

DATED 9 February 2009

- (1) NORTH NORFOLK DISTRICT COUNCIL
- (2) BROADLAND DISTRICT COUNCIL
- (3) THE SECRETARY OF STATE FOR JUSTICE
- (4) ARQIVA LIMITED

AGREEMENT
UNDER SECTION 106
OF THE TOWN AND COUNTRY PLANNING ACT 1990
relating to
LAND AT THE FORMER RAF COLTISHALL


Michelmores

Woodwater House
Pynes Hill
Exeter EX2 5WR
DX 135608 EXETER 16
Tel: 01392 688688
Fax: 01392 360568
Email: jmi@michelmores.com

**PLANNING OBLIGATION BY DEED OF AGREEMENT UNDER THE TOWN AND
COUNTRY PLANNING ACT 1990 S106**

THIS AGREEMENT is made the *Ninth* day of *February* 2009

BETWEEN

- (1) **NORTH NORFOLK DISTRICT COUNCIL** of Council Offices Holt Road Cromer NR27 9JA ("North Norfolk")
- (2) **BROADLAND DISTRICT COUNCIL** of Thorpe Lodge 1 Yarmouth Road Thorpe St Andrew Norwich NR7 0DU ("Broadland")
- (3) **THE SECRETARY OF STATE FOR JUSTICE** ("the Developer")
- (4) **ARQIVA LIMITED** whose registered office is at Crawley Court Crawley Winchester Hampshire SO21 2QA (Company registration number 2487597) ("the Lessee")

RECITALS

- 1 North Norfolk is the local planning authority for the purposes of the 1990 Act for the area in which the Site (other than the Broadland Site) and part of the Access Land are situated
- 2 Broadland is the local planning authority for the purposes of the 1990 Act for that part of the Site in which the Broadland Site is situated and for part of the Access Land and Broadland have transferred responsibility for the Second Application (in so far as it concerns the Broadland Site and part of the Access Land) to North Norfolk
- 3 The Developer is a Minister of the Crown and the freehold owner of the Site and the Access Land as set out in Schedule 1
- 4 The Lessee is the leasehold owner of that part of the Site as is comprised in title NK379336 and has agreed to enter into this Deed in manner hereinafter appearing
- 5 The Developer has submitted the First Application to North Norfolk and the Second Application to Broadland
- 6 Broadland has agreed with North Norfolk that the Second Application shall be determined by North Norfolk
- 7 The Developer North Norfolk and Broadland have agreed to enter into this Deed in order to secure the planning obligations contained in it
- 8 North Norfolk resolved on the 22nd day of January 2009 to grant the First Planning Permission subject to the prior completion of this Deed
- 9 North Norfolk acting on behalf of Broadland resolved on the 22nd day of January

2009 to grant the Second Planning Permission subject to the prior completion of this Deed

10 The Parties have agreed to enter into this Deed in the manner hereinafter appearing

NOW THIS DEED WITNESSES as follows:

1 DEFINITIONS AND INTERPRETATION

1.1 Definitions

For the purposes of this Deed the following expressions shall have the following meanings:

- 1.1.1 **'the 1990 Act'** means the Town and Country Planning Act 1990 (as amended)
- 1.1.2 **'the Access Land'** means part of the land against which this Deed may be enforced as is more particularly described in Part 4 of Schedule 1
- 1.1.3 **'the Access Road'** means that part of the Broadland Site shown edged pink on the plan attached hereto marked "Plan A"
- 1.1.4 **'Alternative Site Costs'** means the sum specified in paragraph 1.5 of Part 1 of Schedule 3
- 1.1.5 **'the Broadland Site'** means that part of the Site more particularly described in Part 3 of Schedule 1
- 1.1.6 **'the Commencement of Development'** means the commencement of any material operation (as defined in the 1990 Act section 56(4)) forming part of the Development other than (for the purposes of this Deed and for no other purpose) operations consisting of site clearance demolition work archaeological investigations investigations for the purpose of assessing ground conditions remedial work in respect of any contamination or other adverse ground conditions diversion and laying of services erection of any temporary means of enclosure the temporary display of site notices or advertisements and 'Commence the Development' shall be construed accordingly
- 1.1.7 **'Condition Report'** means a detailed site investigation in order to determine the ground conditions on and beneath the First Transfer Land and the Second Transfer Land and such investigation shall:
 - 1.1.7.1 include sufficient sampling and laboratory analysis of soils controlled water and ground gases to enable a factual and interpretative report to be produced
 - 1.1.7.2 demonstrate the condition of the First Transfer Land and the Second Transfer land in order for a detailed assessment of the potential risks to the future users of the First Transfer Land and the Second Transfer Land the wider environment and all identified potential receptors

- 1.1.7.3 evaluate the potential for any of the areas of land to be determined as "contaminated land" as defined in Part IIA of the Environmental Protection Act 1990
- 1.1.7.4 include any necessary remediation options
- 1.1.7.5 include all risk assessments and modelling and options appraisals to be carried out in line with currently accepted "Best Practice"
- 1.1.8 **'the Development'** means the development of the Site as a prison pursuant to the First Planning Permission and the Second Planning Permission
- 1.1.9 **'the Expert'** means in relation to any dispute to be resolved under Clause 8 an independent person of at least 10 years standing in the area of expertise relevant to the dispute to be agreed between the Parties or failing agreement to be nominated at the request and option of any of them at their joint expense by or on behalf of the President for the time being of the Law Society
- 1.1.10 **'Final Report'** means the report specified in paragraph 5 of Part 3 to Schedule 3
- 1.1.11 **'the First Access Right'** has the meaning specified in paragraph 4.2 of Part 1 of Schedule 3
- 1.1.12 **'the First Application'** means the application for planning permission for the Development on the North Norfolk Site submitted to North Norfolk and received by them on the 11th day of November 2008 and allocated reference number 20081568
- 1.1.13 **'the First Approved Scheme'** has the meaning specified in paragraph 3.2 of Part 1 of Schedule 3
- 1.1.14 **'the First Planning Permission'** means the full planning permission subject to conditions to be granted by North Norfolk pursuant to the First Application in the form set out in Part 1 of Schedule 2
- 1.1.15 **'the First Transfer Land'** has the meaning specified in paragraph 4.1 of Part 1 of Schedule 3
- 1.1.16 **'Initial Instruction'** means the instruction set out in paragraph 1 of Part 3 of Schedule 3
- 1.1.17 **'Investigation Period'** means the period commencing on the date of the Commencement of Development and expiring on such date as shall be two years after the date of the Commencement of Development
- 1.1.18 **'the North Norfolk Site'** means that part of the Site more particularly described in Part 2 of Schedule 1
- 1.1.19 **'the Offer'** has the meaning specified in paragraph 2.1 of Part 2 of Schedule 3

- 1.1.20 **'the Parties'** means the parties to this Deed and 'Party' shall be construed accordingly
- 1.1.21 **'the Report'** means the Renewable Energy and Energy Conservation Report prepared by Pearce Buckle (Design Engineer) Limited a copy of which is annexed hereto
- 1.1.22 **'the Second Access Right'** has the meaning specified in paragraph 1.2.2 of Part 2 of Schedule 3
- 1.1.23 **'the Second Application'** means the application for planning permission for the Development on the Broadland Site submitted to Broadland and received by them on the 10th day of November 2008 and allocated reference number 20081556 which has in turn has been passed to North Norfolk
- 1.1.24 **'the Second Approved Scheme'** has the meaning specified in paragraph 1.1 of Part 2 of Schedule 3
- 1.1.25 **'the Second Planning Permission'** means the full planning permission subject to conditions to be granted by North Norfolk on behalf of Broadland pursuant to the Second Application in the form set out in Part 2 of Schedule 2
- 1.1.26 **'the Second Transfer Land'** has the meaning specified in paragraph 1.2.1 of Part 2 of Schedule 3
- 1.1.27 **'the Site'** means part of the land against which this Deed may be enforced and is more particularly described in Part 1 of Schedule 1
- 1.1.28 **'Wind Turbine'** means the turbine or turbines for wind powered generation of electricity

1.2 Interpretation

- 1.2.1 Reference in this Deed to any recital clause paragraph or schedule is unless the context otherwise requires a reference to the recital clause paragraph or schedule in this Deed so numbered
- 1.2.2 Words importing the singular meaning include the plural meaning and vice versa where the context so admits
- 1.2.3 Words of the masculine gender include the feminine and neuter genders and words denoting actual persons include companies corporations and firms and all such words shall be construed interchangeably in that manner
- 1.2.4 Wherever an obligation falls to be performed by more than one person the obligation can be enforced against every person so bound jointly and against each of them individually unless there is an express provision otherwise
- 1.2.5 Any reference to an Act of Parliament shall include any modification extension or re-enactment of that Act for the time being in force and shall include all instruments orders plans regulations permissions and directions for the time being made issued or given under that Act or deriving validity

from it

1.2.6 References to any Party shall include the successors in title to that Party and any person deriving title through or under that Party and in the case of North Norfolk and Broadland the successors to their respective statutory functions

1.2.7 Headings where they are included are for convenience only and are not intended to influence the interpretation of the Deed

2 LEGAL BASIS

2.1 This planning obligation is made pursuant to the 1990 Act section 106 the Local Government Act 1972 section 111 and the Local Government Act 2000 section 2

2.2 The terms of this Deed create planning obligations binding on the Developer pursuant to Section 106 of the 1990 Act and are enforceable as such by North Norfolk as local planning authority for the North Norfolk Site and by Broadland as local planning authority for the Broadland Site

3 CONDITIONS DURATION AND ENFORCEMENT

3.1 Conditions precedent

This Deed is conditional upon:

3.1.1 the grant of the First Planning Permission and the Second Planning Permission; and

3.1.2 the Commencement of Development

save for the provisions of Clause 8 which shall come into effect immediately upon completion of this Deed

3.2 Duration

3.2.1 This Deed shall cease to have effect in so far only as it has not already been complied with if either the First Planning Permission or the Second Planning Permission are quashed revoked or otherwise withdrawn or without the consent of the Developer it is modified by any statutory procedure or expires before the Commencement of Development

3.2.2 No person shall be liable for any breach of any of the planning obligations or other provisions of this Deed after parting with his interest in that part of the Site on which the breach occurs but without prejudice to liability for any subsisting breach arising before parting with that interest

3.2.3 Nothing in this Deed shall prevent compliance with any obligation pursuant to it before that obligation comes into effect under this Clause 3 and no such early compliance shall amount to a waiver of the effect of this Clause 3

3.3 Other development

Nothing in this Deed shall prohibit or limit the right to develop any part of the Site in accordance with a planning permission (other than the First Planning Permission and

the Second Planning Permission) granted (whether or not on appeal) after the date of this Deed

3.4 Non-enforcement

The obligations contained in this Deed shall not be binding upon or enforceable against:

- 3.4.1 any statutory undertaker who acquires any part of the Site or any interest in it solely for the purposes of its statutory undertaking or functions for the supply of electricity gas water drainage or telecommunication services
- 3.4.2 the Developer after he has disposed of his interest in the Site or in the event of a disposal of part in the part disposed of other than disposal of an interest in the nature of an easement or the benefit of a restriction or similar but not so as to release the Developer from any antecedent breach non-performance or non-observance of his obligations

4 DEVELOPER'S COVENANTS

- 4.1 The Developer covenants with North Norfolk as set out in Part 1 of Schedule 3
- 4.2 The Developer covenants with Broadland as set out in Part 2 of Schedule 3
- 4.3 The Developer covenants with North Norfolk and Broadland as set out in Part 3 of Schedule 3

5 PLANNING AUTHORITY COVENANTS

- 5.1 North Norfolk covenants with the Developer as set out in Part 1 of Schedule 4 and with Broadland as set out in Schedule 5
- 5.2 Broadland covenants with the Developer as set out in Part 2 of Schedule 4 and with North Norfolk as set out in Schedule 5

6 PREVIOUS OBLIGATIONS

North Norfolk release and cancel all previous planning obligations in respect of the Site and the Access Land made under the 1990 Act section 106 or under previous similar enactments

7 THE LESSEE

- 7.1 In accordance with the 1990 Act Section 106 the Lessee assents to the terms and conditions contained in this Deed and consents to the Developer entering into this Deed with North Norfolk and Broadland in so far as this Deed relates to the lands comprised in title NK298374 forming part of the Site
- 7.2 The Lessee will not be liable for any enforcement provisions capital or other expenditure costs charges expenses or liabilities arising under or in consequence of the completion or implementation of this Deed and the Developer will indemnify the Lessee in respect of all reasonable costs fees and disbursements incurred in negotiating preparation and execution of this Deed and all capital or other expenditure and reasonable costs fees and disbursements (if any) that may arise as a direct consequence of or from the Lessee being a party to this Deed and/or the completion or implementation of this Deed

8 DISPUTE RESOLUTION

- 8.1 If a dispute between the Parties persists beyond 20 working days and relates to any matter contained in this Deed (including any matter to be agreed or approved under this Deed but excluding matters of its interpretation) the dispute may be referred to the Expert by any Party. The Expert shall act as an expert and not as an arbitrator. His decision shall be final and binding on the Parties and his costs shall be in his award.
- 8.2 The Expert shall be appointed subject to an express requirement that he must reach his decision and communicate it to the Parties within the minimum practical timescale allowing for the nature and complexity of the dispute and in any event not more than 20 working days from the date of his appointment to act.
- 8.3 The Expert shall be required to give notice to each of the Parties inviting each of them to submit to him within 20 working days written submissions and supporting material and shall afford to the Parties an opportunity to make counter submissions within a further 5 working days in respect of any such submission and material. His decision shall be given in writing within 30 working days of his appointment with reasons and in the absence of manifest error shall be binding on the Parties.

9 PROVISIONS OF IMMEDIATE EFFECT

- 9.1 On completion of this Deed the Developer shall pay to North Norfolk the reasonable legal costs incurred in the negotiation preparation and execution of this Deed of no more than £3,000.00.
- 9.2 On completion of this Deed the Developer shall pay to Broadland the reasonable legal costs incurred in the negotiation preparation and execution of this Deed of no more than £3,000.00 of which the sum of £1,000.00 has already been paid by the Developer to Broadland.
- 9.3 Nothing in this Deed shall create any rights in favour of any person pursuant to the Contracts (Rights of Third Parties) Act 1999.

10 NOTICES

- 10.1 Any notice or communication to be given to North Norfolk or Broadland or the Lessee pursuant to this Deed shall be in writing and shall either be delivered personally or sent by registered post or recorded delivery service at the address stated in this Deed or such other address in England for service as the party to be served may have previously notified in writing.
- 10.2 Any notice or communication to be given to the Developer pursuant to this Deed shall be in writing and shall be sufficiently served by being forwarded by registered post or recorded delivery service to him at The Ministry of Justice NOMS Custodial Property Estates Section, Abell House, John Islip Street, London SW1P 4LH or such address as the Developer may notify in writing.
- 10.3 Any notice so sent or delivered in accordance with Clauses 10.1 and 10.2 above shall be deemed to be given (as the case may be) at the time of personal delivery or at the time when it ought in due course of post to be delivered at the address to which it is sent.

10.4 Any notice or other written communication to be given by North Norfolk shall be deemed valid and effectual if on its face it is signed on behalf of the North Norfolk by an officer or duly authorised signatory

10.5 Any notice or other written communication to be given by Broadland shall be deemed valid and effectual if on its face it is signed on behalf of the Broadland by an officer or duly authorised signatory

11 LOCAL LAND CHARGE

11.1 This Deed shall be registered as a local land charge by North Norfolk and Broadland and they shall immediately after the date of this Deed register it as such

11.2 Following the performance and satisfaction of all the obligations contained in this Deed North Norfolk and Broadland shall immediately effect the cancellation of all entries made in the Register of Local Land Charges in respect of this Deed

12 JURISDICTION AND LEGAL EFFECT

12.1 This Deed shall be governed by and interpreted in accordance with the law of England and Wales

12.2 In so far as any clause or clauses of this Deed are found (for whatever reason) to be invalid illegal or unenforceable that invalidity illegality or unenforceability shall not affect the validity or enforceability of the remaining provisions of this Deed

12.3 No waiver (whether expressed or implied) by North Norfolk and Broadland of any breach or default in performing or observing any of the covenants terms or conditions of this Deed shall constitute a continuing waiver and no such waiver shall prevent North Norfolk and Broadland from enforcing any of the relevant terms or conditions or from acting upon any subsequent breach or default

12.4 The provisions of this Deed (other than this clause 12.4 which shall be effective in any event) shall be of no effect until this Deed has been dated

13 VAT

All consideration given in accordance with the terms of this Deed shall be exclusive of any value added tax properly payable

IN WITNESS whereof the Common Seals of North Norfolk and Broadland and the Corporate Seals of the Developer have been hereunto affixed the day and year first before written

SCHEDULE 1

PART 1

THE SITE

Land at the former RAF Coltishall as shown edged red on the plan numbered 882-000-A-TPA-49 annexed hereto and comprised (together with other land) in Titles NK298374 and NK383148 of which the Developer is the freehold owner and Title NK379336 of which the Lessee is the Leasehold owner

PART 2

THE NORTH NORFOLK SITE

That part of the Site shown edged red on the plan numbered 882-000-A-TPA-49 annexed hereto **BUT EXCLUDING** therefrom the land shown edged in green within such red edging on such plan

PART 3

THE BROADLAND SITE

That part of the Site shown edged in green (within the red edging) on the plan numbered 882-000-A-TPA-49 annexed hereto which for the avoidance of doubt includes the Access Road

PART 4

THE ACCESS LAND

Lands at the former RAF Coltishall as are shown edged blue on the said plan numbered 882-000-A-TPA-49 annexed hereto and comprised (together with other land) in Titles NK298405 NK298406 NK298407 NK298404 NK298403 NK191247 and NK189959



W.R.
102902
W.R.
W.R.

W.R.

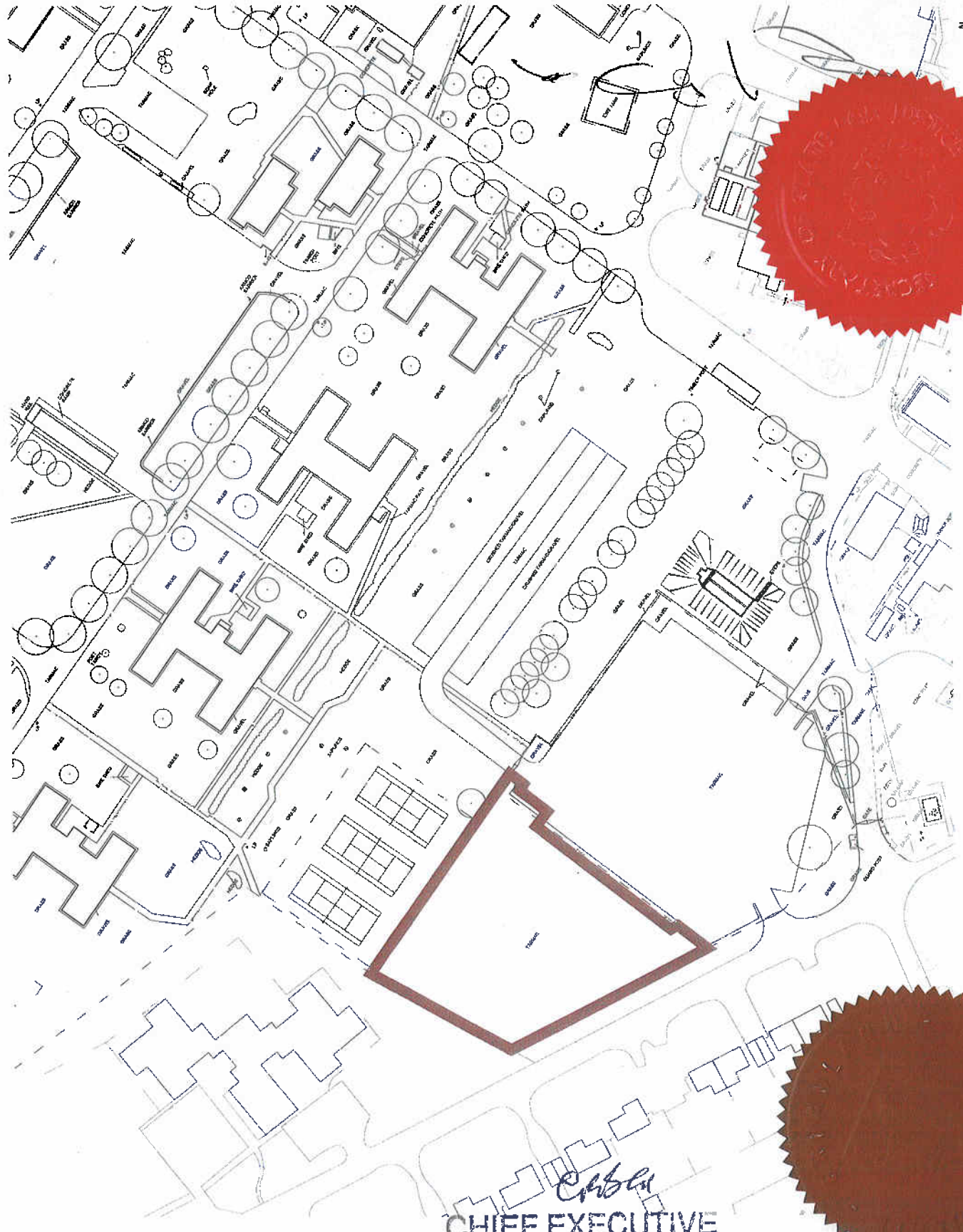
CHIEF EXECUTIVE

AMENDMENTS		DATE
 Ministry of JUSTICE		
NOMS National Offender Management Service Working together to reduce re-offending		
Custodial Property		
Prison: Former RAF Coltishall		
Drwg. Title: Proposed Site Plan		
Drwg No.: 882-000-A-TPA-49		
AMENDMENT		
Drawn By	DATE	SCALES
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Original Scale 1:1		



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AMENDMENTS		DATE	
 HM Prison and Probation Service Working together to reduce re-offending			
Ministry of JUSTICE		Custodial Property	
Prison: Former RAF Colishall			
Dwg. Title: Proposed Boundary of Lawned Area			
Dwg. No.: 882-000-A-TPA-46			
Author:	DATE:	SCALE:	STATUS:
G1	06.08.08	1:500@A1	
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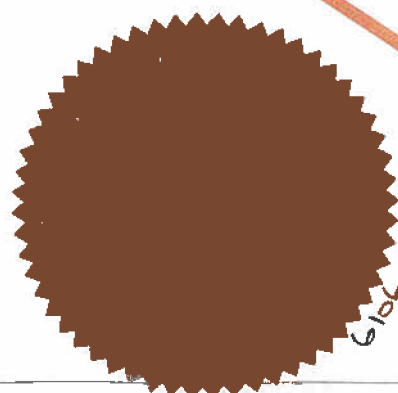
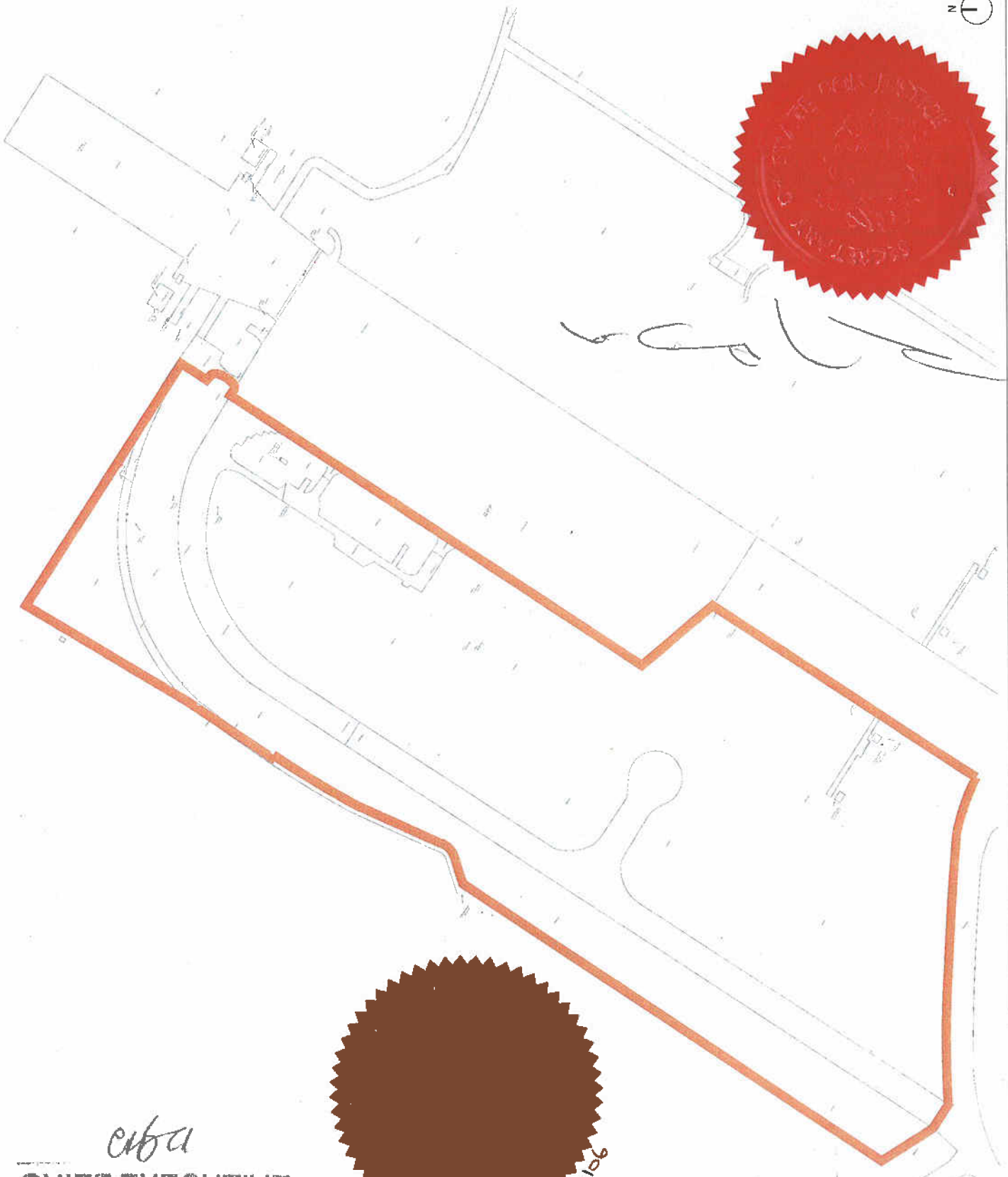
Handwritten signature 'C. Allen'
CHIEF EXECUTIVE





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AMENDMENTS	DATE	NOMS National Offender Management System Working together to make a difference	Ministry of JUSTICE	Custodial Property
Prison		Former RAF Collishall		
Drawn By		Proposed Boundary of		
Title		Memorial Garden & Woodland Area		
Drawn No.:		882-000-A-TPA-48		
AMENDMENT		SCALE		
Drawn By		DATE		
G.I.		09/05/08		
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Sha
PM
WBS
JMS

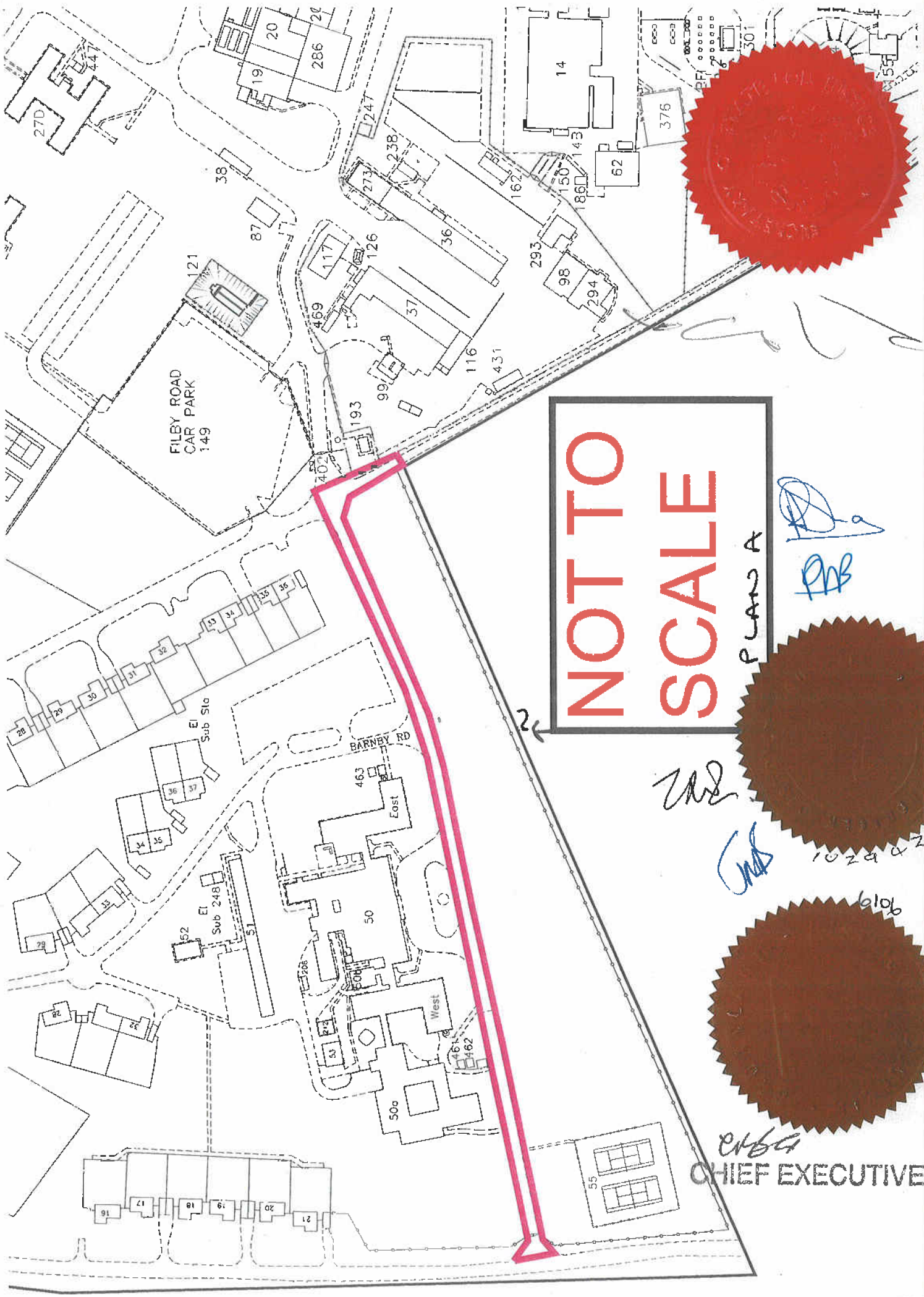
102942

 HM Prison Service National Offender Management Service Working together to reduce re-offending		DATE
Ministry of JUSTICE		ARGUMENTS
Prison: Former RAF Collyishall		Drawing Title: Proposed Boundary of Triangular Road
Drawing No.: 882-000-A-TPA-47		Drawing Date: 08/09/08
Drawing Scale: 1:500 @ A1		Drawing Size: A1
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CHIEF EXECUTIVE





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Page 2

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SCHEDULE 2

PART 1

DRAFT OF THE FIRST PLANNING PERMISSION

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NOTICE OF DECISION

NATIONAL OFFENDER MANAGEMENT SERV
C/O LAMBERT SMITH HAMPTON
UK HOUSE
180 OXFORD STREET
LONDON
W1D 1NN

01 20081568 PF

Date Received
11 Nov 2008

TOWN AND COUNTRY PLANNING ACT 1990

PERMISSION FOR DEVELOPMENT

SCOTTOW

NORTH NORFOLK DISTRICT COUNCIL, in pursuance of powers under the
above-mentioned Act hereby PERMIT

CONVERSION OF FORMER RAF BUILDINGS TO CATEGORY C PRISON AND ERECTION
OF BUILDINGS TO PROVIDE ANCILLARY ACCOMMODATION AT RAF COLTISHALL
TUNSTEAD ROAD SCOTTOW

In accordance with the accompanying plans and subject to the conditions
specified hereunder :

1) The development to which this permission relates must be begun
not later than the expiration of three years beginning with the date
on which this permission is granted.

2) Unless otherwise agreed in writing by the Local Planning
Authority, this permission is granted in accordance with the plans
which comprise the bound document entitled 'Planning Application
Drawings' received by the Local Planning Authority on 21 January
2009 and signed by the Chair of the Council's Development Control
Committee (East). Specifically the following drawing numbers apply
to the approved development:

882-000-A-TPA-01, 882-000-A-TPA-04, 882-000-A-TPA-05
882-000-A-TPA-07, 882-000-A-TPA-08, 882-000-A-TPA-09

Decn. Date

.....
Acting under Delegated Authority
On Behalf of the Council

(1)

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NOTICE OF DECISION

NATIONAL OFFENDER MANAGEMENT SERV
C/O LAMBERT SMITH HAMPTON
UK HOUSE
180 OXFORD STREET
LONDON
W1D 1NN

01 20081568 PF

Date Received
11 Nov 2008

882-003-A-TPA-11, 882-003-A-TPA-13, 882-003-A-TPA-15
882-003-A-TPA-17, 882-003-A-TPA-19, 882-003-A-TPA-21
882-004-A-TPA-23, 882-005-A-TPA-26, 882-006-A-TPA-27
882-007-A-TPA-28, 882-008-A-TPA-29, 882-009-A-TPA-30
882-010-A-TPA-31, 882-002-A-TPA-34, 882-002-A-TPA-35
882-000-A-TPA-36, 882-000-A-TPA-37, 882-000-A-TPA-38
882-000-A-TPA-39, 882-000-A-TPA-40, 882-000-A-TPA-45
882-000-A-TPA-60, 882-000-A-TPA-51, 882-000-A-TPA-53
882-000-A-TPA-55, 882-000-A-TPA-56, 882-011-A-TPA-57
113-08-101 (site layout-Proposed Drainage)

3) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, the vehicular access onto Hautbois Road shall be constructed in accordance with the Norfolk County Council Industrial Access construction specification and additionally, in accordance with details to be approved in writing by the Local Planning Authority, for the first 15m into the site as measured back from the near edge of the adjacent carriageway.

4) The gradient of the vehicular access shall not exceed 1:12 for the first 15m into the site as measured from the near edge of the highway carriageway.

5) Notwithstanding the provisions of Class A of Schedule 2, Part 2 of the Town and Country Planning (General Permitted Development) Order 1995, (or any Order revoking, amending or re-enacting that Order) no gate shall be erected across the approved access onto

Decn. Date

.....
Acting under Delegated Authority
On Behalf of the Council
(2)

NOTICE OF DECISION

NATIONAL OFFENDER MANAGEMENT SERV
C/O LAMBERT SMITH HAMPTON
UK HOUSE
180 OXFORD STREET
LONDON
W1D 1NN

01 20081568 PF

Date Received
11 Nov 2008

Hautbois Road unless details have first been submitted to and approved in writing by the Local Planning Authority.

6) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, a visibility splay measuring 4.5m x 215m shall be provided to each side of the access where it meets the highway at its junction with Hautbois Road. Such splays shall thereafter be maintained free from any obstruction exceeding 0.225m above the level of the adjacent highway carriageway.

7) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, the proposed access and on-site car and cycle parking, servicing, loading, unloading, turning and waiting areas shall be laid out and demarcated in accordance with the approved plans. They shall be retained thereafter for those specific uses.

8) The access shall be constructed with drainage measures to prevent surface water run-off onto the adjacent public highway (Hautbois Road), in accordance with a detailed scheme to be submitted to and approved in writing by the Local Planning Authority, in consultation with the Highway Authority.

9) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, offsite highway works to Scottow Road/Hautbois Road, (by means of carriageway widening to 6.0m) and the installation of direction

Decn. Date

.....
Acting under Delegated Authority
On Behalf of the Council

(3)

NOTICE OF DECISION

NATIONAL OFFENDER MANAGEMENT SERV
C/O LAMBERT SMITH HAMPTON
UK HOUSE
180 OXFORD STREET
LONDON
W1D 1NN

01 20081568 PF

Date Received
11 Nov 2008

signing to/from the development on Hautbois Road, Scottow Road and the B1150 shall be completed in accordance with details previously submitted to and approved in writing by the Local Planning Authority, in consultation with the Highway Authority.

10) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, details of an Interim Travel Plan shall be submitted to and approved in writing by the local planning authority and implemented in accordance with these approved details. During the first year following prisoner occupation of the secure accommodation, an Approved Full Travel Plan based on the Interim Travel Plan shall be submitted to and approved in writing by the Local Planning Authority in consultation with the Highway Authority. The Approved Full Travel Plan shall be implemented in accordance with the timetable and targets contained therein and shall continue to be implemented as long as any part of the development is occupied, subject to any approved modifications agreed by the Local Planning Authority in consultation with the Highway Authority as part of the annual review.

11) During the period of construction of the development hereby permitted, wheel cleaning facilities shall be provided in full accordance with the details submitted with the planning application.

12) For the duration of the construction period all traffic associated with the construction of the development shall comply with the traffic route details supplied with the application by

Decn. Date

.....
Acting under Delegated Authority
On Behalf of the Council

(4)

NOTICE OF DECISION

NATIONAL OFFENDER MANAGEMENT SERV
C/O LAMBERT SMITH HAMPTON
UK HOUSE
180 OXFORD STREET
LONDON
W1D 1NN

01 20081568 PF

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11 Nov 2008

Wates Construction Limited and shall use no other local road unless approved in writing with the Local Planning Authority in consultation with the Highway Authority.

13) The landscaping schemes as detailed on drawing numbers 882-000-A-TPA-39, 882-000-A-TPA-40, 882-000-A-TPA-45 and 882-000-A-TPA-51, received by the Local Planning Authority on 9 December 2008 shall be carried out no later than the next available planting season following the commencement of development or such further period as the Local Planning Authority may allow in writing.

14) Before the development hereby permitted is begun, all the existing trees on the site other than those identified for removal in the submitted Arboricultural Statement (Appendix 3) shall be protected from damage during the course of the development by means of protective fencing in accordance with the details referred to in the submitted Arboricultural Statement.

The protective fencing shall be maintained during the period of construction works on the site to the satisfaction of the Local Planning Authority. Within the fenced areas no soil, fuel, chemicals or materials shall be stored, temporary buildings erected plant or vehicles parked or fires lit.

15) Any new tree or shrub which within a period of five years from the date of planting dies, is removed or become seriously damaged or diseased, shall be replaced during the next planting season with another of a similar size and species to the Local Planning

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Acting under Delegated Authority
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UK HOUSE
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11 Nov 2008

Authority's satisfaction, unless prior written agreement is given to any variation.

16) The external materials to be used on the development hereby permitted shall be in full accordance with the 'Schedule of Proposed Materials' attached to the e-mail from Lambert Smith Hampton dated 5 December 2008, subject to the profiled metal roof cladding being in a matt finish, unless otherwise agreed in writing by the Local Planning Authority.

17) The rating level of any noise emitted by all fixed plant on the site shall not exceed the background noise level by more than 5dB at any time. The noise levels shall be determined at the nearest noise sensitive properties. The measurement and assessment shall be according to BS 4142:1997.

18) No deliveries of goods or services, except in the case of emergency, shall be taken at or despatched from the site outside the hours of 7am to 6pm during Mondays to Saturdays nor at any time on Sundays, Bank or Public Holidays.

19) Prior to the commencement of use of the kitchen building hereby permitted a scheme for a kitchen extractor system shall be submitted to and approved in writing by the Local Planning Authority. The scheme submitted shall include measures to control noise and odour from the extractor system. The scheme as approved shall be installed prior to the commencement of use of the kitchen and maintained thereafter in accordance with the manufacturers specifications.

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20) No movement of vehicles to or from car park F (as indicated on drawing number 882-000-A-TPA-07) shall take place except between the hours of 7.00am and 11.00pm on any day.

21) All external lighting shall be in full accordance with the details referred to in the Electrical Statement and paragraphs 4.34 and 4.35 in the Design and Access Statement submitted with the planning application, unless otherwise agreed in writing by the Local Planning Authority.

22) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, full details of measures to prevent vehicular access to and from the site via Filby Road shall firstly be submitted to and approved in writing by the Local Planning Authority, and secondly, installed in full accordance with the approved details. The approved measures shall be retained thereafter to the satisfaction of the Local Planning Authority.

23) Security fencing shall be installed in full accordance with that illustrated on the approved plans and referred to in paragraphs 4-31 and 4-32 of the submitted Design and Access Statement, unless otherwise agreed in writing by the Local Planning Authority.

24) No existing building on the site shall be occupied until it has been converted in full accordance with the details indicated on the approved plans, unless otherwise agreed in writing by the Local

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Planning Authority.

25) The first floor windows on the south-western elevation of the education and learning resource centre (as indicated on drawing number 882-004-A-TPA-23) shall be installed so that they are non-opening and have obscured glazing, and shall retained as such thereafter.

26) All converted existing buildings shall be adapted to meet the BREEAM 'Good' standard and all new buildings shall be built to meet the 'Very Good' or 'Excellent' standard. On completion of the development the applicants shall submit to the Local Planning Authority an assessment carried out by a licensed BREEAM assessor to demonstrate that these standards have been met.

27) The development hereby permitted shall be undertaken in accordance with the following mitigation measures relating to protected species on the site:

a) The measures identified in the submitted Ecology Statement received by the Local Planning Authority on 3 November 2008 and the Ecology Mitigation Strategy received by the Local Planning Authority on 9 January 2009. These measures shall be completed prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison, unless otherwise agreed in writing by the Local Planning Authority.

b) The lower and middle rows of ventilation bricks in building

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numbers 27B, 27C, 27D, 27E and 28 as referred to in Section 4.1 of the Ecological Assessment shall not be disturbed outside the period 1 November and 1 March in any year.

c) No building shall be refurbished or demolished, and no vegetation cleared during the period 1 March to 1 August in any year (bird breeding season) unless otherwise agreed in writing by the Local Planning Authority.

d) Prior to the commencement of development the amphibian exclusion fencing referred to in Section 4.4 of the Ecological Assessment shall be installed in accordance with the details specified and shall be retained during the period of construction works.

28) Prior to the date on which the first prisoner is accommodated overnight in secure conditions approved by this planning permission (or such other date or stage in development as may be agreed in writing by the Local Planning Authority), the following components of a scheme to deal with the risks associated with contamination of the site shall each be submitted to and approved in writing by the Local Planning Authority:

- a) A preliminary risk assessment which has identified:
- All previous uses.
 - Potential contaminants associated with those uses.
 - A conceptual model of the site indicating sources, pathways and receptors.
 - Potential unacceptable risks arising from contamination at the

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site.

b) A site investigation scheme, based on (a) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.

c) The site investigation results and the detailed risk assessment (b) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.

d) A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in (c) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.

Any changes to these components require the express consent of the Local Planning Authority. The scheme shall be implemented as approved.

29) Notwithstanding any details submitted with the planning application and prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, a scheme for sewage disposal from the site subject to this permission shall be submitted to and approved in writing by the Local Planning Authority. Sewage disposal shall be operated and maintained in full accordance with the approved scheme unless

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otherwise agreed in writing by the Local Planning Authority.

30) The scheme for the provision and implementation of surface water drainage incorporating the implementation of rainwater harvesting shall be constructed in accordance with drawing number 113/08/101. This scheme shall be constructed and completed before occupancy of any part of the proposed development.

The reasons for the Council's decision to grant permission for development subject to the compliance with the conditions hereinbefore specified are :

- 1) The time limit condition is imposed in order to comply with the requirements of Section 91 of the Town and Country Planning Act 1990 as amended by Section 51 of the Planning and Compulsory Purchase Act 2004.
- 2) To ensure the satisfactory layout and appearance of the development in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policies GS3 and ENV2 of the Broadland Local Plan (Replacement) 2006.
- 3) To ensure satisfactory access into the site, in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.
- 4) To ensure safe access to the site in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and

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On Behalf of the Council
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TRA14 of the Broadland Local Plan (Replacement) 2006.

5) To ensure safe access to the site in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

6) To ensure safe access to the site in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

7) To ensure the permanent availability of the parking and manoeuvring area, in the interests of highway safety, and in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

8) To prevent extraneous material being deposited on the highway in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

9) To ensure that the highway improvement works are designed to an appropriate standard in the interests of highway safety and to protect the environment of the local highway corridor, in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

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Acting under Delegated Authority
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10) To ensure that the development offers a wide range of travel choices to reduce the impact of travel and transport on the environment in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

11) To prevent extraneous material being deposited on the highway in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

12) In the interests of maintaining highway efficiency and safety in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

13) To protect and enhance the visual and residential amenities of the area, in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policies GS3, ENV2 and ENV3 of the Broadland Local Plan (Replacement) 2006.

14) In order to protect trees on the site, in accordance with the requirements of Policy EN 4 of the adopted North Norfolk Core Strategy and Policy and ENV5 of the Broadland Local Plan (Replacement) 2006.

15) To protect and enhance the visual amenities of the area, in accordance with Policy EN 4 of the adopted North Norfolk Core

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Strategy and Policy and ENV5 of the Broadland Local Plan
(Replacement) 2006.

16) To accord with the expressed intentions of the applicant, in the interests of the visual amenities of the area and because the Local Planning Authority wishes to retain control over the type of possible alternative materials to be used in the approved development in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policy GS3 of the Broadland Local Plan (Replacement) 2006.

17) To control noise emitted from the site in the interests of residential amenity, in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy and Policies GS3 and CS14 of the Broadland Local Plan (Replacement) 2006.

18) To control the noise emitted from the site in the interests of residential amenity, in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy and Policies GS3 and CS14 of the Broadland Local Plan (Replacement) 2006.

19) To control noise and odour emitted from the site in the interests of residential amenity, in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy and Policies GS3 and CS14 of the Broadland Local Plan (Replacement) 2006.

20) To control the noise emitted from the site in the interests of residential amenity, in accordance with Policy EN 13 of the adopted

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North Norfolk Core Strategy and Policies GS3 and CS14 of the
Broadland Local Plan (Replacement) 2006.

21) In the interests of visual amenity and to avoid light pollution
in accordance with Policy EN 13 of the adopted North Norfolk Core
Strategy and Policies GS3 and CS14 of the Broadland Local Plan
(Replacement) 2006.

22) In the interests of the residential amenities of the area and in
accordance with Policy EN 4 of the adopted North Norfolk Core
Strategy and Policy GS3 of the Broadland Local Plan (Replacement)
2006.

23) In the interests of the visual amenities of the area in
accordance with Policy EN 4 of the adopted North Norfolk Core
Strategy and Policies GS3 and ENV2 of the Broadland Local Plan
(Replacement) 2006.

24) In the interests of the amenities of the area in accordance with
Policy EN 4 of the adopted North Norfolk Core Strategy and Policies
GS3 and ENV2 of the Broadland Local Plan (Replacement) 2006.

25) In order to protect the amenities of the nearby Pupil referral
Unit in accordance with Policy EN4 of the adopted North Norfolk Core
Strategy.

26) In order that the development accords with the submitted
Sustainability Statement in accordance with Policy EN 6 of the

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adopted North Norfolk Core Strategy.

27) In the interests of wildlife protection in accordance with Policy EN 6 of the adopted North Norfolk Core Strategy and Policy ENV4 of the Broadland Local Plan (Replacement) 2006.

28) To ensure that the proposed development does not cause pollution of Controlled Waters and that development complies with approved details in the interests of protection of Controlled Water in accordance with Policy EN 13 of the adopted North Norfolk Structure Plan.

29) In the interests of public amenity and in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy.

30) To ensure a satisfactory method of surface water drainage, as is outlined in paragraph F.4 of PPS25.

Notes:

1) The application site is the subject of an Obligation under Section 106 of the Town and Country Planning Act 1990.

2) The proposal has been considered against Development Plan policy comprising Policies SS 1, SS2, SS 4, SS 5, SS 6, EN 2, EN 4, EN 6, EN 8, EN 10, EN 13, EC 2, EC 4 and CT 5 of the adopted North Norfolk Core Strategy and Policies GS1, GS3, ENV1, ENV2, ENV3, ENV4, ENV5,

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TRA2, TRA3, TRA14 and CS14 of the Broadland District Local Plan (Replacement) 2006. The Local Planning Authority considers that the proposed development complies with the objectives of these policies and is also of the view that the national need for additional prison places is a material consideration to be taken into account in determining the application. As such it is considered that approval of the application is justified, proportionate and in accordance with planning law.

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Acting under Delegated Authority
On Behalf of the Council
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PART 2

DRAFT OF THE SECOND PLANNING PERMISSION

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NATIONAL OFFENDER MANAGEMENT SERVICE
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BROADLAND REFERENCE: 20081556

Date Received 10 November 2008

TOWN AND COUNTRY PLANNING ACT 1990

PERMISSION FOR DEVELOPMENT

NORTH NORFOLK DISTRICT COUNCIL, in pursuance of powers under the above-mentioned Act hereby PERMIT

CONVERSION OF FORMER RAF BUILDINGS TO CATEGORY C PRISON AND ERECTION OF BUILDINGS TO PROVIDE ANCILLARY ACCOMMODATION AT RAF COLTISHALL TUNSTEAD ROAD SCOTTOW

in accordance with the accompanying plans and subject to the conditions specified hereunder :

1) The development to which this permission relates must be begun not later than the expiration of three years beginning with the date on which this permission is granted.

2) The development to which this permission relates must be begun not later than the expiration of three years beginning with the date on which this permission is granted.

3) Unless otherwise agreed in writing by the Local Planning Authority, this permission is granted in accordance with the plans which comprise the bound document entitled 'Planning Application Drawings' received by the Local Planning Authority on 21 January 2009 and signed by the Chair of the Council's Development Control Committee (East). Specifically the following drawing numbers apply to the approved development:

882-000-A-TPA-01, 882-000-A-TPA-04, 882-000-A-TPA-05
882-000-A-TPA-07, 882-000-A-TPA-08, 882-000-A-TPA-09
882-003-A-TPA-11, 882-003-A-TPA-13, 882-003-A-TPA-15
882-003-A-TPA-17, 882-003-A-TPA-19, 882-003-A-TPA-21
882-004-A-TPA-23, 882-005-A-TPA-26, 882-006-A-TPA-27

882-007-A-TPA-28, 882-008-A-TPA-29, 882-009-A-TPA-30
882-010-A-TPA-31, 882-002-A-TPA-34, 882-002-A-TPA-35
882-000-A-TPA-36, 882-000-A-TPA-37, 882-000-A-TPA-38
882-000-A-TPA-39, 882-000-A-TPA-40, 882-000-A-TPA-45
882-000-A-TPA-60, 882-000-A-TPA-51, 882-000-A-TPA-53
882-000-A-TPA-55, 882-000-A-TPA-56, 882-011-A-TPA-57
113-08-101 (site layout-Proposed Drainage)

4) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, the vehicular access onto Hautbois Road shall be constructed in accordance with the Norfolk County Council Industrial Access construction specification and additionally, in accordance with details to be approved in writing by the Local Planning Authority, for the first 15m into the site as measured back from the near edge of the adjacent carriageway.

5) The gradient of the vehicular access shall not exceed 1:12 for the first 15m into the site as measured from the near edge of the highway carriageway.

6) Notwithstanding the provisions of Class A of Schedule 2, Part 2 of the Town and Country Planning (General Permitted Development) Order 1995, (or any Order revoking, amending or re-enacting that Order) no gate shall be erected across the approved access onto Hautbois Road unless details have first been submitted to and approved in writing by the Local Planning Authority.

7) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, a visibility splay measuring 4.5m x 215m shall be provided to each side of the access where it meets the highway at its junction with Hautbois Road. Such splays shall thereafter be maintained free from any obstruction exceeding 0.225m above the level of the adjacent highway carriageway.

8) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, the proposed access and on-site car and cycle parking, servicing, loading, unloading, turning and waiting areas shall be laid out and demarcated in accordance with the approved plans. They shall be retained thereafter for those specific uses.

9) The access shall be constructed with drainage measures to prevent surface water run-off onto the adjacent public highway(Hautbois Road), in accordance with a detailed scheme to be submitted to and approved in writing by the Local Planning Authority, in consultation with the Highway Authority.

10) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, offsite highway works to Scottow Road/Hautbois Road, (by means of carriageway widening to 6.0m) and the installation of direction signing to/from the development on Hautbois Road, Scottow Road and the B1150 shall be completed in accordance with details previously submitted to and approved in writing by the Local Planning Authority, in consultation with the Highway Authority.

11) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, details of an Interim Travel Plan shall be submitted to and approved in writing by the local planning authority and implemented in accordance with these approved details. During the first year following prisoner occupation of the secure accommodation, an Approved Full Travel Plan based on the Interim Travel Plan shall be submitted to and approved in writing by the Local Planning Authority in consultation with the Highway Authority. The Approved Full Travel Plan shall be implemented in accordance with the timetable and targets contained therein and shall continue to be implemented as long as any part of the development is occupied, subject to any approved modifications agreed by the Local Planning Authority in consultation with the Highway Authority as part of the annual review.

12) During the period of construction of the development hereby permitted, wheel cleaning facilities shall be provided in full accordance with the details submitted with the planning application.

13) For the duration of the construction period all traffic associated with the construction of the development shall comply with the traffic route details supplied with the application by Wates Construction Limited and shall use no other local road unless approved in writing with the Local Planning Authority in consultation with the Highway Authority.

14) The landscaping schemes as detailed on drawing numbers 882-000-A-TPA-39, 882-000-A-TPA-40, 882-000-A-TPA-45 and 882-000-A-TPA-51, received by the Local Planning Authority on 9 December 2008 shall be carried out no later than the next available planting season following the commencement of development or such further period as the Local Planning Authority may allow in writing.

15) Before the development hereby permitted is begun, all the existing trees on the site other than those identified for removal in the submitted Arboricultural Statement (Appendix 3) shall be protected from damage during the course of the development by means of protective fencing in accordance with the details referred to in the submitted Arboricultural Statement.

The protective fencing shall be maintained during the period of construction works on the site to the satisfaction of the Local Planning Authority. Within the fenced areas no soil, fuel, chemicals or materials shall be stored, temporary buildings erected plant or vehicles parked or fires lit.

16) Any new tree or shrub which within a period of five years from the date of planting dies, is removed or become seriously damaged or diseased, shall be replaced during the next planting season with another of a similar size and species to the Local Planning Authority's satisfaction, unless prior written agreement is given to any variation.

17) The external materials to be used on the development hereby permitted shall be in full accordance with the 'Schedule of Proposed

Materials' attached to the e-mail from Lambert Smith Hampton dated 5 December 2008, subject to the profiled metal roof cladding being in a matt finish, unless otherwise agreed in writing by the Local Planning Authority.

18) The rating level of any noise emitted by all fixed plant on the site shall not exceed the background noise level by more than 5dB at any time. The noise levels shall be determined at the nearest noise sensitive properties. The measurement and assessment shall be according to BS 4142:1997.

19) No deliveries of goods or services, except in the case of emergency, shall be taken at or despatched from the site outside the hours of 7am to 6pm during Mondays to Saturdays nor at any time on Sundays, Bank or Public Holidays.

20) Prior to the commencement of use of the kitchen building hereby permitted a scheme for a kitchen extractor system shall be submitted to and approved in writing by the Local Planning Authority. The scheme submitted shall include measures to control noise and odour from the extractor system. The scheme as approved shall be installed prior to the commencement of use of the kitchen and maintained thereafter in accordance with the manufacturers specifications.

21) No movement of vehicles to or from car park F (as indicated on drawing number 882-000-A-TPA-07) shall take place except between the hours of 7.00am and 11.00pm on any day.

22) All external lighting shall be in full accordance with the details referred to in the Electrical Statement and paragraphs 4.34 and 4.35 in the Design and Access Statement submitted with the planning application, unless otherwise agreed in writing by the Local Planning Authority.

23) Prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, full details of measures to prevent vehicular access to and from the site via Filby Road shall firstly be submitted to and approved in writing by the Local Planning Authority, and secondly, installed in full accordance with the approved details. The approved measures shall be retained thereafter to the satisfaction of the Local Planning Authority.

24) Security fencing shall be installed in full accordance with that illustrated on the approved plans and referred to in paragraphs 4-31 and 4-32 of the submitted Design and Access Statement, unless otherwise agreed in writing by the Local Planning Authority.

25) No existing building on the site shall be occupied until it has been converted in full accordance with the details indicated on the approved plans, unless otherwise agreed in writing by the Local Planning Authority.

26) The first floor windows on the south-western elevation of the education and learning resource centre (as indicated on drawing number 882-004-A-TPA-23) shall be installed so that they are non-opening and have obscured glazing, and shall be retained as such

thereafter.

27) All converted existing buildings shall be adapted to meet the BREEAM 'Good' standard and all new buildings shall be built to meet the 'Very Good' or 'Excellent' standard. On completion of the development the applicants shall submit to the Local Planning Authority an assessment carried out by a licensed BREEAM assessor to demonstrate that these standards have been met.

28) The development hereby permitted shall be undertaken in accordance with the following mitigation measures relating to protected species on the site:

a) The measures identified in the submitted Ecology Statement received by the Local Planning Authority on 3 November 2008 and the Ecology Mitigation Strategy received by the Local Planning Authority on 9 January 2009. These measures shall be completed prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison, unless otherwise agreed in writing by the Local Planning Authority.

b) The lower and middle rows of ventilation bricks in building numbers 27B, 27C, 27D, 27E and 28 as referred to in Section 4.1 of the Ecological Assessment shall not be disturbed outside the period 1 November and 1 March in any year.

c) No building shall be refurbished or demolished, and no vegetation cleared during the period 1 March to 1 August in any year (bird breeding season) unless otherwise agreed in writing by the Local Planning Authority.

d) Prior to the commencement of development the amphibian exclusion fencing referred to in Section 4.4 of the Ecological Assessment shall be installed in accordance with the details specified and shall be retained during the period of construction works.

29) Prior to the date on which the first prisoner is accommodated overnight in secure conditions approved by this planning permission (or such other date or stage in development as may be agreed in writing by the Local Planning Authority), the following components of a scheme to deal with the risks associated with contamination of the site shall each be submitted to and approved in writing by the Local Planning Authority:

a) A preliminary risk assessment which has identified:

- All previous uses.
- Potential contaminants associated with those uses.
- A conceptual model of the site indicating sources, pathways and receptors.
- Potential unacceptable risks arising from contamination at the site.

b) A site investigation scheme, based on (a) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site.

c) The site investigation results and the detailed risk assessment

(b) and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken.

d) A verification plan providing details of the data that will be collected in order to demonstrate that the works set out in (c) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.

Any changes to these components require the express consent of the Local Planning Authority. The scheme shall be implemented as approved.

30) Notwithstanding any details submitted with the planning application and prior to the date on which the first prisoner is accommodated overnight in secure conditions at the prison hereby permitted, a scheme for sewage disposal from the site subject to this permission shall be submitted to and approved in writing by the Local Planning Authority. Sewage disposal shall be operated and maintained in full accordance with the approved scheme unless otherwise agreed in writing by the Local Planning Authority.

31) The scheme for the provision and implementation of surface water drainage incorporating the implementation of rainwater harvesting shall be constructed in accordance with drawing number 113/08/101. This scheme shall be constructed and completed before occupancy of any part of the proposed development.

The reasons for the Council's decision to grant permission for development subject to the compliance with the conditions hereinbefore specified are :

1) The time limit condition is imposed in order to comply with the requirements of Section 91 of the Town and Country Planning Act 1990 as amended by Section 51 of the Planning and Compulsory Purchase Act 2004.

2) The time limit condition is imposed in order to comply with the requirements of Section 91 of the Town and Country Planning Act 1990 as amended by Section 51 of the Planning and Compulsory Purchase Act 2004.

3) To ensure the satisfactory layout and appearance of the development in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policies GS3 and ENV2 of the Broadland Local Plan (Replacement) 2006.

4) To ensure satisfactory access into the site, in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

5) To ensure safe access to the site in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

6) To ensure safe access to the site in accordance with Policy CT 5

of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

7) To ensure safe access to the site in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

8) To ensure the permanent availability of the parking and manoeuvring area, in the interests of highway safety, and in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

9) To prevent extraneous material being deposited on the highway in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

10) To ensure that the highway improvement works are designed to an appropriate standard in the interests of highway safety and to protect the environment of the local highway corridor, in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

11) To ensure that the development offers a wide range of travel choices to reduce the impact of travel and transport on the environment in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

12) To prevent extraneous material being deposited on the highway in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

13) In the interests of maintaining highway efficiency and safety in accordance with Policy CT 5 of the adopted North Norfolk Core Strategy and Policies GS3 and TRA14 of the Broadland Local Plan (Replacement) 2006.

14) To protect and enhance the visual and residential amenities of the area, in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policies GS3, ENV2 and ENV3 of the Broadland Local Plan (Replacement) 2006.

15) In order to protect trees on the site, in accordance with the requirements of Policy EN 4 of the adopted North Norfolk Core Strategy and Policy and ENV5 of the Broadland Local Plan (Replacement) 2006.

16) To protect and enhance the visual amenities of the area, in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policy and ENV5 of the Broadland Local Plan (Replacement) 2006.

17) To accord with the expressed intentions of the applicant, in the

Interests of the visual amenities of the area and because the Local Planning Authority wishes to retain control over the type of possible alternative materials to be used in the approved development in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policy GS3 of the Broadland Local Plan (Replacement) 2006.

18) To control noise emitted from the site in the interests of residential amenity, in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy and Policies GS3 and CS14 of the Broadland Local Plan (Replacement) 2006.

19) To control the noise emitted from the site in the interests of residential amenity, in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy and Policies GS3 and CS14 of the Broadland Local Plan (Replacement) 2006.

20) To control noise and odour emitted from the site in the interests of residential amenity, in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy and Policies GS3 and CS14 of the Broadland Local Plan (Replacement) 2006.

21) To control the noise emitted from the site in the interests of residential amenity, in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy and Policies GS3 and CS14 of the Broadland Local Plan (Replacement) 2006.

22) In the interests of visual amenity and to avoid light pollution in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy and Policies GS3 and CS14 of the Broadland Local Plan (Replacement) 2006.

23) In the interests of the residential amenities of the area and in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policy GS3 of the Broadland Local Plan (Replacement) 2006.

24) In the interests of the visual amenities of the area in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policies GS3 and ENV2 of the Broadland Local Plan (Replacement) 2006.

25) In the interests of the amenities of the area in accordance with Policy EN 4 of the adopted North Norfolk Core Strategy and Policies GS3 and ENV2 of the Broadland Local Plan (Replacement) 2006.

26) In order to protect the amenities of the nearby Pupil referral Unit in accordance with Policy EN4 of the adopted North Norfolk Core Strategy.

27) In order that the development accords with the submitted Sustainability Statement in accordance with Policy EN 6 of the adopted North Norfolk Core Strategy.

28) In the interests of wildlife protection in accordance with Policy EN 6 of the adopted North Norfolk Core Strategy and Policy ENV4 of the Broadland Local Plan (Replacement) 2006.

29) To ensure that the proposed development does not cause pollution of Controlled Waters and that development complies with approved details in the interests of protection of Controlled Water in accordance with Policy EN 13 of the adopted North Norfolk Structure Plan.

30) In the interests of public amenity and in accordance with Policy EN 13 of the adopted North Norfolk Core Strategy.

31) To ensure a satisfactory method of surface water drainage, as is outlined in paragraph F.4 of PPS25.

Notes:

1) The application site is the subject of an Obligation under Section 106 of the Town and Country Planning Act 1990.

2) The proposal has been considered against Development Plan policy comprising Policies SS 1, SS2, SS 4, SS 5, SS 6, EN 2, EN 4, EN 6, EN 8, EN 10, EN 13, EC 2, EC 4 and CT 5 of the adopted North Norfolk Core Strategy and Policies GS1, GS3, ENV1, ENV2, ENV3, ENV4, ENV5, TRA2, TRA3, TRA14 and CS14 of the Broadland District Local Plan (Replacement) 2006. The Local Planning Authority considers that the proposed development complies with the objectives of these policies and is also of the view that the national need for additional prison places is a material consideration to be taken into account in determining the application. As such it is considered that approval of the application is justified, proportionate and in accordance with planning law.

Decision Date

.....
Acting under Delegated Authority on Behalf of the Council

SCHEDULE 3

PART 1

THE DEVELOPER'S COVENANTS WITH NORTH NORFOLK

- 1 The Developer covenants with North Norfolk that the Developer shall:
 - 1.1 within one month following the Commencement of Development to submit to North Norfolk or procure the submission of a written strategy for a Wind Turbine within either the Site or the Access Land of sufficient capacity to generate electricity at least equal to 10% of the predicted energy demands of the prison which is to be erected as the Development as determined in accordance with the Report and obtain North Norfolk's agreement thereto;
 - 1.2 during the Investigation Period or such extended period as North Norfolk may agree in writing the Developer shall carry out or procure the carrying out of all appropriate and necessary surveys and investigations to ascertain whether any part of either the Site or the Access Land is suitable for the erection of a Wind Turbine thereon for the generation of electricity. The result of such surveys and investigations together with all supporting reports and other material shall be supplied by the Developer to North Norfolk;
 - 1.3 if during the Investigation Period it is established to the reasonable satisfaction of North Norfolk that a Wind Turbine is feasible on either the Site or the Access Land and North Norfolk confirms this in writing then within six months of such confirmation the Developer shall submit or procure the submission of a planning application for the Wind Turbine;
 - 1.4 if planning permission for a Wind Turbine is granted then the Developer will within 3 years of being granted such permission carry out or procure:
 - 1.4.1 the erection of the Wind Turbine;
 - 1.4.2 the connection of the Wind Turbine to the National Grid; and
 - 1.4.3 that the Wind Turbine is operating to its full capacitythe Developer will submit to North Norfolk or procure the submission of annual records of the amount of electricity generated by the Wind Turbine and supplied to the National Grid;
 - 1.5 in the event of it being established that a Wind Turbine is not feasible on either the Site or the Access Land or the planning application referred to in paragraph 1.3 above is refused then within a period of six months following the date that it is established that a Wind Turbine is not feasible on either the Site or the Access Land or if the planning application is refused or within six months of the final determination of any appeal made by the Developer then in substitution for any obligation on the part of the Developer to erect or procure the erection of a Wind Turbine on either the Site or the Access Land the Developer shall pay to North Norfolk such sum of money as shall be agreed between the Developer and North Norfolk as being reasonable to represent the costs that will be incurred by North Norfolk in erecting or procuring the erection of a Wind Turbine on another suitable site within the District of the North

Norfolk District Council Such costs shall be determined by North Norfolk and the Developer within two months of a written request to so determine the same from the Developer and if the parties fail to agree on the amount of such costs within the two month period the same shall be referred to the Expert for determination under the provisions of Clause 8 of this Deed The sum agreed between the parties or determined by the Expert under the provisions of this paragraph 1.5 is the Alternative Site Costs;

- 2 The Developer further covenants with North Norfolk that the Developer shall not use the prison to be erected on the Site other than as one for prisoners who cannot be trusted in open conditions but who do not have the resources and will to make a determined escape attempt

- 3 The Developer further covenants with North Norfolk that the Developer shall in respect of:

- 3.1 that part of the Site adjoining Filby Road shown edged brown within the red edging on the plan numbered 882-000-A-TPA-49 annexed hereto as lies immediately to the south of the secure area of the proposed prison (such land being more particularly shown edged brown on the plan numbered 882-000-A-TPA-46 annexed hereto):

- 3.2 that part of the Access Land located at the northern end of the former airfield shown edged orange on the plan numbered 882-000-A-TPA-49 (such land being more particularly shown edged orange on the plan numbered 882-000-A-TPA-48 annexed hereto):

carry out the approved landscaping scheme required to such land under the Conditions annexed to the Planning Permission ("the First Approved Scheme")

- 4 Following completion of the carrying out of the First Approved Scheme to the reasonable satisfaction of North Norfolk and the submission of the Final Report to North Norfolk the Developer will offer to:

- 4.1 transfer the freehold interest in all the lands described in paragraphs 3.1 and 3.2 above (such lands being the "First Transfer Land") to North Norfolk to be held by North Norfolk for use as public open space subject to the occupations by any statutory undertakers and reserving to the transferor the electricity sub-station shown in the approximate position by an "X" within a black square on the plan numbered 882-000-A-TPA-49 annexed hereto and the electricity ring main under the First Transfer Land and the right to use all utility services on and under the First Transfer Land and serving the transferor's retained land together with all appropriate easements for repairing maintaining and renewing the same

- 4.2 grant to North Norfolk and all persons authorised by North Norfolk a right of access to and egress from First Transfer Land to and from the public highway along such route or routes as shall be agreed between North Norfolk and the Developer such route or routes being maintained by the Developer to a minimum of a farm track standard (such right being the "First Access Right")

in accordance with the provisions of paragraph 5 below

- 5.1 the First Transfer Land shall together with the First Access Right be offered to North Norfolk in consideration of the payment of the sum of £1 and the Developer shall pay

its own legal and other reasonable costs;

- 5.2 from the date of the Developer's offer to North Norfolk under paragraph 5.1 above such offer shall remain open for 28 days for North Norfolk to accept the same and upon North Norfolk deciding to accept the offer the transfer of the First Transfer Land to North Norfolk shall be completed within three months of the date of such acceptance;
- 5.3 the First Transfer Land will be unencumbered by any financial charges but will otherwise be subject to all encumbrances affecting such title as specified in the Charges Register of the Title Numbers NK298374 and NK383148 on the date of transfer as affect the First Transfer Land and to the occupation of any statutory undertakers and the Developer will at his own cost following the date of this Deed and at any time prior to completion of the Transfer provided for in this paragraph on the reasonable request of North Norfolk deduce or verify title to the First Transfer Land and the First Access Right;
- 5.4 the transfer to North Norfolk will incorporate covenants by North Norfolk restrictive of the use and development of the First Transfer Land providing for its use to be limited to open space (as that expression is defined in Section 336 (1) of the 1990 Act) and to be incapable of development (within the meaning of section 55 of the 1990 Act);
- 5.5 the transfer to North Norfolk of the First Transfer Land shall be accompanied by a collateral warranty from the Developer's contractor in respect of the Final Report together with a sum equal to fifteen times the annual maintenance costs for the First Transfer Land such costs to be agreed between the Developer and North Norfolk so as to represent fifteen times the annual costs of carrying out the First Approved Scheme that are expected to be incurred by North Norfolk maintaining those parts of the First Transfer Land that have been included in the Transfer to North Norfolk. If the sum payable by the Developer to North Norfolk under this paragraph has not been expended by North Norfolk on maintaining the First Transfer Land any unexpended part of the sum shall be refunded by North Norfolk to the Developer on such date as shall be fifteen years after the date that the sum was first paid to North Norfolk together with such interest as North Norfolk may have earned on such unexpended sum
- 6 In the event that North Norfolk declines to accept a transfer of the freehold interest in respect of any part of the First Transfer Land then in respect of such land or lands not transferred to North Norfolk a management plan based on the First Approved Scheme shall be submitted to North Norfolk within three months of North Norfolk's decision to decline the said offer for approval (such approval not to be unreasonably withheld or delayed) and thenceforth such land or lands will be maintained by the Developer in accordance with such substitute approved management plan
- 7 In the event of any dispute or disagreement arising between the Developer and North Norfolk with respect to the terms of this Part 1 of Schedule 3 the form of Transfer or the management plan the matter in dispute will be determined in accordance with the dispute resolution procedure contained in Clause 8 of this Deed

SCHEDULE 3

PART 2

THE DEVELOPER'S COVENANTS WITH BROADLAND

Subject to the provisions of Schedule 5 of this Deed the Developer covenants with Broadland that the Developer shall:

- 1.1 in respect of the Broadland Site other than for the Access Road carry out the approved landscaping scheme required to such land under the Conditions annexed to the Planning Permission ("the Second Approved Scheme")
- 1.2 following completion of the carrying out of the Second Approved Scheme to the reasonable satisfaction of Broadland and the submission of the Final Report to Broadland the Developer will offer to:
 - 1.2.1 transfer the freehold interest in all the lands described in paragraph 1.1 above (such lands being the "Second Transfer Land") to Broadland to be held by Broadland for use as public open space subject to the occupations by any statutory undertakers and reserving to the Developer all services and the right to use the same on and under the Second Transfer Land and serving the Developer's retained land together with all appropriate easements for repairing maintaining and renewing the same **AND** for the avoidance of doubt it is hereby expressly agreed that the land or lands to be transferred to Broadland hereunder shall not include any part of the Access Road
 - 1.2.2 grant to Broadland and all persons authorised by Broadland a right of access to and egress from the Second Transfer Land to and from the public highway along such route or routes as shall be agreed between Broadland and the Developer such route or routes being maintained to a minimum of a farm track standard (such right being the "Second Access Right")

in accordance with the provisions of paragraphs 2.1 to 2.5 inclusive below

- 2.1 the Second Transfer Land shall together with the Second Access Right be offered ("the Offer") to Broadland in consideration of the payment of the sum of £1 and the Developer shall pay its own legal and other reasonable costs;
- 2.2 upon Broadland confirming acceptance of the Offer the Developer will convey the Second Transfer Land and Second Access Right to Broadland;
- 2.3 the Second Transfer Land will be transferred with limited title guarantee and with vacant possession and unencumbered by any financial charges but will otherwise be subject to all encumbrances affecting such title as specified in the Charges Register of the Title Numbers NK298374 and NK383148 on the date of transfer as affect the Second Transfer Land and to the occupation of any statutory undertakers and the Developer will at his own cost following the date of this Deed and at any time prior to completion of the Transfer provided for in this paragraph on the reasonable request of Broadland deduce or verify title to the Second Transfer Land and the Second Access Right;

- 2.4 the transfer to Broadland will incorporate covenants by Broadland restrictive of the use and development of the Second Transfer Land providing for its use to be limited to open space (as that expression is defined in Section 336 (1) of the 1990 Act) and to be incapable of development (within the meaning of section 55 of the 1990 Act);
- 2.5 the transfer to Broadland of the Second Transfer Land shall be accompanied by a collateral warranty from the Developer's contractor in respect of the Final Report together with a sum equal to fifteen times the annual maintenance costs for the Second Transfer Land such costs to be agreed between the Developer and Broadland so as to represent fifteen times the annual costs of carrying out the Second Approved Scheme that are expected to be incurred by Broadland maintaining those parts of the Second Transfer Land that have been included in the transfer to Broadland
- 3 if the sum payable by the Developer to Broadland under this paragraph has not been expended by Broadland on maintaining the Second Transfer Land any unexpended part of the sum shall be refunded by Broadland to the Developer on such date as shall be fifteen years after the date that the sum was first paid to Broadland together with such interest as Broadland may have earned on such unexpended sum
- 4 in the event that Broadland decline to accept a transfer of the freehold interest in respect of any part of the Second Transfer Land then in respect of such lands not transferred to Broadland a management plan based on the Second Approved Scheme shall be submitted to Broadland within six months of Broadland's decision to decline the said Offer for approval (such approval not to be unreasonably withheld or delayed) and thenceforth the land or lands will be maintained by the Developer in accordance with such approved management plan
- 5 in the event of any dispute or disagreement arising between the Developer and Broadland with respect to the terms of this Schedule the form of Transfer or the management plan the matter in dispute will be determined in accordance with the dispute resolution procedure contained in Clause 8 of this Deed

PART 3

COVENANTS BY THE DEVELOPER WITH NORTH NORFOLK AND BROADLAND

- 1 Within one month of the date hereof the Developer will submit to North Norfolk and to Broadland a draft of the Developer's proposed instruction to its contractor ("the Initial Instruction") which the Developer proposes to engage to prepare the Condition Report
- 2 Within twenty-eight days of North Norfolk and Broadland receiving the Initial Instruction North Norfolk and Broadland will inform the Developer of any comments that they wish to make thereon and the Developer will discuss and agree any changes to the Initial Instruction with North Norfolk and Broadland
- 3 Upon the Initial Instruction being agreed with North Norfolk and Broadland such agreed Initial Instruction will be used as the Developer's instruction to its contractor to prepare the Condition Report
- 4 Upon the Developer's contractor preparing its initial draft of the Condition Report such initial draft shall be submitted to the Developer North Norfolk and Broadland

and agreed with the Developer North Norfolk and Broadland prior to it being adopted

- 5 Upon the initial draft of the Condition Report being adopted the final edition of the Condition Report shall be issued by the Developer's contractor to the Developer North Norfolk and Broadland ("the Final Report")
- 6 The Developer covenants with North Norfolk and Broadland to act in accordance with the directions given by North Norfolk and Broadland as set out in Schedule 5 to this Deed

SCHEDULE 4

THE PLANNING AUTHORITY COVENANTS

PART 1

NORTH NORFOLK COVENANTS WITH THE DEVELOPER

1 USE AND RETURN OF CONTRIBUTIONS

All sums paid to North Norfolk under the provisions of paragraph 5.5 of Part 1 of Schedule 3 shall be utilised by North Norfolk within 15 years of the same having been received by North Norfolk and if not so utilised shall be returned by North Norfolk to the Developer together with such interest as North Norfolk may have earned on such sum

2 DISCHARGE OF OBLIGATIONS

Upon request North Norfolk shall provide written confirmation of the discharge of the obligations contained in this Deed when satisfied that such obligations have been performed

PART 2

BROADLAND COVENANTS WITH THE DEVELOPER

1 USE AND RETURN OF CONTRIBUTIONS

Subject to the provisions of Schedule 5 all sums paid to Broadland under the provisions of paragraph 2.5 of Part 2 of Schedule 3 shall be utilised by Broadland within 15 years of the same having been received by Broadland and if not so utilised shall be returned by Broadland to the Developer together with such interest as Broadland may have earned on such sum

2 DISCHARGE OF OBLIGATIONS

Upon request Broadland shall provide written confirmation of the discharge of the obligations contained in this Deed when satisfied that such obligations have been performed

SCHEDULE 5

MUTUAL COVENANTS BETWEEN NORTH NORFOLK AND BROADLAND

- 1 Upon receipt of the Offer Broadland will within 21 days inform North Norfolk of such receipt and thereafter North Norfolk will within 21 days inform Broadland whether North Norfolk wishes Broadland to accept or decline the Offer
- 2 Upon North Norfolk informing Broadland of any desire to decline the Offer Broadland will within 21 days inform the Developer of such decision and upon such notification being given the Developer shall no longer be obliged to effect the transfer of the Second Transfer Land together with the Second Access Right under the provisions of this Deed
- 3 Upon North Norfolk deciding to accept the Offer North Norfolk shall simultaneously inform Broadland and the Developer of such decision within 21 days and on receipt of such notice Broadland shall direct the Developer to transfer the Second Transfer Land and the Second Access Right to North Norfolk together with all such sums payable by the Developer to Broadland under the provisions of Part 2 of Schedule 3 of this Deed
- 4 Pursuant to the provisions of paragraph 3 above North Norfolk will accept the transfer of the Second Transfer Land together with the Second Access Right and following completion of the said transfer all sums paid to North Norfolk under the provisions of paragraph 3 above shall be utilised by North Norfolk within 15 years of the same having being received by North Norfolk and if not so utilised shall be returned to the Developer together with such interest as North Norfolk may have earned on such sum
- 5 Broadland will not be liable for any enforcement provisions costs or liabilities under this Deed in relation to the Second Transfer Land or the Second Access Right and North Norfolk will indemnify Broadland in respect of all costs fees and disbursements (if any) that may arise from any activity connected with the transfer of the Second Transfer Land and the Second Access Right by the Developer to North Norfolk in accordance with paragraph 3 of this Schedule
- 6 In the event of the Transfer of the Second Transfer Land together with the Second Access Right to North Norfolk then for the avoidance of doubt Broadland will not be responsible for the maintenance of the Second Transfer Land
- 7 North Norfolk do covenant to maintain the Second Transfer Land to the reasonable satisfaction of Broadland
- 8 The parties hereby agree that for the purposes of Schedule 5 time shall not be of the essence

**RENEWABLE ENERGY AND
ENERGY CONSERVATION REPORT
AT
PROPOSED PRISON AT FORMER RAF COLTISHALL
FOR
MOJ PROPERTY SERVICES**

Client

Wates Construction Ltd
Wates House
Station Approach
Leatherhead
Surrey
KT22 7SW

Consultant:

Pearce Buckle (Design Engineers) Limited
3 Europa Court
Sheffield Business Park
Sheffield
S9 1XE

Tel: (0114) 290 0980
Fax: (0114) 290 0981

Ref: 07-082
Author: A Machan & H Thornton

AMENDMENT SHEET

REVISION	DESCRIPTION	DATE	APPROVED
A	Preliminary Assessment	March 08	R Cherrill
B	Revised following initial consultation	April 08	R Cherrill
C	Issued to support Planning Submission	May 08	D Dignam
D	Biomass Sections Amended	May 08	D Dignam
E	Document revised following review meeting 13.05.08	May 08	D Dignam
F	Document revised following comments 16.05.08	May 08	D Dignam

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1.0 EXECUTIVE SUMMARY

We have carried out a sustainable energy and natural resource study for the proposed new build and refurbished areas of the proposed 500 inmate category C Prison at the former RAF Coltishall, in accordance with the requirements of the Ministry of Justice and Wates' Construction Brief for a 'stand alone' Mechanical and Electrical services strategy.

Key Driver:-

The key driver for this report is Norfolk County Council's requirement to provide 10% of the energy used by the development from renewable sources (10% reduction in emission CO₂ emission).

Summary of Applications of Renewable Technologies

Each technology is assessed in terms of an outline feasibility study. If that technology is proved feasible, a technical and economic feasibility study is carried out. The summary of this process is shown in the table below, along with the section of the report where the details can be found:-

Technology	Outline Feasibility	Technical Feasibility	Economic Feasibility	Overall Feasibility
Wind Turbines	YES (see section 4.1)	YES, two options available (see section 5.4)	YES (see section 6.1)	YES (see section 7.0)
Ground Source Heating & Cooling	YES (see section 4.2)	YES subject to significant technical challenges (see section 5.4 for details)	NO (see section 6.1)	NO (see section 7.0)
Biomass Heating	YES (see section 4.3)	YES subject to significant technical challenges (see section 5.4 for details)	NO (see section 6.1)	NO (see section 7.0)
Biomass Combined Heat & Power	NO (see section 4.4)	N/A	N/A	NO
Photovoltaics	YES (see section 4.5)	YES (see section 5.4)	NO (in combination with Solar Thermal - see section 6.1)	NO, does not satisfy Planning Requirement (see section 7.0)

Summary of Applications of Renewable Technologies (continued)

Technology	Outline Feasibility	Technical Feasibility	Economic Feasibility	Overall Feasibility
Solar Thermal	YES (see section 4.6)	YES (see section 5.4)	NO (in combination with PV - see section 6.1)	NO, does not satisfy Planning Requirement (see section 7.0)
Fuel Cells using hydrogen from renewable sources	NO (see section 4.7)	N/A	N/A	NO
Gas from anaerobic digestion	NO (see section 4.7)	N/A	N/A	NO
Geothermal	NO (see section 4.7)	N/A	N/A	NO
Micro hydro	NO (see section 4.7)	N/A	N/A	NO
Ground cooling air systems	NO (see section 4.7)	N/A	N/A	NO
Solar Air Collectors	NO (see section 4.7)	N/A	N/A	NO

As a result of the outline and technical feasibility studies, a total of 6 possible options have been developed for the site, these are discussed fully in a detailed analysis of the pros and cons in the summary of technically feasible options below. The options discussed are as follows:-

- Option A:** 250kW Wind Turbine
- Option B:** 2 no. 80kW Wind Turbines
- Option C:** Ground Source Heat Pumps for the H-Blocks and Kitchen
- Option D:** Biomass Boilers for the Whole Site
- Option E:** Biomass Boilers for 3 no. H-Blocks on the north end of the site
- Option F:** Photovoltaic panels and Solar Thermal Water Heating for the buildings outside the perimeter fence

The summary shows that we consider wind turbines to be the only feasible technology to satisfy North Norfolk District Council's renewable energy policy statement. Of the two options available for this technology, we consider option A (250kW turbine) to be the most attractive option for this site. Should this option proceed, further detailed analysis and consultation with specialists will be required to determine a suitable location for the turbine and design the necessary electrical infrastructure.

SUMMARY OF TECHNICALLY FEASIBLE OPTIONS

Option	Description	CO ₂ offset	Net Present Value	Advantages	Disadvantages
A	1 no. 250kW wind turbine	17.6% of site emissions	£ 105,166	- Simple, single solution - Easy to install - Exceeds 10% CO₂ offset requirements - Could be planned for additional expansion of the site by other potential users - Little or no delay to programme - Good return on investment	- Turbine preferred to be located close to substation, limits choice of possible sites - Possible planning restrictions
B	2 no. 80kW wind turbines	12.2% of site emissions	£ 105,156	- Simple solution - Easy to install - Exceeds 10% CO₂ offset requirements (but not as much as option A) - Could be planned for additional expansion of the site by other potential users - Turbines are slightly smaller than the 250kW turbine - Little or no delay to programme - Good return on investment	- Turbine preferred to be located close to substation, limits choice of possible sites - Possible planning restrictions - Additional complexity with mounting 2 turbines - Lower CO₂ reductions than option A
C	Ground Source Heat Pumps	10.0% of site emissions	£ 877,799	- Can achieve 10% renewables requirement - Small visual impact	- Complexity of cross-site infrastructure - Increased size of plantrooms - Increased electrical supply & increased size of generator to run the heat pumps - Approximately 6 months delay to programme - Increased transport of materials on and off site - Technical complexity of secondary heating system - Boreholes may only be suitable far from the building served - Very high cost and poor payback on investment

Option	Description	CO ₂ offset	Net Present Value	Advantages	Disadvantages
D	Biomass for whole site	37.2% of site emissions	£ 3,880,762	- Exceeds 10% renewables requirement significantly - Local suppliers are available for fuel delivery - Plantroom could be located outside the perimeter fence	- Extensive maintenance required - Possible unreliability of fuel source - Complexity of cross-site infrastructure - A large central plantroom will be required which will be difficult to locate - Large flues will be required with large visual impact and possible planning implications - Excessive fuel deliveries required would increase throughput of traffic onto site. - Delay to programme - Very high cost and poor payback on investment
E	Biomass for 3 no. H-Blocks	10.6% of site emissions	£ 1,207,918	- Can achieve 10% renewables requirement - Local suppliers are available for fuel delivery - Plantroom could be located outside the perimeter fence	- Extensive maintenance required - Reliability of fuel source - Complexity of cross-site infrastructure - A large central plantroom will be required which will be difficult to locate - Large flues will be required with large visual impact and possible planning implications - Many fuel deliveries required increases throughput of traffic onto site. - Delay to programme - Very high cost and poor payback on investment
F	Solar technologies (solar thermal and PV)	10.0% of new build emissions, 3.5% of whole site	£ 588,003	- Easy to install - Small visual impact - Little or no delay to programme	- Only suitable for buildings outside the perimeter fence - Low CO₂ reductions, cannot meet planning requirement - Structural implications on mounting the panels - Poor payback on investment - Low efficiency and energy yield

2.0 INTRODUCTION

This document includes the feasibility of each of the renewable technologies currently available, in accordance with approved assessment criteria, CIBSE Guides and BSRIA Rules of Thumb.

The proposed site shall contain a total of 14 buildings, 9 refurbishment and 5 new builds as follows:-

Ref	Description	No.	Type	GI A (m2)
1&2	Staff Change, FM, Works Dept.	1	Refurbishment	1287
3	Houseblocks A-F	6	Refurbishment	1046
4	Education Block	1	Refurbishment	1011
5	Multi-Functional	1	Refurbishment	1287
6	Segregation	1	New Build	325
7	Reception/Healthcare	1	New Build	920
8	500 Meal Kitchen	1	New Build	737
9	Entry Building and Visits	1	New Build	1600
10	Visitors Centre	1	New Build	165
11	Stores	1	Refurbishment	351

This report has been produced in response to the requirements of North Norfolk District Council Renewable Energy Policy, as well as other renewable energy requirements as described below:-

North Norfolk District Council Renewable Energy Policy:-

'EN6: Sustainable construction and energy efficiency. This policy requires that all new developments will be required to demonstrate how they minimise resources consumption and energy consumption. All developments are encouraged to incorporate onsite renewable energy sources, and developments over 1,000m² will be required to include on site renewable energy technology to provide at least 10% of predicted energy usage'

Guidance from CIBSE Guide L 'Sustainability Strategy' states that

'Despite the typical wording of '10% renewables' policies, the calculations are generally expected to show that the application of renewables achieves a reduction in CO₂ emissions of 10% against a baseline.'

The calculation methodology was developed by Faber Maunsell as the *London Renewables Toolkit* in 2004. This was developed into a Building Regulations second tier document *Low and Zero Carbon Energy Sources: Strategy Guide* published in 2006. Both of these documents set out the calculations which must be carried out as part of renewable energy feasibility studies to be based on the *reduction in CO₂ emissions* rather than the *amount of energy produced* by renewable technologies.

NNDC's Energy Consumption Statement is written to be used directly for domestic buildings and that 'Non-domestic developments should use the approach set out in section 4 of the London Renewables Toolkit'. Therefore this report bases calculations upon 'the application of renewables (or more strictly low and zero carbon energy sources) to achieve a reduction in CO₂ emissions of 10% against a baseline.'

Other Renewable Energy Requirements:-

Assessing the carbon emissions associated with the operation of buildings is now an important part of the overall early design process. As well as planning conditions, public sector buildings are encouraged to meet an 'Excellent' credit scoring set out in the Building Research Establishment Environmental Assessment Method (BREEAM). It is also encouraged to 'consider' the use of renewable sources as part of the Simplified Building Energy Model (SBEM) compliance document to achieve Building Regulation approval.

- **Building Regulations Part L2A**

Recommend that at least 10% of the total predicted building energy is supplied by renewable or low energy source, otherwise known as 'Low Zero Carbon' (LZC). This is only applicable to new buildings or large extensions.

- **BREEAM;** to assist in achieving 'Excellent' Rating, the following credits are applicable to renewable energy;

E1 – Reduction in Carbon Emissions (15 Credits available)*

P11 – Renewable & Low Emission Energy (3 Credits available)

W5 – Water recycling (3 Credits available)

*Please note Credit Reference E1 'Reduction in Carbon Emission' scoring is a result to a combination of various aspects of the development, building construction, lighting types, etc., and not just renewable energy.

Coltishall Renewable Energy Target

This target for the application of renewable technologies on the Coltishall site as set out in this report shall be based on the North Norfolk District Council Renewable Energy Policy to achieve:-

'The application of renewables (or more strictly low and zero carbon energy sources) to achieve a reduction in CO₂ emissions of 10% against a baseline.'

Each potentially feasible technology will be assessed in terms of its practical, technical and economic feasibility for this site.

Please note, this report is based on nationally recognised information and calculation techniques. Further on-site testing from specialists will be required in order to determine actual data for some of the options.

3.0 DEFINITIONS

Sustainability: *'meeting the needs of the present without compromising the ability of future generations to meet their needs'*

Renewable Energy Source: - *'An energy source that is replenished continuously in nature or that is replaced after use through natural means'*.

The application of true 'renewables' is fairly limited since only it is strictly only solar, wind, hydro or wave power which qualifies for this status. Where 'renewable' technology is used in this document, as it is in many other documents, what is really meant is 'Low & Zero Carbon' technology which is defined to include a greater range of technologies.

Zero Carbon Energy Source: - *'A Zero Carbon Technology/development is one that emits zero net carbon emissions from energy use on site, on an annual basis'*

Commonly available qualifying technologies are solar thermal (although there is a small carbon footprint from the circulation pump), photo-voltaics and wind turbines. Other technologies are also possible such as geothermal energy (not the same as ground source heat pumps), hydro-electric or wave power. These technologies have a very limited application and will not be suitable for the proposed prison at former RAF Coltishall site.

Carbon Neutral Technology: - *'Carbon Neutral is defined as a technology that emits the amount of carbon at the point of use as it takes during its lifetime'*

Biomass and biogas technologies can be carbon neutral in certain cases since the fuel burnt is replaced. However there is often a carbon footprint associated with the delivery of fuel which makes these technologies nearly neutral rather than purely neutral

Low Carbon Technology:- *'A Low Carbon technology is one that achieves a reduction in carbon emissions of 50% or more from energy use on site, on an annual basis'*

Low carbon technologies are ground source heat pumps and ground cooling technologies. Because there is a net carbon footprint from the operation of these technologies they cannot be defined directly as 'renewable', but can be used to demonstrate a reduction of CO₂ emissions on site. Combined heat and power is not considered a low carbon technology since the carbon reductions are unlikely to be high enough to qualify. CHP can be used to reduce the *baseline* energy consumption however.

4.0 OUTLINE FEASIBILITY

The practicality of renewable energy options has been assessed using guidance from the London Renewable Toolkit. This provides flowcharts for each technology to do an outline assessment of feasibility. Those technologies which demonstrate potential beyond this stage shall be considered further through a technical and economic feasibility study.

The most common feasible technologies are as follows:

- Wind Turbines
- Ground Source Heating & Cooling
- Biomass Heating
- Biomass Combined Heat & Power
- Photovoltaics
- Solar Thermal

There are other technologies available which, due to the nature of the renewable energy source, are site specific to particular locations where there is an abundance of that particular source. These are:-

- Fuel Cells using hydrogen from renewable sources
- Gas from anaerobic digestion
- Geothermal
- Micro hydro
- Ground cooling air systems
- Solar Air Collectors

Note:-

Due to the special circumstances surrounding a live prison site, an additional line in the flowchart has been added to assess whether each technology is considered suitable to be used in this environment.

Further information on all the renewable technologies considered can be found in Appendix A.

4.1 ROOF MOUNTED OR STAND ALONE WIND TURBINES

Question 1 - Is there an average wind speed of at least 6.0 m/s on site?

Answer - Wind speed from the DTI Wind speed Database (www.berr.gov.uk) for Postcode NR10 5JW as follows:

Average wind speed 10m agl = 5 m/s
Average wind speed 25m agl = 5.8 m/s
Average wind speed 45m agl = 6.3 m/s

Turbines will need to be sited at approximately 45m agl to make the turbines feasible.

Question 2 - Is the site free of obstructions (trees, structures, buildings etc)?

Answer - Yes, exact position of wind turbines is currently unknown, it is however likely that a position can be found on the existing RAF base site which would be free of major obstructions.

Question 3 - Is there sufficient land on the development to allow the placement of the turbines(s) away from residential areas (distance depends on turbine size)?

Answer - Yes

Question 4 - Is the site near a conservation area or an area of historic interest on in Green Belt or Metropolitan Open Land?

Answer - The site is not within a Green Belt, Metropolitan Open Land or a Conservation Area. There are however Scheduled Ancient Monuments on the airfield that will be a restraint on the siting of turbines.

Question 5 - Is this technology suitable for use within a live prison site?

Answer - There are security issues arising from locating any equipment on the roofs of buildings within the prison perimeter fence since maintenance access would be required to them which could be abused. Roof mounted turbines are therefore not suitable. Large stand-alone turbines do not suffer this problem so are still considered feasible.

Conclusion

Stand-alone wind turbines are likely to be feasible for this site, although they will have to be mounted at approximately 45m agl which could have planning implications. Turbines should be mounted as close as practical to the substation to reduce trenching costs and distribution losses.

Roof mounted turbines are not feasible for buildings within the perimeter fence.

4.2 GROUND SOURCE HEATING/COOLING

Question 1 – Will there be room for horizontal buried pipe?

Answer - No

Comment - There will be excavation of a trench to lay cabling for electrical services, leaving the possibility of using this trench to lay horizontal collector loop. However, the depth of excavation is insufficient for reliable use and the arrays would be run too far from buildings served to enable high efficiency. The cross site infrastructure is too congested to install sufficient horizontal ground arrays anywhere else on the site.

Question 3 Is the ground accessible for vertical distribution system?

Answer - Possibly, the site is very heavily serviced and the drilling of circa 75 holes together with associated interconnecting pipework will require careful coordination. Because inside the secure area is so heavily serviced the only option for drilling is outside of the perimeter fence. This impacts upon pumping distances (and hence efficiencies) and requires considerable additional trenching (complicated by the requirement to cross the internal services) to bring the distribution pipework back to the plant rooms.

Question 4 Is ground drilling allowed on site area

Answer- Unknown, if feasible technically, we will check with relevant authority at outline design stage

Question 5 - Decide on the amount of heating to be supplied by the ground system. Can an adequate length of pipe be installed to meet the heating requirement?

Answer - Circa 75 no. boreholes will be required to achieve the required heat output for the H-Blocks and Kitchen (see section 5.3 for details). This presents a major operation which is predicted to cause a delay to the construction programme of approximately 6 months due to the complexity of the installation. Due to the site congestion, it will not be possible to locate all the boreholes close to the buildings they are serving, severely limiting the efficiency of the system.

Question 6 - Can the heating system be designed to accommodate low temperature circulation water (such as underfloor heating)?

Answer - The new buildings are modular construction for which underfloor heating is not a suitable design option. As part of the floor in the house blocks is being replaced (in cell areas) it would be possible to incorporate underfloor heating supplied by ground source heat pumps. However, since there is insufficient floor area to provide all of the heating requirements of the cells from this source, additional heating will be required. Ground source energy could be used in the kitchen to provide the warm air heating requirement and in the entry/visits building and reception & healthcare building via VRF heating/cooling fan coil units.

Question 7 - Is this technology suitable for use within a live prison site?

Answer - Yes, the visual impact is small and there are few security issues surrounding this technology. Because robustness of services is so important within a live prison site, additional gas-fired plant will be required which will be technically difficult to incorporate within the buildings.

Conclusion

This option will be feasible for the kitchen due to the low off coil temperatures required on the kitchen supply AHU. It will also be feasible for part of the H-Blocks where the floors are to be replaced (i.e. in cells). The other application the system is feasible for is to heat and cool the reception & healthcare and entry & visits buildings via VRF fan coil units. The system is not feasible in the modular buildings (with the exception of the 2 buildings with VRF systems) since underfloor heating is not possible. Since floors are only being replaced in the H-blocks, retrofitting underfloor heating in the other refurbished buildings is not considered feasible due to the cost of replacement and impact on programme.

This technology may also be used for hot water pre-heat but only as a by-product of the heating demand. The efficiency of the heat pumps reduces when used for water heating so it is therefore not considered a viable application of this technology in this case.

4.3 BIOMASS HEATING

Question 1 - Is there the potential for a local supply, delivery and storage for biomass fuel?

Answer - Yes

Comment - The closest local supplier is Norfolk Woodfuels Ltd based in Dereham NR20, 3PD, approximately 30km from the Collishall site. The security issue would require evaluating as regular deliveries would be required. For the purpose of the report we assume the above meets the approval of the Establishment.

Question 2 - Can the boiler house be located so it is suitable for biomass supply, with sufficient storage capacity?

Answer - There will be a requirement for a large area on the site for a plantroom to be located outside of the perimeter fence, subject to site layout and planning approval. There remains the problem of a very congested cross-site infrastructure which will need careful coordination to distribute heating mains.

Question 3 - Will boiler(s) be part of a modular system to allow for shut down and cleaning?

Answer - Yes - Additional gas fired boiler plant will be required for standby purposes and for shut-down and cleaning. This presents an additional cost for the Client.

Question 4 - Is this technology suitable for use within a live prison site?

Answer - Yes, the boiler house can be located outside the perimeter fence. Regular fuel deliveries are not desirable however and reliability of fuel quality is an issue. Full standby facilities would need to be provided. In addition, the boiler house would require a large flue and a fuel storage silo which could have planning implications.

Conclusion

Savings in CO₂ emissions could be significant. However there will be cost implications relating to increased maintenance and additional standby facilities.

The best area of the site is adjacent 3 of the H-blocks where there is potentially space to locate a boiler house and distribute heating mains. Although this presents the most practically feasible option for this technology, it is by no means ideal and will require very careful planning to ensure it works effectively. Because of the complications of providing the biomass plant and infrastructure, there will be a delay to the construction programme.

4.4 BIOMASS COMBINED HEAT AND POWER

Question 1 - Will the development have a year-round demand for heat, and a communal heating system?

Answer - No, the hot water services energy demand is the only heat energy demand required during the summer months. Hot water is a small energy demand compared to heating (see Appendix B for details) so the plant would be undersized in comparison with total load to make it operate efficiently or would not be running at any where near its optimal run time if it were sized for total load.

Conclusion Not feasible for this site due to inconsistency in demand

4.5 PHOTOVOLTAICS

Question 1 - Will or can the building have an east to west (through south) facing roof or flat roof?

Answer - Yes

Comment - Yes, there are a total of 15 buildings on site (as well as a central energy centre and modular external plantrooms) including 5 new builds. All of the buildings have pitched roofs with one side facing south, south-east or south-west

Question 2 - Will or can the roof façade be free from over shading for most of the day from other buildings or structures?

Answer - Yes

Question 7 - Is this technology suitable for use within a live prison site?

Answer - Only the buildings outside the secure perimeter (Visitors Reception, Works Department and Store) will be suitable for this technology due to security issues around providing maintenance to the panels.

Conclusion

Photovoltaic panels are likely to be feasible technically. However as previously mentioned the establishment is unlikely to accept panels to be mounted on the roofs within the secure areas due to security implications. PV is therefore only suitable for the Visitors Reception, Works Department and Stores buildings.

4.6 SOLAR THERMAL

Question 1 - Will the building have a year round hot water demand? (e.g. canteen, washrooms, showers)?

Answer - Yes

Question 2 - Will the building have an open aspect south east to south west facing roof (or flat roof)?

Answer - Yes, there are a total of 15 buildings on site (as well as a central energy centre and modular external plantrooms) including 5 new builds. All of the buildings have pitched roofs with one side facing south, south-east or south-west

Question 3 - Is there space for a hot water cylinder(s) close to the panels? If not, can the design be altered to provide suitable space?

Answer - Yes, there will need to be adequate space for the storage cylinder(s) to be installed.

Question 4 - Is this technology suitable for use within a live prison site?

Answer - Only the buildings outside the secure perimeter (Visitors Reception, Works Department and Store) will be suitable for this technology due to security issues around providing maintenance to the panels.

Conclusion

Solar Thermal Systems are likely to be feasible technically. However as previously mentioned the establishment is unlikely to accept panels to be mounted on the roofs within the secure areas due to security implications. Solar thermal is therefore only suitable for the facilities management building, visitors' centre and stores building.

4.7 OTHER TECHNOLOGIES

Other technologies (Fuel Cells using hydrogen from renewable sources, Gas from anaerobic digestion, Geothermal, Micro hydro, Ground cooling air systems, Solar Air Collectors) have been reviewed but deemed inappropriate for this proposal. See Appendix A7 for details

5.0 TECHNICAL FEASIBILITY

We have carried out an exercise to predict the annual gas and electricity consumption to enable us to carry out the Renewable baseline carbon emissions for the development. The detailed calculations are available if required; the input data and results are shown in Appendix B of this document.

5.1 ANNUAL CARBON EMISSION REDUCTION TARGET

This target for the application of renewable technologies on the Coltishall site as set out in this report shall be based on the North Norfolk District Council Renewable Energy Policy to achieve:-

'The application of renewables (or more strictly low and zero carbon energy sources) to achieve a reduction in CO₂ emissions of 10% against a baseline.'

The target based on the baseline carbon emissions is set out as follows:-

Block No.	Description	Total kgCO ₂	10% Target kgCO ₂
1 & 2	Staff Change / FM / Works Dept.	76,885	7,689
3	House Block A	85,670	8,567
3	House Block B	85,670	8,567
3	House Block C	85,670	8,567
3	House Block D	85,670	8,567
3	House Block E	85,670	8,567
3	House Block F	85,670	8,567
4	Education Block	46,404	4,640
5	Sports/Gym/Multifaith	65,615	6,562
	Stores	20,596	2,060
	Refurbishments	723,520	72,352
6	Segregation	24,340	2,434
7	Reception / Healthcare	51,309	5,131
8	Kitchen	220,279	22,028
9	Entry Building and Visits	88,433	8,843
10	Visitors Centre	7,049	705
	New Builds	391,409	39,141
	Totals	1,114,928	111,493

Total Carbon Reduction Targets as follows:

Refurbishments = 72,352 kgCO₂/year
 New Builds = 39,141 kgCO₂/year
 Total Site = 111,493 kgCO₂/year

For the purpose of this report, it is assumed that the carbon emissions reductions can be sourced from applying renewable technologies to any of the buildings by offsetting the carbon emissions of these buildings to the buildings without renewable technologies. This represents the most flexible option.

5.2 THE CONTRIBUTION OF PROPOSED RENEWABLE ENERGIES

Further to our outline feasibility produced in sections 4.0 to 4.7 of this report we have evaluated the technical feasibility five remaining renewable energy sources to the following criteria:-

Wind Turbines

Since roof-mounted turbines were rejected on the basis of practicality, only large-scale wind power remains a feasible option. The technical feasibility is therefore based on one or more turbines mounted at around 45m agl to offset in excess of 10% of the site carbon emissions by generating electrical energy for the site. This technology is attributable to the whole development and is not directly apportioned to single buildings.

Ground Source Heat Pumps

The technical feasibility calculations shall be based on offsetting carbon emissions by using ground source heat pumps on the following:

1. Heating and cooling for healthcare & reception, entry & visits via water to water ground source heat pumps to fan coil units mounted in ceiling voids.
2. Ventilation heating for the kitchen via low-grade heating batteries in the main air handling unit.
3. Heating in the H-Blocks in areas where the floors are to be replaced. Note, this applies to cells only so the contribution from ground source is reduced to 73%.

Calculations are based on vertical boreholes only since it is unlikely that the required load could be met through ground arrays due the highly congested cross site infrastructure.

Biomass Boilers

Biomass boilers can be applied to all the buildings on the site by the means of underground heating mains from a central boiler house. As indicated in section 4.3, there are considerable technical barriers around providing underground heating mains for the whole site due to extremely congested cross-site infrastructure. The technical feasibility is therefore based on two options. First, the whole site option supplying the heat generating demands of all the buildings on the site. The second is the slightly simpler option of providing biomass boilers to the three H-Blocks on the north end of the site. For the purpose of the technical feasibility, biomass would be used to generate heat for heating, hot water and ventilation heating. The boilers are assumed to cover only 90% of the annual demand to allow for shut down for cleaning, breakdowns etc. Gas fired boilers shall run for the other 10%.

Photovoltaics

The technical feasibility is based on applying PV panels to the roofs of the buildings outside the perimeter fence. The quantity of panels is based on the maximum number practically feasible to install on the available roof area.

Solar Thermal

Solar thermal systems can be used to provide heating in some conditions, but generally, in commercial applications, they are only feasible for hot water heating. As indicated in section 4.6, there are security restrictions around the location of panels on roofs in secure areas so the technical feasibility of solar thermal shall be based on buildings outside of the secure area. The periods of low solar yield will be met by conventional gas-fired boiler plant.

5.3 TECHNICAL SUMMARY

The calculation details are shown in the Appendix B. The summary of results is as follows:-

Technology	Building	Offset of CO ₂	Details
Wind Turbine	N/A	17.6%	Based on 1 no. 250 kW Wind Turbine* (rotor diameter of 29.5m)
		12.2%	Based on 2 no. 80 kW Wind Turbines* (rotor diameter of 18m)
Ground Source Heat Pump	Kitchen	1.3%	3 no. 18.6kW heat pumps and 15 no. 90m deep boreholes required** Satisfies 66% of total ventilation heating demand
	All 6 H-Blocks	8.7%	12 no. 18.6kW heat pumps and 60 no. 90m deep boreholes required** Satisfies 73% of total heating demand
	Entry / Visits	0.31%	1 no. 18.6kW heat pump and 5 no. 90m deep boreholes required** Satisfies 90% of total heating/cooling demand
	Reception & Healthcare	0.27%	1 no. 18.6kW heat pump and 5 no. 90m deep boreholes required** Satisfies 90% of total heating/cooling demand
Biomass	3 no. H-Blocks	10.7%	760kW boiler house required 22m ³ fuel storage required***
	Whole Site	37.2%	2.6MW boiler house required 79m ³ fuel storage required***
Photovoltaics	Facilities Management Building	2.0 %	520m ² of panels required****
	Stores	0.7%	175m ² of panels required****
	Visitor's Centre	0.3%	83m ² of panels required****
Solar Water Heating	Facilities Management Building	0.4%	47m ² of panels required
	Stores	< 0.1%	5m ² of panels required
	Visitor's Centre	0.1%	10m ² of panels required

* Based on wind turbines currently available on the market (care of WES Ltd)

** Based on largest heat pump commercially available by Viessmann Ltd.

*** Storage required for 1 month average back-up supply.

**** PV panels not building specific, the total area could be split differently over the roofs if required

5.3 TECHNICAL SUMMARY

The calculation details are shown in the Appendix B. The summary of results is as follows:-

Technology	Building	Offset of CO ₂	Details
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Photovoltaics	Facilities Management Building	2.0 %	520m ² of panels required****
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	Visitor's Centre	0.3%	83m ² of panels required****
Solar Water Heating	Facilities Management Building	0.4%	47m ² of panels required
	Stores	< 0.1%	5m ² of panels required
	Visitor's Centre	0.1%	10m ² of panels required

* Based on wind turbines currently available on the market (care of WES Ltd)

** Based on largest heat pump commercially available by Viessmann Ltd.

*** Storage required for 1 month average back-up supply.

**** PV panels not building specific, the total area could be split differently over the roofs if required

5.4 TECHNICAL CONCLUSION

The analysis in sections 4.0 to 4.7 enables us to produce a list of possible options for the site. The technical and cost details of each option, as well as an analysis of the pros and cons are shown in section 9.0. The options discussed are as follows:-

Option A: Wind Power – 250kW turbine

The technical analysis shows that a commercially available 250kW turbine would save approximately 17.6% of the total site CO₂ emissions if mounted with a hub height approximately 45m agl and rotor diameter of 29.5m. To maximise the effectiveness of this solution, the turbine would need to be sited as close to the substation as practical to reduce trenching costs and electrical distribution losses.

This solution would be simple to install by a specialist and if located appropriately will not impact adversely on the construction programme. Due the fact that this solution exceeds the CO₂ emissions target the turbine could be shared with other potential users on the site.

Option B: Wind Power – 2 no. 80kW turbine

As an alternative option, 2 no. 80kW turbines would offset 12.2% of the total site CO₂ emissions if mounted with a hub height approximately 45m agl and a rotor diameter of 18m in order for them to generate efficiently. Similarly to option A, to maximise the effectiveness of this solution, the turbine would need to be sited as close as practical to the substation to reduce trenching costs and electrical distribution losses.

This solution would be simple to install by a specialist and if located appropriately will not impact adversely on the construction programme. Due the fact that this solution exceeds the CO₂ emissions target the turbine could be shared with other potential users on the site.

This solution is likely to cause additional technical complications over option A since two turbines need to be incorporated onto the site.

Option C: Ground Source Heat Pumps

Although GSHPs are technically feasible to apply to the reception & healthcare building and Entry/Visits Building, the CO₂ yield is very low compared to the application on the other buildings. We feel therefore that a ground source solution should include the H-Blocks and Kitchen alone. This solution would offset 10.0% of the total site CO₂ emissions and do so with minimal visual impact but would present a major technical challenge. Larger plantrooms would be required to house all the heat pump units (15 in total), as well as the conventional gas-fired facilities which would still be required for top-up and standby.

In the H-Blocks, the ground source heat pumps would supply underfloor heating circuits in the cell accommodation areas. Because the underfloor heating cannot satisfy the entire heating demand in the cells due to the poor thermal performance in these areas, high level radiant panels would also be required. These panels would need to be supplied via conventional gas fired boiler plant to ensure adequate standby facilities. This means each H-Block would require 2 separate heating systems at a significant additional cost (see section 6.0 for cost analysis).

The main kitchen supply AHU would be served via a heating coil supplied via the ground source heat pump. Due to the low grade heat output of the heat pump, the coil would be very large and the maximum supply temperature would be low. An additional coil would also be required; supplied via a conventional gas fired boiler as a top up and standby facility.

The number of 90m deep boreholes required (circa 75) presents a major challenge as well. The site is extremely congested in terms of the cross site infrastructure so careful planning will be required to ensure the boreholes can be kept close as possible to the buildings they are serving. If the boreholes are a long way from the buildings, the efficiency of the system reduces and the CO₂ emissions target will not be met. There will also be an increase in materials on and off site to fill the boreholes and remove the excavated material.

Because the heat pumps run on grid-supplied electricity, there will be a greater demand for electricity on site which could possibly require a larger substation and generator. This presents yet more additional cost to the client. Because of the complexity of the systems to be installed, it is predicted that the delay to the programme will be 2-3 months.

Option D: Biomass Boilers for the Whole Site

The analysis shows that the use of biomass boilers to produce the energy requirements of the whole site would lead to a 37.2% reduction in carbon emissions. For this to happen, all buildings, including new builds and refurbishments, including those outside the perimeter fence would have the heating and hot water demand supplied by Biomass boilers.

The boiler plant would need be centralised and contained within a large single plant room, this would have a cost implication over the original plan of having several individual plant rooms located around the site. The plantroom and fuel storage silo would need to be sited outside the perimeter fence to enable fuel deliveries to take place without significant disruption to the prison. 100% duplication of the biomass boilers would also need to be provided by gas fired boilers to provide full standby facilities and cover periods of boiler shutdown for cleaning and decoking.

Distribution to the buildings would be via underground heating mains. This causes a significant technical challenge due to the complexity of the cross site infrastructure. The central plantroom is predicted to be 144m² in size and at least 3m high. 2.6MW of boiler power would be required which would require 6 no. 300mm diameter flues to a height of 25m. In addition, a predicted 959 tonnes of fuel (wood pellets, we do not recommend the use of wood chip due to unreliability problems with poor quality and variable moisture content) would be required per annum requiring a fuel storage compound of approximately 79m³ to provide 1 month backup supply.

The constraints of the site mean that the largest HGVs will not be able to deliver fuel onto site and the maximum load will be approximately 10tonnes. A total of 56 deliveries per year will therefore be required, more than 1 per week. Because of the complexity of the systems to be installed, it is predicted that the delay to the programme will be 3-4 months.

Option E: Biomass Boilers for 3 H-Blocks

The analysis shows that the use of biomass boilers to produce the energy requirements of the three H-Blocks on the north side of the site would lead to a 10.7% reduction in carbon emissions. The heating and hot water demand in these blocks would be supplied by the biomass boilers via the internal heating and hot water distribution systems already proposed as part of the baseline model.

As with the whole site option, the boiler plant would need be centralised and contained within a large single plant room adjacent the three blocks, this would have a cost implication over the original plan of having several individual plant rooms located around the site. The plantroom and fuel storage silo would need to be sited outside the perimeter fence to enable fuel deliveries to take place without significant disruption to the prison. 100% duplication of the biomass boilers would also need to be provided by gas fired boilers to provide full standby facilities and cover periods of boiler shutdown for cleaning and decoking.

As with the whole site option, distribution to the 3 no. H-Blocks would be via underground heating mains. This causes a significant technical challenge due to the complexity of the cross site infrastructure, though not quite as significant as the whole site option. The central plantroom is predicted to be 112m² in size and at least 3m high. 760kW of boiler power would be required which would require 4 no. 250mm diameter flues to a height of 25m. In addition, a predicted 271 tonnes of wood pellet fuel would be required per annum requiring a fuel storage compound of approximately 22m³ to provide 1 month backup supply.

A total of 16 no. 10 tonne fuel deliveries per year will be required, more than 1 per month. Because of the complexity of the systems to be installed, it is predicted that the delay to the programme will be 2-3 months.

Option F: Solar Systems (solar thermal and photovoltaics)

The detailed analysis shows that by locating a combination of photovoltaic panels and solar thermal panels on the roofs of all buildings outside the perimeter fence (the Facilities Management, Visitors Centre and Stores Buildings) will be sufficient to satisfy the total carbon savings target for the new build parts of the site only (10.0% of the new build CO₂ emissions). These technologies cannot be used to satisfy the 10% target of the whole site (the solution proposed only provides a 3.5% reduction in emissions).

A total of 778m² of PV panels and 61m² of solar thermal panels would be sited over the three available roofs. The visitor's centre has pitched roof and part of the facilities management building does also, but the stores building has a flat roof so panels would need to be angled in the direction of the south facing aspect to maximise efficiency. It is currently unknown as to whether there will be any structural implications associated with the additional weight on the roofs and whether adequate maintenance access can be provided. It is predicted that the solar panel systems can be provided to the roofs without adversely affecting the construction programme.

6.0 WHOLE CYCLE COSTS

The cost analysis is applied to those solutions which provide the adequate amount of CO₂ savings for this site, as calculated in the previous section. These are the six options A to F discussed fully in section 5.4. The details of the calculations are shown in Appendix D and the summary of results and conclusions in section 6.1.

The costs indicated below are based on data taken from the industry approved sources CIBSE Guides, BSRIA, BWEA and Spons Guides. Additional costs are taken from manufacturers including Rotary Engineering UK Ltd and Viessmann Ltd. Energy costs are taken from Corona Energy Ltd, EDF Energy Ltd and Wood Energy Ltd.

All costs are indicated as the difference from the baseline costs (i.e. extra over costs on top of the base proposed installation). In all cases, the capital costs are extra over costs since this is a live prison site where full standby facilities are required. In addition, each capital cost is marked up by 40% to allow for site complications, preliminaries, design fees, consultancy, builderswork and contingencies. Approximate Breakdown of Costs used to establish Whole Cycle Cost is as follows;

Capital Costs

Wind power	£ 190,000 for 80kW turbine (>25 year lifetime)
	£ 595,000 for 250kW turbine (>25 year lifetime)
GSHP	£ 1,200 per kW for mechanical equipment installed
	£ 50,000 per H-Block extra over cost for bulk material move, larger plantrooms, complexity of heating system etc
Biomass	£ 250 per kW for boiler plant (15 year lifetime)
	£ 200 per KW for boiler house construction
	£ 200 per KW for distribution trenching
PV array	£ 4,300 per kWp (mono-crystalline system, >25 year lifetime)
Solar Thermal	£ 794 per m ² panel installed

Running Costs

Wind turbines	£ 7,500 per annum servicing (1 specialist callout per month)
GSHP	£ 500 per heat pump per annum servicing
Biomass	£ 25,000 for small boiler house
	£ 50,000 for large boiler house
	For onsite maintenance operative and specialist callouts for cleaning, organising deliveries, decoking feeding hopper and servicing
PV and Solar Thermal	£ 3,000 for total system per annum cleaning and servicing

Energy Costs

Gas Cost	2.776p/kWh (inc. climate change levy)
Electricity Cost	8.021p/kWh (inc. climate change levy)
Wood pellet cost	3.100p/kWh

6.1 WHOLE LIFE CYCLE COST SUMMARY CONCLUSIONS

The cost analysis for each option is shown in Appendix C. The summary of costs is shown in the table below:-

Option	Description	Capital Cost*	Energy Cost per annum*	Running Cost per annum*	Net Present Value**	Cost of CO ₂ (£/tonne)**
A	250kW Wind Turbine	£ 595,000	- £ 37,220	£ 7,500	£ 105,166	£ 21
B	2 no. 80kW Wind Turbines	£ 380,800	- £ 25,829	£ 7,500	£ 105,156	£ 60
C	Ground Source Heat Pumps	£ 888,720	- £ 11,885	£ 7,000	£ 877,799	£ 316
D	Biomass for whole site	£ 2,430,301	£ 13,825	£ 50,000	£ 3,880,762	£ 374
E	Biomass for 3 H-Blocks	£ 694,820	£ 3,953	£ 25,000	£ 1,207,918	£ 433
F	Solar systems	£ 653,487	- £ 6,973	£ 3,000	£ 588,003	£ 602

* Relative to the cost of the conventional plant (negative cost represents a saving)

** Based on the cost of the investment in real terms over the 25 year term of the study

It is clear that the cheapest option in terms of capital cost is option B. However, as stipulated in section 5.4, there may be additional complications associated with the 2 turbines which can only be determined at a part of a more detailed assessment. The two wind turbine options show a similar return on investment over the 25 year term as shown in the net present value, however, Option A presents the lowest cost per tonne of CO₂ saved over the 25 term due to the relatively high yield of the large turbine.

Although the capital costs of options C, E and F are not hugely greater than option A, the investment is much less attractive since energy costs and running costs are much higher, resulting in a much higher NPV. The cost per tonne of CO₂ saved for these options is more than 10 times higher than the wind turbine options A and B. The least attractive investment in terms of return on investment is the whole site Biomass option D and the highest cost per tonne of CO₂ saved is the solar systems option F, mainly due to the high cost of PV panels relative to their efficiency.

7.0 CONCLUSION

All of the items considered have a greater or lesser impact on sustainability, with varying capital costs, paybacks and environmental impact. The main pros and cons of the various options have been discussed throughout the report and are summarised in the table in section 9.0. Our overall assessment of the remaining options is as follows:-

A single 250kW wind turbine is feasible to attain the required 10% CO₂ emissions saving target for the whole site (in fact it offsets approximately 17.6%). The capital costs are relatively low and the turbine almost pays back the cost of the investment, in real terms, over the period of the study (25 years). As an alternative option, 2 no. smaller turbines can be installed to meet 12.2% CO₂ emissions but they would not save quite so much in energy costs. This represents the most attractive investment opportunity, as well as the best technical and practical solution. However, it should be noted that the 250kW turbine will have a lesser visual impact, generate a larger quantity of energy and be a simpler installation. We therefore feel that this is the most feasible option for the site.

Since ground source heat pumps can only be applied to a limited number of buildings on the site, it is difficult to apply this technology to satisfy the 10% reduction in CO₂. Even those buildings which the technology can be applied show major practical and technical obstacles to overcome. As well as this, the economic potential for investment is very limited with this technology since in most cases cheap fuel (gas) is being replaced with expensive and more CO₂ intensive fuel (electricity). The combination of the technical challenges discussed in section 5.4 and the poor return on investment discussed in section 6.1 make this a very difficult technology to apply to this site and we do not consider it to be a feasible technology.

The 2 options for biomass boilers give varying results with regard to cost effectiveness, despite both options exceeding the 10% target for CO₂ emissions saving, for the whole site. Because of the relatively high cost of wood pellets, the boilers incur additional energy costs on top of considerable one-off capital costs. Because of this, the net present value is prohibitively high compared to other options and the combination of practical and economic constraints mean that biomass is not a viable option for the site.

Although the combination of solar energy systems is practically feasible to be installed onto the roofs of buildings outside the perimeter fence, the supporting calculations show that this will be insufficient to meet the required 10% reduction in CO₂ emissions of the whole site (although it can satisfy a reduction of CO₂ emissions of 10% of the new buildings only). Due to the low yield of the panels (particularly the PV panels), the cost is prohibitively high relative to the benefit. We therefore do not consider this to be a suitable technology for the site.

8.0 RECOMMENDATION

We consider wind turbines to be the only feasible solution for meeting the target CO₂ reductions as they easily reach the target and have a fairly good return on investment. There are also fewer technical constraints to their application to this site than all of the other options.

Of the two possible wind turbine solutions, we would recommend that the larger 250kW single turbine since this presents a simpler installation and will have a lesser visual impact. It also has the highest CO₂ yield per £ spent and exceeds the 10% renewables target significantly.

A

APPENDIX A - RENEWABLE TECHNOLOGY OVERVIEW

This details specific options which we have investigated to reduce the impact on the environment due to the consumption of water and the use of energy within the building, therefore reducing pollution and annual Carbon Emissions.

The most common feasible technologies are as follows:

- Wind Turbines
- Biomass Heating
- Solar Thermal
- Ground Source Heat Pumps
- Photovoltaics
- Combined Heat & Power
- Ground cooling air systems
- Solar Air Collectors

There are other technologies available which, due to the nature of the renewable energy source, are site specific to particular locations where there is an abundance of that particular source. These are:-

- Fuel Cells using hydrogen from renewable sources
- Gas from anaerobic digestion
- Geothermal
- Micro hydro

A1

Wind Turbines

Wind power becomes feasible when wind speeds exceed 4m/s however for the larger amount of energy required for the site a 'large' turbine will be required these large turbines only become suitable for application when wind speeds exceed 7m/s.

There are two main types of wind turbines;

Stand alone Wind Turbines

Available with either horizontal (HAWT) or vertical axis (VAWT)

Suitable for large open areas

Generates large quantities of power,

Operational wind speeds 6.0m/s to 25.0m/s

Roof mounted micro Wind Turbines

Available with horizontal (HAWT) axis

Requires less wind speed and space compared with stand alone type

Produces less power and breakout noise, suitable for inner city applications

Operational wind speeds 4.0m/s to 15.0m/s



The main drawback facing wind power technology in general is problems obtaining planning permission for the turbine due to the visual impact of the turbine (Stand alone turbines are normally mounted in highly visible exposed areas to get the required wind speed) coupled with the noise issues of the energy production.

A2

Ground Source Heating/Cooling

The ground acts as massive solar collector and thermal store, due to the fact that the average temperature of the ground just below the surface is between 8 and 13°C. A GSHP system operates by circulating water or refrigerant through pipes which are buried in the ground either horizontally in a trench or vertically in bore holes, the liquid absorbs the heat from the ground and transfers it to a heat pump which generates water at temperatures between 40 and 45°C which is a suitable temperature for pre heating domestic hot water or low temperature heating systems such as underfloor heating. The heat pump uses electricity to drive a compressor and although electricity is more expensive than natural gas the systems are very efficient and can produce 3-4 KW of heat for every 1 KW of electrical input energy (Coefficient of performance). However capital costs are often high typically £800 up to £1200 per kW.

A3

Biomass Heating

Energy can be produced from a variety of biomass sources by burning organic matter such as trees crops or animal waste. There are two types of bio energy: solid biomass or liquid biofuel. Biomass can be sourced from a variety of sources such as forest products such as short rotation coppice (i.e. fast growing regenerative wood.) or Waste wood such as wooden pellets or scrap wood from construction/destruction. The energy content of biomass is highly dependant on the moisture content of the product therefore a pre drying process is often applied. Bio fuels are produced from cellulose or vegetable oil crops such as palm oil or rapeseed oil which are processed to produce liquid fuels which can be used to fuel vehicles or to run engines including plant engines. Bio energy products need to be burnt to release there energy and as such are carbon based and generate carbon emissions, however these emissions are equivalent to the amount of carbon that the crops absorbed during there growth and as such bio energy is carbon neutral. Unlike fossil fuels bio energy products can be quickly replaced.

The system does depend on a viable source of fuel close to the site (to reduce carbon emissions of transport), and there is a requirement for ash removal/disposal as well as de-coking They also require a suitably sized fuel storage hopper/silo and automatic screw drive and controls as well as pre drying facilities. For a prison installation as proposed for ex RAF Coltishall it would be required for any biomass installation to have 100% standby provided via conventional boilers to provide surety of service rather than to replace them entirely.

Issues facing biomass boilers include the requirement for the location of suppliers close to the plant with convenient transport links (to reduce carbon emissions of transport), sufficient space for the storage and pre drying of the product, the erection of an additional building to house the plant and the associated excavations required to distribute the service around site.



A4

Solar Thermal Water Heating

Solar thermal systems collect and absorb solar radiation from the sun via solar collectors and then transfer this solar heat directly to the internal space or to pre heat domestic hot water services. Obviously due to the nature of the energy being harnessed the systems are not continuous, however hot water storage can help to get round this by being able to match hot water supply with demand all year round. The most effective systems implement active heat circulation using pumps, which give an additional electrical energy requirement. Solar thermal systems have several key influencing factors; the collectors need good access to solar energy i.e. no shadows. To get the most out of the solar radiation the collectors need to be sited on flat roofs or on pitched roofs inclined to the sun and south facing (or East-West through South). An issue can be obtaining planning permission for the panels on roofs due to the visual impact, especially when located near to roads or in a conservation area. Also it is also likely that collectors on the roofs of some of the buildings at the site would not be advisable due to the need for roof access and maintenance within an active prison site.

There are three main types of solar collectors;

Flat plate collectors (shown in picture)

Most common due to simple construction/lower cost

Typical efficiency 35% based on absorber area

Typical cost £400/m² absorber area

Evacuated tube collectors

Highest efficiencies of all collector types 50-60%

Glass in glass and metal in glass constructions

Glass in glass is slightly less efficient

Typical cost £850/m² absorber area

Concentrating or focusing collectors

Generally used in industrial process loads and power generating plant



A5

Photovoltaics

Photovoltaic materials generate direct current electrical power when exposed to light. The current technology on Photovoltaic cells can deliver up to about 17% of the energy received from the sun, as only a limited amount of sun energy can split the electron hole pairs to generate electrical current. They are generally constructed from two forms of semi-conducting cells;

Monocrystalline silicon

Gives best efficiencies, however most expensive to produce;

Polycrystalline silicon

Cheaper to produce but leads to lower efficiencies;



A6 Combined Heat and Power (CHP)

Ordinary (fossil fuel powered) Combined Heat and Power engines are not defined as a renewable source. CHP is considered as a method for reducing the baseline CO₂ emissions of the site but not as a method of offsetting CO₂ emissions against the baseline. They only fall under this title of 'renewable technology' if the fuel source is defined as Biomass, i.e. carbon neutral. Although there are Biomass CHP plants currently available in today's market, the technology is fairly new and is currently only suitable for very large sites (in excess of 20MW).

A7 Other Technologies

Fuel Cells using hydrogen from renewable sources

Fuel cells can be used as CHP systems in buildings. They are only considered renewable if the energy source used to produce the hydrogen fuel is produced from a renewable source (i.e. wind turbines, geothermal etc). The technology is very much in its infancy and is not applicable to this site due to the problems associated with converting renewable energy to hydrogen.

Gas from anaerobic digestion

This technology has been pioneered recently in Southwark to generate gas from an anaerobic digester which is then burnt to generate heat. Sites appropriate for this technology are those which generate large quantities of organic waste, such as land fill sites. That is not applicable to this site so gas from anaerobic digestion as an energy source is not considered feasible.

Geothermal

Geothermal energy is heat from the earth's core welling up to positions where it can be easily tapped into. These can be hot springs or hot dry rocks which are used to provide heating and hot water energy within buildings. This technology is highly site specific due to the particular geological conditions of the site and is therefore very rare in the UK, where geothermal activity is low. Even if there is geothermal energy available on site, which is very unlikely, this type of energy can be unreliable since geothermal conditions change over time. Since robustness of services is vital within a live prison site, geothermal technology is not considered feasible.

Micro hydro

There are no active watercourses within the existing site so electricity generation via micro-hydro turbines is not possible for this site.

Ground cooling air systems

A cooling effect can be achieved by distributing air through ducts buried 2-3 metres below ground. These systems are used mainly in hotter climates than the UK where cooling is vital and the effect by ground-cooling is more significant to that in the UK. The proposed new prison is anticipated to have very little requirement for cooling making and the relatively low yield means that the energy contribution by this technology is very limited. We therefore do not consider this technology suitable for this site.

Solar Air Collectors

A small heating effect can be achieved by distributing air through opaque panels on the roofs and used in warm air heating systems in buildings. This has a very limited applicability in commercial buildings due to the low energy yield relative to the size of panels required. Since warm air heating systems are not appropriate for most of the buildings on site (only the kitchen uses such a system) and panels cannot be placed on roofs within the perimeter fence, this technology is not considered suitable for this site.

B APPENDIX B - CALCULATION OF BASELINE ENERGY DEMAND

B1 HEATING & COOLING ENERGY DEMAND

Degree Days based on CIBSE TM41:2006 Degree Days, Theory & Application using standard mean monthly temperature data from the Hevacomp Database. Spreadsheets detailing the formulas used and calculation procedure are available upon request.

The input data used in the calculations are as follows:-

Ref	Description	No.	Infiltration Rate (ach/hr)	Hours of occupation per day	Days of occupation per week	kWh/annum
1&2	Staff Change, FM, Works Dept.	1	1	8am-6pm	5 days	206,999
3	Houseblocks A-F	6	1	24hrs	7 days	181,273
4	Education Block	1	1	8am-6pm	7 days	74,625
5	Multi-Functional	1	1	8am-6pm	5 days	119,643
6	Segregation	1	0.5	24hrs	7 days	42,157
7	Reception/Healthcare	1	0.5	8am-6pm	7 days	67,635 ^[2]
8	500 Meal Kitchen	1	N/A ^[1]	9am-5pm	7 days	N/A ^[1]
9	Entry Building and Visits	1	0.5	8am-6pm	6 days	83,058 ^[2]
10	Visitors Centre	1	0.5	8am-6pm	7 days	18,588
11	Stores	1	1	8am-6pm	6 days	62,995

U-values have been based on 2002 building regulations minimum standards for the new buildings. The refurbishment areas have U-values to match the lower standard of insulation

The 'baseline' method of heating is traditional LPHW radiator circuits via gas-fired boiler plant. The seasonal efficiency of the boiler plant has been taken to be 90%.

Notes:-

^[1]: Kitchen is fully ventilated.

^[2]: Systems in these buildings are mainly VRF fan coil units with a coefficient of performance of 3.0. The cooling energy requirement is as follows:

Entry/Visits Building – 16,246 kWh/annum

Reception/Healthcare – 17,155 kWh/annum

B2

HOT WATER ENERGY DEMAND

The hot water load is calculated via a combination of guidance in CIBSE Guide G – Public Health Engineering and an assessment of working conditions within the buildings. The different, descriptions, occupancies and usages are shown below:-

Ref	Description	No.	Occupancy	Hot Water Use/Person	HWS Usage	Total kWh/ annum
1&2	Staff Change, FM, Works Dept.	1	20 Transient Staff	21 ^[2]	420	32,498
			Staff Change	4 showers ^[7]	2160	
3	Houseblocks A-F	6	84	36 ^[1]	3023	44,961
4	Education Block	1	175 in classrooms	9 ^[5]	1573	27,103
			12 Admin	21 ^[2]	1825	
5	Multi-Functional	1	60 Admin	9 ^[5]	540	64,216
			83 Multi-faith	9 ^[6]	742	
			42 Admin	21 ^[2]	882	
			Sports/gym	4 showers ^[7]	2160	
6	Segregation	1	10	36 ^[1]	360	5,353
7	Reception/Healthcare	1	40 Admin	21 ^[2]	840	21,385
			6 treatment rooms	100/room	600	
8	500 Meal Kitchen	1	500 meals	6/meal ^[3]	6000	89,105
9	Entry Building and Visits	1	Admin - 60	21 ^[2]	1260	22,749
			Inmates/Visitors - 120	4.5 ^[4]	1860	
10	Visitors Centre	1	100 Visitors	4.5 ^[4]	450	6,691
11	Stores	1	10 Staff	21 ^[2]	210	3,122

The 'baseline' method of water heating is taken to be via gas-fired boiler plant with an efficiency of 90%

Notes:

- [1]: Based on one 6 minute shower every other day and 2 hand washes per day per inmate
- [2]: CIBSE Guide G Table 2.11 Average hot water use/day for general office staff
- [3]: CIBSE Guide G Table 2.11 Average hot water use/meal for school/college, 2 meals/day (assumed to have continental breakfast)
- [4]: Based on 2 hand washes per visitor, visitors in morning/afternoon sessions.
- [5]: CIBSE Guide G Table 2.11 Average hot water use/day for schools/colleges
- [6]: Based on hand and foot washing requirement
- [7]: Based on 2 hour showering facility

B3**VENTILATION ENERGY DEMAND**

The buildings with a significant ventilation rate are shown below. Other buildings will have some supply ventilation but this will be negligible compared to the overall load.

The air handling units will be served with LPHW heater batteries via gas-fired boiler plant (efficiency = 90%). The heating energy demand has been calculated using mean monthly temperature data from the Hevacomp Database.

Ref	Building	Heat recovery Efficiency	Air Flow Rate (m ³ /s)	Supply Temp (°C)	kWh/ annum
9	Visits/Entry Building	65%	2.16	21	38,390
7	Healthcare & Reception	65%	0.48	21	8,531
8	Kitchen - General	65%	0.735	21	13,063
8	Kitchen - Canopy	Full Fresh Air	7.33*	16	169,788

Notes:

* MOJ Standard Prison Specification – Kitchen Design & Standards Issue 2: March 2008

B4**CATERING ENERGY DEMAND**

No detailed specification for the equipment in the kitchen so far exists so the info in the table below is based on the MOJ Standard Prison Specification – Kitchen Design & Standards Issue 2: March 2008 for a standard 500 meal kitchen

Equipment	qty	Gas flowrate (l/s)	Total Flowrate (l/s)	Diversity	hours on/day	kWh/ annum
20 grid combi-oven	6	0.6	3.6	0.5	8	183,013
atmospheric steamer	2	0.45	0.9	0.5	8	45,753
175 litre tilting kettle	3	Included in HWS energy				
6 ring boiling table	1	0.48	0.48	0.5	8	24,401
2-pan deep fat fryer	6	0.75	4.5	0.5	8	228,767
175 litre bratt pan	3	0.4	1.2	0.5	8	61,004
Total			10.68			542,941

Note: Catering energy (electrical) for the kitchen only is based on a load density of 30W/m²

B5 LIGHTING & SMALL POWER ENERGY DEMAND

The lighting and small power energy demand (based on a diversity of 85%) is calculated as follows:

Block No.	Description	GIA (m2)	hrs/ day	days / week	lighting load W/m2	Lighting Energy Demand kWh/m2	Small Power load W/m2	Small Power Energy Demand kWh/m2
1 & 2	Staff Change / FM / Works Dept.	1,188	9	6	12	34,120	8	22,746
3	House Block A	1,046	8	7	12	31,154	20	51,923
3	House Block B	1,046	8	7	12	31,154	20	51,923
3	House Block C	1,046	8	7	12	31,154	20	51,923
3	House Block D	1,046	8	7	12	31,154	20	51,923
3	House Block E	1,046	8	7	12	31,154	20	51,923
3	House Block F	1,046	8	7	12	31,154	20	51,923
4	Education Block	960	5	7	12	17,870	25	37,230
5	Sports/Gym/Multi faith	1,222	9	5	12	29,247	12	29,247
11	Stores	351	9	6	12	10,081	5	4,200
	Refurbishments	9,997				278,242		404,964
6	Segregation	310	15	7	12	17,312	10	14,427
7	Reception / Healthcare	873	8	7	12	24,376	25	50,784
8	Kitchen	700	8	7	12	20,849	13	21,718
9	Entry Building and Visits	1,491	10	7	12	55,510	16	74,013
10	Visitors Centre	165	9	6	12	4,739	10	3,949
	New Builds	3,539				122,786		164,890
	Totals	13,536				401,028		569,855

B6 ANNUAL BASELINE ELECTRICAL ENERGY CONSUMPTION

Block No.	Description	GIA (m ²)	Annual Electrical Energy Consumption (kWh/annum)					Total Electrical
			Lighting ⁽¹⁾	Small Power ⁽¹⁾	Heating/ Cooling ⁽²⁾	Ventilation Fan Power ⁽¹⁾	Catering ⁽¹⁾	
1 & 2	Staff Change / FM / Works Dept.	1,188	35,915	23,944	0	0	0	59,859
3	House Block A	1,046	32,794	54,656	0	0	0	87,450
3	House Block B	1,046	32,794	54,656	0	0	0	87,450
3	House Block C	1,046	32,794	54,656	0	0	0	87,450
3	House Block D	1,046	32,794	54,656	0	0	0	87,450
3	House Block E	1,046	32,794	54,656	0	0	0	87,450
3	House Block F	1,046	32,794	54,656	0	0	0	87,450
4	Education Block	960	18,811	39,189	0	0	0	58,000
5	Sports/Gym/Multifaith	1,222	30,786	30,786	0	0	0	61,572
	Stores	351	10,611	4,421	0	0	0	15,033
	Refurbishments	9,997	292,886	426,278	0	0	0	719,165
6	Segregation	310	18,223	15,186	0	0	0	33,409
7	Reception / Healthcare	873	25,659	53,457	23,868	3,320	0	106,304
8	Kitchen	700	21,946	22,861	0	45,637	43,032	133,475
9	Entry Building and Visits	1,491	58,432	77,909	27,048	14,938	0	178,326
10	Visitors Centre	165	4,988	4,157	0	0	0	9,145
	New Builds	3,539	129,248	173,569	50,916	63,895	43,032	542,005
	Totals	13,536	422,135	599,847	50,916	63,895	43,032	1,261,170

Notes:-

1. Based on an electrical power factor of 0.95

2. Based on a seasonal coefficient of performance of 3.0

B7 ANNUAL BASELINE NATURAL GAS ENERGY CONSUMPTION

Block No.	Description	GIA (m ²)	Annual Natural Gas Energy Consumption (kWh/annum)				
			LPHW Heating ^[1]	Hot Water ^[1]	Ventilation Heating ^[1]	Catering	Total Natural Gas
1 & 2	Staff Change / FM / Works Dept.	1,188	229,999	36,109	0	0	266,108
3	House Block A	1,046	201,414	49,957	0	0	251,371
3	House Block B	1,046	201,414	49,957	0	0	251,371
3	House Block C	1,046	201,414	49,957	0	0	251,371
3	House Block D	1,046	201,414	49,957	0	0	251,371
3	House Block E	1,046	201,414	49,957	0	0	251,371
3	House Block F	1,046	201,414	49,957	0	0	251,371
4	Education Block	960	82,917	30,114	0	0	113,031
5	Sports/Gym/Multifaith	1,222	132,937	71,351	0	0	204,288
	Stores	351	69,995	3,469	0	0	73,463
	Refurbishments	9,997	1,724,331	440,783	0	0	2,165,115
6	Segregation	310	46,841	5,948	0	0	52,789
7	Reception / Healthcare	873	0	23,761	9,479	0	33,240
8	Kitchen	700	0	99,006	203,168	542,941	845,115
9	Entry Building and Visits	1,491	0	25,277	42,655	0	67,932
10	Visitors Centre	165	9,006	7,434	0	0	16,440
	New Builds	3,539	55,847	161,426	255,302	542,941	1,015,516
	Totals	13,536	1,780,178	602,209	255,302	542,941	3,180,630

Notes:-

1. Based on a boiler efficiency of 90%

B8 ANNUAL BASELINE TOTAL ENERGY CONSUMPTION

Block No.	Description	GIA (m ²)	Electricity kWh	Gas kWh	Total kWh	Electrical kgCO ₂ ⁽¹⁾	Gas kgCO ₂ ⁽²⁾	Total kgCO ₂	Electrical kgCO ₂ /m ²	Gas kgCO ₂ /m ²	Total kgCO ₂ /m ²
1 & 2	Staff Change / FM / Works Dept.	1,188	59,859	266,108	325,967	25,261	51,625	76,885	21.3	43.5	64.7
3	House Block A	1,046	87,450	251,371	338,821	36,904	48,766	85,670	35.3	46.6	81.9
3	House Block B	1,046	87,450	251,371	338,821	36,904	48,766	85,670	35.3	46.6	81.9
3	House Block C	1,046	87,450	251,371	338,821	36,904	48,766	85,670	35.3	46.6	81.9
3	House Block D	1,046	87,450	251,371	338,821	36,904	48,766	85,670	35.3	46.6	81.9
3	House Block E	1,046	87,450	251,371	338,821	36,904	48,766	85,670	35.3	46.6	81.9
3	House Block F	1,046	87,450	251,371	338,821	36,904	48,766	85,670	35.3	46.6	81.9
4	Education Block	960	58,000	113,031	171,031	24,476	21,928	46,404	25.5	22.8	48.3
5	Sports/Gym/Multifaith	1,222	61,572	204,288	265,860	25,983	39,632	65,615	21.3	32.4	53.7
	Stores	351	15,033	73,463	88,496	6,344	14,252	20,596	18.1	40.6	58.7
	Refurbishments	9,997	719,165	2,165,115	2,884,280	303,487	420,032	723,520	30.4	42.0	72.4
6	Segregation	310	33,409	52,789	86,198	14,099	10,241	24,340	45.5	33.0	78.5
7	Reception / Healthcare	873	106,304	33,240	139,544	44,860	6,449	51,309	51.4	7.4	58.8
8	Kitchen	700	133,475	845,115	978,590	56,326	163,952	220,279	80.5	234.2	314.7
9	Entry Building and Visits	1,491	178,326	67,932	246,258	75,254	13,179	88,433	50.5	8.8	59.3
10	Visitors Centre	165	9,145	16,440	25,585	3,859	3,189	7,049	23.4	19.3	42.7
	New Builds	3,539	542,005	1,015,516	1,557,521	194,398	197,010	391,409	54.9	55.7	110.6
	Totals	13,536	1,261,170	3,180,630	4,441,800	497,886	617,042	1,114,928	36.8	45.6	82.4

Notes:-

⁽¹⁾ CO₂ conversion factor for electrical energy = 0.422 kgCO₂/kWh

⁽²⁾ CO₂ conversion factor for natural gas energy = 0.194 kgCO₂/kWh

C APPENDIX C – TECHNICAL CALCULATIONS

C1 WIND TURBINES

	Symbol	Units	Derived from or value	Option A – 250kW Wind Turbine	Option B – 2 no. 80kW Wind Turbines
Total Site Baseline CO ₂ emissions	C_{tot}	kgCO ₂		1,114,928	1,114,928
% CO ₂ emissions saving target		%		10%	10%
CO ₂ emission savings target	C_s	kgCO ₂	$C_{tot} \times \%$	111,493	111,493
Rated turbine unitary output for typical wind speed	R	kWh/kW		2500	2500
Inverter efficiency	K_i	%		0.75	0.75
Unitary output	U	kWh/kW	$R \times K_i$	1875	1875
CO ₂ emission factor for grid electricity	C_f	kgCO ₂ /kWh	0.422	0.422	0.422
Annual electricity output to meet CO ₂ target	Q_e	kWh	C_s / C_f	264,201	264,201
Capacity of turbine to meet CO ₂ target	L_T	kW	Q_e / U	141	141
Capacity of commercially available turbines		kW	Manufacturer	250	160
Actual turbine output (wind speed 6.0 m/s)		kW	Manufacturer	40	10
Actual electricity output of turbine	Ca	kWh	Manufacturer	464,000	322,000
Actual CO ₂ emissions saving of turbine		kgCO ₂	$Ca \times C_f$	195,808	135,884
Actual % CO ₂ emission saving		%		17.6	12.2

Option A based on 1 no. 250kW turbine

Option B based on 2 no. 80kW turbines

Both options care of WES Ltd.

C2 GROUND SOURCE HEAT PUMPS

	Symbol	Units	Derived from or value	House block	Reception	Kitchen	Entry/Visits	Option C
Annual heating/cooling demand	Q_{heat}	kWh		181,273	71,604	182,851	81,145	1,270,487
Percentage of heating demand met by ground source heat pump	G	%		73%	90%	66%	90%	
Annual heating supplied by heat pump	Q_{gshp}	kWh	$Q_{\text{heat}} \times B$	132,128	64,444	120,148	73,031	
CoP of the ground source heat pump	CoP _{gshp}	none		4.5	4.5	4.5	4.5	
Resulting power input requirement of the heat pump	Q_h	kWh	$Q_{\text{gshp}} / \text{CoP}_{\text{gshp}}$	29362	14321	26700	16229	202,871
Resulting CO ₂ emissions due to the operation of the heat pump	C_{gshp}	kgC	$Q_h \times C_h$	12,391	6,043	11,267	6,849	
Heat pump run time per year (hours)	T	h	$Q_{\text{gshp}} / P_{\text{gshp}}$	3552	4380	2153	4380	
Capacity of plant to meet the defined percentage of heating demand	P_{gshp}	kW	Manufacturer	37.2	18.6	55.8	18.6	279
Number of 18.6kW heat pumps (largest available)				2	1	3	1	15
number of 90m deep boreholes				10	5	15	5	75
Seasonal efficiency of conventional heating plant (boiler)	E_{con}	%	electric=300%, gas = 90%	90%	300%	90%	300%	
Fuel input to the conventional heating plant to provide equivalent output to the ground source heat pump	Q_{con}	kWh	$Q_{\text{gshp}} / E_{\text{con}}$	146809	21481	133498	24344	1,014,353
CO ₂ factor for fuel supply to the conventional heating plant	Cf_{con}	kgC/kWh	electr.=0.422 gas=0.194	0.194	0.422	0.194	0.422	
Resulting carbon emissions due to the operation of the conventional heating plant	C_{con}	kg	$Q_{\text{con}} \times Cf_{\text{con}}$	28,481	9,065	25,899	10,273	
CO ₂ emissions saving	C_g	kgC	$C_{\text{con}} - C_{\text{gshp}}$	16090	3022	14631	3424	111,173
Total Site Baseline CO ₂ emissions	C_{tot}	kgC		1,114,928	1,114,928	1,114,928	1,114,928	1,114,928
% CO ₂ emissions saving		%		1.44%	0.27%	1.31%	0.31%	10.0%

Option C is a combination of all 6 H-Blocks and the Kitchen

C3 BIOMASS

	Symbol	Units	Derived from or value	Option D - Whole Site	Option E - 3 no. House- Blocks
Annual heating demand for heating and hot water provision	Q_{heat}	kWh		2,373,920	678,700
Percentage of heating demand met by biomass plant	B	%		90%	90%
Annual heating supplied by biomass plant	Q_{bio}	kWh	$Q_{\text{heat}} \times B$	2,136,528	610,831
Seasonal efficiency of biomass heating plant (typically ~80%)	E_{bio}	%		80%	80%
Calorific content of fuel input to the biomass heating plant	Q_{bfuel}	kWh	$Q_{\text{bio}} / E_{\text{bio}}$	2,670,660	763,538
CO ₂ burden of the biomass fuel supply ⁽¹⁾	C_{bfuel}	kgCO ₂ /kWh	0.025	0.025	0.025
Resulting carbon emissions due to the operation of the biomass plant	C_{bio}	kg	$Q_{\text{bfuel}} \times C_{\text{bfuel}}$	66,767	19,088
Seasonal efficiency of conventional heating plant (86% for grade A gas boiler)	E_{con}	%	86%	86%	86%
Fuel input to the conventional heating plant to provide equivalent output to the biomass heating plant	Q_{con}	kWh	$Q_{\text{bio}} / E_{\text{con}}$	2,484,335	710,268
CO ₂ factor for fuel supply to the conventional heating plant	C_{fcon}	kgCO ₂ /kWh	0.194	0.194	0.194
Resulting CO ₂ emissions due to the operation of the conventional heating plant	C_{con}	kg	$Q_{\text{con}} \times C_{\text{fcon}}$	481,961	137,792
Carbon emissions saving	C_s	kgCO ₂	$C_{\text{con}} - C_{\text{bio}}$	415,195	118,704
Plant run time per year	T			800	804
Plant capacity	P _{bio}	KW	Q_{bio}/T	2671	760
Total Site Baseline CO ₂ emissions	C_{tot}		kgC	1,114,928	1,114,928
% CO ₂ emissions saving			%	37.24%	10.65%

⁽¹⁾ CO₂ conversion factor = 0.025 kgC/kWh (from BRE)

C4 SOLAR THERMAL SYSTEMS

	Symbol	Units	Derived from or value	Facilities Management	Stores	Visitors Centre	Total
Annual hot water demand	Q_{hwtot}	kWh		32,498	3,122	6,691	42,311
Maximum annual irradiation at the specific location	I_{max}	kWh/m ² /y		1,050	1,050	1,050	1,051
SHW system conversion efficiency	K_E	%		45	45	45	45
Positioning factor based on system's tilt and orientation	K_P	%		95	95	95	95
Utilisation factor	K_u	%		100	100	100	100
Output per functional unit installed	U	kWh/m ²	$I_{max} \times K_E \times K_P \times K_u$	449	449	449	449
Percentage of hot water demand met by SHW system	M	%		65%	65%	65%	65%
Annual hot water supplied by SHW system	Q_{hwh}	kWh	$Q_{hwtot} \times M$	21,124	2,029	4,349	27,502
Area of the SHW system	A	m ²	Q_{hwh} / U	47	5	10	61
Energy input for circulating water in the SHW system (circulating pump)	Q_{pump}	kWh		474	46	98	618
C02 emission factor for used electricity	C_f	kgC02/kWh	0.422	0.422	0.422	0.422	0.422
Resulting carbon emissions due to the operation of the SHW system	C_{shw}	kgC02	$Q_{pump} \times C_f$	200	19	41	261
C02 emission factor for fuel supply to a conventional boiler	C_{con}	kgC02/kWh	gas = 0.194	0.194	0.194	0.194	0.194
Conventional boiler efficiency	C_{be}	%		86	86	86	86
Resulting C02 emissions due to the operation of an conventional boiler for a equivalent output of the SHW system	C_{con}	kgC02	$Q_{hwh} \times C_{con} / C_{be}$	4,765	458	981	6,204
C02 emission saving	C_s	$C_{con} - C_{shw}$	kgC02	4,565	439	940	5,943
Total Site Baseline C02 emissions	C_{tot}	kgC02		1,114,928	1,114,928	1,114,928	1,114,928
Actual % C02 emission saving		%		0.4%	0.0%	0.1%	0.5%

C5 PHOTOVOLTAICS

	Symbol	Units	Derived from or value	Facilities Management	Stores	Visitors Centre	Total	Option F – PV and Solar
Total Site Baseline CO ₂ emissions	C _{tot}	kgCO ₂		1,114,928	1,114,928	1,114,928	1,114,928	1,114,928
Area of the PV system required (constrained to available area)	A	m ²	Q _e / U	520.0	175.5	82.5	778.0	
Maximum annual irradiation at the specific location	I _{max}	kWh/m ² /yr		1,050	1,050	1,050	1,050	
Module conversion efficiency	K _E	%		15%	15%	15%	15%	
Positioning factor based on system's tilt and orientation	K _P	%		95%	95%	95%	95%	
Inverter efficiency	K _I	%		90%	90%	90%	90%	
System losses	K _L	%		75%	75%	75%	75%	
Packing density	K _D			100%	100%	100%	100%	
Output per functional unit installed	U	kWh/m ²	$I_{max} \times K_E \times K_P \times K_I \times K_L \times K_D$	101	101	101	101	
Module rated output	R	kWpeak/m ²		0.125	0.125	0.125	0.125	
CO ₂ emission factor for grid electricity	Cf _e	kgCO ₂ /kWh	0.422	0.422	0.422	0.422	0.422	
Annual electricity output to meet carbon target	Q _e	kWh	C _s / Cf _e	52,518	17,725	8,332	78,576	
PV system rated output	P	kWpeak	R x A	65.0	21.9	10.3	97.3	
CO ₂ emissions saving				22,162.8	7,479.9	3,516.2	33,158.9	39,102
Total Site Baseline CO ₂ emissions	C _{tot}	kgCO ₂		1,114,928	1,114,928	1,114,928	1,114,928	1,114,928
Actual % CO ₂ emission saving		%		2.0%	0.7%	0.3%	3.0%	3.5%

Option F based on a combination of solar thermal systems and photovoltaic panels on the roofs of buildings outside the perimeter walls

D APPENDIX D – WHOLE LIFE CYCLE COST CALCULATIONS

D1 OPTIONS A & B - WIND TURBINES

			Option A – 250kW Turbine	Option B – 2 no. 80kW turbines
Climate Change Levy	Gas	p/kWh	0.1590	0.1590
	Electricity	p/kWh	0.0456	0.0456
Wholesale Energy Prices	Gas	p/kWh	2.6170	2.6170
	Electricity	p/kWh	7.9760	7.9760
Delivered Energy Cost	Gas	p/kWh	2.7760	2.7760
	Electricity	p/kWh	8.0216	8.0216
Energy Cost	Cost/year		£ -	£ -
	Savings/Year		£ 37,220.22	£ 25,829.55
	Net Cost		- £ 37,220.22	- £ 25,829.55
Capital Cost	Functional unit	kWp	250.0	160.0
	Price per Functional unit	£/unit FU	1700	1700
	Mark-up		40%	40%
	Cost		£ 595,000	£ 380,800
	Lifetime (years)		26	26
Running Cost Items	Cost		£7,500	£7,500
	Regularity (times/year)		1	1
DCF Analysis	Life of measure	years	25	25
	Discount rate	%	3.5%	3.5%
	Net Present Value		£ 105,166	£ 101,156
	Payback Within Lifetime		no	no
C0 ₂ saved over lifetime		tC0 ₂	4895.2	1698.6
Cost of C0 ₂		£/tC0 ₂	£21	£60

D2 OPTION C - GROUND SOURCE HEAT PUMPS

			Option C
Climate Change Levy	Gas	p/kWh	0.1590
	Electricity	p/kWh	0.0456
Wholesale Energy Prices	Gas	p/kWh	2.6170
	Electricity	p/kWh	7.9760
Delivered Energy Cost	Gas	p/kWh	2.7760
	Electricity	p/kWh	8.0216
Energy Cost	Cost/year		£ 16,273.47
	Savings/Year		-£ 28,158.44
	Net Cost		-£ 11,884.97
Capital Cost Items	Functional unit	kW	279.0
	Price of unit of Functional unit	£/unit FU	1200
	Plant Cost		£ 334,800
	Lifetime (years)		15
	Additional one-off cost		£ 300,000
	Markup		40%
	Capital Cost		£888,720
Running Cost Items	Cost		£7,000
	Regularity (times/year)		1
DCF Analysis	Life of measure	years	25
	Discount rate	%	3.5%
	Net Present Value		877,799
	Payback Within Lifetime		no
C0₂ saved over lifetime		tC0₂	2779.3
Cost of C0₂		£/tC0₂	£316

Notes:-

Total is based on serving the H-Blocks and the Kitchen with Ground Source Heat Pumps
Additional one-off costs are associated with the difficulties with logistics etc on site

D3 OPTIONS D & E - BIOMASS

			Option D - Whole Site	Option E - 3 no. H Blocks Only
Climate Change Levy	Gas	p/kWh	0.1590	0.1590
	Electricity	p/kWh	0.0456	0.0456
Wholesale Energy Prices	Gas	p/kWh	2.6170	2.6170
	Electricity	p/kWh	7.9760	7.9760
Delivered Energy Cost	Gas	p/kWh	2.7760	2.7760
	Electricity	p/kWh	8.0216	8.0216
	Wood Pellet	p/kWh	3.1000	3.1000
Energy Cost	Cost/year		£ 82,790.47	£ 23,669.69
	Savings/Year		-£ 68,965.14	-£ 19,717.05
	Net Cost		£ 13,825.32	£ 3,952.64
Capital Cost Items	Functional unit	kW	2670.7	763.5
	Price of Functional unit	£/unit FU	250	250
	Plant Cost		£667,665	£190,885
	Lifetime (years)		15	15
	Additional one-off capital cost		£ 1,068,264	£ 305,415
	Markup		40%	40%
	Capital Cost		£2,430,301	£694,820
Running Cost Items	Cost		£50,000	£25,000
	Regularity (times/year)		1	1
DCF Analysis	Life of measure	years	25	25
	Discount rate	%	3.5%	3.5%
	Net Present Value		£ 3,880,762	£ 1,285,941
	Payback Within Lifetime		no	no
Carbon saved over lifetime		tCO2	10379.9	2967.6
Cost of carbon		£/tCO2	£374	£433

Costs based on 6mm pellet since this is regarded as the least maintenance intensive of the fuel types.

D4
OPTION F – PHOTOVOLTAICS AND SOLAR THERMAL

			OPTION F
Climate Change Levy	Gas	p/kWh	0.1590
	Electricity	p/kWh	0.0456
Wholesale Energy Prices	Gas	p/kWh	2.6170
	Electricity	p/kWh	7.9760
Delivered Energy Cost	Gas	p/kWh	2.7760
	Electricity	p/kWh	8.0216
Energy Cost	Cost/year		£ 49.55
	Savings/Year		-£ 7,022.75
	Net Cost		-£ 6,973.20
Capital Cost Items	Cost		£653,487
	Lifetime (years)		25
Running Cost Items	Cost		£3,000
	Regularity (times/year)		1
DCF Analysis	Life of measure	years	25
	Discount rate	%	3.5%
	Net Present Value		£ 588,003
	Payback Within Lifetime		no
Carbon saved over lifetime		tCO2	977.6
Cost of carbon		£/tCO2	£602

THE COMMON SEAL of)
NORTH NORFOLK DISTRICT COUNCIL)
was hereunto affixed in the presence of:)

Philip Burton
CHIEF EXECUTIVE

[Signature]
STRATEGIC DIRECTOR

THE COMMON SEAL of)
BROADLAND DISTRICT COUNCIL)
was hereunto affixed in the presence of)

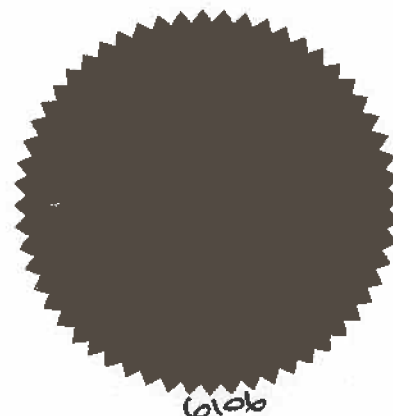
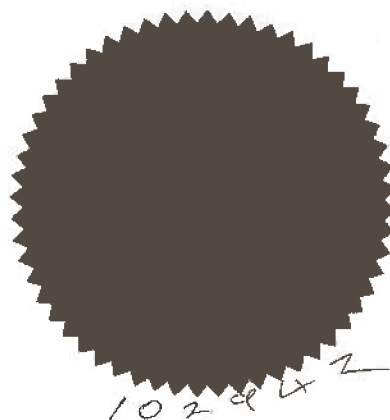
Ciba
CHIEF EXECUTIVE

THE CORPORATE SEAL of the)
SECRETARY OF STATE FOR JUSTICE)
hereunto affixed is authenticated by:)

[Signature]

WILLIAM GEORGE LOADER

Authorised by the Secretary of State



SIGNED as a **DEED** (but not delivered until the date hereof) by **ARQIVA LIMITED** acting by its Authorised Attorneys:

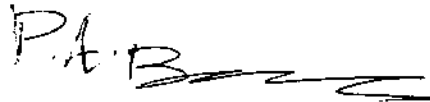
Authorised Attorney:



Authorised Attorney:



In the presence of:



Witness Name:

Peter Barney

Address:

Crawley Court SO21 3QR

Occupation:

Surveyor