

Cheshire East Local Plan

First Draft

**Jodrell Bank Observatory  
Supplementary Planning  
Document**

November 2021



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# 1. Part 1: Background and Context

## Introduction

- 1.1 On 7 July 2019, in recognition of its internationally significant heritage, science and cultural impact, Jodrell Bank Observatory (JBO) was awarded UNESCO World Heritage Site (WHS) status and has been inscribed on the World Heritage List.
- 1.2 Jodrell Bank now joins a prestigious group of sites across the globe recognised by UNESCO's international community as sites of Outstanding Universal Value (OUV). The WHS inscription acknowledges Jodrell Bank's tremendous scientific endeavours and its role in achieving a transformational understanding of the Universe.
- 1.3 It places the site on an equal heritage footing with places such as Stonehenge and the Taj Mahal, representing an enormous accolade, not only for Jodrell Bank and The University of Manchester (UoM), but also for the region, and the UK as a whole. As a WHS, Jodrell Bank and its Consultation Zone (JBOCZ) are important to us all, and the planning system has a role to play in ensuring that the universal value of the site is protected. By providing guidance on development across the JBO site itself and the JBOCZ, the planning system can make sure development takes place in a way that protects and enhances the significance of the heritage assets here and enables the ongoing functional operation of the telescopes.
- 1.4 The Outstanding Universal Value of JBO uniquely arises, in part, to its ongoing and continued functional operation as a working scientific facility. The planning system has a vital role in protecting the ability of the observatory to carry out leading scientific research, by ensuring that new development does not create electrical interference that harms the efficiency of the telescopes. The operational efficiency of the telescopes is therefore intrinsically linked to, and inseparable from, the heritage value of JBO and its Outstanding Universal Value.
- 1.5 Planning policies held in the development plan for Cheshire East seek to protect the heritage value of JBO and this SPD provides further guidance on how those policies will be applied in decision making.

## Background

- 1.6 JBO has been awarded WHS status by UNESCO under three criteria:
  - i) It is a masterpiece of human creative genius related to its scientific and technical achievements.
  - ii) It represents an important interchange of human values over a span of time and on a global scale.

- iii) It is an outstanding example of a technological ensemble which illustrates a significant stage in human history It directly and tangibly associated with events and ideas of outstanding universal significance.
- 1.7 Founded in 1945, JBO was a pioneer of a completely new science; the exploration of the Universe using radio waves instead of visible light.
- 1.8 This transformational development completely opened humanity's understanding of the Universe. The new science of radio astronomy discovered previously undreamt-of things – quasars, pulsars, gravitational lenses, and the fading glow of the Big Bang, allowing us to see way beyond our galaxy and back in time almost 14 billion years to the origin of the Universe itself.
- 1.9 The emergence of radio astronomy has defined the landscape of Jodrell Bank and it is the only remaining site in the world that retains traces of the development of this science from its earliest days to the present. Research at JBO has led to revolutionary scientific discoveries, and advanced engineering.
- 1.10 Scientific research first began here in 1945 when surplus army radar equipment was used to study meteor showers. Further experiments followed, leaving behind a physical trail of the development of a whole new science.
- 1.11 Radio astronomers at Jodrell Bank proceeded to build the world's largest radio telescopes in succession. The 66m Transit Telescope made the first ever identification of a radio object outside our own galaxy - the great nebula in Andromeda. It was superseded by the Lovell Telescope (1957), the first act of which was to track the carrier rocket of Sputnik 1 by radar, witnessing the dawn of the Space Age.
- 1.12 The site has remained at the forefront of radio astronomy since its inception and today, the Jodrell Bank team are world-leaders in pulsar research. Part of The UoM, the site runs state-of-the-art astronomical research programmes on the e-MERLIN array of national facility radio telescopes. Jodrell Bank also hosts the international headquarters of the Square Kilometre Array - a global project to create the largest radio telescope on Earth.
- 1.13 The site also hosts Jodrell Bank Discovery Centre, which sees over 185,000 visitors every year, including some 27,000 school children, to tell the story of radio astronomy. The discovery centre also hosts the annual BlueDot music and arts festival attracting over 25,000 people, and will host a new exhibition space, the First Light Pavilion, within the Jodrell Bank Gardens.

## Purpose and Scope of the SPD

- 1.14 JBO was designated as a UNESCO WHS in July 2019 and great care must be taken to make sure that development of the site, and within the consultation zone, does not harm the significance and operational functionality of the telescopes.
- 1.15 The boundary of the WHS extends across the Jodrell Bank site itself and an extensive area of land south, east and west, of the telescopes. This area is

referred to as the JBOCZ and considered to be same as the 'WHS Buffer Zone' (WHSBZ). For the avoidance of doubt, this SPD will refer to the JBOCZ throughout.

- 1.16 Great emphasis is placed on protecting the OUV of the site. In all instances, new development should not harm the OUV, including the continued operational efficiency of the telescopes, and should positively contribute to further revealing the value of the site itself.
- 1.17 Four criteria define the OUV of Jodrell Bank:
- Criterion (i): JBO is a masterpiece of human creative genius related to its scientific and technical achievements.
  - Criterion (ii): JBO represents an important interchange of human values over a span of time and on a global scale on developments in technology related to radio astronomy.
  - Criterion (iv): JBO represents an outstanding example of a technological ensemble which illustrates a significant stage in human history (1940s-1960s) – the transition from optical astronomy to radio astronomy and the associated consequence for the understanding of the Universe through multi-wavelength astrophysics.
  - Criterion (vi): JBO is directly and tangibly associated with events and ideas of outstanding universal significance.
- 1.18 The integrity of the site is well preserved and the consultation zone, and buffer zone of the property is designed to limit development (and therefore electrical interference) in order to protect the scientific capabilities of the Observatory from radio emissions in its vicinity. By limiting development, and electrical interference, these zones are therefore an essential planning tool to ensure the continued functional integrity of the property and are fundamental to the OUV. In this way the harm that may be created by new development to the efficiency of the telescopes, is inextricable from the harm to the heritage significance of the WHS.
- 1.19 Heritage assets are an irreplaceable resource and should be conserved in a manner appropriate to their significance, so that they can be enjoyed for their contribution to the quality of life of existing and future generations. The impact of development on a heritage asset can therefore be given great weight in planning decisions, and the weight attributed to the impact on a heritage asset increases with the significance of the heritage asset. As a WHS, the impact of development on the telescopes at Jodrell Bank and their operational capacity will be given very significant weight in decision making on planning applications.
- 1.20 Both parts one (the Local Plan Strategy) and two (the emerging Site Allocations and Development Policies Document) of Cheshire East Council's Local Plan include policies that address how development should take place across the Jodrell Bank site itself and the JBOCZ. This SPD is therefore a tool to assist applicants and decision makers in understanding how proposals will be assessed against those policies (primarily SE 14 'Jodrell Bank' and emerging

HER 9 'World Heritage Site') and the type of information that will be required as part of a planning application for sites across the JBOCZ.

- 1.21 Supplementary Planning Documents (SPDs) add further detail to policies contained within the development plan and are used to provide guidance on specific sites or particular issues. SPDs do not form part of the adopted development plan but they are a material planning consideration in decision making.
- 1.22 An SPD cannot introduce new policy requirements. It must limit its scope to providing advice on the implementation of existing policies held in the development plan. In this case the core policies that this SPD provides further guidance on are SE 14 'Jodrell Bank' and emerging HER 9 'World Heritage Site'.
- 1.23 The SPD sets out an approach that is divided between the JBO site itself, and the JBOCZ as defined on the Policies Map of the Local Plan. The JBO site includes all the operational equipment and buildings that form the functional asset; many of the structures here are subject to individual heritage listings.
- 1.24 Therefore, the scope of this SPD is to provide further guidance on policies held in the LPS and emerging SADPD, providing guidance to applicants on what type of information they will need to submit and how the policies of the development plan will be applied when determining planning applications across the JBO site and JBOCZ.
- 1.25 The key policies that this SPD provides guidance on are:
  - **Local Plan Strategy Policy SE 14 Jodrell Bank**
    - i) *Within the Jodrell Bank Radio Telescope Consultation Zone, as defined on the Proposals Map, development will not be permitted if it:*
      - (1) *Impairs the efficiency of the telescopes;*
      - (2) *Or. (ii) Has an adverse impact on the historic environment and visual landscape setting of the Jodrell Bank Radio Telescope.*
    - ii) *Conditions will be imposed to mitigate identified impacts, especially via specialised construction techniques.*
    - iii) *Proposals should consider their impact on those elements that contribute to the potential outstanding universal value of Jodrell Bank.*
  - **Emerging SADPD Policy HER 9: World Heritage Site:**
    - iv) *Proposals that conserve or enhance the outstanding universal value of the WHS at Jodrell Bank will be supported.*
    - v) *Development proposals within the WHS at Jodrell Bank (or within its consultation zone) that would cause harm to the significance of the heritage asset (including elements that contribute to its outstanding universal value)*



*will not be supported unless there is a clear and convincing justification; and an appropriate heritage impact assessment has evaluated the likely impact of the proposals upon the significance of the asset and the attributes that contribute to its outstanding universal value.*

vi) *Where development has a demonstrable public benefit, and harm to the outstanding universal value is unavoidable and has been minimised, this benefit will be weighed against the level of harm to the outstanding universal value of the WHS.*

- 1.26 Based on policies of the LPS and SADPD that apply to JBO and the JBOCZ, the scope of this SPD is to provide guidance on the following topics:
- The type of development and other factors, such as location of development, that may impair the **efficiency of the telescopes** as well as how and when the UoM will be consulted on this matter.
  - How the **historic environment** may be relevant to planning applications and how Heritage Impact Assessments should be prepared.
  - The role that the **visual landscape** setting of the WHS plays in the determination of planning applications and the type of information applicants will need to submit to address this.
  - How the **OUV** of the WHS should be taken into account and what this means across different parts of the JBO site and JBOCZ
  - The type of **conditions** that may be imposed on proposed development, to make sure that the OUV of the site remains protected.

## Within the Jodrell Bank Observatory Site

- 1.27 The JBO site itself is under the ownership and management of the UoM. Alongside the policies of the development plan, the UoM Conservation Management Plan (CMP) for the site forms the primary guidance for development here. The CMP forms part of this SPD and will be treated as a material consideration in the determination of planning applications.
- 1.28 Further guidance on the CMP is provided below at paragraph section 5.

## Within the Jodrell Bank Observatory Consultation Zone

- 1.29 The JBOCZ protects the scientific capabilities of the Observatory from radio emissions in its vicinity, contributing to maintenance of the functional integrity of the property and its ability to continue research. The JBOCZ is therefore an integral and essential component of the OUV of the WHS, and development that harms this will not be supported.
- 1.30 Development may require consultation with The UoM, to determine whether the proposal will harm the operational efficiency of the telescopes. This assessment primarily focuses on the level of electrical interference that will be created by a proposal.



- 1.31 The SPD also sets out a range of mitigation measures that may be employed as planning conditions in instances where development that is otherwise harmful can be made acceptable in planning terms through the application of planning obligations and conditions.
- 1.32 Interference and mitigation issues are addressed at Section 6 of this document.

## Status of the SPD

- 1.33 The SPD has been prepared in accordance with the Planning Act 2004 and the associated Town and Country Planning (Local Planning) (England) Regulations 2012 (as amended).
- 1.34 Once finalised and published, this document will be used alongside policies in the Development Plan to inform decision making on planning applications within the JBOCZ.

## 2. Draft SPD Consultation

- 2.1 Consultation on the draft SPD will take place between 22<sup>nd</sup> November 2021 and 20<sup>th</sup> December 2021. Comments must be received by the Council **no later than midnight on 20<sup>th</sup> December 2021**.
- 2.2 The consultation documents can be viewed online at <https://cheshireeast-consult.objective.co.uk/portal/planning/spd>, and at public libraries in Cheshire East during opening hours (for information about opening hours see [www.cheshireeast.gov.uk/libraries](http://www.cheshireeast.gov.uk/libraries) or telephone 0300 123 7739).

## SEA and HRA

- 2.3 There is no legal requirement for SPDs to be accompanied by Sustainability Appraisal, and this is reinforced in national planning guidance. However, “in exceptional circumstances” there may be a requirement for SPDs to be subject to Strategic Environmental Assessment (SEA) where it is considered likely that they may have a significant effect on the environment that has not already been assessed within the SEA of the Local Plan. A screening assessment has been undertaken and concludes that such an assessment is not necessary.
- 2.4 A screening exercise has been carried out to determine whether the document gives rise to the need for Appropriate Assessment (under the Habitats Regulations). This similarly concludes that such an assessment is not necessary.
- 2.5 These screening assessments have been published and you can give your views on their findings too.

## Submitting your views

- 2.6 The council's online consultation portal is our preferred method for submitted responses, but you can also respond by e-mail or in writing using a comment form available online and at the locations listed above. You can respond:
- **Online:** Via the consultation portal at: <https://cheshireeast-consult.objective.co.uk/portal/planning/spd/BNG>
  - **By e-mail:** To [planningpolicy@cheshireeast.gov.uk](mailto:planningpolicy@cheshireeast.gov.uk)
  - **By post:** Strategic Planning (Westfields), C/O Municipal Buildings, Earle Street, Crewe CW1 2BJ
- 2.7 Please make sure that your comments reach us by **midnight on the 2nd December 2021**. We are not able to accept anonymous comments and you must provide us with your name and contact details. Your personal data will be processed in line with our Strategic Planning Privacy Notice, which is available on the council's website ([www.cheshireeast.gov.uk](http://www.cheshireeast.gov.uk)). Your name and comments will be published and made available to view on the council's online consultation portal.

## What happens after the consultation?

- 2.8 Following consultation, the council will carefully consider all representations received before deciding whether any amendments to the draft SPD are needed. The final version of the SPD alongside a Consultation Statement summarising the feedback and changes to the SPD will then be published for further comment before the SPD is proposed for adoption by the Council.
- 2.9 Once adopted the SPD will be formal planning guidance and will be considered as a material consideration when assessing planning applications in Cheshire East.

## 3. Legal Framework

- 3.1 In addition to the planning framework that is primarily set out in the Town and Country Planning Act 1990, the legislative framework related to heritage includes the following:
- the Planning (Listed Buildings and Conservation Areas) Act 1990 provides specific protection for buildings and areas of special architectural or historic interest
  - the Ancient Monuments and Archaeological Areas Act 1979 provides specific protection for monuments of national interest
  - the Protection of Wrecks Act 1973 provides specific protection for wreck sites of archaeological, historic, or artistic interest
  - the Historic Buildings and Ancient Monuments Act 1953 makes provision for the compilation of a register of gardens and other land (parks and gardens, and battlefields).
- 3.2 Whilst not part of the legislative framework, the UNESCO Convention Concerning the Protection of the World Cultural and National Heritage 1972 (to which the UK is a signatory) makes provision for the World Heritage List, which is a list of cultural and/or natural heritage sites of outstanding universal value.
- 3.3 Any decisions where listed buildings and their settings and conservation areas are a relevant factor must address the statutory considerations of the Planning (Listed Buildings and Conservation Areas) Act 1990 (see sections 16, 66 and 72) as well as applying the relevant policies in the development plan and the National Planning Policy Framework.
- 3.4 In addition to the legislation cited here, the Town and Country (Jodrell Bank Radio Telescope) Direction 1973 requires the Local Planning Authority to consult with The UoM before granting planning permission on any application for development. The Direction sets out exceptions to these requirements and specifies the exceptions that apply to the JBOCZ.
- 3.5 The Direction, and the exceptions to the Direction, are set out in full at Appendix 3. The schedule of exceptions has been used to inform the approach to the guidance set out in this SPD relating to when The UoM is consulted on planning applications.
- 3.6 The conversion or redevelopment of a range of buildings, including dwelling houses may not require consultation with The UoM, subject to the circumstances of the planning application meeting criteria set out in the Direction. However, whilst consultation with The UoM may not be necessary, this does not mean that such proposals should be assumed to be acceptable in planning terms. As such, all proposals will be considered on their own merits and applicants should demonstrate accordance with the Development Plan for Cheshire East. Further advice on this is set out in section 6 of this SPD.

## 4. Planning Policy Framework

### National Policy Context

4.1 The National Planning Policy Framework (NPPF) February 2019 has, at its heart, the core principle of sustainable development and sets out several requirements related to heritage. The key section of the NPPF that is relevant to heritage is Section 16: Conserving and Enhancing the Historic Environment, which contains important policy requirements, with the following notable paragraphs:

- *“When considering the impact of a proposed development on the significance of a designated heritage asset, great weight should be given to the asset’s conservation (and the more important the asset, the greater the weight should be). This is irrespective of whether any potential harm amounts to substantial harm, total loss or less than substantial harm to its significance.”* (NPPF 2019, Paragraph 193)
- *“Any harm to, or loss of, the significance of a designated heritage asset (from its alteration or destruction, or from development within its setting), should require clear and convincing justification. Substantial harm to or loss of 56 a) grade II listed buildings, or grade II registered parks or gardens, should be exceptional; b) assets of the highest significance, notably scheduled monuments, protected wreck sites, registered battlefields, grade I and II\* listed buildings, grade I and II\* registered parks and gardens, and WHSs, should be wholly exceptional.”* (NPPF 2019, Paragraph 194)

### Planning Practice Guidance

4.2 The Planning Practice Guidance (PPG) also provides guidance on the historic environment. On WHSs the PPG provides advice on the principles that need to be considered when developing plans and strategies for WHSs (Paragraph: 032 Reference ID: 18a-032-20190723); the approach to the setting of WHSs (Paragraph: 034 Reference ID: 18a-034-20190723) and the approach to be taken to assess the impact of development (Paragraph: 035 Reference ID: 18a-035-20190723).

4.3 It should also be noted that WHSs are considered to be ‘sensitive areas’ for the purposes of Environmental Impact Assessment and that the threshold that triggers a need for a Design and Access Statement is also lower within a WHS (see Section 12 of this SPD).

### Cheshire East Council Local Plan Strategy

4.4 Cheshire East Council’s Local Plan is being prepared in two parts. The first part of the Local Plan, the Local Plan Strategy (LPS), sets out several key policies that align to the NPPF (2019) and seek to make sure that development does not harmfully impact the Jodrell Bank site or JBOCZ. The primary policy here is SE 14 ‘Jodrell Bank’ however several other policies are also relevant:

- Policy SE 14 ‘Jodrell Bank’ seeks to make sure that that the telescopes can continue to operate efficiently and that the historic environment and visual landscape setting of the telescopes is not harmed. The policy requires applications to consider their impact on JBO and highlights that conditions may require specialised construction techniques.
- Policy SE 7 ‘The Historic Environment’ recognises the importance of heritage assets and seeks to make sure that their significance is enhanced, managed, and protected from harmful development.
- Policy SE 4 ‘The Landscape’, recognises the role that landscape plays in delivering high quality development and seeks to make sure that development protects and/or conserves the historical qualities of an area.

## Saved Policies

4.5 Several policies from the legacy local plans for Crewe and Nantwich, Congleton and Macclesfield have been saved. Some of the most relevant to this SPD are listed here:

- Policy GC14 ‘Jodrell Bank’ of the Macclesfield Borough Local Plan establishes the spatial extent of the JBO Consultation Zone (the area to which the 1973 Directive applies) within the former Macclesfield Borough area
- Policy PS10 ‘Jodrell Bank Radio Telescope Consultation Zone’ of the Congleton Borough Local Plan First Review establishes the spatial extent of the JBO Consultation Zone (the area to which the 1973 Directive applies) within the former Congleton Borough area

## Cheshire East Council Site Allocations and Development Polices Document

4.6 The council is currently preparing part two of its Local Plan, the Site Allocations and Development Policies Document (SADPD) which, once adopted, will form part of the development plan, and provide additional policies related to LPS policy SE 14 ‘Jodrell Bank’, and policy SE 7 ‘The Historic Environment’. Emerging SADPD policies most relevant to this SPD are:

- HER 1 ‘Heritage assets’, which sets out a requirement to provide proportionate information that assess and describes the impact of proposals on the significance of a relevant heritage asset, including WHSs.
- HER 4 ‘Listed buildings’, which requires proposals to preserve and enhance the heritage asset and its setting wherever possible.
- HER 9 ‘WHS’, which supports development that conserves or enhances the outstanding universal value of the WHS and requires applicants to submit an appropriate Heritage Impact Assessment evaluating the

proposals impact on the significance of the asset and on the attributes that contribute to the outstanding universal value of JBO.

- 4.7 The SADPD will form the second part of the Local Plan. It will set non-strategic and detailed planning policies to guide planning decisions and allocate additional sites for development to assist in meeting the overall development requirements set out in the LPS.
- 4.8 A revised publication draft version of the SADPD was published for a period of public representations between the 26 October and the 23 December 2020 and was submitted to the Secretary of State on 29 April 2021 for examination.
- 4.9 Although the SADPD must proceed through public examination before adoption, this draft Jodrell Bank Observatory SPD has been prepared to be consistent with emerging planning policies in the SADPD. Whilst this is not a legal or national planning policy requirement, this approach provides opportunity for this SPD to complement and support the implementation of future development plan policies too.

## Neighbourhood Plans

- 4.10 Relevant neighbourhood plan policies are mapped and available to view on the Council's [GIS network](#). Within the JBOCZ, there are two made neighbourhood plans that may be relevant when determining planning applications; Goostrey and Marton.
- 4.11 All neighbourhood plans, including those for Goostrey and Marton, can be [accessed via the Councils web pages](#).

## 5. Part 2: Development within the Jodrell Bank Observatory Site

### The Conservation Management Plan

- 5.1 Within the defined JBO site itself great value will be given to the positive management and development of the site to further enhance and reveal the OUV of the heritage assets, including their settings.
- 5.2 Toward that aim, a long-term CMP has been produced by The UoM to guide development and ensure successful management of the site. The primary purpose of the CMP is to secure the strategic long-term protection of the JBO WHS to make sure that the OUV of the site, and the significance of the heritage assets within it, are protected and enhanced for current and future generations.
- 5.3 The CMP is included in full at Appendix 5 and its principles will be used to inform decision making on planning applications within the JBO site.
- 5.4 The CMP:
- contains the location, boundary details and description of the site;
  - specifies how the OUV, including the attributes, authenticity, and integrity of the site, is to be managed and maintained;
  - provides an overview of the current condition of the property and factors which may have positive or negative effects on attributes, authenticity and integrity;
  - presents a collective vision for the management of the property over the coming decades, and the policies, objectives and actions over the next five years. This covers descriptions of the various management structures and plans in place and the way that they are coordinated and support each other;
  - examines issues affecting its conservation and enjoyment, including development, tourism, interpretation, education and transport; and
  - describes an implementation strategy, including monitoring and review.
- 5.5 The CMP also includes a full list and description of the features of the JBO site. The main components are listed in Table 1 below:

Brief description	CMP Code	Type	Condition	Protection	Note
<b>1. The Lovell Telescope: Radio telescope, standing 89m high, with dish of diameter 76m. First very large radio telescope in the world.</b>	B07	Structure	Good	Grade I listed	Still in use as a radio telescope
<b>2. The Control Building: Principal building in the property, completed in 1955 and housing the Control Room for the Lovell Telescope.</b>	B05	Building	Good	Grade II listed	Later (unlisted) extensions in poorer condition



Brief description	CMP Code	Type	Condition	Protection	Note
3. Helical Antenna base: Concrete pad, approx. 4m x 4m, which was originally the base of the Helical Antenna installed by the US Space Technology Laboratories team in around 1959.	A01	Archaeology	Good		
4. The Green: Landscape at the heart of the property	L05	Landscape	Good-moderate		
5. 30ft Telescope base: Concrete pad, approx. 4m x 4m, originally the footing of the steerable 30ft Telescope that was part of the inspiration for the Lovell Telescope.	A02	Archaeology	Good		
6. Cosmic Noise Hut: Concrete building now known as the Link Hut, originally the control room for the 30ft Telescope, later altered to accommodate solar and optics experiments.	B11	Building	Mixed	Grade II listed	
7. Polarisation Hut: Another typical hut in the style of the ensemble around the Green. Originally used as the base for early experiments in long-baseline interferometry.	B13	Building	Good		
8. Mechanical Workshop	B17	Building	Moderate		
9. Electrical Workshop: Original site of the Main Office for the Observatory, including Lovell's office, lecture room and library.	B19	Building	Good	Grade II listed	
10. Radiant Hut: originally home to the meteor research group	B26	Building	Moderate		
11. Moon Hut: original home to the lunar and planetary radar group	B25	Building	Moderate		
12. Park Royal: Original control building for the Transit Telescope, subsequently used as the control room for the Mark II Telescope	B20	Building	Good	Grade II listed	
13. Powerhouse: location for electrical generators	B23	Building	Moderate		Still in use for original purpose
14. Mark II Telescope: Completed 1964, it was the first large telescope in the world to be controlled by digital computer.	B21	Structure	Good	Grade I listed	Still in use as a radio telescope
15. Remains of searchlight aerial: only the base remains	A05	Archaeology	Good	Grade II listed	
16. Remains of 218ft Transit Telescope: first very large paraboloidal telescope at the site, inspiration for Lovell Telescope	A13	Archaeology	Good		

**Table 1: Main heritage components of JBO**

5.6 The CMP seeks to achieve the strategic long-term protection of the JBO through setting out a vision for the site, principles for development and non-planning policies that should be used to achieve the identified objectives. The principles set out in the CMP will be a material consideration and should be considered when determining planning applications within the Jodrell Bank Site.

## Vision

5.7 The Vision contained in the CMP is:

*“The Jodrell Bank Observatory will be a WHS that changes people’s lives for the better and demonstrates humanity’s ongoing exploration of our place in the Universe. It will bring together stakeholders to continue to protect and develop a site that people from regional, national and global communities can learn about or visit and have a genuinely world-class experience. Visitors will bring a sustainable growth in tourism to local communities, benefiting their quality of life and raising the profile of the region as a place to live, work and invest. This nomination will transform this regional and national icon into an international icon of science, a showcase of international cooperation and endeavour that exemplifies astronomy and engineering at its best.”*

## CMP principles

### Principle 1

5.8 **Protection, conservation and maintenance of the OUV, integrity and authenticity of the property, including the identification and promotion of change that conserves and enhances these qualities; and the modification and/or mitigation of development and change that might damage them.**

### Principle 2

5.9 **Jodrell Bank Observatory continues to perform its function as a radio astronomy facility. It is important to conserve and enhance the heritage of the site whilst maintaining this role as a world-leading scientific research facility, thus retaining its authenticity of use and function.**

### Principle 3

5.10 **Sustainable use for the benefit of the local population and economy.**

### Principle 4

5.11 **Commitment to a comprehensive programme of presentation and education, including a commitment to sustainable visitation.**

### Principle 5

5.12 **Importance of gathering all stakeholders in a shared understanding of the property; in a commitment to developing and implementing the management plan; and to furthering the obligations of the World Heritage Convention.**

### Principle 6

- 5.13 **Commitment to ensuring effective governance, resources and monitoring are in place to support implementation of the plan, including a commitment to capacity building and to the planning, implementation, evaluation and feedback cycle.**
- 5.14 A Heritage Impact Assessment (HIA) may be required as part of the submission of a planning application. All HIAs need to consider the impact of any proposed project or change, on the Outstanding Universal Value of a WHS, both individually and collectively and it is essential to link these impacts to the WHS's Management Plan, which itself should be linked to planning arrangements at the national, regional and local level.

## 6. Part 3: Development in the Jodrell Bank Observatory Consultation Zone (JBOCZ)

- 6.1 This section sets out guidance on how important matters addressed in policies SE 14 'Jodrell Bank' and emerging SADPD policy HER 9 'World Heritage Site' of the development plan will be considered when assessing planning applications within the JBOCZ.

### The Consultation Zone

- 6.2 The JBOCZ extends south, east and west of the observatory, across a large area of countryside.
- 6.3 The area is predominantly agricultural but includes the settlement of Goostrey, which is close to the main site and, at a greater distance, Holmes Chapel. Several smaller hamlets, individual homes and farmsteads are also dispersed across the JBOCZ. At the far south east of the JBOCZ lies the northern edge of Congleton, which is subject to significant planned development.
- 6.4 In addition to policies related to JBO, development in the JBOCZ is controlled by a number of policies, notably PG 6 'Open Countryside', which limits development in the countryside to specific uses.
- 6.5 Within the JBOCZ full weight will be given to policies in the development plan that relate to the OUV of the WHS. The impact of development on the WHS and its OUV will be given full weight in determining planning applications.

### Threats and Risks

- 6.6 The JBOCZ is a largely agricultural area and development is controlled through several planning policies. Some areas immediately adjoining the JBO site are owned by The UoM, which has more direct control over proposed developments on this land.
- 6.7 However, there are potential risks across a range of issues that this SPD seeks to provide guidance on. The threats and risks relate primarily to heritage, landscape and the efficient operation of the telescopes (as identified in LPS Policy SE 14) but also include the ability to manage development through a planned system. The planning system has an important role to play in managing these issues through assessing the impact of development and consenting that which is consistent with the policies of the Local Plan (unless material considerations indicate otherwise). The ability of the LPA to exercise development management is therefore essential to preserving the OUV of the WHS and ensuring that development does not harm the continued operation of telescopes at JBO.

### Efficient Operation of the Telescopes

- 6.8 The continued efficient operation of the telescopes at JBO is a fundamental component of the OUV of the site and inextricable from the heritage significance

of JBO. Protecting the operational efficiency from harm is essential to ensure the continued functioning of the telescopes at JBO and development that harms this capacity, individually or cumulatively will not normally be acceptable.

- 6.9 The main threat to the continued efficient operation of the telescopes arises from electrical and radio interference generated by development and populations within JBOCZ.
- 6.10 This issue has been present and has required management since the earliest days of JBO and in 1973 an act of parliament ('the 1973 Direction') was introduced to help manage the proliferation of electrical interference through new building in the vicinity of JBO. However, since then development has occurred in the area, and permitted development rights have expanded to allow development that may otherwise have been prevented by the 1973 Direction. More importantly the proliferation of electrical devices in recent years means that new residential dwellings in particular are able to generate higher levels of electrical interference than previously.
- 6.11 Radio interference created by electrical equipment across the JBOCZ is harmful to the continued efficient operation of the telescopes. For the Telescopes at JBO, external radio interference to precision timing measurements of pulsars is the most significant concern to the continued efficient operation of the telescope. Within the JBOCZ the level of electrical interference is already substantially too high and on a cumulative basis even small-scale development can have a significant negative impact on the efficient operation of the telescopes and therefore on the OUV of the WHS. External radio interference is significant for the following reasons:
  - i) Precision measurement of pulsars is the most important and internationally significant research programme carried out by the Lovell Telescope as a single dish and has the greatest potential for breakthroughs in fundamental physics;
  - ii) this programme relies on continuing to make the most precise timing measurements possible at regular intervals over the coming years and making use of the data gathered over the last 40 years;
  - iii) these measurements can be degraded and corrupted in an irrevocable manner by interference, especially the type of sporadic broad-band interference caused by domestic and industrial equipment.
- 6.12 The International Telecommunications Union (ITU) defines the level of interference that should be considered as detrimental to radio astronomy measurements as 10% of the intrinsic thermal noise created by radio astronomy equipment itself, combined with background interference present in the atmosphere.
- 6.13 Over decades radio astronomers have reduced the intrinsic (thermal) noise in the receivers they use, using cryogenic cooling (typically to -260C) and sophisticated semiconductor technologies. The ITU recommendation simply says that interference should not contribute an additional component of variation

that is more than 10% of this intrinsic thermal noise (including the irreducible noise from the atmosphere etc.).

- 6.14 Determining if the ITU threshold is exceeded rests on the measurement of the brightness of a radio source, and a measurement that determines its impact on a receiver. JBO is a receiver system that measures data emitted by pulsars and interference creates a scatter in these measurements. Electrical equipment, including the telescopes themselves, and background interference ('noise' from other sources and electrical equipment across the JBOCZ) create a normative baseline of interference which manifests itself as a scatter in the data measurements received by the telescopes. By understanding the baseline, it is possible to establish whether the observed scatter is greater than expected due to normal everyday background noise. Therefore, an increase in background noise is measurable and observable as a deviation from the baseline and may be modelled. The degree to which that deviation increases above the baseline is the core concern when determining the impact of development on the operational efficiency of the telescopes at JBO. The ITU threshold is such that interference should not increase this observed scatter by more than 10% of the baseline amount.

### Application requirements and considerations

- 6.15 **To demonstrate compliance with policy SE14 of the CELPS, within the JBOCZ applicants are expected to submit a Radio Interference Assessment, at their own cost, of the interference likely to be generated by their proposal. This should be carried out by an accredited test lab and include a design review and noise profile of the proposed development. The assessment should also include proposals to mitigate the identified impacts.**
- 6.16 The UoM will be consulted on such assessments and, in instances where it is
- 6.17 necessary for the UoM to verify or carry out their own assessments, the following approach will be employed.
- 6.18 **Noise Assessments carried out by the UoM**
- 6.19 When consulted, The UoM will undertake an assessment of interference likely to be generated by development proposals and determine the impact of this on the operation of JBO. The methodology for this assessment is set out at paragraphs 7.36 to 7.42 of this SPD.
- 6.20 The main factors that will be considered by The UoM in determining whether a development proposal is likely to individually, or cumulatively harm the operational efficiency of the telescopes at JBO are:
- i) **Location of development** - the closer a proposal is to the telescopes, the more potential there is for harm. Similarly, the more elevated a site the more potential there is for harm.
  - ii) **Type of development** - interference arises from the proliferation of radio and electromagnetic interference, therefore residential development that increasingly incorporates digital transmission alongside home-based radio

electromagnetic interference has the most scope to introduce proliferation of electrical devices

- iii) **Scale** – individual dwellings present a cumulative harm and this harm is increased when the number of dwellings on an application site is increased; more intensive development introduces more risk
- iv) **Radio Interference Assessment** – each proposal will generate a degree of electrical interference. An exercise that quantifies what that level of interference may be, and its impact, is carried out by the UoM when proposals trigger the requirement for consultation.

- 6.21 The likely level of interference generated by a development will be given great weight in decision making on planning applications in the JBOCZ and whether and to what extent a proposal is likely to generate interference that impacts on the efficiency of the telescopes, will be an assessment undertaken in consultation with The UoM and based on the thresholds set out in the 1973 Directive.
- 6.22 Where consultation with the UoM is carried out, the following methodology will be used.

## Methodology

- 6.23 The following is a summary of the full methodology and technical explanation employed by The UoM, an example of which is included in full at Appendix 7. Applicants are expected to address these matters in their own assessments.
- 6.24 **Stage 1: Analysis of interference from the proposed development**
  - **Single appliance emission:** It is necessary to set out the reduction of interference required to avoid harmful interference from a single piece of domestic equipment. This is known as the 'minimum coupling loss'.
  - **Aggregate emission:** To understand the impact of a dwelling on interference, it is necessary to establish the aggregated level of the emissions from all appliances in that dwelling. This is done through an independent estimate based on published values of ambient man-made radio noise per type of equipment and an estimate of the number of pieces of equipment per dwelling.
  - **Path loss:** Path loss is the interference that will be generated between the proposed development and the Lovell Telescope. This is determined by modelling the interference created by the development against mitigating factors that may reduce that impact (such as reduction of interference through wall and other barriers). This analysis also accounts for the profile of the terrain, which may help reduce the impact (if the development is site in a depression) or amplify it (if the development is prominent or elevated in the landscape).



- **Estimated interference compared to ITU threshold:** This is the expected strength of total interference from the proposed development compared to the accepted ITU threshold.
- 6.25 **Stage 2: Analysis of interference from the proposed development and interference from the wider area**
- 6.26 It is important to assess the impact of any proposed development in the context of interference already existing in the wider area of JBO. Sky maps are used to plot individual buildings across the JBOCZ and assign each a level of interference. The process identifies how much interference is being generated by location, across the JBOCZ, and highlights that dominant contributions to interference arise from nearby relatively small settlements rather than larger more distant settlements.
- 6.27 This analysis demonstrates that the baseline level of interference is already high across the JBOCZ. Applying this to analysis of a single development proposal means focusing on the relevant pathway between the proposal and JBO, to establish the background level of interference on this particular pathway and determine the extent to which the additional interference caused will be individually or cumulatively harmful.

## Historic Environment

### Introduction

- 6.28 Most of the heritage assets of the WHS are located within the JBO site and identified as part of the CMP.
- 6.29 In the wider JBOCZ, it is unlikely (but not impossible) that development will have an adverse impact on the visual setting of the listed assets. However, with the WHS/JBOCZ heritage statements are required providing proportional information on how relevant heritage matters have been addressed. Therefore, a full HIA may not be required for every application.
- 6.30 Development proposals within the WHS will require a heritage statement (or an impact assessment for minor works), proportionate to the scale and likely impact of development, to support a planning application. Applicants are advised to seek pre-application advice from the Council to determine whether HIA is likely to be required and the level of detail that may be needed.
- 6.31 Generally, the closer a proposal is to the main Jodrell Bank Observatory, the greater the potential for development to have an impact on heritage assets, particularly in relation to the setting of the WHS. However, the Heritage value of JBO and its OUV are inseparable from the continued functioning and operation of the telescopes. Therefore, the impact of a development on heritage significance manifests not only on impact on buildings, structures and landscapes but in the extent to which a proposal interferes with the operation of the telescopes. Therefore the Radio Interference Assessment is an essential component of understanding a proposals impact on the heritage value of the WHS.
- 6.32 If a Heritage Impact Assessment is required, the following guidance sets out how this report should be prepared.

### Application requirements and considerations

- 6.33 Paragraph 189 of the NPPF (2019), requires applicants to describe the significance of any Heritage Assets<sup>1</sup> affected by their proposals, including any contribution made by the setting of the asset. Within the WHS (including the JBOCZ) a heritage statement will be required to support planning applications.
- 6.34 In the context of this SPD the WHS (JBO and its setting - the JBOCZ) are designated heritage assets, and the JBO site itself includes multiple listed buildings. Therefore, most applications within this defined area will be required

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<sup>1</sup> Heritage Assets are defined as: "A building, monument, site, place, area or landscape identified as having a degree of significance meriting consideration in planning decisions, because of its heritage interest. Heritage Assets include designated Heritage Assets and assets identified by the local planning authority".

to submit a Heritage Statement that includes information on the matters set out below.

6.35 Where required HIAs should include:

- i) A comprehensive understanding of the WH property and its OUV, authenticity and integrity, condition, context (including other heritage attributes) and interrelationships.
- ii) An understanding of the range of impacts arising from the development or other proposal for change;
- iii) An objective evaluation of those impacts (beneficial and adverse) on the heritage elements, especially the site's OUV, integrity and authenticity;
- iv) An assessment of the risk posed to the retention of OUV and the likelihood that the property may be in potential or actual danger;
- v) A statement of heritage benefits which may arise from proposals including better knowledge and understanding and awareness-raising;
- vi) Clear guidelines as to how impact can be mitigated or avoided;

6.36 The level of information required should be proportionate to the scale of work proposed and the significance of the Heritage Asset affected. Therefore, smaller scale change proposed for a Heritage Assets of less importance (i.e. a non-designated heritage asset) may enable the Design and Access Statement to be prepared by the applicant, but larger scale change to more significant Heritage Assets will require more detailed evaluation and may also require professional assessment.

6.37 As a minimum, the relevant Historic Environment Record should be consulted, and the Heritage Assets assessed using appropriate expertise where necessary. For minor development we recommend this assessment is provided in the form of a letter and for major development in a Heritage Statement.

6.38 The letter or statement to support the application should incorporate the following sub-headings and make use of at least the Historic Environment Record.

6.39 **Heading 1: Description of Heritage Asset's Significance:**

6.40 Provide a factual description of the Heritage Asset including, but not limited to:

- i) the reason it is designated
- ii) its age
- iii) its character and appearance.

6.41 This information can be found online using the Historic Environment Record.

6.42 **Heading 2: Description of Change Proposed:**

- 6.43 Describe the works or development proposed and provide justification why it is needed and how it will take place.
- 6.44 **Heading 3: Assessment of Impact on Significance:**
- 6.45 Explain how the change proposed will impact upon the reason the Heritage Asset is designated. Use the following to guide the assessment:
- i) the nature of the asset's significance and its interest (a modern building of high architectural interest will have quite different sensitivities from an archaeological site where the interest arises from the possibility of human remains)
  - ii) the extent of the fabric that holds that interest (this can lead to a better understanding of how adaptable the asset may be)
  - iii) the level of importance of that interest (this guides how protectively policies should be applied)
- 6.46 **Heading 4: Sources used**
- 6.47 The heritage statement should detail the sources that have been considered and the expertise that has been consulted.
- 6.48 Where a planning application is submitted in parallel with an application for Listed Building consent, a single, combined statement should address the requirements of design, access and impact on Heritage Assets. Without this information applications will be invalidated as they will contain insufficient information for the Council to reach a decision.

## Visual Landscape

- 6.49 The landscape across JBOCZ consists of managed farms, some woodlands, and shallow river valleys. It is a mainly flat, at times rolling and undulating, plain interspersed with small settlements and individual farmsteads and dwellings. Whilst the landscape holds an intrinsic visual quality, it is valued for its open and mainly flat typology that allows the telescopes at JBO to transmit and receive signals across pathways that are largely uninterrupted, and beyond into space.
- 6.50 Threats to the value of the landscape may rise primarily from developments that reduce the openness of the plain through introducing built form and physical clutter that interfere with pathway transmissions. Development that is prominent in the landscape, or that is unusually tall, is most likely to present a threat to the value of the landscape.
- 6.51 Generally, if a site is more elevated, a development will become more prominent in the landscape and may therefore require further assessment regarding the impact of the development on landscape matters. If this is the case, it is expected that the approach set out below is followed to provide information on this matter to the local planning authority.
- 6.52 Applicants are advised to seek pre-application planning advice from the council to establish whether a Landscape Value Impact Assessment (LVIA) will be required as part of the application.

### Application requirements and considerations

- 6.53 In assessing a planning application from a landscape design perspective, there are a number of general design principles to be considered whilst taking account of the individual factors relevant for any scheme. The following information should be provided as a minimum for applications within the JBOCZ:
- i) drawings showing the location of existing landscape features, including a tree survey if there are significant numbers of trees, and their loss or retention
  - ii) drawing showing landscape proposals
  - iii) visuals and photos to demonstrate the visual impact of a development, and a full Landscape and Visual Impact Assessment if the scale of the scheme merits this
  - iv) levels information or cross sections to indicate any significant changes in levels.
  - v) measures for the protection of trees and vegetation to be retained.
  - vi) details associated with temporary access roads, compounds, storage areas for construction
- 6.54 LVIAs should be carried out by a suitably qualified professional and in accordance with the most recent Guidelines for Landscape Value Impact Assessment produced by the Landscape Institute. In any LVIA, proposals

should describe and explain how the following matters have been addressed in the design process:

- 6.55 **Evaluation of existing features**, based on accurate site surveys (physical and ecological) and their retention, protection and enhancement as appropriate for trees, hedges, habitats, walls, fences, etc.
- 6.56 **Respecting local landscape character**, taking account of any character statements, e.g. landscape assessments, village design statements.
- 6.57 **Designations**: Respecting landscape designations (for example, Public rights of Way, Sites of Biological Importance/Local Wildlife Sites, Conservation Areas, Tree Preservation Orders).
- 6.58 **Siting**: Appropriate siting of the development to integrate with its surroundings.
- 6.59 **Density**: Balance of provision for open space and vegetation in relation to density of built development and infrastructure.
- 6.60 **Impact**: Consideration of the landscape and visual impact of proposals.
- 6.61 **Mitigation**: Providing landscape mitigation proposals where appropriate, (for example replacement habitats, ponds, new structure planting, screening, boundary planting, acoustic barriers.)
- 6.62 **Proposals**: Providing new landscape proposals appropriate to the scheme (for example pedestrian access routes, paving, boundary treatments, street furniture, lighting, replacement tree planting, structure planting, hedges, ornamental planting).
- 6.63 **Quality**: Quality of proposals in relation to their appropriateness to design intent and setting.
- 6.64 **Access**: Adequate provision for pedestrian and cycle access, including disabled access.
- 6.65 **Security**: "Secured by Design" principles for crime prevention.
- 6.66 **Feasibility**: Technical feasibility of a scheme design.
- 6.67 **Materials**: Appropriate choice of hard (i.e. built elements such as paving, fencing) and soft materials (i.e. plant material and earthworks) throughout.
- 6.68 **Management**: Adequate provision for maintenance and management of the scheme following completion.

## Development Management

- 6.69 The location of the JBO site was originally selected because of its distance from urban settlements, and therefore the lack of interference from other electrical equipment nearby.
- 6.70 Managing development across the JBOCZ is essential to preserve the OUV of the WHS. This is primarily achieved through the planning system and the application of national and local planning policies. Guidance set out in the 1973 Direction provides additional requirements on when The UoM should be consulted regarding development proposals. The Direction is reproduced in full at Appendix 3.
- 6.71 Where development proposals exceed the thresholds set out in Table 1 below, The UoM will be consulted and the impact of the proposal on the efficiency of the telescopes will be assessed. The outcome of this assessment will be a very significant material consideration in determining planning applications.

<b>First Schedule</b>	
(consultation is not required if development is one of the following and meets the criteria set out)	
<b>Development</b>	<b>Criteria</b>
Redevelopment of a building	Redevelopment must be for the same use
	Redevelopment must be on the same site (or substantially the same site)
	The cubic content of the new building is not increased
	The area of land occupied by the new building does not exceed the area of land occupied by the existing building
Redevelopment of a dwelling house	Must currently be in use as a dwelling house
	Redevelopment must be on the same site (or substantially the same site)
	The cubic content of the original dwelling house (as ascertained by external measurement) is not exceeded by more than 914 cubic metres or 30% whichever is greater)
The enlargement improvement or other alteration of any dwelling house which is in use.	The erection of a garage within the curtilage of a dwelling house shall be treated as the enlargement of the dwelling house
Building a new single dwelling house	Occupied by a person employed locally in agriculture
Conversion of a building or buildings to form a single dwelling house	Occupied by a person employed locally in agriculture



The formation, laying out or widening of a means of access	
The erection, construction, improvement or other alteration of gates, fences, walls or other means of enclosure	
<b>The Second Schedule</b>	
(consultation is not required if development is one of the following and meets the criteria set out)	
<b>Development</b>	<b>Criteria</b>
The erection, enlargement or other alteration of a building or buildings	Development must not be for more than one dwelling house
	The erection of a garage within the curtilage of a dwelling house shall be treated as the enlargement of the dwelling house
Operations in connection with the conversion of a single dwelling house for use as not more than two dwelling houses	
The erection, enlargement or other alteration of a shop	The sales area must be confined to the ground floor.
	The gross floor area of the building must not exceed 610 square metres
The erection, enlargement or other alteration of a medical or dental surgery, health centre or office	Limited to two storeys
?	Gross floor area must not exceed 610 square metres
<b>Change of Use</b>	<b>Acceptable Change</b>
The change in use of a building or buildings	not more than one dwelling house
single dwelling house	to use as not more than two dwelling houses
The change in use of a building or buildings	Change must be for a shop, medical or dental surgery, health centre or office

**Table 1: Development thresholds**

## Guidance on Design and Access Statements

- 6.72 A Design and Access Statement (D&AS) is a short report that accompanies and supports a planning application. It illustrates the process that has led to the development proposal and explains the design and the different options considered in the design process.
- 6.73 Applicants are encouraged to seek pre-application planning advice to determine the relevant planning issues that may need to be addressed in detail within their applications. In some instances, it may be appropriate to address matters of landscape and heritage within a design and access statement, rather than preparing a separate LVIA or HIA. However, where heritage or landscape matters are relevant planning issues that require more detailed information, applicants should prepare their supporting information accordingly.
- 6.74 D&ASs help to make sure that development proposals are based on a thoughtful design process and a sustainable approach to access. They help us to better understand the analysis that has underpinned the design, which in turn helps negotiations and decision-making and should lead to an improvement in the quality, sustainability, and inclusiveness of the development whilst demonstrating how the proposal meets design related policy criteria of the Development Plan.

### When is a Design and Access Statement required?

- 6.75 A D&AS is required for major development and all developments in Conservation Areas and WHSs.
- 6.76 In major developments, a D&AS is required for:
- i) sites with an area of 0.5 hectares or more and it is not known whether the development relates to dwelling houses
  - ii) all sites having an area of 1 hectare or more
  - iii) the provision of 10 or more dwelling houses
  - iv) A building or buildings where the floor space to be created by the development is 1,000 square metres or more
- 6.77 Certain major developments are excluded, such as mining operations or waste development, where the form of particular schemes will largely be dictated by their function.
- 6.78 In areas of historic value, smaller proposals may also have a significant impact on the character of an area. Therefore, D&AS will be required for proposals within the JBOCZ where:
- i) the proposal includes the provision of one or more dwelling houses
  - ii) the proposal includes the provision of a building or buildings where the floor space created by the development is 100 square metres or more
- 6.79 Developments of this scale can have a greater impact on the immediate surroundings and the wider area and a D&AS can perform a valuable function

in helping the local planning authority and third parties to understand the analysis underpinning the design of a scheme and assess its impact on the WHS.

## Content requirements

- 6.80 In preparing the D&AS, developers need to consider and explain the merit of the design and how it relates to the existing setting. This will include considering:
- i) The mass, form and scale of buildings.
  - ii) The immediate landscape and wider landscape, and how the proposal relates to this.
  - iii) The impact on heritage, including views to and from the Jodrell Bank site
  - iv) The level of likely electrical interference likely to be created by the development and the measures proposed to mitigate and contain this.

## Design component

- 6.81 Development proposals within the JBOCZ must be accompanied by a D&AS that must relate to the context of the WHS, identify the specific issues that arise within the proposed development site and explain how those issues have been addressed.
- 6.82 To agree a suitable approach, proposals within the JBOCZ should submit a Radio Wave Prevention Scheme alongside their proposals, demonstrating how they have sought to minimise interference through design and materials led solutions.
- 6.83 All D&ASs must:
- i) explain the design principles and concepts that have been applied to the development
  - ii) demonstrate the steps taken to appraise the context of the development and how the design of the development takes that context into account in relation to the proposed use
  - iii) explain the policy adopted as to access and how policies relating to access in relevant development plan documents have been considered
  - iv) state what, if any, consultation has been undertaken on issues relating to access to the development and what account has been taken of the outcome of any such consultation
  - v) explain how any specific issues that might affect access to the development have been addressed
- 6.84 When preparing a D&AS the following headings should be used:
- 6.85 **Heading 1: Amount and Type of Development**
- 6.86 The statement for both outline and detailed applications should explain the amount of development proposed for each use, how this will be distributed

across the site, how the proposal relates to the site's surroundings and what consideration is being given to make sure that accessibility for users to and between parts of the development is maximised. Where the application specifies a range of floorspace for a particular use, the reasons for this should be explained clearly in the D&AS.

6.87 For residential development, this means the number of proposed units for residential use. For all other development, this means the proposed floor space for each proposed use.

6.88 Amount cannot be reserved within an outline application, although it is common to express a maximum amount of floorspace for each use in the planning application and for this to be made the subject of a planning condition.

6.89 **Heading 2: Layout**

6.90 The layout and location of development within a site is an important variable that can impact on the operation of Jodrell Bank's telescopes. Therefore, layout choices can be important in determining whether a proposal is harmful to the operation of the telescopes.

6.91 The D&AS accompanying an outline application should explain:

- i) the principles behind the choice of development zones and blocks or building plots proposed and how these principles, including the need for appropriate access will inform the detailed layout.
- ii) the underlying terrain of the site and how the proposal makes best use of low-lying areas for development.
- iii) how the layout, relationship between buildings, public and private spaces, will help to create safe, vibrant and successful places
- iv) the accessibility of the site in term of travel distances, gradients and topography.
- v) how the layout has been used to minimise energy consumption
- vi) how the layout creates a safe and accessible environment

6.92 **Heading 3: Scale**

6.93 Scale is the height, width and length of a building or buildings in relation to its surroundings.

6.94 If scale has been reserved at the outline stage, the application should still indicate the upper and lower limits of the height, width and length of each building, to establish a 3-dimensional building envelope within which the detailed design of buildings will be constructed. In such cases the design component of the D&AS should explain the principles behind these parameters and how these will inform the final scale of the buildings.

6.95 The height of buildings can have an adverse effect on the operational functionality of the telescopes. The higher the building, the more adverse effect is likely. As such, proposals should carefully consider building height and explain how this matter has been considered in the process.

- 6.96 For detailed applications, and outline applications that do not reserve scale, the D&AS should explain the scale of buildings proposed, including why particular heights have been settled upon, and how these relate to the site's surroundings and the relevant skyline. The statement should also explain the size of building parts, particularly entrances and facades, with regard to how they will relate to the human scale.
- 6.97 **Heading 4: Landscaping**
- 6.98 Landscaping is the treatment of private and public spaces to enhance or protect the amenities of the site and the area in which it is situated through hard and soft landscaping measures.
- 6.99 Statements should explain:
- i) the function of the landscaping
  - ii) the principles that will inform any future landscaping scheme for the site.
  - iii) the purpose of landscaping and its relationship to the surrounding area. Where possible, a schedule of planting and proposed hard landscaping materials to be used is recommended.
- 6.100 Some development proposals (for example, alterations to an existing building) may include no landscaping element. For such proposals, this section of the D&AS would simply need to state why landscaping is not relevant to the application.
- 6.101 **Heading 5: Appearance**
- 6.102 Appearance is the aspect of a place or building that determines the visual impression it makes, including the external built form of the development, its architecture, materials, decoration, lighting, colour and texture.
- 6.103 If appearance is reserved at the outline stage, the outline application does not need to provide any specific information on the issue. In such cases the design and access statement should explain the principles behind the intended appearance and how these will inform the final design of the development.
- 6.104 For detailed applications, and outline applications that do not reserve appearance, the design and access statement should explain the appearance of the place or buildings proposed including how this will relate to the appearance and character of the development's surroundings. It should explain how the decisions taken about appearance have considered accessibility. The choice of materials and textures will have a significant impact upon a development's accessibility. Judicious use of materials that contrast in tone and colour to define important features such as entrances, circulation routes or seating for example will greatly enhance access for everyone. Similarly, early consideration of the location and levels of lighting will be critical to the standard of accessibility ultimately achieved.
- 6.105 **Heading 6: Context**
- 6.106 An important part of a D&AS is the explanation of how local context has influenced the design. Context should be discussed in relation to the scheme

as a whole, rather than specifically in relation to the five sub-components of amount, layout, scale, landscaping and appearance.

6.107 A D&AS should demonstrate the steps taken to appraise the context of the proposed development. It is important that an applicant should understand the context in which their proposal will sit and use this understanding to draw up the application.

6.108 A good understanding of context includes:

- i) Assessment of the site's immediate and wider context in terms of physical, social and economic characteristics and relevant planning policies. This may include both a desk survey and on-site observations and access audit. The extent of the area to be surveyed will depend on the nature, scale and sensitivity of the development.
- ii) Involvement of both community members and professionals. Depending on the scale, nature and sensitivity of the proposed development, this might include consultation with local community and access groups and planning, building control, conservation, design and access officers. The statement should indicate how the findings of any consultation have been considered for the proposed development and how this has affected the proposal.
- iii) Evaluation of the information collected on the site's immediate and wider context, identifying opportunities and constraints and formulating design and access principles for the development. Evaluation may involve balancing any potentially conflicting issues that have been identified.
- iv) Design of the scheme using the assessment, involvement, and evaluation information collected. Understanding a development's context is vital to producing good design and inclusive access and applicants should avoid working retrospectively, trying to justify a predetermined design through subsequent site assessment and evaluation.

6.109 **Heading 7: Use**

6.110 A D&AS should explain how this understanding of the context has been considered in relation to its proposed use. The use is the use or mix of uses proposed for land and buildings. Use cannot be reserved within an outline application.

6.111 D&ASs for both outline and detailed applications should explain the proposed use or uses, their distribution across the site, the appropriateness of the accessibility to and between them and their relationship to uses surrounding the site.

6.112 **Heading 8: Access**

6.113 The access component should explain how you plan to make sure that all users will have equal and convenient access to buildings and spaces and the public transport network.

6.114 For outline applications, where access is reserved, the application should still indicate the location of points of access to the site. Statements accompanying such applications should, however, clearly explain the principles that will be

used to inform the access arrangements for the final development at all scales, from neighbourhood movement patterns where appropriate to the treatment of individual access points to buildings.

6.115 The level of detail provided in the access component of the statement should be proportionate to the nature and scale of the access that will be required to the site. For proposals that will have no public access and only limited maintenance or operational access, the access component need not be long.

6.116 The access component should:

- i) Address the need for flexibility of the development and how it may adapt to changing needs.
- ii) Explain the policy adopted and how relevant policies in local development documents have been considered.
- iii) Provide information on any consultation undertaken in relation to issues of access and how the outcome of this consultation has informed the development proposals. This should include, for example, a brief explanation of the applicant's policy and approach to access, with particular reference to the inclusion of disabled people, and a description of how the sources of advice on design and accessibility and technical issues will be, or have been, followed. Access for the emergency services should also be explained where relevant. Such information may include circulation routes round the site and egress from buildings in the event of emergency evacuation.

6.117 Matters for consideration in relation to access include:

- i) Transport links
- ii) Disabled parking provision or setting down points or garaging
- iii) Approach routes to building – wayfinding signage, gradient, width, surface finish
- iv) External hazards/features – hard landscaping, projections, furniture
- v) External steps/ramps – gradient, width, guarding and height
- vi) Entrances – primary and secondary
- vii) Doors – operation, size, level threshold, automatic
- viii) Visibility of external signage – size and contrast for people with impaired vision
- ix) Spectator seating - number of spaces, choice of viewing point, facilities

6.118 The access component should be amended to reflect any decisions reached on site so that any new owner or occupier can be aware of the rationale used in making decisions which impact on accessibility and their ongoing obligations under the Equality Act 2010.



## Mitigation and the Application of Conditions

- 6.119 Mitigation measures to reduce the impact of interference to radio astronomy are possible and may be useful in certain cases where development is found otherwise acceptable. These measures include control of activities likely to cause interference; installation of shielding to reduce the level of signals emitted; and techniques used in observing and processing radio astronomy data.
- 6.120 Control measures in place at JBO include restrictions on the use of radio transmitters, mobile phones and Wi-Fi; testing of radio frequency emissions from electronic and electrical equipment. Enhanced restrictions for particular observations have been implemented including complete curfews on the use of all electrical and electronic equipment, except for items in highly shielded 'Faraday cages' for certain periods. None of these control measures would be feasible in a residential setting.
- 6.121 Shielding measures in place at JBO include the construction of highly shielded rooms made of steel plates riveted to a steel frame with metal gasketing and copper tape over all joints. Such rooms that have no windows and a submarine-type radio quiet door provide up to 80 dB additional attenuation for particular equipment. In other rooms, shielded racks provide typically 50 dB attenuation for computing servers. None of these shielding measures would be feasible, appropriate, or enforceable in a residential setting.
- 6.122 Simple shielding measures that are appropriate and recommended by JBO for residential buildings include the use of foil backed plasterboard and metallised window glass, both of which are generally required to meet thermal insulation requirements in modern buildings. The mitigation effects of these measures have already been described and considered in the methodology that calculates the impact of interference on the operation of the telescopes.
- 6.123 It is not practical to build a convenient house with full radio frequency screening, so the proposed solution is to install targeted screening on the roof and those walls that face generally towards Jodrell Bank. Radio emissions travel on a horizontal plane and therefore the objective is to direct any radio emissions generated within the house away from the telescopes, so it is equally important that there should be no screening on walls that face away from the telescopes. A house in which all the walls are built to the same specification would not achieve the required objective.
- 6.124 In order to avoid unnecessary costs and potential conflicts with normal building regulations, the JBO encourages screening solutions that employ standard building materials, provided these can be shown to have appropriate radio frequency properties. The observatory has conducted tests to identify a selection of suitable materials, as listed below and is willing to conduct further tests on other materials that may be proposed. Ideally, such tests should be completed before a formal planning application is made, so that the design proposed can take account of the test results.

## Planning Conditions

6.125 Planning conditions may be applied to make a development proposal acceptable in planning terms. Such conditions could be applied to mitigation measures that will reduce potential electrical interference from a development proposal.

## Screening Materials and Design

6.126 Where development is found acceptable, subject to the delivery of measures on the Radio Wave Prevention Scheme, other conditions and having regard to the site and the area in which it is located, and the need to minimise electromagnetic interference that would impact upon the JBO, conditions will be applied to require the delivery of measures agreed in the Radio Wave Prevention Scheme.

6.127 Materials and components with radio frequency screening properties, suitable for use in roofs or external walls facing toward the telescope, should generally incorporate a continuous sheet of metal within them. The following may be used in walls, roofs and elevations facing toward the telescopes:

- i) Plasterboard with aluminium foil backing on one or both sides that has been tested by The UoM and found suitable for screening rolls. It would also serve to screen the roof if applied to the ceiling of the top story.
- ii) Pilkington K glass that has been tested by the UoM and found suitable for screening windows. This is a proprietary low emissivity glass. Other types of low emissivity glass may provide similar radio frequency screening but would need to be tested before use.
- iii) Reflective insulating blanket material intended for use in walls and lofts, a sample of which (incorporating a layer of aluminium foil) has been tested by UoM and found to provide satisfactory screening. Other products that are similar in appearance but contain no metallic film would be ineffective so testing of the exact product to be used is essential. Where a suitable material of this type is used, adjacent strips should be overlapped by at least 100mm for maximum screening.
- iv) Doors should be of metallic construction or incorporate an aluminium foil barrier.

6.128 It is essential that the walls facing away from the telescope should permit the radio waves to escape. In general, this means that materials and components incorporating metallic films sheets or meshes must be avoided. Plain glass, standard brickwork, wooden doors and plasterboard with no aluminium foil are acceptable. Large areas of reinforced concrete would be a problem. Or the materials should be tested before use.

## Permitted Development

- 6.129 Whilst the planning system allows the LPA to manage development through the issuing of consents, development that falls within permitted development rights does not require consent and therefore this reduces the ability of the LPA to exercise control of development.
- 6.130 All electrical equipment within the JBOCZ gives rise to interference that impedes the efficiency of the telescopes at Jodrell Bank. Permitted development rights apply to a wide range of development and are not limited to residential matters, however this category is generally of most concern to The UoM due to the high volume of electrical devices that homes hold, and therefore the risk to increases in electrical interference from this source of development. There is scope for permitted development to cumulatively harm the efficient operation of the telescopes through other matters such as electrical charging points for vehicles, which also fall within permitted development rights, and plant machinery associated with agricultural and other industries.
- 6.131 The 1973 Direction applies across the JBOCZ and sets out size, scale and use thresholds for development. If development exceeds these thresholds The UoM must be consulted and an assessment of the developments impact on JBO will be undertaken. However, the General Permitted Development Order (GPDO) introduces multiple scenarios that allow development to exceed the thresholds set out in the 1973 Direction, and for which no planning consent is required, and therefore no consultation would take place with The UoM regarding the impact of that development on JBO. Changes of use within a use class generally do not constitute development and therefore are not subject to planning consent.

## Removal of Permitted Development Rights

- 6.132 In addition to conditions regarding screening and the minimization of interference, to ensure continued control over the extent of further building on the site, conditions will be applied that remove future permitted development rights, including changes of use, that are reasonably likely to create electrical or radio interference within the JBOCZ.
- 6.133 An example condition is:

“Notwithstanding the provisions of the Town and Country Planning (General Permitted Development) Order 2015 (or any order revoking or re-enacting that order), no development (as defined by Section 55 of the Town and Country Planning Act 1990) as may otherwise be permitted by virtue of Class(es) A, B, C, D, E and G of Part 1 Schedule 2 of the Order shall be carried out.”

## 7. Appendix 1: UNESCO's criteria for the Assessment of Outstanding Universal Value

UNESCO's criteria for the assessment of OUV (para 77 of the Operational Guidelines):

- (i) represent a masterpiece of human creative genius;
- (ii) exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;
- (iii) bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;
- (iv) be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;
- (v) be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;
- (vi) be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (vii) contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
- (viii) be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;
- (ix) be outstanding examples representing significant ongoing ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;
- (x) contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

## 8. Appendix 2: World Heritage Committee Decision and Statement of Outstanding Universal Value

Decision: 43 COM 8B.35

Jodrell Bank Observatory (United Kingdom of Great Britain and Northern Ireland)

The World Heritage Committee,

Having examined Documents WHC/19/43.COM/8B and WHC/19/43.COM/INF.8B1,

Inscribes the Jodrell Bank Observatory, United Kingdom of Great Britain and Northern Ireland, on the World Heritage List on the basis of criteria (i), (ii), (iv) and (vi);

Adopts the following Statement of Outstanding Universal Value:

### Brief synthesis

Jodrell Bank Observatory was important in the pioneering phase and later evolution of radio astronomy. It reflects scientific and technical achievements and interchanges related to the development of entirely new fields of scientific research. This led to a revolutionary understanding of the nature and scale of the Universe. The site has evidence of every stage of the history of radio astronomy, from its emergence as a new science to the present day.

Jodrell Bank Observatory is located in a rural area in northwest England. Originally, scientific activity was located at the southern end of the site, and from that time activity has moved to the north across the site with many new instruments developed and then abandoned. Remnants of early scientific instruments survive.

At the south end of the site is the location of the Mark II Telescope and it is bounded by an ensemble of modest research buildings in which much of the early work of the Observatory took place.

To the north of the Green, the site is dominated by the 76 metre diameter Lovell Telescope which sits in a working compound containing a number of engineering sheds and the Control Building. There are spaces open to the general public which include visitor facilities set around the Lovell Telescope. Other visitor facilities are outside the property to the northeast.

Jodrell Bank Observatory is the hub of the UK's national wide array of up to seven radio telescopes (e-MERLIN) including the Lovell and Mark II Telescopes.

Criterion (i): Jodrell Bank Observatory is a masterpiece of human creative genius related to its scientific and technical achievements. The adaptation and development of radar and radio frequency reflectivity to develop radically new equipment, such as

the Transit Telescope and Lovell Telescope, were a key part in the development of entirely new fields of scientific research and led to a dramatic change in the understanding of the Universe. The Observatory was important in the pioneering phase and later evolution of radio astronomy.

Criterion (ii): Jodrell Bank Observatory represents an important interchange of human values over a span of time and on a global scale on developments in technology related to radio astronomy. The scientific work at Jodrell Bank was at the heart of a global collaborative network. In particular, several important technological developments such as very large paraboloidal dish telescopes and interferometer were developed at the Observatory, and were later influential in scientific endeavours in many parts of the world.

Criterion (iv): Jodrell Bank Observatory represents an outstanding example of a technological ensemble which illustrates a significant stage in human history (1940s-1960s) – the transition from optical astronomy to radio astronomy and the associated consequence for the understanding of the Universe through multi-wavelength astrophysics. The property is also associated with the peacetime development of ‘Big Science’ as a major change in the way in which scientific research was supported and undertaken. The surviving evidence at the property related to the evolutionary development of radio astronomy from the post-war pioneering phase through to sophisticated, large scale research activity in the field makes Jodrell Bank an outstanding example of such a technological ensemble.

Criterion (vi): Jodrell Bank Observatory is directly and tangibly associated with events and ideas of outstanding universal significance. The development of the new field of radio astronomy at the property led to a revolutionary understanding of the Universe which was only possible through research beyond the possibilities of optical astronomy to explore the electromagnetic spectrum beyond visible light. Understanding of the nature and scale of the Universe has been dramatically changed by research in radio astronomy at the Observatory.

## Integrity

The property retains all attributes that document its development as a site of pioneering astronomical research. Practically all stages of development from the very beginning, with improvised, re-used or borrowed equipment, onwards are represented by buildings, physical remains or in some cases archaeological remnants. Some important stages, such as represented by the large Transit Telescope, have not survived intact although traces remain. The later, large scale and far more ambitious instruments are still present at the property. This includes the iconic Lovell Telescope with its Control Building. The property also retains many quite modest structures which are, none the less, important for their research use, or which otherwise supported the work of the Observatory.

In general, all the structures are very well preserved and the property continues to be

dominated by the large scale Lovell Telescope and Mark II Telescope. However, several early wooden buildings have suffered from neglect and dis-use. Their restoration is to be undertaken. The grounds are well cared for. Recent buildings have a simple and subdued character, which do not detract from the overall appreciation of the property.

The Consultation zone, consultation zone of the property, protects the scientific capabilities of the Observatory from radio emissions in its vicinity, contributing to maintenance of the functional integrity of the property.

## Authenticity

The location of the property has continued unchanged, and the largely agricultural setting is essentially identical apart from the construction of the Square Kilometre Array building as part of the ongoing scientific use of the Observatory. The form and design has evolved through time reflecting the important development history of the property. This includes the somewhat improvised character of many structures indicative of the priority given to scientific research rather than the quality of buildings. Materials and substance have been mostly retained although there has been some replacement of deteriorated materials over time. The property retains its ongoing scientific use.

Protection and management requirements.

Most of the attributes of Jodrell Bank Observatory have been listed under the Planning (Listed Buildings and Conservation Areas) Act 1990. The two major telescopes have been listed in the highest category, Grade 1. There are some elements which have no listing at the present time, although they are managed for their heritage values as part of the property.

In addition, World Heritage inscription affords all attributes a protection status equivalent to the highest level or Grade 1, in accordance with the National Planning Policy Framework (2012) and the spatial planning system which operates through several pieces of legislation, including the Town and Country Planning Act 1990. Any changes to listed buildings require approval.

The consultation zone is based on the Jodrell Bank Radio Telescope Consultation Zone which has operated effectively to protect the Observatory for many decades. It was established by the Town and Country Planning (Jodrell Bank Radio Telescope) Direction 1973.

The property is managed by the UoM with a committee, the Jodrell Bank Site Governance Group responsible for coordination. This committee includes key internal stakeholders such as the three main site user groups. Each of the site user groups has its own well-developed and independent management and operational structures. Roles managing the heritage of the Observatory are integrated with the daily work of



the Jodrell Bank Centre for Astrophysics, responsible for scientific and engineering research, telescope operations and engineering, and the Jodrell Bank Discovery Centre which is responsible for visitor management and heritage coordination. These user groups are supported by other management groups within the University. The third site user group is the Square Kilometre Array Organisation, located just outside the property within the consultation zone but within the overall Observatory.

The management of the property is based on existing University structures, to be augmented by a WHS Steering Committee which will have oversight of the property and undertake coordination between the University, users and external stakeholders. The Conservation Management Plan (2016) provides an overview of the instruments and procedures for the effective management of the property. The plan, supplemented by an extensive Site Gazetteer, is currently being updated. The Observatory has a long experience with managing visitors. There is a current tourism management plan and enhanced presentation of the property is ongoing.

Recommends that the State Party give consideration to the following:

- Providing a summary end of project report following completion of the current major conservation project,
- Confirming the timeframe for the conservation of the two Botany Huts,
- Continuing to respect and portray the historical character of the buildings and site development. This character often includes relatively primitive buildings, often with additions undertaken with little regard to aesthetics or quality construction,
- Providing the revised Conservation Management Plan and associated Site Gazetteer when completed, to the World Heritage Centre,
- Considering masterplanning for the property and consultation zone to anticipate possible future development needs.



## 9. Appendix 3: Jodrell Bank Radio Telescope Direction 1971

THE TOWN AND COUNTRY PLANNING ACT 1971

THE TOWN AND COUNTRY PLANNING GENERAL DEVELOPMENT ORDER 1973

THE TOWN AND COUNTRY PLANNING (JODRELL BANK RADIO TELESCOPE) DIRECTION 1973

The Secretary of State for environment in exercise of the powers conferred on him by paragraph (1) of Article 10 and paragraph (3) of Article 13 of the town and country planning general development order 1973 hereby directs as follows:-

### Definitions

'The map' Means a map certified by the Secretary of State to be the map for the purposes of this Direction.

'The radio telescope' means the laboratories, radio telescopes and associated equipment of the Victoria UoM, which are together known as the Nuffield Radio Astronomy Laboratories and are situated at Jodrell Bank in the Parishes of Withington and Goostrey in the County of Chester.

'The inner zone' means the area around the radio telescope which is cross hatched on the map.

'The outer zone' means the area around the telescope which is hatch to vertically on the map.

'The University' means the Victoria UoM.

Any other expressions of the meanings assigned to them by virtue of the Town and Country Planning Act 1971.

### Requirement to Consult

The local planning authority shall consult with the University before granting planning permission on: -

Any application for development within the inner zone (subject to the exception specified in the First Schedule hereto).

Any application for development within the outer zone (subject to the exceptions specified in the First and Second Schedules hereto).

### Determination of Applications

Where the local planning authority are disposed to grant consent to an application contrary to the views expressed by the University, they shall not do so within a period of 21 days from the date on which they notify the University of their intention to grant permission.

Dated this 6th day of April

1973

SJ heritage

Authorised by the Secretary of State to sign in that behalf

### THE FIRST SCHEDULE

Planning applications in respect of which consultation is not required with the University in the inner zone:-

The re-building for the same use on the same or substantially the same site of any building which is in use otherwise than in breach of planning control on the date of the application, provided the cubic content of the new building is not increased and the area of land occupied by the new building does not exceed the area of land occupied by the existing building.

The re-building on the same or substantially the same site of any dwelling house which is in the use as such on the date of the application and the enlargement improvement or other alteration of any dwelling house which is in use as such on the date of application, so long as in either case the cubic content of the original dwelling house (as ascertained by external measurement) is not exceeded by more than 914 cubic metres or 30%, whichever is the greater, provided that the erection of a garage within the curtilage of a dwelling house shall be treated as the enlargement of the dwelling house for the purposes of this direction.

An application for the erection of a single dwelling house or the conversion of a building or buildings to form a single dwelling house where the terms of the application are such that if it is granted the dwelling house will be occupied by a person employed locally in agriculture.

The formation, laying out or widening of a means of access.

The erection, construction, improvement or other alteration of gates, fences, walls, or other means of enclosure.

### THE SECOND SCHEDULE

Planning applications in respect of which consultation is not required with the University in the outer zone.

(A) Any application which involves:

The erection, enlargement or other alteration of a building or buildings for use as not more than one dwelling house, provided that the erection of a garage within the curtilage of a dwelling house shall be treated as the enlargement of the dwelling house for the purposes of this direction;

Operations in connexion with the conversion of a single dwelling house for use as not more than two dwelling houses;

The erection, enlargement, or other alteration of buildings to be used for or in connexion with any of the following purposes: -

A single shop, the sales area of which is to be confined to the ground floor provided the gross floor area of the building does not exceed 610 square metres;

A medical or dental surgery, health centre or office, provided that each building of such types is not more than two storeys in height and the gross floor area of the building does not exceed 610 square metres;

Any application for development in relation to which either before or after the coming into force of this direction the local planning authority have consulted with the University on the question of whether such land should be developed and upon such consultation the University have informed the local planning authority in writing they have no objection to such development provided that this exception shall not apply where the proposal materially differs from that disclosed to the University when such consultation took place.

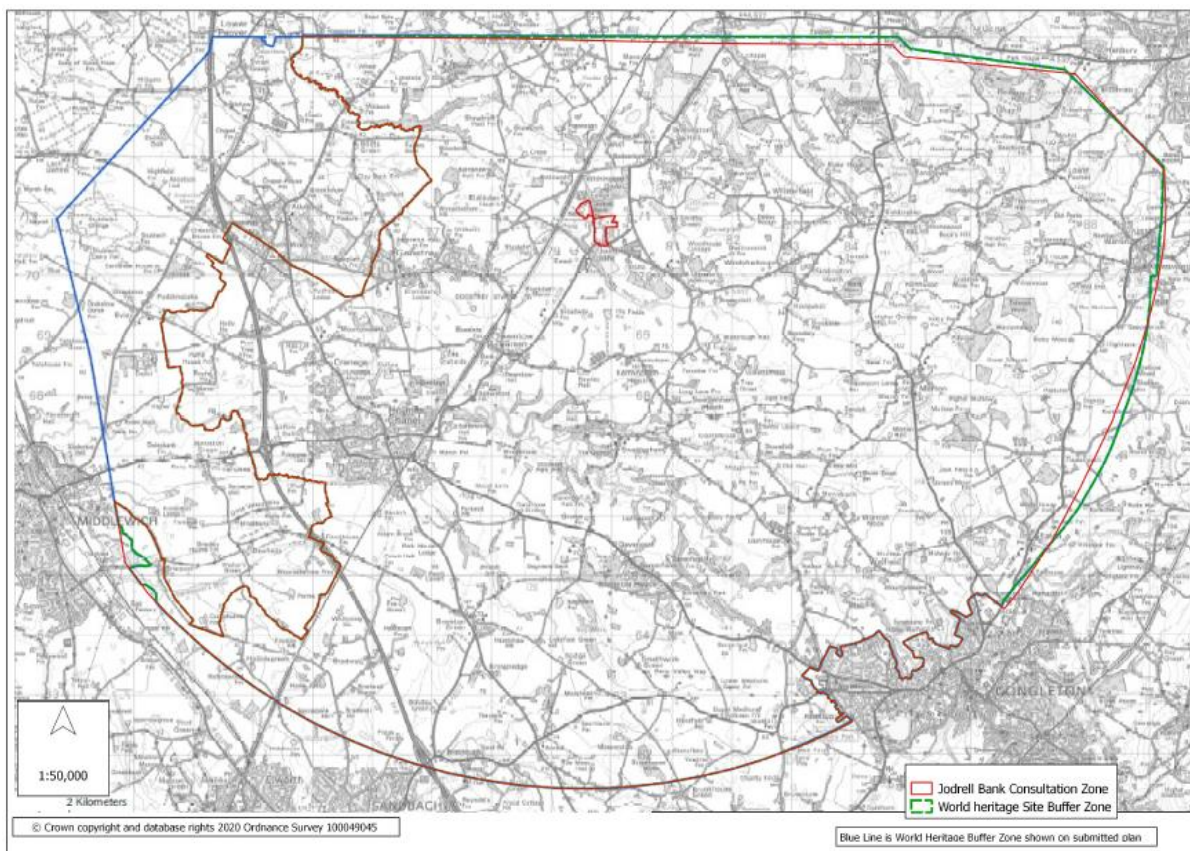
15.25 (B) Applications in respect of development by change of use:-

The change in use of a building or buildings to use as not more than one dwelling house and the change in use of a single dwelling house to use as not more than two dwelling houses;

The change in use of a building or buildings to use for or in connexion with any of the purposes specified in paragraph A3 of this schedule (subject to the limitations and other provisions contained in the said paragraph).

# 10. Appendix 4: Conservation Management Plan

# 11. Appendix 5: Defined JBO Consultation Zone



## 12. Appendix 6: Schedule of Relevant Appeal Decisions

- 12.1 Land Off Main Road, Goostrey. Planning Appeal Reference: [APP/R0660/W/15/312954](#). Appeal dismissed.
- 12.2 Brickbank Farm, Boothbed Lane, Goostrey. Planning Appeal Reference [APP/R0660/W/21/3267030](#). Appeal dismissed.
- 12.3 Rose Bank, Twemlow Lane, Cranage, Crewe CW4 8E. Planning Appeal Reference: [APP/R0660/W/19/3224057](#). Appeal dismissed.
- 12.4 Over Peover Methodist Church, Cinder Lane, Over Peover. Planning Appeal Reference: [APP/R0660/W/19/3226479](#). Appeal dismissed.
- 12.5 Macclesfield Road, Holmes Chapel. Planning Appeal Reference: [APP/R0660/W/18/3214286](#). Appeal dismissed.
- 12.6 Maintenance Shed at the Coach House, Peover Lane, Chelford. Planning Appeal Reference: [APP/R0660/W/18/3204248](#). Appeal dismissed.
- 12.7 Coachman's Cottage, Macclesfield Road, Jodrell Bank. Planning Appeal Reference: Appeal Ref: [APP/R0660/W/18/3206533](#). Appeal dismissed.
- 12.8 Crossmere Farm, Davenport Lane, Brereton Heath. Planning Appeal Reference: Appeal Ref: [APP/R0660/W/18/3202847](#). Appeal dismissed.
- 12.9 Moss Nook, Moss Lane, Brereton Heath. Planning Appeal Reference: Appeal Ref: [APP/R0660/W/18/3206467](#). Appeal allowed.
- 12.10 51 Main Road, Goostrey. Planning Appeal Reference: Appeal Ref: [APP/R0660/W/18/3218817](#). Appeal dismissed.

# 13. Appendix 7: Example Methodology

## Introduction

- 1.1 This document sets out the University of Manchester's further representations in accordance with Part 2 of the Town and Country Planning Act 2009 to the Appeal Statement submitted by Fisher German LLP on behalf of Mr Boffey following the refusal of Application 20/2250C by Cheshire East Council.
- 1.2 The further representations will address the impact of the proposed development on the operations of the Jodrell Bank Radio Telescope and demonstrate how that impact impairs the efficiency of the Radio Telescope.
- 1.3 Policy PS10 of the Congleton Borough Local Plan and SE14 of the Cheshire East Local Plan Strategy require consideration to be given to development that can be shown to impair the efficiency of the Jodrell Bank Radio Telescope.

## Summary

- 2.1 Radio astronomy provides a unique view of the Universe, often revealing material that cannot be detected by telescopes operating at visible or other wavelengths, looking into the most highly obscured parts of galaxies, and routinely producing images at higher resolution than any other telescopes. However, unlike any other type of astronomy, the 'light pollution' which affects radio telescopes in the form of radio transmissions and unwanted radio noise, is very powerful and all-pervasive. The future of radio astronomy relies on simultaneously maintaining the continued regulatory protection of key frequency bands, continued protection of radio telescope sites from the build-up of activity which generates uncontrolled radio interference, and continual development of radio astronomy techniques to distinguish between cosmic and terrestrial signals.
- 2.2 Jodrell Bank Observatory (JBO) is the UK's primary radio astronomy facility, operated and maintained by the University of Manchester and the UK Science and Technology Facilities Council (STFC) as part of the Jodrell Bank Centre for Astrophysics (JBCA). The 76-m Lovell Telescope is still the third largest steerable radio telescope in the world and, thanks to major upgrades, it is more capable than ever before. It is one of the most productive radio telescopes in terms of pulsar research and has produced the longest database of pulsar timing observations in the world – a unique resource which makes current observations even more valuable. Pulsar timing is the most important and internationally significant research programme carried out by the Lovell Telescope as a single telescope and has the potential for breakthroughs in fundamental physics.
- 2.3 The Lovell Telescope and other JBO telescopes are used by hundreds of research astronomers from the UK and around the world, including almost all UK university astrophysics research groups. Jodrell Bank radio telescopes are used

as part of international networks which combine signals from all of the largest radio telescopes in Europe and around the world. JBCA carries out world-class research in many of the key science topics of modern astrophysics and also has a vital and well-established role in communicating that science to the general public through the Jodrell Bank Discovery Centre. Its contributions throughout the development of radio astronomy as a technique and a new branch of science are unrivalled in the world. Continued investment in JBO has maintained its world-class status and further major investment is being made now to guarantee its future scientific competitiveness for the next 20 years or more. This combination of an unequalled heritage, world-class science, public engagement and ongoing development underlie the decision to host the headquarters of the International Square Kilometre Array at Jodrell Bank with the full support of UK government.

- 2.4 National bodies which administer the use of the radio spectrum (Ofcom in the UK) protect key frequency bands for radio astronomers and respect internationally recognized definitions of the levels at which interference into these bands causes harm to radio astronomy. However, the unintentional emission of radio signals by domestic or industrial equipment is not controlled by the spectrum allocation process and such equipment can and does cause interference in frequency bands used for radio astronomy. This interference is already causing artifacts and distortions in radio images and spectra, may mimic astronomical sources, and will add a component of variable noise to timing measurements of pulsars or radio images of objects. For JBO the perturbation to timing measurements of pulsars is of the greatest concern, since this is such an important and internationally significant research programme and because these measurements can be degraded and corrupted in an irrevocable manner by interference, especially the type of sporadic broad-band interference caused by domestic and industrial equipment.
- 2.5 The methodology for the assessment of radio interference is based on the procedure established in the case of the appeal by Gladman Developments for a site in Goostrey (APP/R06609/W/15/3129954). This appeal was dismissed by the Secretary of State and in paragraph 15 of the decision he says that the methodology to predict interference was reasonable. The same methodology was accepted at the inquiry for the appeal by Henderson Homes (APP/R0660/W/16/3166025) for a development of 6 homes on an adjacent site.
- 2.6 Detailed modelling, also accepted in these previous appeals, uses a carefully constructed map of the degree to which signals reaching the Lovell Telescope from any location in the NW are attenuated by the combination of distance and intervening terrain. By combining this map with the distribution of buildings and population density data, the relative contributions to interference received at the Lovell Telescope can be predicated as a function of distance and direction. This work confirms that the dominant contributions are expected to come from local settlements rather than larger more distant conurbations. Whilst additional interference from small scale development may appear small, it nonetheless



represents a further impairment to the efficiency of the telescope, involving a breach of the international threshold for harmful interference. It is also important to place this type of assessment in its proper context, which is that it is a further degradation relative to existing levels of interference which are already impairing the efficiency of the telescope and affecting the work carried out at Jodrell Bank.

## **Policy protection for radio astronomy**

- 3.1 Some radio astronomy observatories (notably Green Bank in the US and the SKA sites in Australia and South Africa) have defined 'radio quiet zones' surrounding the observatories within which there is legislative control on radio transmission and sources of radio interference. The ITU report ITU-R RA.2259 'Characteristics of Radio Quiet Zones' contains more details and examples.
- 3.2 There is no such radio quiet zone in the UK and instead JBO has relied on the consultation process established in the 1973 Article 11 Direction to the Town and Planning Act 1971 to safeguard its radio frequency environment by reviewing planning applications within a defined consultation zone.
- 3.3 The relevant planning policy statement is SE14 in the Cheshire East Local Plan Strategy: 'Within the Jodrell Bank radio telescope consultation zone, as defined on the proposals map and inset maps, development will not be permitted if it (i) impairs the efficiency of the telescopes; or (ii) has an adverse impact on the historic environment and visual landscape setting of the Jodrell Bank Radio Telescope.' The Congleton and Macclesfield Borough Local Plans contains a similar policy, PS10/GC14.
- 3.4 Below we explain the relevant recommendation of the International Telecommunications Union (ITU) which defines the level of interference which should be considered as detrimental to radio astronomy observations. This is the only internationally recognized standard for interference thresholds in radio astronomy and is widely used by national administrations including the UK when dealing with frequency allocations. In his decision on the appeals by Gladman Developments, the Secretary of State relied upon this ITU benchmark when assessing whether the proposals in that case complied with policy PS10 (now SE14), as did the Inspector in dismissing other recent appeals.

## **Impact of radio interference on radio astronomy operations at Jodrell Bank**

### **4.1 General Remarks**

- 4.2 In almost all cases the radio signals emitted by astrophysical phenomena are noise-like and extremely weak. Unlike communications systems, the signals being sought are typically a hundred to a million times lower than the internal noise generated by the receiver on the telescope even with the very best receiver designs cooled to a few degrees above absolute zero. Radio astronomers can work successfully in this low signal-to-noise (S/N) regime because they can

measure the average properties of the signal over long periods or across large bandwidths in order to detect small changes in the total noise level. Interfering signals can be much more powerful than the radio astronomy signal and disrupt this process.

- 4.3 Interference manifests itself in many different ways depending on its strength and how it is distributed in time and frequency. It causes artifacts and distortions in images and spectra; it may mimic astronomical sources such as emission at a particular frequency or a newly discovered type of transient source; it may add a component of variable noise to timing measurements of pulsars or radio brightness measurements of individual objects.

#### **4.4 Impacts on Jodrell Bank Radio Telescopes**

- 4.5 For the Lovell Telescope at JBO, the perturbations to precision timing measurements of pulsars is the most significant concern for the following reasons:

- 4.5.1 this is the most important and internationally significant research programme carried out by the Lovell Telescope as a single dish and has the greatest potential for breakthroughs in fundamental physics;

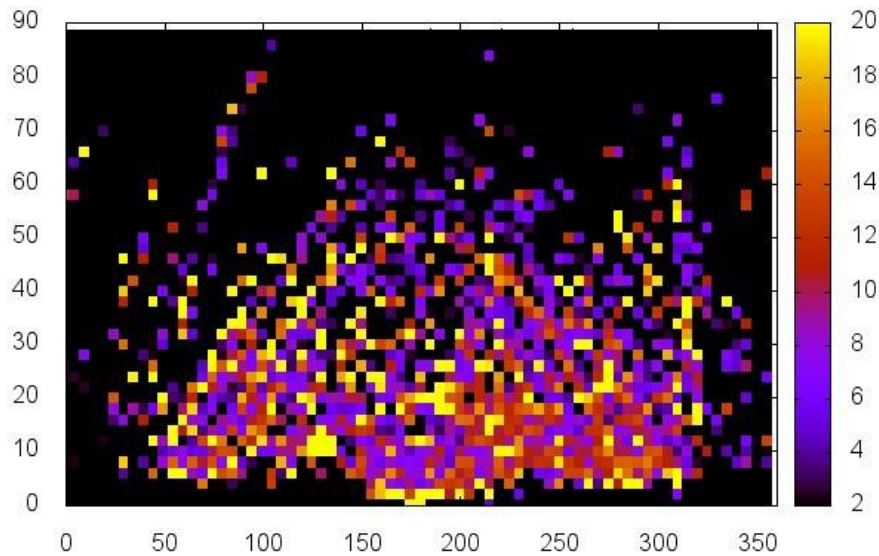
- 4.5.2 this programme relies on continuing to make the most precise timing measurements possible at regular intervals over the coming years and making use of the data gathered over the last 40 years;

- 4.5.3 these measurements can be degraded and corrupted in an irrevocable manner by interference, especially the type of sporadic broad-band interference caused by domestic and industrial equipment.

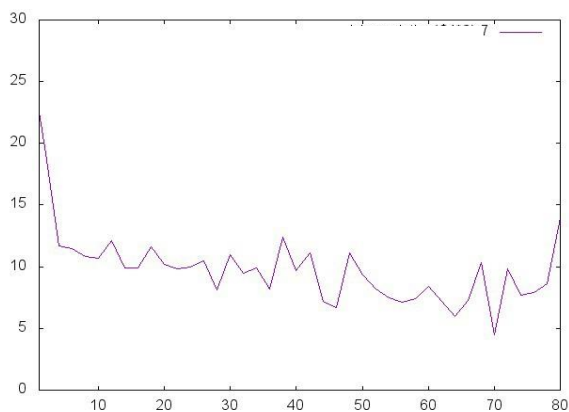
- 4.6 Strong interfering signals can sometimes be recognized as such and removed from the observation by deleting data for particular periods of time, or for certain frequency ranges, or both. However valuable data are then lost and the efficiency of the telescope operation is reduced. But more importantly key features of the data in the frequency or time domain may be missed.

- 4.7 Analysis of recent pulsar observations show that on average 10.4% of data are completely discarded due to the presence of broad-band (usually impulsive) interference and that this fraction increases to 22% at the lowest elevations when the telescope is pointed more closely towards terrestrial sources of interference. These are only the minority of the more powerful bursts of sporadic interference, each of which is easily visible.

4.8 The 10-20% of data that are deleted are only the most extreme examples and it is the much larger number of less powerful (but still above the ITU threshold) instances buried in the data which can have the greater effect. These data will have been corrupted in a way which cannot be corrected.



**Figure 1** distribution of the fraction of JBO pulsar data completely discarded due to interference in the time domain. Horizontal is azimuth (compass bearing from JBO), vertical is elevation (angle above the horizon), colour scale runs from 0 to 20% deletion. Individual pixels are 5dg (az) x 2 dg (el) and only pixels with more than 100 sub-integrations are plotted. The black areas are mostly where there are no data rather than a low fraction of deletion.



*Figure 2: Plot of the percentage of Lovell pulsar data deleted at different telescope elevations*

- 4.9 Interference at a level which is not so strong that it is easily recognized but is comparable to the noise is hard to deal with and severely affects the results of an experiment or measurement. Almost all observations and experiments already involve some form of optimal filter designed to maximize the response to the particular objective while minimizing the response to interference and noise. Such optimal filters work best for highly targeted experiments such as timing a particular pulsar and have much less advantage when carrying out a survey or search for new objects or unexpected phenomena. The fact that pulsar searches can no longer and are no longer carried out at Jodrell Bank, is an example of where particular projects become completely unfeasible because of interference. The loss of such capability is a significant impact on the efficient operation of the telescope.
- 4.10 In many cases interference can have similar characteristics to the signals which are being sought, which can be very difficult to deal with. Examples include: all repetitive interference with periods of milliseconds to seconds will mimic pulsars; all narrow-band interference can mimic spectral line emission from different molecules.
- 4.11 Any impulsive interference which is not removed from observations of pulsars will degrade the accuracy with which the pulse arrival times can be measured. All of the pulsar observations with the Lovell Telescope, which account most of the observations made by the telescope when operating as a single dish are aimed at timing measurements. These timing measurements are the basis of one of the most significant research projects carried out by the telescope: the understanding of pulsar timing behaviour is essential to the search for gravitational waves and testing general relativity for example. Although much effort is put into removing the obvious impulsive interference events there are inevitably a large number which are below a recognition threshold but which collectively perturb the accurate determination of the pulse arrival times. Figure 3 shows a typical example of how impulsive interference can affect a pulsar timing observation. Many of the interference bursts are brighter than the pulsar signal but they often lie on top of the pulsar signal and distort the timing measurement; the larger number of fainter bursts further distort the measurement. This impact on the most important research carried out by the telescope is a reduction in the efficiency of the telescope in terms of its ability to receive radio emissions from space with a minimum of interference from electrical equipment.

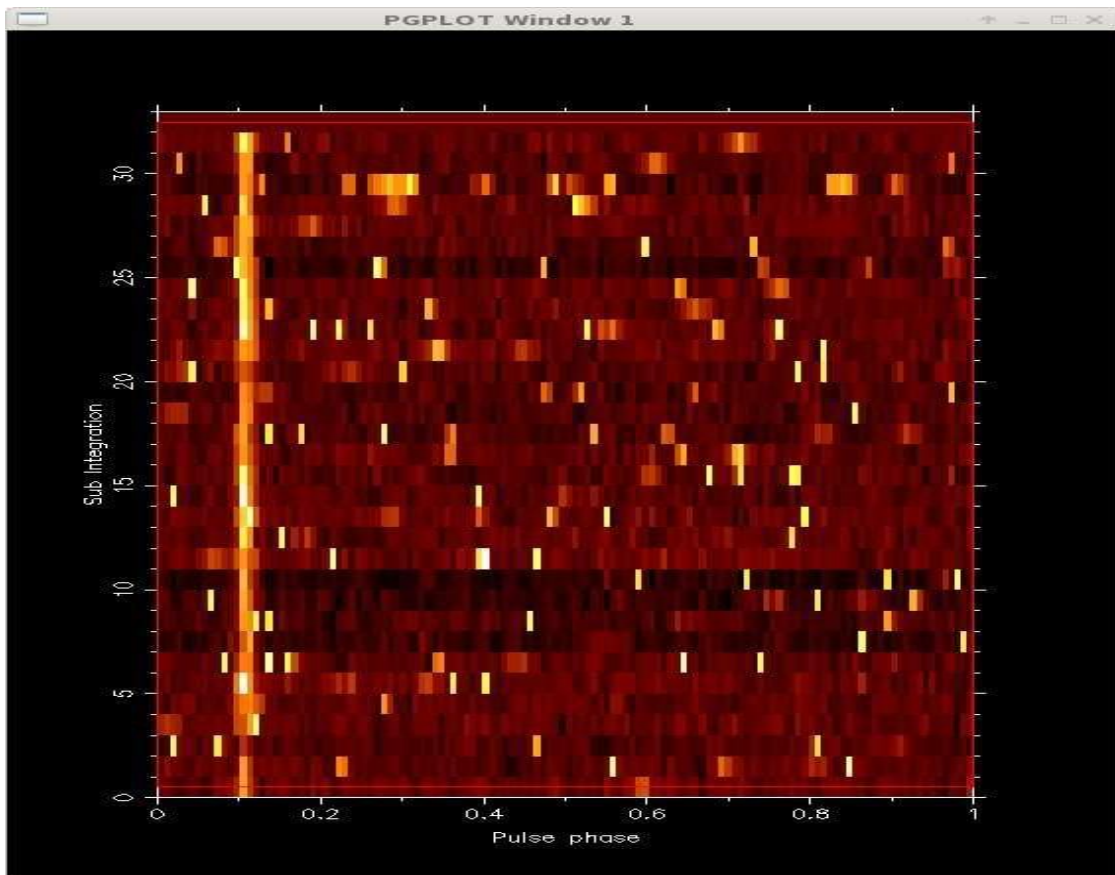


Figure 3 Typical example of sporadic interference in recent JBO pulsar observations. Each row in the plot represents 10 second of data which have been folded at the pulsar period so that the pulsar itself is visible as the faint continuous vertical line from top to bottom. Every 10 sec sub-integration contains sporadic interference at a range of strengths. There will also be many bursts below the level which is easily seen in this plot. Because the data have been folded, individual bursts are in fact reduced in strength in this plot. There are many examples where the bursts lie on top of the pulse itself and hence distort any attempt to measure the pulse arrival time. These data are for the protected band 1400-1427 MHz only and were taken at 20:55 06 May 2016, with the telescope at an elevation of 42 degrees. The pulsar is B1530+27 which has a period of 1.125s and a dispersion measure of  $15 \text{ pc.cm}^{-3}$

4.12 There are also examples of interference mimicking astronomical signals very closely indeed. There is currently great interest in the phenomena of Fast Radio Bursts (FRBs), single broad-band bursts of radio emission lasting only a few milliseconds. Their confirmation and the demonstration that they originate beyond our Galaxy by Jodrell Bank researcher Dan Thornton is one of the most intriguing discoveries in astronomy over the last decade. The physical origin of these bursts is still unclear and they were a completely unexpected phenomenon after decades of observations which could in principle have detected them. It is now estimated that easily detectable FRBs occur at the rate of 10,000 every day across the entire sky. So far more than a hundred have been detected: they are so hard to find simply because the beam of a large telescope is so narrow (about 0.16 degrees for the Lovell Telescope at 1420 MHz) that it looks at less than one millionth of the area of the whole sky at any one time. These intriguing phenomena have been detectable for decades in principle and such individual bright spikes may well have been removed as likely interference in the past. Since

they are such fleeting events it is very difficult to pin down where they come from, although a few repeating FRBs have now been localised in external galaxies; their true nature remains a mystery. In searching for FRBs a related class of objects was found by the Parkes Telescope in Australia with the characteristic frequency sweep of an FRB. They were eventually traced to a microwave oven near the telescope. The frequency sweep occurs only when the oven door is opened during operation and in the instant of shutting down this causes radio emission which sweeps in frequency through the radio astronomy band. The degree with which they match the FRB signals is remarkable and the story of perytons is a key example of how difficult it can be to distinguish terrestrial and cosmic signals even in cases where the cosmic signals have a very distinctive characteristic, which had been thought unique.

## **ITU Definition of harmful interference for radio-astronomy**

- 5.1 The International Telecommunications Union defines the level of interference which should be considered as detrimental to radio astronomy measurements as 10% of the measurement error of radio power due to system noise (receiver, atmosphere etc.) alone. The basis and calculations for this are set out in the ITU Recommendation ITU- RA.769-2 (which has its basis in the annex of the CCIR Report 224-1 1966).
- 5.2 Recommendation ITU-R RA.769-2 is the only internationally recognized standard for interference thresholds across the spectral bands used for radio astronomy currently in force and is widely used by national administrations when dealing with frequency allocation and protection for radio astronomy. It is referred to by the Radio Regulations, a treaty to which participating administrations are signatories.
- 5.3 In the UK the protection of spectrum for radio astronomy is administered by Ofcom via grants of Recognized Spectrum Access (RSA) to the relevant research council (Science and Technology Facilities Council – STFC) under section 18 of the Wireless Telegraphy Act (2006).
- 5.4 The recognized maximum levels of interference for a number of frequency bands between 150 MHz and 31 GHz is specified in schedules 1 and 2 of the RSA Grant and these maximum allowable levels of interference ('Spectrum quality benchmarks') are taken directly from ITU-R RA.769.
- 5.5 At the European level, RA.769-2 is the basis of the recent ECC Decision (09)02 on interference caused by the Iridium satellite system to radio astronomy.
- 5.6 In practical terms, the ITU threshold can be understood as follows. Over decades

radio astronomers have strived to reduce the intrinsic (thermal) noise in the receivers they use, using cryogenic cooling (typically to -260C) and sophisticated semiconductor technologies (e.g. Indium Phosphide high electron mobility transistors – HEMTs). Each incremental increase in performance is hard won. The ITU recommendation simply says that interference should not contribute an additional component of variation which is more than 10% of this intrinsic thermal noise (including the irreducible noise from the atmosphere etc.). The fiducial example used for the ITU recommendation is a measurement of the brightness of a radio source: such measurements are still done to monitor the variability of quasars on a regular basis. The receiver noise introduces a scatter in these measurements. If the receiver system and telescope are well understood and accurately characterized, it would be possible to say with some confidence whether the observed scatter were greater than that expected due to intrinsic noise. The ITU threshold is such that interference should not increase this observed scatter by more than 10% of its intrinsic amount.

## **Demonstration that the proposed development will lead to harmful levels of interference to the Jodrell Bank radio telescope**

### **6.1 Methodology**

6.2 Below is set out the methodology to assess the extent to which a proposed development would lead to harmful interference when measured against the ITU threshold described above. This method is the same as that accepted by the Secretary of State and the Inspector in the recent appeal by Gladman Developments APP/R0660/W/15/312954) and by the Inspectors in the appeals by Henderson Homes (APP/R0660/W/16/3166025) and Mr N Barrett (APP/R0660/W/18/3197429) all of which were dismissed.

6.3 Having established the likely radio emission from domestic appliances and electronic equipment from the CISPR standards and the level of harmful interference for radio telescopes from ITU-R RA.769-2 it is possible to calculate a value for the coupling loss (between the equipment and the telescope) below which one or more pieces of equipment will cause harmful interference and hence impair the efficient operation of the telescope. This method is similar to that described by Jessner in the context of interference by industrial equipment (using the CISPR 11 standard) and is the basis of interference evaluation for the Square Kilometre Array.

### **6.4 Analysis**

6.5 The following paragraphs first set out the attenuation required to avoid harmful interference for a single piece of domestic equipment (considering both narrow and broad band emission). This is known as the minimum coupling loss (MCL).

Secondly, it is necessary to consider attenuation required taking into account the aggregated emission from all the appliances in a single dwelling or group of dwellings. This is supported by an independent estimate based on published values of ambient man-made radio noise. Thirdly, the expected attenuation or loss between the equipment and the Lovell Telescope estimated using the ITU recommended model, with appropriate allowances made for additional attenuation by the walls of the dwelling and local 'clutter' (trees, other buildings) in a village environment. Fourthly and finally, this estimated path loss, taking all these into account is compared to the minimum loss required to avoid harmful interference, to provide an estimate of the extent to which the ITU threshold is breached. These steps are set out in detail below but in summary it is found that the proposed development would itself cause radio interference at or above the level of the ITU threshold and hence cause harmful interference to the Jodrell Bank radio telescopes.

## 6.6 Estimate of Minimum Coupling Loss for a single appliance

6.7 The table below shows the minimum coupling loss (MCL) for a single appliance or device radiating at the CISPR14 or CISPR 22 level for the case of broad band and narrow band emission. In the broad band case it is assumed that the emission is constant across the 1400-1427 MHz radio astronomy band and the continuum threshold from RA.769-2 is used. In the narrow band case, the emission is confined to the 20 kHz line width specified in RA.769-2 and the appropriate spectral line threshold is used. In general domestic appliances including washing machines, cookers, fridges, hairdryers etc. under CISPR 14 are more likely to be broad band emitters while IT equipment including tablets, games machines, digital entertainment equipment etc. are more likely to be narrow band emitters (related to processor clock signals). Hence a reasonable value of the MCL per device in both cases is -145 dB.

6.8 Table 1: Field strength values in CISPR 14 and 22 and derived minimum coupling loss to meet RA.769-2 limit of harmful interference to radio astronomy observations.

	Field strength dBuV/m	Bandwidth MHz	EIRP (dBW)	RA.769 threshold (dBW)	MCL (dB)
CISPR 14	42	27	-60	-205	-145
CISPR 14	42	0.02	-83	-220	-138
CISPR 22	50	27	-61	-205	-144
CISPR 22	50	0.02	-75	-220	-145



## 6.9 Estimate of MCL for aggregated emission

6.10 There are likely to be many appliances of both types in each house and potentially more than a hundred appliances in a development of 6 houses. A typical house inventory might include 10-30 domestic appliances/tools (CISPR 14) and 5-10 IT devices. To estimate an overall aggregation factor is difficult and depends on the usage of each device and appliance. Some appliances are in continual use but their motors/heaters may only operate intermittently with a duty cycle of approx. 20-50% (e.g. fridges); others are used for anything between 1% and 20% of the time (TV, cooking appliances, dishwashers etc.). An approximate estimate can be made from the typical UK domestic electricity consumption (2014) of 0.45 kW in the following categories<sup>2</sup>:

6.11 Table 2: Breakdown of domestic energy use by appliance category and estimate of average usage of appliances

Category	Percentage	kW	Typical kW/device	Equivalent number in continuous
Computing/electronics	34%	0.15	0.05	3
Cooking	17%	0.08	2	0.04
Light	14%	0.06	0.015	4
Cold	16%	0.07	0.2	0.4
Washing	19%	0.08	0.75	0.1

6.12 In the analysis below, an average broadband transmission power of -60 dBW inside each house is assumed, equivalent to a single IT/entertainment appliance (CISPR22), recognizing that this may be made up of multiple lower power devices or a single more powerful device for a fraction of the time. This may well be a conservative estimate: even the appellant's technical expert (Dr Roberto Trotta) at the Gladman inquiry for 119 houses in Goostrey gave a range of aggregation factors of between 3 and 15 continuous devices at this power level, with 10 being the 'typical' value.

6.13 An entirely independent estimate of the per capita transmission power can be made using published data on ambient man-made radio noise (e.g. ITU-R P.372;

<sup>2</sup> The total and category consumption data are from the Department of Energy & Climate Change report 'Energy Consumption in the UK (2015)'

Ofcom Study AY4113). Using a Monte Carlo analysis, the per capita interference power for residential areas at a population density<sup>4</sup> of 320/sq km is -75 dBW at 1413 MHz in a 27 MHz band. Taking into account attenuation by buildings (see below) this is consistent with the value derived in 5.5. Estimate of expected path loss between proposed development and the Lovell Telescope at Jodrell Bank

6.14 The expected coupling loss between equipment at the location of the proposed development can be estimated using a propagation model together with some additional allowances. The appropriate model is the ITU recommendation ITU-R P.452 'Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz'. This is the internationally accepted propagation model for the purpose of interference assessment used in the communications sector. This method includes a complementary set of propagation models which ensure that the predictions embrace all the significant interference propagation mechanisms that can arise. It incorporates a calculation of diffraction along the specified terrain profile between the transmitter and receiver as well as statistical treatments of effects for longer paths (>100km) including tropospheric scattering and anomalous propagation including surface ducting, elevated layer reflection and refraction. Specifications for typical local clutter in different environments and the associated height-gain variations are included. The basic input parameters used in this case were as follows:

6.15 Table 3: Parameters used in ITU-R P.452 propagation model

Parameter	Value	Comments (see also comments in text)
Frequency (f)	1.42 GHz	Key protected band for radio astronomy and most common observing frequency for Lovell Telescope
Required time percentage (p)	50%	Applies to statistical estimates for anomalous propagation. Specifies the probability that the loss is less than the estimated value. Typically this is <10% for protection against interference.
Station positions		Specified through terrain profiles

<sup>3</sup> Wagstaff A and Merricks, N (2005) IEE Proc.-Commun.,152, 371 / Work done in conjunction with Dr A Jessner (MPIfR Bonn, Germany)

<sup>4</sup> The average population density for Cheshire East, which we take to be a representative rural area is 3.21/ha using data from the 2011 Census.

Antenna gains	0,0 dBi	Assume omnidirectional antenna patterns for both transmitter and receiver. This is the default for ITU-R 769
Transmitter height	3m	Average between 1st and 2nd floor.
Receiver height	63m	Representative Lovell Telescope focus height
Average year/worst month	Average year	The propagation models predict the annual distribution of basic transmission loss.
Refractive index lapse rate ( $\Delta N$ )	45 units/km	N- Estimated for UK from ITU P-452-14 fig 11
Surface refractivity $N_0$	328 units	N- Estimated for UK from ITU P-452-14 fig 11

6.16 An additional allowance must be made for propagation loss through the walls of the houses (for indoor equipment). A recent Ofcom report on 'Building Materials and Propagation' (Ofcom 2014) presents results from a significant measurement campaign on representative small modern houses including those with metalised windows and foil-backed- plasterboard which are reasonable low-cost radio frequency shielding techniques. The typical wall attenuation values with these measured are 15-20 dB at 1.4 GHz.

6.17 Estimate of interference from the proposed development compared to the ITU threshold

6.18 The expected strength of the total interference signal from the proposed development compared to the accepted ITU definition of harmful interference can now be estimated based on the following assumptions:

6.19 The existence of dozens of individual appliances of different types with different usage patterns equivalent to one CISPR 22 device per household in continuous use; A total path loss from the appliances of 106 +20 (building) + 15 (clutter) = 141 dB; A minimum coupling loss of 145 dB in order to meet RA.769-2 for a single appliance or device in either the broad or narrow band case;

6.20 No effective directivity (gain) in either the source of interference or from the

radio telescope and its receiver.

6.21 With the assumptions made above, the total interference signal from the proposed development received at the telescope would exceed the RA.769- 2 threshold for harmful interference by 4 dB i.e. a factor of 2.5 for a single dwelling. Following the comments at the end of 5.5 this is likely to be a conservative estimate and there is every chance that the ITU benchmark could be regularly exceeded, not just by the use of multiple devices but also by the use of outdoor devices, or those which exceed the CISPR levels. This constitutes impairment of the efficient operation of the Jodrell Bank radio telescope, which is highly relevant even before the cumulative impact of existing development around JBO is taken into account.

## **Conclusion**

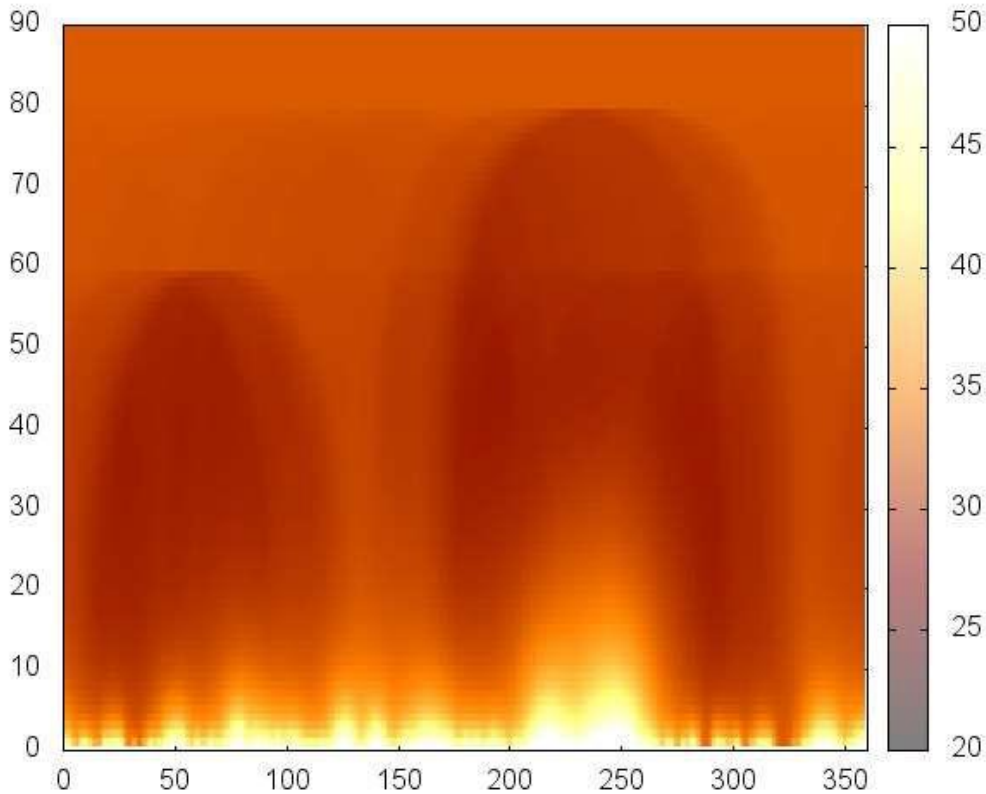
7.1 The University of Manchester concludes that the proposed development would impair the efficient operation of the Jodrell Bank radio telescope for the following reasons:

7.2 the proposed development in itself is predicted to produce levels of interference exceeding the ITU threshold for harmful interference to radio astronomy;

7.3 the consequent interference would cause an unwanted perturbation of sensitive radio astronomy measurements, including additional measurement error, irrecoverable loss of some data, potentially at key times and at key frequencies, and a requirement to extend or repeat observations in an attempt to make up for lost data.

7.4 Modeling the interference contributions from the wider area. The conclusions above are based on the contributions from the proposed development alone. In this section, the contribution from the proposed development is assessed in the context of the likely emission from all properties in the Jodrell Bank Consultation Zone, and then all buildings in an area extending to 40km radius from JBO.

7.5 Sky maps of the expected interference received by the Lovell Telescope were produced using the antenna sensitivity pattern specified in ITU-R SA.509 and including individual residential buildings across the Jodrell Bank Consultation Zone together with the high resolution loss map. Each building was assigned an emission power as above. The sky map is shown in Figure 6.



**Figure 6 sky map of predicted interference from all residential properties within the JB Consultation zone**

- 7.6 The analysis shows that local developments such as Goostrey and Holmes Chapel (azimuth range 215-255 degrees) are evident features when houses within the consultation zone are included in the model.
- 7.7 The analysis of the 100x100km area around JBO also shows that even when much larger areas are considered, local settlements of Holmes Chapel and Goostrey remain a major contribution due to their proximity.
- 7.8 The conclusion that the dominant contributions are expected to come from nearby relatively small settlements rather than larger more distant conurbations does not substantially change whether the contributions to interference are calculated based on building area or on detailed population density information obtained from the 2011 Census.
- 7.9 Both these analyses show that in the direction of the proposed development the existing residential development is likely to produce interference which already exceeds the ITU threshold by a large factor (>1000). The University of Manchester does not dispute this – it is why observations at JBO are already significantly challenged. The University also accepts that the fractional increase in interference due to this individual proposed development will also be relatively

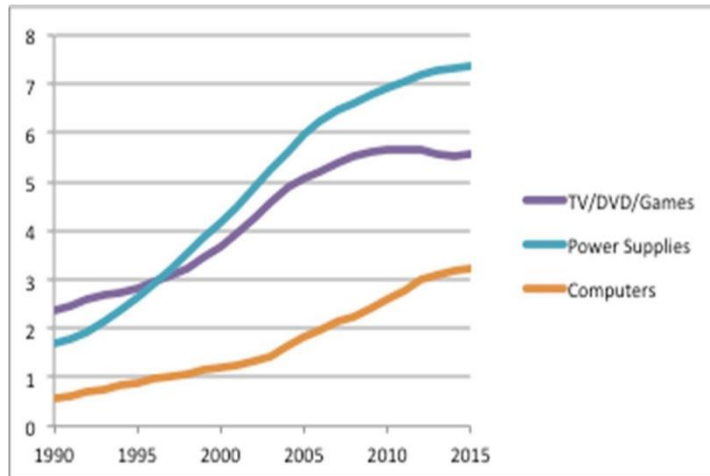
small (because of the large existing level). However, the fact remains that the proposed development will contribute a significant amount of interference, exceeding the accepted ITU definition of harmful interference to radio astronomy. It is also important to place it in its proper context, which is that it is a further degradation relative to existing levels of interference which are already impairing the efficiency of the telescope and affecting the work carried out at Jodrell Bank. Allowing this scheme would create an ever-worsening baseline of interference against which it would be difficult to control future development which also breached the international threshold.

## **Interference Mitigation**

- 8.1 Mitigation measures to reduce the impact of interference to radio astronomy are possible and may be useful in certain cases. These measures include control of activities likely to cause interference; installation of shielding to reduce the level of signals emitted; and techniques used in observing and processing radio astronomy data.
- 8.2 Control measures in place at Jodrell Bank Observatory include restrictions on the use of radio transmitters, mobile phones and Wi-Fi; testing of radio frequency emission from electronic and electrical equipment. Enhanced restrictions for particular observations have been implemented including complete curfews on the use of all electrical and electronic equipment, except for items in highly shielded 'Faraday cages' for certain periods. None of these control measures would be feasible in a residential setting.
- 8.3 Staff and visitors at JBO understand the requirement for keeping 'radio quiet' and can be relied upon to comply if any further restrictions are required or if a particular piece of equipment is found to be a source of interference. Such compliance cannot be guaranteed or even expected from the general public within their own homes.
- 8.4 Shielding measures in place at JBO include the construction of highly shielded rooms made of steel plates riveted to a steel frame with metal gasketing and copper tape over all joints. Such rooms which have no windows and a submarine-type radio quiet door provide up to 80 dB additional attenuation for particular equipment. In other rooms, shielded racks provide typically 50 dB attenuation for computing servers. None of these shielding measures would be feasible, appropriate, or enforceable in a residential setting.
- 8.5 Simple shielding measures which are appropriate and recommended by JBO for residential buildings include the use of foil backed plasterboard and metallised window glass, both of which are generally required to meet thermal insulation requirements in modern buildings. These mitigation effects of these measures

have already been described and taken in to account in the calculations above. Significant enhancement to this type of shielding is impossible to achieve without covering all wall and roof openings and is difficult to maintain over any long period since there is no realistic enforcement mechanism.

## 8.6



**Figure 7 the numbers of consumer electronics items per household, derived from 'Energy Supply in the UK 2016' BEIS.**

## Residential vs Commercial or Other Use

### 9.1 General remarks

9.2 The analysis has so far concentrated on the expected emission from a new residential development. This quantitative approach has the advantage of not being strongly dependent on the assumptions about the sources of interference or details of attenuation by building walls etc.

9.3 The growing use of consumer electronics at home over the last 30 years is obvious: in 1990 only 20% or so of UK homes owned a desktop PC, or a games console, the internet was in its infancy (the world's first website at CERN was created in December 1990) and domestic access was via a dial-up modem. Today there are more (domestic) computers than homes in the UK, and even a slow residential broadband connection (4 Mb/s) is faster than the total data rate transported across the entire planet in 1990; almost every home has a printer/copier/scanner and 80% of homes have a games console. Add to this the plethora of tablets, smartphones, and all the new internet-enabled devices from lightbulbs to thermostats now flooding the market, and it is clear that today's and moreover tomorrow's home is bristling with active electronic and electrical

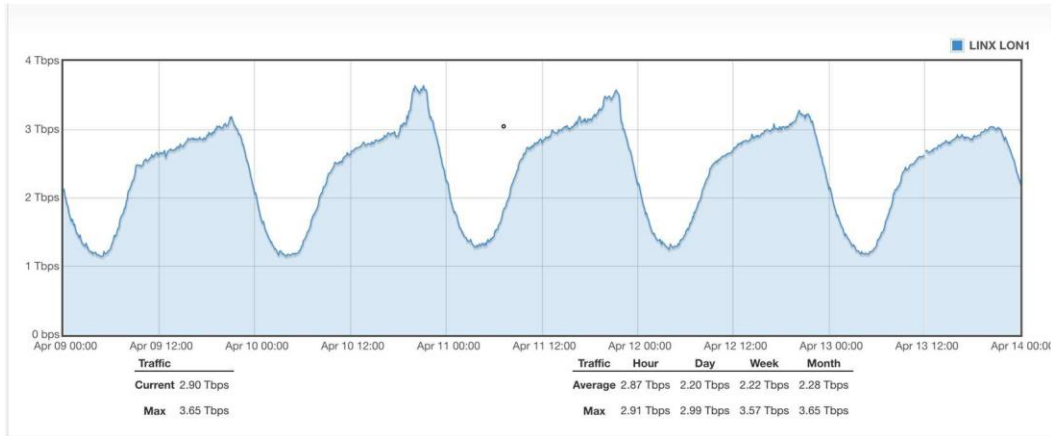
equipment all of which is a potential source of radio interference. These devices are ubiquitous because they are very cheap, and mass produced and hence more likely to produce unwanted radio emission. By comparison, the use of electronic and electrical equipment in the workplace has not changed anywhere near as dramatically: a typical workplace contains roughly as many desktop computers and office machines now as it did in 1990, and a small business now has similar internet connectivity to a modern home. Equipment used in businesses is more likely to be higher quality and less likely to cause unexpected interference. A simple look around a modern house compared to a 3-4 person office reveals the obvious difference in the numbers of electrical/electronic appliances. This growth is shown Fig 7 generated from statistics compiled by BEIS<sup>5</sup>. The numbers of large domestic appliances (white goods, laundry, cooking etc.) has remained roughly constant over the same period.

9.4 Although industrial activity has the potential to cause significant radio interference, it is significantly easier to control through discussion and negotiation with commercial operators compared to private residents. The workplace is an inherently more regulated environment than the home, and what is reasonable to restrict and regulate at a workplace would almost certainly be intolerable intrusion in a dwelling house. JBO has experience over many years of locating sources of industrial interference and tackling this via discussions with operators. Remedial actions might include fitting of local screening or modification to industrial equipment, restrictions on use etc. It is feasible to obtain an ongoing undertaking from commercial operators to keep radio emission below a certain level, which cannot reasonably be done for the individual or collective emission from a residential development. This approach is being followed in the case of the Keuper Gas Storage Plant where the promoter accepted the need for harmful interference to be avoided. The promoter has committed to the submission and approval of a Control of Radio Frequency Emissions Plan which must include a scheme to ensure that the authorised development operates at all times so the total radiated power emitted from development does not exceed the limits set out in ITU-R RA.769. The scheme must also allow for regular monitoring of activity to ensure that the limits are consistently met “which has recently been proposed. In that case the proposer will make an undertaking to ensure that radio frequency emissions are kept within prescribed limits with regular on-site monitoring to ensure that this is the case. Any such approach for residential developments has been consistently ruled out in discussions with developers and the Planning Authority.

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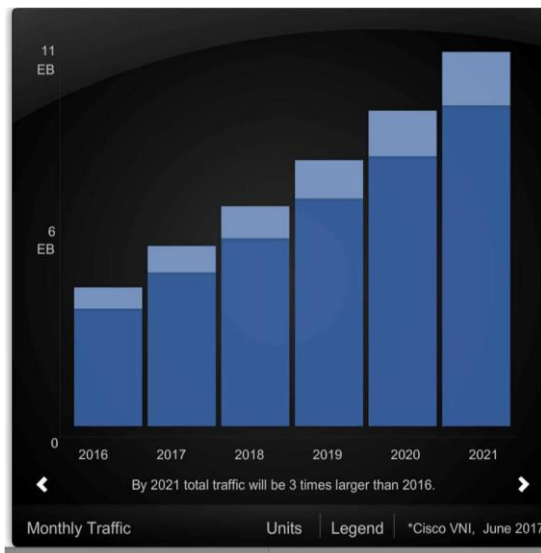
<sup>5</sup> Energy Use in the UK, Department for Business, Energy & Industrial Strategy





9.5

**Figure 8: Internet data rates logged by main LINX internet exchange in London, representing a large fraction of total UK internet traffic, between 00:00 on Monday 09 April 2017 and 00:00 on Saturday 14 April. The peak use is always after the end of the working day, typically around 9 pm.**



9.6

**Figure 9 UK Data traffic predictions for the period 2016-2021 using the CISCO VNI tool ([www.cisco.com](http://www.cisco.com)) showing residential use in dark blue and business use in light blue. Over the period the ratio of residential to commercial use is 5.9:1**

9.7 It is now a feature of modern life that in general the intensity of use of electronic equipment is greater in our leisure time at home than it is at work. This can be substantiated as follows: UK internet traffic peaks in the evening (LINX traffic stats – see Fig 8) , well after the close of the business day, clearly demonstrating that the leisure use of mobile phones, tablets and internet-TV exceeds business use; CISCO forecasts for UK in the period 2016-2021 show that total domestic use consistently exceeds total business use by a factor of 6 (Cisco VNI; see also Fig 9); the internet data use of an adult at home exceeds business traffic per employee by a factor of 3 (Cisco; quoted in [25]); a detailed regression study of working time and internet use time series shows that UK internet use (measured by bandwidth) is 2.2 times greater during our free time than when working or

studying<sup>25</sup>; and the average UK broadband use (2017) is 190 GB/month<sup>6</sup> i.e. 0.49 Mb/s compared to a typical office worker use of 0.1 Mb/s<sup>12</sup>. Much of the use of electronic and electrical equipment is by children: recent studies show that time online by children has doubled over the last 10 years, and that children spend at home 15 hrs/week online, 10 hours/week electronic gaming and 14 hours/week watching TV<sup>7</sup>. Indeed, many children (and their parents) seem to be more than capable of doing at least two of these simultaneously.

9.8 In general the use of a building as a holiday let is likely to have less impact than a domestic dwelling in terms of the generation of intentional or unintentional radio emission: there are likely to be fewer electronic devices installed and it will not be occupied full time.

## 9.9 Conclusions

9.10 Interference received at the Jodrell Bank radio telescope from electrical and electronics equipment associated with the proposed development is likely to exceed the internationally agreed definition for harmful interference as set out by the ITU. The methodology used to reach this conclusion has been accepted by the Secretary of State and the Planning Inspector in the recent appeal by Gladman Developments (APP/R0660/W/15/312954) and by the inspector in the appeal by Henderson Homes (APP/R0660/W/16/3166025), both of which were dismissed.

9.11 Although this is a smaller scheme, the additional interference will further worsen the current situation in which interference from local population centres are the dominant contributions to interference received at the telescope.

9.12 The cumulative effect of continued development around the Jodrell Bank site has caused the continued degradation of the radio frequency environment of the radio telescope. This continued degradation, if allowed to continue as a result of developments which themselves may only generate smaller incremental impacts on interference, will ultimately reduce the international competitiveness of the research carried out by the Jodrell Bank telescopes and may have wider impacts, including the way in which the UK is viewed as a partner in billion-pound scale international projects such as the SKA, as noted by the chief executive of the UK Science and Technology Facilities Council (the funding body for astronomy and particle physics) and the Director General of the Square Kilometre Array

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<sup>6</sup> Connected Nations 2017, Ofcom

<sup>7</sup> Children and Parents: Media Use and Attitudes Report, Ofcom, November 2017

Organisation.

9.13 As demonstrated above the resulting interference from the proposed development will impair the efficiency of the Jodrell Bank Radio Telescopes contrary to Policies PS10/GC14 and SE14.

9.14 Finally, it was agreed by the Secretary of State and the Inspector in the Goostrey planning appeal that reasonable protection of JBO is a matter of global significance and furthermore that JBO is a facility of international importance such that its protection from the identified harm of local housing developments transcends current housing land supply circumstances in Cheshire East.

## 14. Glossary

Development	Defined by the Town and Country Planning Act 1990 as “the carrying out of building, engineering, mining or other operation in, on, over or under land, or the making of any material change of use of any building or other land.” Most forms of development require planning permission, unless expressly granted planning permission via a development order.
Development Plan	This includes adopted Local Plans and Neighbourhood Plans and is defined in Section 38 of the Planning and Compulsory Planning Act 2004
Design and Access Statement	A short report accompanying and supporting a planning application. They provide a framework for applicants to explain how a proposed development is a suitable response to the site and its setting, and demonstrate that it can be adequately accessed by prospective users An explanation of
Habitats Regulations Assessment	The process that competent authorities must undertake to consider whether a proposed development plan or programme is likely to have significant effects on a European site designated for its nature conservation interest.
Heritage Impact Assessment	An assessment of a proposal on heritage matters
Jodrell Bank Consultation Zone	The area around Jodrell Bank Observatory within which Policy SE14 of the CELPS applies
Landscape Value Impact Assessment	An assessment of the landscape value of an area and determination of a proposals impact on that landscape
Local Plan	The plan for the development of the local area, drawn up by the local planning authority in consultation with the community.  In law this is described as the Development Plan Documents adopted under the Planning and Compulsory Purchase Act 2004.

Current core strategies or other planning policies, which under the regulations would be considered to be Development Plan Documents, form part of the Local Plan. This term includes old policies which have been saved under the 2004 Act.

Local Plan Strategy	Development Plan Document setting out the spatial vision and strategic objectives of the planning framework for an area, having regard to the Community Strategy.
Local Planning Authority	The local authority or council that is empowered by law to exercise planning functions. In the case of this SPD, the Local Planning Authority is Cheshire East Council.
Neighbourhood Plan	A plan prepared by a parish council or neighbourhood forum for a particular neighbourhood area (made under the Planning & Compulsory Purchase Act 2004).
Radio Interference Assessment	Technical assessment of the impact of a proposals electrical devices on the efficiency of JBO telescopes
Site Allocations and Development Policies Document	Part of the Local Plan which will contain land allocations and detailed policies and proposals to deliver and guide the future use of that land.
Supplementary Planning Document	A Local Development Document that may cover a range of issues, thematic or site specific, and provides further detail of policies and proposals in a 'parent' Development Plan Documents.
Sustainability Appraisal	An appraisal of the economic, environmental and social effects of a plan from the outset of the preparation process to allow decisions to be made that accord with sustainable development.
Strategic Environmental Appraisal	SEA is a process and a tool for evaluating the effects of proposed policies, plans and programmes on natural resources, social, cultural and economic conditions and the institutional environment in which decisions are made.
Viability Study	A report, including a financial appraisal, to establish the profit or loss arising from a proposed development. It will usually provide an analysis of both the figures inputted and output results together

with other matters of relevance. An assessment will normally provide a judgement as to the profitability, or loss, of a development.