

MED/2018-19/013

Standard Business Case

Replacement of Primary Cardiac MRI Scanner (MRI2)

Revision 3.2

DRAFT

Radiology Department

Medical Physics Department**CONTENTS**

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## 1. Executive summary

This Standard Business case (SBC) considers the options available when replacing the primary cardiac MRI scanner located on level 2.

The main drivers for the project are as follows:

1. The project will deliver a modern, high specification Cardiac MRI
2. The scanner will be capable of meeting the complex demands of the specialised National Cardiac MRI service, providing improved diagnostic visualisation
3. The scanner will form part of the wider pool of MRIs meeting the scanning requirements for all patient groups

The business case describes the purpose of the project and the reasons for the selected business option based on estimated costs, risks and expected benefits.

The current MRI scanner reached 10 years old in April 2018. The system has been flagged for replacement under the organisation’s planned equipment replacement programme. The replacement appears on the 2018/19 prioritised medical equipment plan as a result of a risk assessment process carried out by the Medical Equipment Group (MEG).

The following naming convention will be used throughout this business case:-

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Model** | **Description** | **Field Strength** | **Bore** |
| MRI1 | GE MR450 | General MRI | 1.5T | Wide |
| MRI2 | Siemens Avanto | Primary cardiac MRI | 1.5T | Narrow |
| MRI3 | Siemens Aera | New general MRI with limited cardiac functionality | 1.5T | Wide |
| MRI4 | Siemens Amira | New general MRI | 1.5T | Narrow |

Table 1

For the purposes of this document the primary cardiac MRI scanner can be considered as consisting of:

* MRI scanner with dedicated cardiac package
* A range of MRI coils appropriate to it’s intended use
* Turnkey installation including replacement of RF cage

The project involves the like for like replacement of the cardiac MRI scanner incorporating up to date technology. There are no additional staffing resources required.

This business case recommends the following:

1. The equipment replacement plan commences with the equipment replaced on a like for like basis reflecting up to date advances in technology.
2. The equipment will be purchased from the National Procurement Framework Contract

The financial assessment describes the capital and revenue impact

|  |  |  |
| --- | --- | --- |
|  | **Capital (£)** | **Recurring revenue (£)** |
| Replacement of cardiac MRI scanner | 930,000 | Assumed to be as a minimum equal to existing maintenance costs |

Table 2

### 1.1 Key points

The scope includes the for like replacement of the existing Cardiac MRI scanner utilising up to date technology to deliver improved diagnostic visualisation and analysis.

The business case and project will consider the following:

* Procurement and lifecycle management of a replacement cardiac MRI and associated peripherals
* The turnkey solution for installation of the scanner
* Maintaining flexibility between the 4 MRI scanners
* Future proofing the scanner capabilities

The business case describes the process that considers:

* Should the equipment be replaced?
* What replacement equipment is needed to meet changing patient demands?

and

* The procurement process.

The business case describes these points and recommends the replacement of the cardiac MRI scanner (MRI2). This supports significant patient benefits.

These benefits are summarised below:

* Meets service demands and future sustainability
* Supports the delivery of National and Regional cardiac services
* Delivers a system with optimum workflow for the physical location of the scanner
* Maximises flexibility and efficiency between the 4 scanners within the physical constraints of delivering an MRI service across 2 MRI suites.
* Simplified user training
* Produces high quality imaging meeting the demands of the service
* Provides high quality training and opportunities for staff professional development
* Provides scope for development of the service
* Research opportunities

### 1.2 Outcome from appraisal process

The list of business options considered was:

**Option 1: Do minimum**

Continue to use the ageing system, but recognise that this will require increased maintenance and replacement over the next 5 years.

**Option 2: Replace the MRI scanner, utilising the existing NHS National Imaging Equipment Group/NSS procurement framework**

Use the Board’s existing medical equipment acquisition process to purchase a replacement.

The outcome from the appraisal process for the business case has been summarised in the table below:

|  |  |  |
| --- | --- | --- |
|  | **Option 1** | **Option 2** |
| Benefits assessment | 590 (2) | 890 (1) |
| Financial assessment | (2) | (1) |
| Economic assessment | (2) | (1) |
| Risk assessment | 63 (2) | 60 (1) |
| Overall rank of options | 2 | 1 |

Table 3

The whole life costs of the project demonstrate that option 1 is the most expensive and option 2 is the financial and economically most viable. This is due to the aging of the existing system and the requirement to replace within the next 5 years. Due to the differential of the risk scoring between both options being minimal, both options have ranked as one for the appraisal process.

The comparison of risks demonstrated option 2 carrying only marginally lower risk than option 1. Both options are consequently ranked equal. It should be noted that the risks relating to option 2 are mostly transient for the duration of the project and are principally due to the disruption created by project implementation, whereas the risks associated with option 1 are ongoing and expected to rise due to the increasing unreliability and obsolescence.

The reliability of the existing cardiac MRI scanner is expected to decrease and failure rates increase in line with well established equipment management principles and have been reflected in the economic assessment. The planned equipment replacement program exists to address this issue before it becomes an operational concern. Given the significant benefits, option 2 is the preferred option.

### 1.3 Statement of affordability

The financial impact is detailed within the business case. It is also important to note that there are also significant benefits in the avoidance of risks associated with the use of aging medical equipment, and also include the benefits of efficient workflow, connectivity and up to date medical technology. These have been assumed within the economic appraisal.

The current installed system is ageing and lacks the up to date hardware capabilities to support recent advancements in cardiac imaging.

Investment in the replacement system in MRI 2 at this time is in line with the organisation’s Planned Equipment Replacement Programme for 2018/19. The primary return on the investment is the avoidance of operational risks associated with equipment obsolescence. Additionally, consistent with the Board’s vision around strengthening our international and national portfolio and reputation the replacement of MRI 2 will support the organisation to continue to increase participation in research activities.

Funding for the equipment is included in the approved capital plan for the year 2018/19. These costs included in the financial appraisal may be subject to variation on receipt of the final project cost, if this variation is significant it will be taken back to the Capital Group. The annual capital plan needs to be delivered within the approved budget.

### 1.4 Implementation of project plan

The Cross Sectional Imaging Group will function as the Project Board. The project will be managed using a methodology based on PRINCE 2. It will be split into a series of management stages, each requiring formal approval of the project board before initiation. All stages will be subject to adjustment in timescales and content resulting from continual project management, assessment of ongoing risks and reaction to incidents. This may provide additional scope for slippage or acceleration providing the risk assessment supports this. Financial approval will also be required by the Board’s Capital Group.

Figure 1: Project management stages

An MRI Implementation Group has been established as a subgroup of the Cross Sectional Imaging Group. This group is responsible for devising an implementation/contingency plan to manage the ongoing delivery of the clinical service during the period of planned downtime to accommodate the build. The plan is a live document and will continue to be updated by the implementation group as the project progresses. This allows the group to react to new and developing risks and opportunities. A copy of the plan, correct as of 12/11/18, is included in Appendix 1.

## 2. Introduction/background

The MRI service is currently delivered through four scanners located between level 2 and the recently created MRI suite on level 1.

MRI2 is the only magnet with full cardiac capabilities and supporting infrastructure to accommodate the full range of cardiac patient groups. This includes a dedicated recovery area, patient monitoring and provision for anaesthesia in the magnet room.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Model** | **Description** | **Field Strength** | **Bore** |
| MRI1 | GE MR450 | General MRI | 1.5T | Wide |
| MRI2 | Siemens Avanto | Primary cardiac MRI | 1.5T | Narrow |
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| MRI4 | Siemens Amira | New general MRI | 1.5T | Narrow |

Table 4

**MRI 1 GE MR450** **MRI2 Siemens Avanto**

****

**MRI3 Siemens Aera MRI4 Siemens Amira**

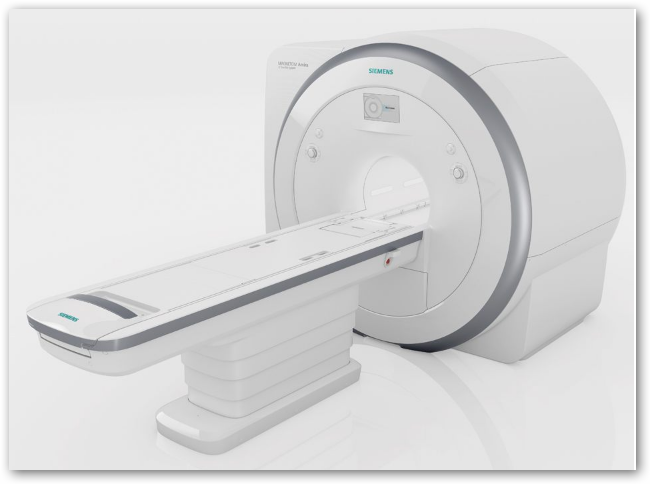
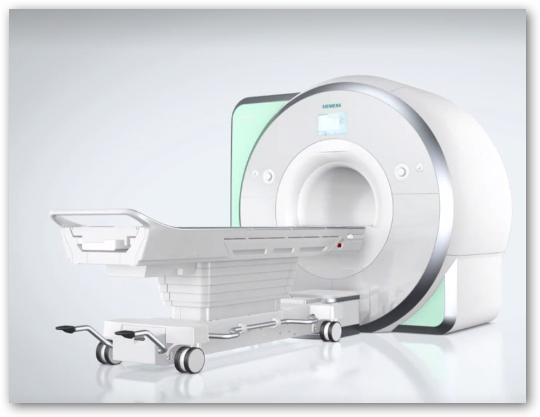


Figure 2: GJNH MRI Scanners

The replacement profile for the four scanners is shown below.



Figure 3

MRI2 is located within the level 2 MRI suite. The replacement system will be installed in same location with no requirement for modifications outwith the existing MRI bay. This is indicated by the red box in the figure below. The floor plan also shows the adjacency of the new second CT scanner (CT2), approved by the Board in September of this year. All build work specific the new CT scanner room and control area is anticipated to be complete before work commences on MRI2.

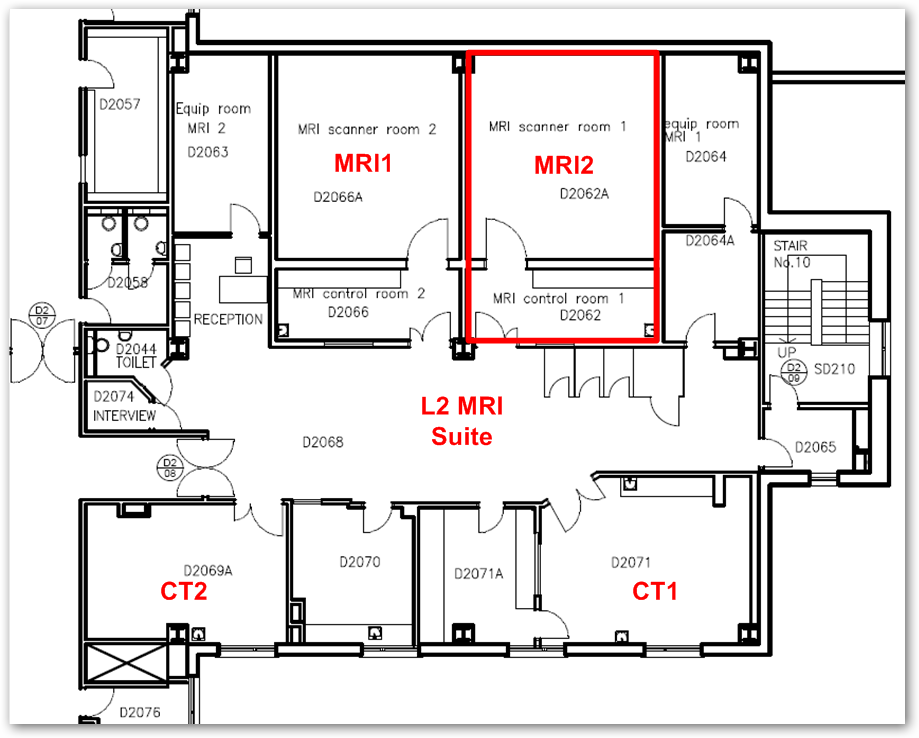


Figure 4

### 2.1 Summary of existing and proposed MRI activity across the Board

The project will deliver a direct like for like replacement for the existing Cardiac MRI scanner utilising up to date technology to deliver improved diagnostic visualisation and analysis. It has been initiated as a result of the planned equipment replacement process overseen by the Medical Equipment Group. The project will maintain activity at least on a par with current throughput.

All four MRI scanners are currently running to staffed capacity.

The Golden Jubilee MRI service currently provides capacity for:

* Health Boards in Scotland as part of their requirement to deliver waiting time guarantees. This includes ‘see and treat’ patients.
* Three National Services, hosted within GJF.
  + SACCS
  + SNAHFS
  + SPVU
* Regional cardiac services.
* GJNH inpatients.
* Cardiac research.

**Cardiac MRI Service**

The replacement of MRI2 will support the complex demands of the Cardiac MRI service delivering high end imaging to three national services, regional cardiac services and GJNH inpatients. This will be maintained by replacing the existing scanner with an up to date system in line with the planned equipment replacement programme. The new scanner will ensure compliance with current clinical guidance[[1]](#footnote-1) for full diagnostic evaluation of cardiac patients with conditions including (but not exclusively):

* Heart Failure
* Ischemic Heart Disease
* Myocardial Infarction/Scar
* Cardiomyopathies
* Myocarditis
* Valvular Heart Disease
* Cardiac Mass
* Pericardial Disease
* Atrial Fibrillation

**Waiting Times**

‘Waiting times’ capacity is agreed annually with the National Waiting Times Unit (SG). Until the introduction of MRI 3 and MRI 4 in November 2017, there was insufficient capacity to fully meet the requirements of referring Health Boards. We currently provide in the region of 14,000 waiting times examinations annually to 7 regional health boards. However, following full realisation of the maximum capacity delivered through all 4 scanners, monthly activity exceeds commitments by 19%. Demand across NHS Scotland remains beyond national capacity.

**Research**

Research projects can be broadly split into two categories, in-house and external research. Both bring additional revenue to the GJNH. Current activity is delivered over 2 ring-fenced flexible sessions per week. This has allowed the service to foster close links with Glasgow University and BHF. The research has resulted in many published cardiac research papers.

The new scanner will be enabled with a number of up-to-date sequences that will be attractive to a wider range of research opportunities. This has the potential to raise the profile of the service through inclusion in innovative peer reviewed studies and publications.

Pooling of scanning resources will continue across all four systems. Flexible scheduling will also be maintained across all four MRI scanners in periods of planned and unplanned downtime. This efficiency will increase the likelihood of being able to accommodate short notice ad-hoc requests for both inpatient and see-and-treat referrals.

The figure below provides an overview of activity on all 4 scanners over the last 18 months. The lower volume of throughput in MRI2 reflects the complexity of scans delivered to this patient group.



Figure 5



Table 5

### 2.2 Achieving full capacity

The system will run at full staffed capacity immediately following the go live date. This will be 50 hours per week delivering between 9 to 11 cardiac examinations per day.

### 2.3 Objectives

The following table describes the objectives of this project and the success criteria applied to these objectives:

| **Objectives (In no particular order)**  ***Quality Criteria*** | **Related Success Criteria**  ***Acceptance Criteria*** |
| --- | --- |
| **Meets service demands**   * Supports complex demands of the Cardiac MRI service, delivering high end imaging to three national services, regional cardiac services and GJNH inpatients * Supports the full range of procedures across the wider MRI service | * The scanner will have a dedicated cardiac package * The scanner will also accommodate the full range of required general MRI procedures |
| **Up to date technology**   * Patients and other stakeholders will benefit from the use of recent technology advances | * Scans will be optimised * State of the art technology will provide excellent image quality, improving diagnostic visualisation and evaluation * Provides high quality training and opportunities for staff professional development |
| **Value for money**  The decision process will consider cost as a primary factor | * Value for money will be demonstrated and measurable through the procurement process |
| **Delivered in a timely manner**  The project is delivered in the specified timescale | * Project timescale will be monitored by the project board with appropriate tolerances applied * The project will be managed over a series of overlapping business stages. |
| **Optimise workflow**  The project will deliver equipment and systems of work to maximise patient throughput | * Delivers optimum workflow on a par or better than the existing waiting times magnet |
| **Image quality**   * Produces high quality imaging meeting the specific demands of the cardiac MRI service | * State of the art technology will provide excellent image quality, improving diagnostic visualisation * Lead clinicians will participate in product evaluation * The multi disciplinary evaluation team will be formed from key stakeholders and given the responsibility to ensure the equipment meets the needs of the service * Clinical Physics will carry out acceptance testing and routine QA * Radiographers will carry out routine QA |
| **Future sustainability**   * Provides scope for development of the Cardiac MR service * Supports innovation | * The system will be a platform designed to accept new innovations and upgrades * The system will be up-to date |
| **Safe**   * Reduces impact of downtime across all four magnets * Comply with relevant British and European standards and legislation * Fully compliant with MEIGaN Regulations | * Uptime will be increased due to the fact that it will be utilised more flexibly * Acceptance testing will be carried out * Will meet MEIGaN requirements |
| **Research**   * Continues to support research activities | * The new scanner will be enabled with a number of up-to-date sequences that will be attractive to a wider range of research opportunities. This has the potential to raise the profile of the service through inclusion in innovative peer reviewed studies and publications. |

Table 6

## 3. Description of the service concerned

This business case relates to the procurement of a replacement Cardiac MRI scanner (MRI2) and ongoing running costs.

## 4. List of business options

**Option 1: Do nothing**

Continue to use the ageing system.

The reliability of the system is expected to decrease and failure rates increase in line with well established equipment management principles, this has been financially modelled through the economic analysis. The planned equipment replacement program exists to address this issue before it becomes an operational risk.

The Board’s Planned Equipment Replacement Programme lays out a structured approach to equipment replacement and the management of associated risks. Guidance on the replacement of medical equipment is produced by the MHRA[[2]](#footnote-2) and the Scottish Government[[3]](#footnote-3). In addition, the Royal College of Radiologists[[4]](#footnote-4) provides specific guidance on the replacement of radiology modalities.

**Option 2: Replace the equipment utilising the existing NHS National Imaging Equipment Group/NSS procurement framework**

Use the Board’s existing medical equipment acquisition process to purchase a replacement via the National Procurement / National Imaging Equipment Group (NIEG) process.

## 5. Implications of not replacing the equipment

**Failure to initiate project**

MRI capabilities are heavily reliant on the computing power of the system. This is particularly important when considering cardiac scanning. The existing system is ten years old and has been technically superseded. Access to up to date analysis techniques and protocols is limited by hardware constraints. The GJNH Cardiac MRI Service will continue to be reliant on suboptimal, outdated imaging technology with reduced interest in this work.

## 6. Benefits appraisal & assessment of risk

The benefits & risks workshop was held on 09 November 2018 and attended by the stakeholders named below.

### 6.1 Initial workshop attendees

In order to facilitate timely completion of the process, the workshop was attended by a core group of stakeholders with comment and approval provided by the Cross Sectional Imaging Group.

### 6.2 Option appraisal process

The purpose of the stakeholder session was to assess the benefits and risks associated with the two business options for MRI2.

**Option 1: Do minimum**

Continue to use the ageing system.

**Option 2: Replace the MRI scanner, utilising the existing NHS National Imaging Equipment Group/NSS procurement framework**

Use the Board’s existing medical equipment acquisition process to purchase a replacement via the National Procurement / National Imaging Equipment Group (NIEG) process.

### 6.3 Assessment of benefit criteria

**Benefits, Ranking and Weighting**

|  |  |  |  |
| --- | --- | --- | --- |
| **Ref** | **Heading** | **Ranking** | **Weighting** |
| **B1** | **Meets service demands**  Supports the delivery of national and regional cardiac services.  Supports the full required range of procedures. | 1 | 30 |
| **B2** | **Flexibility/Optimise workflow**  Maximise flexibility and staffing efficiency across all four scanners. The project will deliver equipment and systems of work to maximise patient throughput. Reduces impact of downtime across all four magnets | 3 | 10 |
| **B3** | **Image quality** Produces high quality imaging meeting the demands of cardiac MRI service. Reduces possibility of patient call backs. | 2 | 20 |
| **B4** | **Safe** Comply with relevant British and European standards and legislation Fully compliant with MEIGaN Regulations Accessible for ambulant patients | 3 | 10 |
| **B5** | **Up to date technology** Patients and other stakeholders will benefit from the use of recent technology advances Provides scope for development of the cardiac MRI service Supports innovation | 2 | 20 |
| **B6** | **Patient experience**  Provides a comfortable environment for the scans Provides a solution with easy access for patients | 3 | 10 |
| **Total** |  |  | 100 |

Table 7

Scoring was done on an individual basis with each member of the group required to assess the extent to which each of the options met the criteria using a scoring scale of 0 (could hardly be worse) to 10 (could hardly be better).

**Results of the benefits scoring exercise**

The outcome of scoring the options is detailed below with copy of the full spreadsheet detailed in Annexe 1

|  |  |  |
| --- | --- | --- |
| **Option** | **Weighted**  **Score** | **Rank** |
| 1 – Do minimum | 590 | 2nd |
| 2 – Replace MRI2 | 890 | 1st |

Table 8

### 6.4 Risk assessment

The risk assessment is intended to identify the key risks associated with the options. The key risks are developed and assessed to determine the extent to which these impact on the shortlisted options.

Four broad areas of risk had been identified and these were grouped under the following headings:

* Financial risks
* Dependency change
* Design & construction
* Capacity and Demand
* Reputation

The group considered each of the risks and their description and each of the options was appraised against the identified risks in terms of the impact/likelihood of occurrence and the scoring is detailed below.

**Risks**

| **Risk** | **Description** |
| --- | --- |
| **Financial** |  |
| Funding availability | The funding required to progress and complete the project is not made available: |
| Project overspend | The project will go over budget, exceeding the costs identified in the planned equipment replacement programme |
| **Dependency change** |  |
| Unexpected change in regulatory standards | A regulatory change may be introduced forcing a change in specification and increasing costs beyond expected tolerances. Examples would include changes to EU regulations designed to protect workers exposed to electromagnetic fields |
| **Design & Construction** |  |
| Downtime during installation | Installation may cause disruption to current service |
| Installation disruption (non MRI2) | Installation of new equipment will create disruption in surrounding areas |
| Unexpected turnkey delays | Delays to commissioning new equipment due to unforeseen turnkey problems  Delays to go live date due to unforeseen equipment problems |
| **Capacity & Demand** |  |
| Unable to fully support all patient activity | Equipment does not support the projected activity |
| **Patient Experience** |  |
| Patient stakeholder requirements not met | The project may not deliver the best possible technical/clinical solution to the patient |
| **Reputation** |  |
| Damage to reputation of GJF as imaging centre of excellence | The solution does not deliver expected capacity, full range of function or opportunities for continued research activity. |

Table 9

**Results of the Scoring Exercise**

The outcome of scoring the options is detailed below:

|  |  |  |
| --- | --- | --- |
| **Option** | **Risk Score** | **Risk Ranking** |
| 1 – Do minimum | 63 | 2 |
| 2 – Replace MRI2 | 60 | 1 |

Table 10

Due to the differential of the risk scoring between both options being minimal, both options have ranked as one for the appraisal process.

The comparison of risks demonstrated option 2 carrying only marginally lower risk than option 1. It should be noted that the risks relating to option 2 are mostly transient for the duration of the project and are principally due to the disruption created by project implementation, whereas the risks associated with option 1 are ongoing and expected to rise due to the increasing unreliability and obsolescence, and on that basis Option 1 has been categorised as a greater risk to the service compared to Option 2.

### 6.5 Conclusion from the assessment of benefits and risks

A summary of the results of the benefits appraisal and risk assessment is provided in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **No.** | **Options** | **Benefit Score** | **Risk Score** | **Option Assessment** |
| 1 | Do minimum | 590  (2) | 63  (2) | Lowest benefit and marginally higher risk |
| 2 | Replace MRI2 | 890  (1) | 60  (1) | Highest benefit and lower risk |

Table 11

Bearing in mind the small number of options being assessed there is correlation between the results of the benefits appraisal and the risk assessment. The conclusions that can be made at this stage are:

* Option 1 offers the least amount of benefits and additionally carries a marginally higher risk to the ongoing delivery of the service.

Option 2 should realise the greatest benefits and with a lower risk score

## 7. Financial appraisal

### 7.1 Overview

This section will describe the financial assumptions for the revenue and capital costs of the two options.

The financial analysis will include the following:

* A detailed analysis of the capital costs of the options including any building and equipment costs;
* A detailed analysis of the revenue costs of the options and where appropriate split between recurring and non recurring;
* An economic analysis of the 2 options describing the net present value option appraisal over the life of the asset;
* An expenditure profile of the preferred option;
* An analysis of the current costs of the service; and
* Details of the funding sources to support the preferred option.

### 7.2 Key financial assumptions

The financial model is driven by key assumptions which potentially have a material effect on the overall operating costs of the new service, such as;

* likely capital costs;
* projected depreciation;
* revenue cost implications including:
  + 1. Pay and non-pay costs of the new service.
    2. It is assumed that the baseline current costs of the GJNH will continue to be funded on an ongoing basis by the Revenue Resource Limit agreed with SGHSCD and any additional agreed funding will be provided as part of the monthly allocation from SGHSCD.

### 7.3 The scope of financial analysis

The financial analysis covers the estimated impact on the expenditure arising from:

* Assumed no additional revenue impact from replacing the current Cardiac MRI
* The revenue consequences (depreciation) of the capital expenditure necessary to support the options; and

### 7.4 Costing methodology

Each of the short-listed options has been costed in a manner that identifies the key elements of change associated with the project. The specific components of this are set out below.



Figure 6

### 7.5 Capital costs

The Project Board has prepared the capital costs based on an appraisal of the capital requirements of the preferred option. The Building/Turnkey costs are based upon the indicative costs provided, the equipment costs are based on indicative costs from suppliers. Within these estimates, the table below summarises the key capital assumptions:

|  |  |
| --- | --- |
| Capital Costs | * Costed at 2018/19 outturn price base. * The capital costs have been split into (a) building/turnkey and (b) equipment costs. * Equipment cost based on an average cost of information provided by suppliers. * Building costs are based on estimates based on previous MRI installations and adjusted for VAT. * Fees have been applied in line with recommendations. * Equipment costs assume costs from framework * VAT is added at 20 %. |

Table 12

Having applied the costing methodology, the resultant capital expenditure is analysed in the figure below.

**Capital Costing Summary - £000**

|  |  |  |
| --- | --- | --- |
| **Prices exclude VAT** | **Option 1- do minimal**  **£’000** | **Option 2**  **Replace the cardiac MRI scanner**  **£’000** |
| Building/Turnkey Works | 0 | 340 |
| Equipment Cost | 0 | 435 |
| **Total Ex VAT** | **0** | **775** |
| **Irrecoverable VAT** |  | **155** |
| **Total** | **0** | **930** |

Table 13

The capital costs will be incurred in the financial year 2018/19

|  |  |
| --- | --- |
|  | **Preferred Option** |
| Year 0 – 2018/19 | 930 |
| **Total** | **930** |

Table 14

It has been assumed that we would order the MRI scanner towards the end of the financial year 2018/19. It is also assumed that the do minimum option will involve replacement of the exiting scanner with the next five years; this is not shown above but is included in the economic appraisal.

### 7.6 Depreciation

The following table details the depreciation calculation for the 2 options. This assumes

* Depreciation has been calculated in line with board standard policy using the following:
  + Turnkey – 10 years
  + Equipment - 10 years

Note: Depreciation is already being incurred by the existing scanner, therefore this is not additional depreciation.

|  |  |  |  |
| --- | --- | --- | --- |
| **Description** | **Option 1**  **As current** | **Option 2** | **Current depreciation costs** |
|  | **£’000** | **£’000** |  |
| Depreciation |  |  |  |
| - Building/Turnkey | 0 | 40.8 | 35.250 |
| - Equipment | 0 | 52.2 | 105.750 |
| **Total** | **0** | **93** | **141** |

Table 15

### 7.7 Recurring core revenue cost analysis

This section will detail the revenue costs for each of the options and the assumptions underlying these.

|  |  |  |  |
| --- | --- | --- | --- |
| **Description of Revenue Costs**  **Estimated full year cost** | **Current costs to be added** | **Option 1**  **£’000** | **Option 2**  **£’000** |
| Staffing costs | 360,802 | 360,802 | 360,802 |
| Consumables | 35,310 | 35,310 | 35,310 |
| Maintenance Contract | 117,500 | 117,500 | 104,504 |
| Repairs | - | 88,125 | - |
| Total | 513,612 | 601,737 | 500,616 |
| **Total Revenue costs** | **513,612** | **601,737** | **500,616** |

Table 16

This will show that the recurring revenue costs will be slightly lower in option two when the exiting scanner ages and requires additional repairs.

**Funding for recurring revenue**

There will be no additional recurring revenue associated with this replacement

### 7.8 Expenditure profile

The following table summarises the capital and revenue expenditure for the 2 options.

|  |  |  |
| --- | --- | --- |
|  | **Option 1**  **£’000** | **Option 2**  **£’000** |
| **Description** | **Full Cost** | **Full Cost** |
| Capital Costs | 1,410  (at year 5) | 930 |
| Recurring revenue costs | 602 | 501 |
| Non recurring revenue costs | - | - |
|  |  |  |
| **Total Costs including capital and revenue** | **2,012** | **1,431** |

Table 17

### 7.9 Affordability

The financial impact is detailed within the business case. It is also important to note that there are also significant benefits in the avoidance of risks associated with the use of aging medical equipment, and also include the benefits of efficient workflow, connectivity and up to date medical technology. These have been assumed within the economic appraisal.

The current installed system is ageing and lacks the up to date hardware capabilities to support recent advancements in cardiac imaging.

Investment in the replacement system in MRI 2 at this time is in line with the organisation’s Planned Equipment Replacement Programme for 2018/19. The primary return on the investment is the avoidance of operational risks associated with equipment obsolescence including risk of downtime, repairs etc. Consistent with the Board’s vision around strengthening our international and national portfolio and reputation the replacement of MRI 2 will support the organisation to increase our participation in research activities through this advanced technology.

Funding for the equipment is included in the approved capital plan for the year 2018/19. These costs included in the financial appraisal may be subject to variation on receipt of the final project cost, if this variation is significant it will be taken back to the Capital Group. The annual capital plan needs to be delivered within the approved budget.

There is a slight change to the revenue costs from the current costs maintained within the preferred option, associated with the cost of the maintenance contract and the likely cost of repairs to the aging system.

## 8. Economic appraisal

### 8.1 Overview

A discounted cash flow for the shortlisted option has been undertaken over a 10 year life. Both the Net present Cost (NPC) and Equivalent Annual Cost (EAC) have been calculated. This has been contrasted against the do-minimum option as recommended code of practice. This is intended to demonstrate the preferred option continues to offer value for money.

**The key elements used in the analysis are summarised below:**

* initial capital outlay for each option exclusive of VAT with under the do minimum option this is assumed at year 5
* detailed lifecycle costs of building and engineering works
* equipment lifecycle costs, this includes estimates for repairs and downtime in the do minimum option;
* total revenue costs for each option (including movements from the baseline position).

### 8.2 Options appraisal

In addition to the capital and revenue analysis described in the previous section, an economic analysis of the 2 options has also to be undertaken.

This includes the revenue and capital costs of both the above options.

The results therefore of the economic appraisal are as follows:

|  |  |  |
| --- | --- | --- |
| **Description** | **Option 1**  **£’000** | **Option 2**  **£’000** |
| **NPC** | **2,468** | **1,644** |
| **EAC** | **246** | **164** |
| **Rank of financial appraisal** | **2** | **1** |

Table 18

The assumptions within the economic appraisal are as follows:

* The building and equipment costs have being calculated over a 10-year project life.
* The discount factor applied is 3.5%
* Exclusive of VAT

The preferred option from an economic and a financial analysis would be option 2. This recognises the reduced risk in replacing an obsolete MRI, through increases costs in repairs, downtime, loss in research income and the requirement to replace this at some point over the 10 year life. For the purposes of the analysis we have assumed this as year 5. Therefore the capital costs for option 2 have been secured as part of the planned equipment replacement process, approved by the Medical Equipment Group.

## 

## 9. Risk analysis

The following risks have been identified at the onset of this project. A live risk register will be maintained by the Project Manager for the duration of the project. This will contain details of risks relating to the preferred option only and will be reviewed regularly by the Project Board.

A full risk register will be initiated and maintained by the named Project Administrator throughout the project life cycle. An initial assessment of the major risks affecting the delivery of this project include:

| **Risk** | **Description** | **Control Measure** |
| --- | --- | --- |
| **Financial** | | |
| Funding availability | The funding required to progress and complete the project is not made available: | Dealing with this threat is outwith the scope of this project. Funding commitment has been agreed therefore this is low risk but will be monitored throughout the life of the project |
| Project overspend | The project will go over budget, exceeding the costs identified in the planned equipment replacement programme | Costs will be tightly controlled through the process:   * Equipment costs will not vary from quoted costs. |
| **Dependency change** | | |
| Unexpected change in regulatory standards | A regulatory change may be introduced forcing a change in specification and increasing costs beyond expected tolerances. Examples would include changes to EU regulations designed to protect workers exposed to electromagnetic fields | This threat will continue to be monitored throughout the project. This maybe particularly relevant with the Brexit deadline. |
| **Design & Construction** | | |
| Downtime during installation | Installation may cause disruption to current service | A robust implementation plan will be in place covering the period of downtime |
| Installation disruption (non MRI2) | Installation of new equipment will create disruption in surrounding areas | The supplier turnkey plan will be agreed with Engineer in Lead and MRI Implementation Group and will be monitored closely |
| Unexpected turnkey delays | Delays to commissioning new equipment due to unforeseen turnkey problems  Delays to go live date due to unforeseen equipment problems | Progress of turnkey installation will be monitored with regular supplier updates to the MRI Implementation Group. These will be reported in summary and by exception to the cross sectional Imaging Group |
| **Capacity & Demand** | | |
| Unable to fully support all patient activity | Equipment does not support the projected activity | Ensure the replacement scanner is fully capable and is approved by senior users before implemented |
| **Patient Experience** | | |
| Patient stakeholder requirements not met | The project may not deliver the best possible technical/clinical solution to the patient | Equipment will be purchased from an industry leading supplier with a proven track-record. Ensure the selected scanner provides an optimised patient experience and is approved by senior users |
| **Reputation** | | |
| Damage to reputation of GJF as imaging centre of excellence | The solution does not deliver expected capacity, full range of function or opportunities for continued research activity. | appropriate oversight and monitoring will be provided by the Project Board |

Table 19

## 10. Preferred option

The option appraisal process demonstrates that Option 2 is the preferred option.

|  |  |  |
| --- | --- | --- |
|  | **Option 1** | **Option 2** |
| Benefits assessment | 590 (2) | 890 (1) |
| Financial assessment | (2) | (2) |
| Economic assessment | 2 | 1 |
| Risk assessment | 63 (2) | 60 (1) |
| Overall rank of options | 2 | 1 |

Table 20

The whole life costs of the project demonstrate that option 2 is the most economically viable option, this also recognises the increased benefits and reduced risks.

The comparison of risks demonstrated option 2 carrying only marginally lower risk than option 1. It should be noted that the risks relating to option 2 are mostly transient for the duration of the project and are principally due to the disruption created by project implementation, whereas the risks associated with option 1 are ongoing and expected to rise due to the increasing unreliability and obsolescence, this has been reflects in the overall risk assessment.

The reliability of the existing cardiac MRI scanner is expected to decrease and failure rates increase in line with well established equipment management principles. The planned equipment replacement program exists to address this issue before it becomes an operational concern. Option 2 is therefore the preferred option.

**Option 2: Replace the MRI scanner, utilising the existing NHS National Imaging Equipment Group/NSS procurement framework**

This option meets the requirements of the cardiac MRI service, the wider Radiology MRI service and the organisation as a whole.

### 10.1 Benefits and realisation monitoring

#### 10.1.1 Expected benefits

Clear responsibility for benefits, collectively and individually is a key requirement for successful benefits realisation.

| **Objectives (In no particular order)**  ***Quality Criteria*** | **Related Success Criteria**  ***Acceptance Criteria*** | **Owner** |
| --- | --- | --- |
| **Meets service demands**   * Supports complex demands of the Cardiac MRI service, delivering high end imaging to three national services, regional cardiac services and GJNH inpatients * Supports the full range of procedures across the wider MRI service | * The scanner will have a dedicated cardiac package * The scanner will also accommodate the full range of required general MRI procedures | **Main owner**  Executive lead – June Rodgers  **Associated**  Senior user – Lynne Ayton, Jennifer Gilchrist |
| **Up to date technology**   * Patients and other stakeholders will benefit from the use of recent technology advances | * Scans will be optimised * State of the art technology will provide excellent image quality, improving diagnostic visualisation * Provides high quality training and opportunities for staff professional development | **Main owner**  Project Manager – Steven Friel  **Associated**  Clinical lead – John Dreisbach, Senior User Vanessa Orchard |
| **Value for money**  The decision process will consider cost as a primary factor | * Value for money will be demonstrated and measurable through the procurement process | **Main owner**  Executive lead – June Rodgers  **Associated**  Procurement lead – Robert Stewart / Brian Laughland |
| **Delivered in a timely manner**  The project is delivered in the specified timescale | * Project timescale will be monitored by the project board with appropriate tolerances applied * The project will be managed over a series of overlapping business stages. | **Main owner**  Executive lead – June Rodgers  **Associated**  Project Manager – Steven Friel |
| **Optimise workflow**  The project will deliver equipment and systems of work to maximise patient throughput | * Delivers optimum workflow on a par or better than the existing waiting times magnet | **Main owner**  Senior user – Jennifer Gilchrist |
| **Image quality**   * Produces high quality imaging meeting the specific demands of the cardiac MRI service | * State of the art technology will provide excellent image quality, improving diagnostic visualisation * Lead clinicians will participate in product evaluation * The multi disciplinary evaluation team will be formed from key stakeholders and given the responsibility to ensure the equipment meets the needs of the service * Clinical Physics will carry out acceptance testing and routine QA * Radiographers will carry out routine QA | **Main owner**  Clinical lead – John Dreisbach  **Associated**  Clinical lead – Vanessa Orchard |
| **Future sustainability**   * Provides scope for development of the Cardiac MR service * Supports innovation | * The system will be a platform designed to accept new innovations and upgrades * The system will be up-to date | **Main owner**  Project Manager – Steven Friel  **Associated**  Senior user – Vanessa Orchard |
| **Safe**   * Reduces impact of downtime across all four magnets * Comply with relevant British and European standards and legislation * Fully compliant with MEIGaN Regulations | * Uptime will be increased due to the fact that it will be utilised more flexibly * Acceptance testing will be carried out * Will meet MEIGaN requirements | **Main owner**  Project Manager – Steven Friel  **Associated**  Senior supplier – George Robertson  Senior user – Vanessa Orchard |
| **Research**   * Continues to support research activities | * The new scanner will be enabled with a number of up-to-date sequences that will be attractive to a wider range of research opportunities. This has the potential to raise the profile of the service through inclusion in innovative peer reviewed studies and publications. | **Main owner**  Project Manager – Steven Friel  **Associated**  Senior user – Vanessa Orchard |

Table 21

## 11. Implementing the preferred option

### 11.1 Project Control

The Cross Sectional Imaging Group will function as the Project Board. The project will be managed using a methodology based on PRINCE 2. It will be split into a series of management stages, each requiring formal approval of the project board before initiation. All stages will be subject to adjustment in timescales and content resulting from continual project management, assessment of ongoing risks and reaction to incidents. This may provide additional scope for slippage or acceleration providing the risk assessment supports this. Financial approval will also be required by the Board’s Capital Group.

An MRI Implementation Group has been established as a subgroup of the Cross Sectional Imaging Group. This group is responsible for devising an implementation and contingency plan to manage the ongoing delivery of the clinical service during the period of planned downtime to accommodate the build. The plan is a live document and will continue to be updated by the implementation group as the project progresses. This allows the group to react to new and developing risks and opportunities. A copy of the plan, correct as of 12/11/18, is included in Appendix 1

### 

### 11.2 Project organisation

|  |  |
| --- | --- |
| **Project board** |  |
| Executive | June Rogers |
| Cross Sectional Imaging Project Operations Lead | Lynne Ayton |
| Project Manager | Steven Friel |
| Engineering Senior Supplier | Gerry Cox |
| Clinical Lead – Consultant Radiologist | John Dreisbach |
| Clinical Lead – Consultant Cardiologist | Niki Walker |
| Senior User | Jennifer Gilchrist / Vanessa Orchard |
| Procurement Senior Supplier | Robert Stewart / Brian Laughland |
| Finance Senior Supplier | Lily Bryson |

Table 22

**Role: Project Board**

The Project Board will provide overall direction and management of the project. It will be accountable for the success of the project and has responsibility and authority for the project.

The Project Board will approve all major plans and authorise any major deviation from agreed Stage Plans. It will sign off the completion of each Stage as well as authorise the start of the next Stage. It will ensure that the required resources are committed and will arbitrate on any conflicts within the project or negotiate a solution to any problems between the project and external bodies. In addition, it will approve the appointment and responsibilities of the Project Manager and any delegation of its Project Assurance responsibilities.

**Role: Executive**

**June Rogers**

The Executive is responsible to the GJF Board

Specific Responsibilities:

* Ensure a tolerance is set for the project
* Authorise expenditure in conjunction with the Director of Finance and set stage tolerances
* Approve the end project report and lessons learned report
* Brief Senior management on progress
* Attend project Board meetings
* Recommend future actions on the project if tolerances are exceeded
* Approve project closure
* Overall business assurance i.e. ensuring that the project remains on target to deliver products which will achieve the expected business benefits and the project will complete within agreed tolerances for budget and timescale.

**Role: Cross Sectional Imaging Project Operations Lead**

**Lynne Ayton**

The Project Operations Lead is responsible to the Project Executive

Specific Responsibilities:

* Chairs Project Board meetings
* Guides project in context of other ongoing clinical priorities
* Provides day to day business assurances on the overall performance of the project

**Role: Project Manager**

**Steven Friel**

The Project Manager’s prime responsibility is to run the project on a day-to-day basis on behalf of the project board and to ensure that the project produces the required products, to the required quality standards and within the specified constraints of time and cost.

Specific Responsibilities:

* Maintain plans and monitor progress for the project as a whole
* Liaise with the suppliers to ensure that project deliverables are properly understood
* Liaise with all stakeholder groups and promote the project

In addition to the project management responsibilities detailed above, the Project Manager will also provide Medical Equipment Lifecycle Management input to all aspect of the project and a direct link to the National Imaging Equipment Group.

**Role: Engineering Senior Supplier**

**Gerry Cox**

Provides specialist input to key stages of the project and has specific direct management responsibility for the turnkey build works described in Management Stage 2. This is appropriate due to the expert knowledge required to undertake this stage of the project.

**Role: Clinical Leads**

**John Dreisbach, John Payne**

Represents the Radiologist and Cardiologist final users’ requirements. Provides assurances that the selected equipment is fit for purpose and provides the necessary level of clinical diagnostic image quality.

**Role: Senior User**

**Jennifer Gilchrist, Vanessa Orchard**

Represents the Radiographer final users’ requirements Provides professional radiological guidance to the project as a whole and specifically:

* Lead user input to production of business case
* MRI protection
* Link to Radiologist equipment users
* Examination of current and projected throughput
* Defining training requirements
* Implementation planning

**Role: Procurement Senior Supplier**

**Robert Stewart, Brian Laughland**

Procurement lead for project, providing specialist regulatory and procedural advice on all aspects of equipment purchase.

**Role: Finance Senior Supplier**

**Lily Bryson**

Acts as finance lead throughout the project with specific responsibility for the following:

* Setting financial tolerances
* Financial appraisal section of the business case
* Economic appraisal section of the business case
* Variation control

### 11.3 Project stages

The project will be managed across a series of stages as described below.

Figure 7

**Management stage 1 (Initiation - Order)**

Project initiation

* Production of Project Brief
* Production of Business Case
  + Cross-Sectional Imaging Group
  + Capital Group approval
  + SMT approval
  + Board approval

Initiate medical equipment acquisition process

* Agree route to market
* Product evaluation
* Place order

Form user group to oversee implementation

* Implementation plan (dealing with disruption, capacity management during period of downtime)
* Training plan

Deliverables from Management stage 1

|  |  |
| --- | --- |
| **Deliverable (product)** | **Responsible** |
| **Project initiation** | |
| Project Brief | Project Manager / Head of Radiology |
| Business case | Project Manager / Head of Radiology /Lead Radiographer MR |
| **Initiate medical equipment acquisition process** | |
| Procurement initiation | Project manager / Procurement |
| CMR for equipment and turnkey | Project manager |
| **Form user group to oversee implementation** | |
| Implementation plan | Head of Radiology / Lead Radiographer MR |
| Training plan | Head of Radiology / Lead Radiographer MR |
| Supplier project plan | Equipment Supplier |

Table 23

**Management Stage 2 (Turnkey build)**

This management stage is project managed directly by the Engineering Senior Supplier (Gerry Cox) due to the specialist nature of the works. Some aspects of this management stage will overlap stages 1 and 3.

Deliverables from Management stage 2

|  |  |
| --- | --- |
| **Deliverable (product)** | **Responsible** |
| Turnkey project plan | Engineering Senior Supplier |
| Room layout drawings | Engineering Senior Supplier |
| Programme of works | Engineering Senior Supplier |
| HAI Scribe | Engineering Senior Supplier |

Table 24

**Management Stage 3 (Commissioning and implementation)**

Some aspects of this management stage overlap stage 2.

Deliverables from Management stage 2

|  |  |
| --- | --- |
| **Deliverable (product)** | **Responsible** |
| Updated project plan reflecting turnkey and Equipment installation | Project Manager |
| Implementation plan update | Head of Radiology / Lead Radiographer MR |
| User training plan update | Lead Radiographer MR |
| Equipment acceptance reports | Medical Physics Radiology Specialist |
| Commissioning report | Medical Physics Radiology Specialist |
| Hand over of Product | Senior users |

Table 25

**Project Closure**

|  |  |
| --- | --- |
| **Deliverable (product)** | **Responsible** |
| Lessons learnt report | Project manager |
| Project closure report | Project Manager |

Table 26

### 11.4 Project timetable

The following timetable is a brief summary of key milestones and initial timescales. A full project plan and detailed stage plans will be used by the project board to manage the project. The dates provided are reasonable estimates based on market knowledge but are subject to change beyond our control. Increased certainty around the dates will come with the selection of the equipment provider.

|  |  |
| --- | --- |
| **Description** | **Milestone** |
| Present Project Brief to Capital | 10/10/18 |
| Present business case to Capital | 21/11/18 |
| Present business case to SMT | 27/11/18 |
| Present business case to Board | 06/12/18 |
| Complete Management Stage 1 | 06/12/18 |
| Go live | 28/03/19 (Estimated) |
| Project Closure | 01/09/19 (Estimated) |

Table 27

Acronyms

|  |  |
| --- | --- |
| CARD | Cardiac |
| EAC | Equivalent Annual Cost |
| MEG | Medical Equipment Group |
| MRI | Magnetic Resonance Imaging |
| NPV | Net Present Value |
| PRINCE 2 | PRojects IN Controlled Environments |
| RIS | Radiology Information System |
| SBC | Standard Business Case |
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## Appendix 1: Implementation plan

The implementation/contingency plan is a live document and will continue to be updated by the implementation group as the project progresses. This allows the group to react to new and developing risks and opportunities. The plan below is correct as of 12/11/18.

**Cardiac MRI (2) Replacement Contingency Plan**

In November 2017 the MRI service expanded from 1 cardiac, and 1 waiting times scanner to 3 waiting times and 1 cardiac scanner. Although there are limited cardiac functions on the original waiting times scanner, these have not been utilised due to the 5,000 exams per year allocated to HB’s in NHS Scotland. MRI 2 is now 10 years old (April 2018), and is the sole provider of the cardiac service to Regional and National services. Replacement was identified as a potential within the current financial controls in August 2018 (Medical Equipment Group), but it was recognised that a contingency plan for sustaining acceptable activity during the downtime of such a replacement was key to the continued safe and effective provision of the cardiac imaging service.

**Background:**

Early indicators of the capacity in MRI 3 and MRI 4 were not fully realised in the first 4 months of operation, and the Regional allocations were set according to initial scanning timings. This totalled 14,205 examinations per year between the 3 waiting times scanners. However, as efficiencies in scanning techniques and effective working progressed, additional capacity was identified in March 2018. It was discussed and agreed that the waiting times activity could be increased on a monthly basis to all health boards. This was on an ad-hoc basis, and has been since May 2019. The Boards who utilise MRI at GJNH are contacted when there is additional capacity, and offered set amounts according to their (and other HB’s), needs. MRI 3 (Siemens Aera), has cardiac functionality, which has the associated technology to support most of the cardiac scanning that MRI 2 currently undertakes, the main exception is research scanning, and some of the SACCS examinations. The MRI 3 scanner is the default scanner in this contingency plan.

**Activity:**

MRI’s 1, 3 and 4 now, collectively exceed the initially agreed waiting times targets for 2018-19 on a monthly basis. This equates to an average positive variance of 19% each month (approximately 192 examinations). To support the downtime required in MR2, this additional activity will temporarily support an increase in cardiac activity utilising MRI 3. Accommodation of 60% of the current cardiac sessions during the MRI 2 replacement, will ensure continuation of the existing service at an agreed reduced level. This can be achieved using MRI 3 in the MRI suite on level 1 GJNH.

The 19% WT variance equates to 4 sessions weekly, this will be converted into set weekly cardiac sessions. It is necessary to augment this activity with 2 additional converted WT sessions weekly to enable the continued (temporarily reduced), cardiac MRI service for the duration of the works.

During this period the excess staff (due to loss of one scanner), have agreed to work 8 weekend sessions each month to ensure minimal waiting times allocations are achieved. This will equate to 5/7 day working during the downtime period only, and has been agreed in collaboration with the existing staff in MRI.

It has been identified that 6 sessions per week in MRI 3 will allow the cardiac MRI service to be safely sustained at reduced numbers. This includes sessions for all current National and Regional services.Research scanning will be halted during the downtime, as using a different model of scanner than the pre-agreed, is not an acceptable option.

Additional activity through MRI 2 for Regional and selected SACCS scans will start in November, aiming to reduce the Regional waiting list to two weeks prior to the start of works in MRI 2. This will allow for an acceptable growth rate in the waiting list over the downtime period, as minimal numbers of Regional scans will only be accommodated.

SACCS scans will be pre-vetted for suitability to be scanned in MRI 3, and discussions are ongoing to arrange doing these exams before the downtime.

The following data illustrates the contingency described above and figures are accurate as of October 2018:

**Session Data:**



**Weekly Sessions Pre and During MRI 2 Replacement:**



**Activity since 2018 – 2019, and into 2019-20, including predictions of numbers during downtime:**



It is noted that that the predicted start of works in MRI 2 will begin during March 2019, and continue for 8-12 weeks, after which it is predicted regular activity will commence in the replaced MRI 2, and excess allocations can be distributed between the HB’s for the remainder of 2019-20.

J Gilchrist,

November 2018

## Appendix 2: Risk and benefits workshop scoring details





1. <https://scmr.org/> [↑](#footnote-ref-1)
2. [MHRA, Managing Medical Devices, 2015](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/421028/Managing_medical_devices_-_Apr_2015.pdf) [↑](#footnote-ref-2)
3. [CEL 35, Scottish Government, 2010, A policy for property and asset management](http://www.sehd.scot.nhs.uk/mels/CEL2010_35.pdf) [↑](#footnote-ref-3)
4. [Good Practice Guide for Radiologists , 2012](http://www.rcr.ac.uk/docs/radiology/pdf/BFCR(12)1_GoodPractice.pdf) [↑](#footnote-ref-4)