers and acquisitions, corporate broking and the raising and restructuring of capital.
"CAP"	Means corrective action plan, a remediation plan to remedy issues highlighted by the Firm's internal audit function.
"Cash Equity"	An actual stock, as opposed to the derivative of a stock.
"CitiSmart"	The Firm's electronic algorithmic trading system. Orders which are created in PTE are sent to CitiSmart where execution strategies, such as volume-weighted average price (VWAP), are applied. Baskets are broken into individual parent orders for each security and are sliced into 'child orders' which are then passed to the smart order router 'XSOR' for transmission to external venues, such as exchanges.
"CitiQuote"	The automated request for quote system used by the Firm to generate and provide price quotes to clients for equity derivatives products.

"Commodities"	Acting as a principal in commodity markets, providing risk management services to clients, acting as a liquidity provider and providing investor solutions and working capital facilities for commodity inventories.
"Considerable Improvements Needed"	Means, as per the definitions in the Firm's audit reports for overall assessment and issue classification levels: that "audit results indicate that considerable deficiencies exist in the design and/or operating effectiveness of controls relative to the size and complexity of the activities within the scope of the audit. These deficiencies prevent inherent risks from being adequately mitigated."
"Delta One"	Trading desk providing access, financing, and investment solutions to a broad spectrum of clients (institutional, corporates and hedge funds) via synthetic products such as swaps, exchange-traded funds (ETFs) and access products.
"DMA"	"Direct Market Access Flow" A trading order which is routed directly to the Smart Order Router (XSOR) strategies, which then route to various venues or external brokers via XSOR (and does not go through CitiSmart algorithms).
"DSA"	A trading order which enters algorithms within CitiSmart for execution.
"EE"	Equities Electronic Execution.
"Equities"	Acting as a market maker in equities, convertible bonds, listed and OTC derivatives, and structured products.
"Equity Markets"	Markets including; equities, convertible bonds, listed and OTC derivatives, structured products, securities financing, and electronic trading.
"ETRC" or E-trading Risk and Controls"	A first line of defence team covering all asset classes, established in 2018 in response to the regulatory requirement for independent real-time monitoring for signs of disorderly markets.
"ETRM" or "Electronic Trading Risk Management"	Second line of defence risk function. ETRM review MECs documented in the MEC standard annually, on behalf of the E-Trading Risk and Compliance Committee, on a sample basis.
"FCA"	The Financial Conduct Authority
"Firm"	Citigroup Global Markets Limited
"Futures and OTC Clearance"	Provides clients with access to global liquidity venues, global execution on all major futures exchanges, multi-asset clearing services on global central counterparties (CCPs) and delivery of collateral solutions.
"GENIE" or "DNA	The main tool for real-time monitoring of orders executed by the Firm's first

Viewer”	line monitoring teams using CitiSmart. GENIE references control limit and threshold configuration tables.
“Global Spread Products”	Provide clients with access to investment grade, high yield and distressed bond markets, as well as credit derivatives and structured credit products.
“HALO”	System taking feeds in a selection of alerts from the relevant trading systems and used to provide independent real-time monitoring. The system is monitored by E-Trading Risk and Controls
“Hard Blocks”	Operational trading limits that cannot be overridden by individual traders.
“Index”	A group or “basket” of securities, derivatives, or other financial instruments that represents and measures the performance of a specific market, asset class, market sector, or investment strategy whereby as the combined value of the securities in the index moves up or down, the numerical value, or the index level, changes to reflect that movement.
“ICG”	Institutional Client Group (dissolved at the end of September 2023). A Citigroup Inc division which incorporated: i) treasury, trade and securities services; ii) global markets services; and iii) investment and corporate banking services.
“Limited Assurance”	Means, as per the definitions in the Firm’s audit reports for overall assessment and issue classification levels: that “audit results indicate that limited assurance can be placed on the design and operating effectiveness of internal controls to mitigate and/or manage one or more of the key inherent risks to which the activities being audited are exposed. The existence of repeat issues is also considered in assigning this overall assessment.”
“MI”	Management information, i.e. information about a business used by its decision-makers.
“MECs” or “MMC”	Mandatory E-Trading Controls / Minimum Mandatory Control (noting that in February 2022 the term MMC was replaced with MEC). MECs documented in the MEC Standard are a set of specific execution and conduct controls required for all E-trading activities and initiate a blocking activity within the system. They are set by the business and reviewed annually by the Business and per section 5.2.5 the E-trading Policy, ETRM on behalf the E-Trading Risk and Compliance Committee (ETRCC) review on a sample basis.
“Multi Asset Group”	Develop asset-based investment and hedging solutions for distributors and institutional investors, with a particular focus on insurance companies, asset managers (including hedge funds) and pension funds.
“MSCI World Index”	An index capturing the performance of large and mid-cap stocks across a

	number of countries.
"the Policy"	The Firm's e-Trading policy.
"PRA"	The Prudential Regulation Authority.
"PRA Rulebook"	The Prudential Regulation Authority Rulebook.
"PRA Penalty Policy"	'The Prudential Regulation Authority's approach to enforcement: statutory statements of policy and procedure January 2016 – Appendix 2 – Statement of the PRA's policy on the imposition and amount of financial penalties under the Act'.
"PRA Settlement Policy"	'The Prudential Regulation Authority's approach to enforcement: statutory statements of policy and procedure January 2024 – Annex 1, Chapter 8 – Statement of the PRA's policy on enforcement statutory notices and the allocation of decision-making in uncontested cases, and settlement decision-making procedure and policy.
"Price Tolerance"	A control which protects against the negative consequences of executing orders in volatile markets, where prices can move quickly. The control works by setting a threshold on the price change away from the desired target level at which a trader is willing to buy or sell
"Prime Finance"	Provide a globally co-ordinated prime brokerage services to clients, including securities lending, margin financing, reporting, clearing, custody and structured financing solutions.
"PSM" or "Periodic Summary Meeting"	An annual firm-specific meeting at which the PRA discusses supervisory work conducted over the previous year, agrees the key issues and the associated supervisory work plan for the coming year, and sets out a medium-to-long-term supervisory strategy.
"PTE" or "Programme Trading Execution"	The trade order management system used by the Delta One and Programme Trading (PT) desks for executing and tracking the progress of equity hedges. There are two versions of PTE: PTE Sales, and PTE Trading.
"Rates"	Rate products, including sovereign and supranational bonds, inflation bonds, as well as interest rate, cross currency and inflation derivatives.
"RCC"	The e-Trading Risk and Compliance Council.
"Room for Improvement"	Means, as per the definitions in the Firm's audit reports for overall assessment and issue classification levels: that review results indicate that while assurance can be placed on the design and operating effectiveness of internal controls to mitigate and/or manage inherent compliance risks to which the activities being reviewed are exposed, attention to the adequacy

	of certain control(s) is required for a number of areas.
“Supervisory Statement”	The PRA’s Supervisory Statement 05/18 (SS5/18) of June 2018, titled ‘Algorithmic Trading’, setting out the PRA’s expectations of a firm’s risk management and governance of algorithmic trading.
“Tribunal”	The Upper Tribunal (Tax and Chancery Chamber).
“VWAP”	Volume-Weighted Average Price. A way for calculating the average price of certain traded equities over a defined period of time.
“Final Notice”	This Final Notice, together with its Annexes and Appendices.
“XSOR”	CitiSmart Order Router system; orders are fed from CitiSmart into XSOR, which then routes the orders to external venues such as exchanges.

APPENDIX 2: RELEVANT STATUTORY AND REGULATORY PROVISIONS

The PRA's objectives

1. The PRA has a general objective, set out in section 2B of the Act, to promote the safety and soundness of PRA-authorised persons. Section 2B(3) of the Act provides that the PRA's general objective is to be advanced primarily by:

   (a) seeking to ensure that the business of PRA-authorised persons is carried on in a way which avoids any adverse effect on the stability of the UK financial system; and

   (b) seeking to minimise the adverse effect that the failure of a PRA-authorised person could be expected to have on the stability of the UK financial system.

Section 206 – Disciplinary powers

2. Section 206 of the Act provides:

   "*If the appropriate regulator considers that an authorised person has contravened a relevant requirement imposed on the person, it may impose on him a penalty, in respect of the contravention, of such amount as it considers appropriate.*"

3. CGML is an authorised person for the purposes of section 206 of the Act. Relevant requirements imposed on authorised persons include rules made under the PRA Rulebook, including the PRA's Fundamental Rules.

Relevant regulatory provisions

4. The PRA has eight Fundamental Rules which apply to all PRA-authorised firms. These are high-level rules which collectively act as an expression of the PRA's general objective of promoting the safety and soundness of regulated firms. The relevant PRA Fundamental Rules are as follows:

   a) Fundamental Rule 2: 'A firm must conduct its business with due skill, care and diligence.'
   b) Fundamental Rule 5: 'A firm must have effective risk strategies and risk management systems.'
   c) Fundamental Rule 6: 'A firm must organise and control its affairs responsibly and effectively.'

The relevant rules from the PRA Rulebook are as follows:

Algorithmic Trading

a) '2.1 A firm must have in place effective systems and risk controls, suitable to the business it operates, to ensure that its trading systems:

…(2) are subject to appropriate trading thresholds and limits; and
(3) prevent the sending of erroneous orders, or the systems otherwise functioning in a way that may create or contribute to a disorderly market.'

b) '2.2 A firm must:

(1) have in place effective business continuity arrangements to deal with any failure of its trading systems; and
(2) ensure that its systems are fully tested and properly monitored to ensure they meet the requirements of (1) and 2.1.'

Relevant policy

Approach to the supervision of banks

5. *The Prudential Regulatory Authority's Approach to Banking Supervision, July 2023* sets out how the PRA carries out its role in respect of deposit-takers and designated investment firms. One of the purposes of the document is to communicate to regulated firms what the PRA expects of them, and what they can expect from the PRA in the course of supervision.

Approach to enforcement

6. *The Prudential Regulation Authority's approach to enforcement: statements of policy and procedure, April 2013* (as updated in January 2024) sets out the PRA's approach to exercising its main enforcement powers under the Act.

7. The PRA's approach to the imposition of penalties is outlined in the Penalty Policy; and the PRA's approach to settlement is outlined in the Settlement Policy.