Historic England

Norfolk

Building Stones of England

The Building Stones of England

England's rich architectural heritage owes much to the great variety of stones used in buildings and other structures. The building stones commonly reflect the local geology, imparting local distinctiveness to historic towns, villages and rural landscapes.

Historic England and the British Geological Survey (BGS), working with local geologists and historic buildings experts, have compiled the Building Stones Database for England to identify important building stones, where they came from and potential alternative sources for repairs and new construction.

Drawing on this research, plus BGS publications and fieldwork, guides like this one have been produced for each English county. The guides are aimed at mineral planners, building conservation advisers, architects and surveyors, and those assessing townscapes and countryside character. The guides will also be of interest if you want to find out more about local buildings, natural history, and landscapes.

This guide was prepared by Andy King (Geckoella Ltd) and Phil Collins (Phil Collins Associates) for Historic England.

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Front cover: St Mary's Church, Roughton. Quaternary Flint and Ironbound Conglomerate. © Geckoella for Historic England.

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HistoricEngland.org.uk/advice/technical-advice/

How to Use this Guide

Each guide describes the local building stones in their geological timescale order, starting with the oldest layers through to the youngest. The guide ends with examples of other notable building stones from other parts of England and further afield.

Geological time periods, groups, formations and building stones

Each building stone is listed under the relevant geological timescale, group and formation. A formation may be divided into members and where relevant these are referenced in individual building stone sections.

Middle Jurassic
↑— geological time period

Inferior Oolite Group, Lincolnshire Limestone Formation
↑— geological group ↑— geological formation

Lincolnshire Limestone
↑— building stone (alternative or local name)

Bedrock geology map and stratigraphic table

To help you with the geology of the area, there is a bedrock geology map and a stratigraphic table which shows the layers of rocks and the associated building stones in this geological timescale, group, formation order.

Page numbers for each building stone are included in the stratigraphic table for ease of reference. The page numbers are inverted to correspond with the geological age order.

Contents list

If you click on the page number for a building stone in the Contents list, you will go straight to the relevant section in the guide.

Building stone sources and building examples

A companion spreadsheet to this guide provides:

- More examples of buildings. Information is included on building type, date, architectural style, building stone source, and listed/ scheduled status
- A list of known (active and ceased) building stone sources such as quarries, mines, pits and delphs
- Additional information on building stones including lithology, grain size, sedimentary structures, key identification features, and notes on failure/weathering, and use.

The Building Stone GIS map allows you to search the Building Stones Database for England for:

- A building stone type in an area
- Details on individual mapped buildings or stone sources
- Potential sources of building stone sources within a given proximity of a stone building or area
- Buildings or stone sources in individual mineral planning authority area.

Further Reading, Online Resources and Contacts

The guide includes geological and building stone references for the area. A separate guide is provided on general Further Reading, Online Resources and Contacts.

Glossary

The guides include many geological terms. A separate Glossary explaining these terms is provided to be used alongside the guides.

The guides use the BGS lexicon of named rock units.

Mineral and local planning authorities

This guide covers the mineral planning authority areas of Norfolk County Council and The Boards National Park, and the local planning authority areas of Norwich, South Norfolk, Great Yarmouth, Broadland, North Norfolk, King's Lynn and West Norfolk, Breckland, and the national park.

Contents

1 Introduction

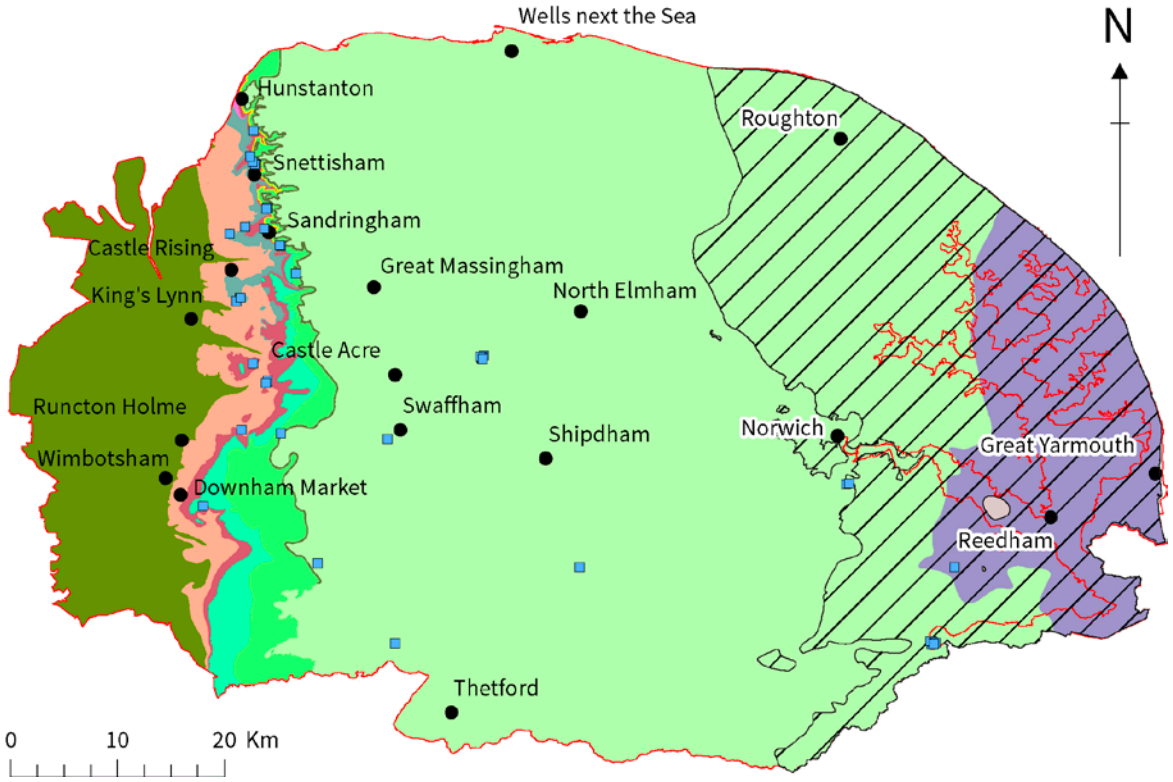
The geology of Norfolk comprises sedimentary strata laid down during the Cretaceous, Tertiary and Quaternary periods of geological time. The succession becomes younger as you travel eastwards across the county.

The oldest exposed strata, which are represented by mudstones and impure limestones of the Upper Jurassic succession, occur in a small area to the west of King's Lynn and Downham Market. Overlying these is a Lower Cretaceous sequence, comprising the Sandringham Sands, Dersingham, Roach, Carstone and Gault formations. These strata are succeeded by the distinctive red-coloured chalks of the Hunstanton Formation (Lower Cretaceous) and then by the more typical grey and white chalks of the Grey Chalk Subgroup and the White Chalk Subgroup (both Upper Cretaceous). Geographically, the chalks lie to the east of a sinuous line that extends from Holme-next-the-Sea on the north coast to Hockwold near the Suffolk border. Much younger (Neogene to Quaternary) shelly sands and gravel deposits of the Crag Group overlie the chalks in the east of the county, and the pre-Quaternary strata more generally are concealed by a variety of superficial deposits, including glacial tills and alluvial sands, silts and gravels, laid down during first two epochs of the Quaternary period. The Crag Group is no longer considered to form part of the bedrock succession, but are instead assigned to the Superficial Deposits Supergroup.

The Cretaceous strata of Norfolk have yielded a range of indigenous stone types suitable for building purposes. None of these can be regarded as good freestones, however, and large volumes of Middle Jurassic Lincolnshire Limestone and Caen Stone (the latter from Normandy, France) have consequently been imported into the county from medieval times onwards.

The Lower Cretaceous succession was an important source of indigenous building stone. The red-brown ferruginous sandstones (carstone) and silvery-grey quartzitic sandstones (Leziate Quartzite) yielded by the Sandringham Sands, Dersingham and Carstone formations were used extensively along their respective outcrops. Red chalk from the Hunstanton area was employed very locally as a rubblestone. The Upper Cretaceous white chalks, meanwhile, were quarried across much of their outcrop for blockstone, or clunch, as well as for flint, which is the most commonly used local building stone. Iron-cemented sandstones and conglomerates (including ironpan) forming part of the Neogene and Quaternary deposits have also been used for building purposes, as indeed have pebbles of flint, chert and more exotic lithologies (including granite, basalt, gneiss and quartzite) obtained from fluvio-glacial deposits, modern beaches and 'stockpiles' of offloaded ship ballast.

Bedrock Geology Map



Key

Building stone sources

Bedrock geology

Extent of Crag Group Cover

London Clay Formation — clay, silt and sand

Palaeogene Strata (projected where overlain by Crag Group)

White Chalk Subgroup — chalk

Melbourn Rock Memeber — chalk and limestone

Grey Chalk Subgroup — chalk

Hunstanton Formation — chalk

Gault Formation — mudstone

Carstone Formation — sandstone

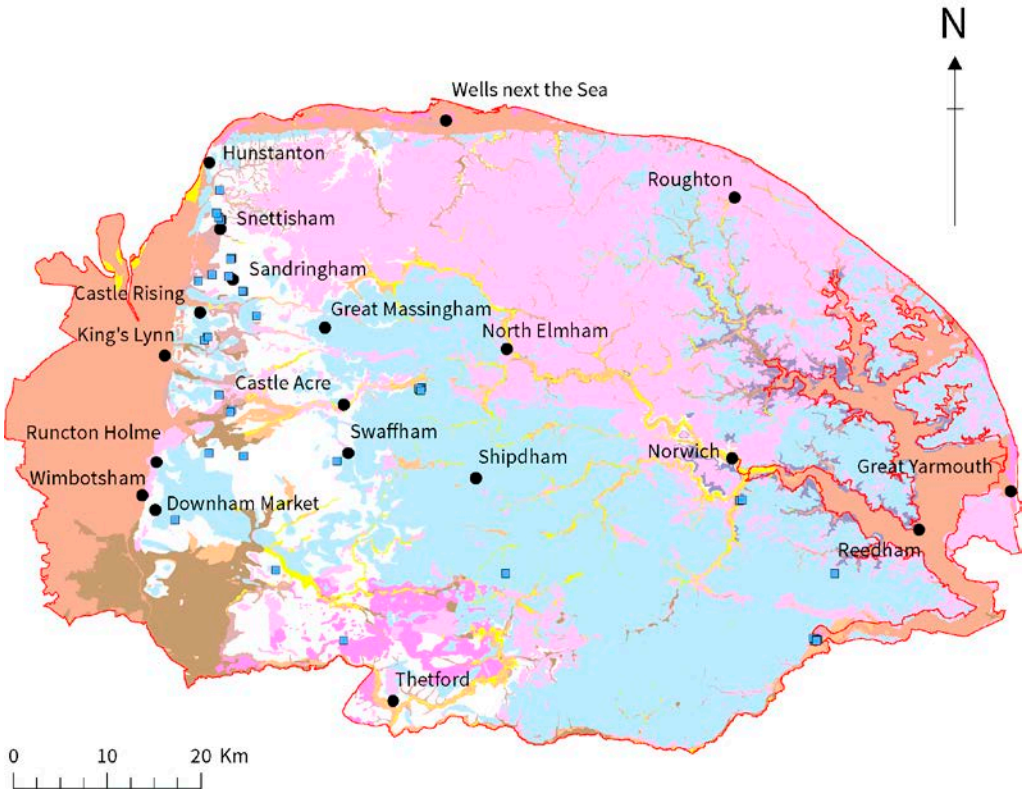
Roach Formation — mudstone and limestone

Dersingham Formation — sandstone and mudstone

Sandringham Sand Formation — sand, sandstone and ferricrete

Ancholme Group — mudstone

Superficial Geology Map



Key

- Building stone sources

Superficial geology

- Alluvium — clay, silt, sands and gravels
- Coastal Deposits — sands, gravels, silt, clay and peat
- River Terraces — sands, gravels and clay
- Aeolian Deposits — silt and sand
- Head — sands, gravels, silt and clay
- Glaciofluvial and Glaciolacustrine Deposits — sands, gravels, silts and clay
- Glacial Tills — clays, sands, gravels and boulders
- Peat — peat
- Crag Group — sands, gravels, silts and clay

Stratigraphic Table

Geological timescale	Group		Formation		Building stone	Page
Quaternary Neogene	Great Britain Superficial Deposits Supergroup	variously subdivided	variously subdivided		Chalky hardpan Quaternary Flint (Beach flint, Fluvio-glacial flint, Field flint) Chert pebbles and cobbles Ironpan (ferricrete, ironbound conglomerate, ironbound sandstone, cinderstone)	55 52 50 48
		Crag Group	not defined			
Tertiary	Thames Group		London Clay Formation			
Upper Cretaceous	Chalk Group	White Chalk Subgroup	Upper Chalk		Quarry Flint (Fresh Flint, Nodule Flint) Chalk (Clunch, White Clunch)	 47 45
			Middle Chalk			
		Grey Chalk Subgroup	Lower Chalk		Totternhoe Stone Lower Chalk Hardgrounds (Paradoxica Bed Stone, Inoceramus Bed Stone)	45 44
Lower Cretaceous	Cromer Knoll Group		Hunstanton Formation		Red Chalk (Hunstanton Chalk, Red Clunch)	42
	Selborne Group		Gault Formation			
	not defined		Carstone Formation		Carstone (Carr stone, Carstone, Gingerbread Stone) Big Carr (Snettisham Carr, Puddingstone)	 42 40
			Roach Formation			
			Dersingham Formation		Small Carr (Shell Carr, Block Carr, Carstone slips)	 38
	not defined		Sandringham Sand Formation	Leziate Member	Leziate Quartzite (Blue) Sandringham Carstone, Silver Carr, Sugar Stone	 37
Upper Jurassic	Ancholme Group		Kimmeridge Clay Formation			

Building stones in geological order from the oldest through to the youngest layers.

2 The Use of Stone in Norfolk's Buildings

Background and historical context

Norfolk has more than 10,800 listed buildings, of which 540 are Grade I and 841 Grade II*. They range from graveyard monuments to the 1960s student accommodation blocks at the University of East Anglia. There are 286 conservation areas.

Good building stones are generally scarce in Norfolk. Timber was the main material used for the construction of secular buildings of all sizes throughout the medieval period. Norfolk is rich in medieval box-framed timber buildings, particularly in the south of the county. The earliest surviving remains of flint-built buildings date from the Roman period. Both field flint and Quarry Flint were used extensively for larger medieval structures, such as castles, houses of the wealthy and ecclesiastical buildings. In the north-west of the county, local stone was far more readily available. Lower Cretaceous Leziate Quartzite, carr and carstone, and Upper Cretaceous red chalk, chalk and ironpans were extracted and used for local building purposes.

Building stone has been imported into Norfolk since at least the Roman period. By the mid-10th century, Norwich had become fully established as a major town, with its own mint. In the 11th century and throughout the medieval period, Norfolk was one of the mostly densely populated and productive agricultural regions in the country. Norwich was the fourth largest town in England. From the 11th century, the port established by the bishop of Norwich at King's Lynn and Norwich's port of Great Yarmouth imported stones from overseas and also various Lincolnshire Limestones from sources across The Wash. The ports grew rapidly, becoming major trading centres with France, the Rhineland, the Low Countries, Iceland, Scandinavia and the Baltic. The trade was dominated by the Hanseatic League, a confederation of merchant guilds, market towns and ports in north-western and central Europe. Great Yarmouth also became a major herring port and trading centre.

Until the Dissolution of the Monasteries in the 16th century, religious communities had a significant influence on the landscape, economy and the extraction and use of building stone in Norfolk. There were more than 90 religious foundations in the county. Many such establishments developed between King's Lynn and Downham Market, in Norfolk's 'holy land'. The important pilgrimage site of Little Walsingham was located a little further east. The construction of Norwich Cathedral began in 1096, and Caen Stone from Normandy was used extensively to face the flint structure of the cathedral.

Churches are the most common examples of surviving medieval buildings in which indigenous stone is used extensively. Norfolk's prosperity led to the building of more parish churches than in any other county in England. Some 659 have survived out of a total of more than 1,000, and the earliest examples date from the 10th century. Norwich alone once had 62 churches. Furthermore, 140 of England's 179 standing round towers are found in Norfolk; they are widely dispersed, but the majority are in the west of the county and in the Waveney Valley south of Norwich. The long history of alteration, extension, rebuilding and repair of Norfolk's churches means they often exhibit a range of stone from different sources and periods. Uncoursed rubble and rough-coursed flint nodules were the predominant building materials used. In west Norfolk, local carstone and ironpans were often a component of the walling, and occasionally chalk. Various imported Lincolnshire Limestones were used to some extent in virtually all medieval monastic and parish churches, particularly for dressings.

More than 20 castles were built in Norfolk during the Middle Ages, the most impressive being Norwich Castle. The keep is built in flint and faced in imported Caen Stone. It was re-faced in Bath Stone in the 19th century. The remains of other stone keeps can be seen at Castle Rising, Castle Acre and Old Buckenham. Periods of unrest resulted in the construction of further castles and the strengthening of the defences of existing structures. At Buckenham, a new castle with a circular stone keep, the oldest in the country, was built in *c* 1146. Fortified manor houses were also constructed, including Baconsthorpe Castle, near Holt, which was built of knapped flint.

Figure 1: Stone Keep, Castle Rising. Lleziate Quartzite with Lincolnshire Limestone pilasters and quoins.

Figure 2: Priory and parlatorium, Castle Acre. Flint rubble with some chalk and carstone and Lincolnshire Limestone dressings.

The economy was already in decline when a large percentage of the population died from the Black Death in *c* 1349. Several settlements suffered a loss of more than 70 per cent of their inhabitants. However, in the late 14th to 15th centuries, increasing wealth from the profits of sheep farming and the wool trade, in combination with changes to religious practices and beliefs in the 16th century, resulted in new work being undertaken at most parish churches. The 'Great Rebuilding' in the Perpendicular style at first focused on the reconstruction of naves, and often the rebuilding of west towers. At least 150 towers were rebuilt. However, many round towers were retained, often with a rebuilt or added belfry stage. Many of the churches of the 14th and 15th centuries are very fine, with large windows, tall arcades and clerestories. From the start of the 14th century, knapping and squaring of flints to produce flat surfaces became common. Flushwork was highly fashionable in the late 15th century, particularly as ornamentation to towers, parapets, plinths and new porches.

Medieval guilds played an important role in Norwich, King's Lynn and Great Yarmouth in the 15th century. There were more than 30 in King's Lynn, for example. Some buildings survive there, such as St George's Guildhall, which is built of brick and limestone, and Holy Trinity Guildhall, which has fine external chequered flintwork.

Figure 3: Holy Trinity Guildhall, King's Lynn. Chequered flintwork.

The Dissolution led to the fragmentation of monastic estates and their transfer to secular landowners. Several abbey and priory churches became parish churches, including the Church of St Nicholas at Great Yarmouth, England's largest parish church, and the Church of St Margaret at King's Lynn. Monastic and church buildings were often demolished gradually, and the stone reused.

From the 15th century, brick was increasingly employed, initially for houses of the wealthy. In the late 16th century, there was extensive rebuilding of old manorial sites, with new houses largely built of brick, often with imported stone dressings. In the 17th and 18th centuries, the building of stately homes came into fashion. An example is the Palladian Holkham Hall built of Holkham gault brick. Established families built many smaller houses from the 16th century to the 1820s. Nearly all were built in brick, often with imported stone dressings.

Few farm buildings, other than large timber-framed aisled barns, survive from before the 17th century. With the growth in wealth of the estates, and often following enclosure, farm buildings were reconstructed, large estate farms were built, and rural housing was improved. In most of the county, flint was used with brick. Distinctive styles of flintwork developed in various areas. The colour of the flint used also varied considerably depending on its origin. In the north-west of the county, materials such as carstone, Big and Small Carr, chalk and red chalk or other local materials were used extensively. In the late 18th and 19th centuries, the use of clay lump became popular for cottages, outbuildings and farm buildings in the south of the county.

Non-conformist chapels and meeting houses were built from the 17th century. There was a substantial upsurge in evangelism in the mid-18th century, leading to the building of many new chapels. Most chapels and meeting houses were built in brick, often with imported stone dressings, columns and porticos. The use of local stone was more favoured in the north-west of the county.

Norfolk was a relatively late addition to the rail network. The first railway in the county was constructed from Ely in Cambridgeshire to King's Lynn in 1847, and an extensive network had developed by the 1890s. The railways enabled the transportation of locally produced brick and the importation of slate, brick and building stones from further afield. The railway network also led to the development of tourism and the expansion of coastal settlements, such as Hunstanton, Cromer, Sheringham and Great Yarmouth. New buildings were often built of local materials, including carstone at New Hunstanton, in particular, and flint and brick at Cromer and Sheringham.

During the Industrial Revolution, Norfolk developed little industry except in Norwich. In the mid-19th century, the textile industry declined and the agricultural depression of the late 19th century affected the entire country, leading to a major depopulation of the countryside and growth of the main urban settlements. Many larger country estates changed hands, were broken up or reduced in size. Land was acquired by farmers and businessmen from outside the county. Sporting estates became established, particularly in the

Figure 4: Voewood, Kelling, Holt. Quaternary Flint facing and Big Carr dressings and details.

west and south-west of the county, including the estate at Sandringham. A significant number of new estate and farm buildings were constructed. At the end of the 19th century and in the early 20th century, rich businessmen seeking rural retreats commissioned several new houses in the Arts and Crafts style. They were often designed by nationally recognised architects, who referenced both regional and historical traditions and used local materials.

During the 19th century, most of the county's churches were restored or rebuilt. Often, they were re-faced in knapped flint and their dressings were replaced in imported limestone. The increasing population of the main settlements and coastal resorts led to the construction of many new churches between 1830 and the start of the 20th century. They were designed predominantly in the Gothic Revival style. Some 62 new churches were built, often using materials reclaimed from their predecessors. Many employed imported stone dressings. In the west of the county, churches made use of local carstone, ironpans and chalk, commonly with imported limestone dressings. The use of brick became increasingly common from the 1870s. A few churches were built or rebuilt in the 20th century, particularly in Norwich. They were generally constructed of Quarry Flint, with stone or brick dressings.

In the 19th century, more than 470 rural schools were built in the county in two periods. Between 1838 and 1858, numerous British and National Schools were constructed, including at Wells-next-the-Sea, West Winch and Thornham. From the late 1860s, wealthy landowners and patrons funded several schools, including those at Erpingham and Blicking. They were built variously in brick, flint, carstone and corrugated iron.

In the late 19th and early 20th centuries, a significant number of prestigious commercial and municipal buildings, such as banks, insurance offices, libraries and town halls, were constructed in the major settlements. They were often faced in imported Portland Stone or Bath Stone. Occasionally, local stone such as carr or flint was used. Flint continued to be employed in buildings in the 20th and 21st centuries. For example, Prospect House, Rouen Road in Norwich uses flint in concrete panels and to face blocks.

From the 1990s, the introduction of design guidance by local authorities, Areas of Outstanding Natural Beauty and the Broads National Park has led to a resurgence in the use of flint in new housing. Furthermore, in the north-west of the county, the use of carstone has increased.

National Character Areas (NCAs)

Local landscape character and the combination of history, cultural and economic activity, geodiversity and biodiversity have been mapped for the whole of England and National Character Areas (NCA) defined (see Further reading). For each NCA there is a profile document which describes the natural and cultural features that shape the landscapes, how the landscapes have changed over time, the current key drivers for ongoing change, and a broad analysis of each area's characteristics and ecosystem services. The profiles include notes on local vernacular and building materials which are expanded in the following section on the ten NCAs covered by this guide:

NCA 46 The Fens
NCA 76 North West Norfolk
NCA 77 North Norfolk Coast
NCA 78 Central North Norfolk
NCA 79 North East Norfolk and Flegg
NCA 80 The Broads
NCA 82 Suffolk Coast and Heaths
NCA 83 South Norfolk and High Suffolk Claylands
NCA 84 Mid Norfolk
NCA 85 The Brecks

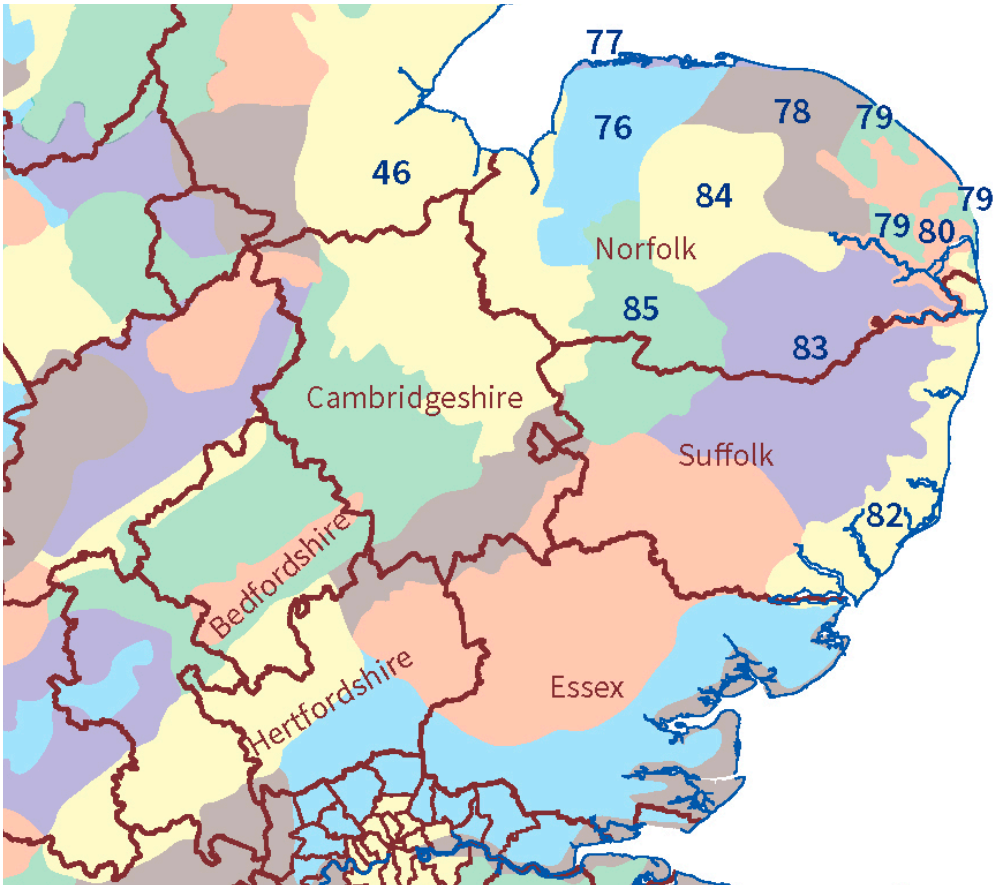


Figure 5: Map showing the National Character Areas (and the NCA numbers).

The Fens

The distinctive, historic and human-influenced wetland landscape of the Fens lies to the south of The Wash. The Fens are largely located in Lincolnshire and Cambridgeshire, with a smaller area in west Norfolk that lies to the west of the Brecks and North West Norfolk. The use of flint here is less common than elsewhere in Norfolk. Outcrops of Small Carr occur in the Fens at West Bilney and Denver. Much of the land is below sea level, relying on pumped drainage and the control of sluices at high and low tides to maintain its agricultural viability. There are three distinct areas of the Fens within Norfolk: the Silt Fen, the Peat Fens, and the Wissey and Little Ouse Fens. Each has its own history of exploitation, settlement, drainage and use of building stones.

The northern Silt Fen lies adjacent to The Wash and the western border of the county, and extends south to Wisbech in Cambridgeshire. The area includes the major Fen edge settlement of King's Lynn and villages to its north and south, including South and North Wootton.

In 1086, the Silt Fen were one of the most densely populated areas of Norfolk. By the 15th century, the suitability of the land for rearing sheep, the proximity to the ports of King's Lynn and Wisbech, and easy access to the large markets of East Anglia led to the Silt Fens being one of the most densely populated areas of the entire UK.

The medieval wealth of the area is reflected in its fine large churches. All make considerable use of imported limestones, and in the north of the area Lincolnshire Limestones are particularly widely used. The use of carstone and other materials, such as Leziate Quartzite, Big Carr, ironpans and cinderstone from the Cretaceous outcrop in north-western Norfolk, extends into the Silt Fens near King's Lynn. Carstone is employed in medieval churches, such as the Church of St Clement at Terrington St Clement and the Church of St Lawrence at Tilney St Lawrence. The Church of St Margaret at Clenchwarton was built of carstone, ironpan, red chalk and chalk rubble, with ashlar dressings. Flint cobbles, often with erratic pebbles, are also present in church wall fabrics, including at Clenchwarton and the Church of St Mary at Wiggenhall.

The Peat Fens were drained later than the Silt Fen. They lie further inland, west of Downham Market, south to the Cambridgeshire border and beyond. From the 17th century, the draining of the Peat Fens started to transform them into rich agricultural lands.

Only isolated hamlets and scattered farmsteads occur in the main fenland. They were mainly built of red or buff brickwork. The few churches of the area date from the 19th century, such as St Mary's Church at Welney, which was built of coursed Small Carr. Fen edge settlements in the Peat Fens are more numerous. They include Downham Market and villages such as Wimbotsham, Hilgay and Denver. A mixture of local building stone brought from north-west Norfolk is evident. Cottages in Denver and Hilgay are built of carstone, with chalk, cinderstone, ironpan, flint and brick. In Stoke Ferry, many buildings are galleted with cinderstone and ironbound sandstone. The Church of St

Figure 6: Church of St Clement, Terrington St Clement. Lincolnshire Limestone and Big Carr.

Mary the Virgin at Wimbotsham is built of cinderstone, with some Big Carr and Totternhoe Stone dressings to the 12th-century south doorway and 19th-century chancel.

Downham Market has a significant number of buildings that are constructed of local stones, including Leziate Quartzite, Big Carr, ironpan, cinderstone and flint. At one time, it was known as the 'Gingerbread Town' on account of brown-coloured Small Carr being the dominant building material used there. A wide range of secular buildings were constructed in Small Carr, from 19th-century terraced cottages to civic buildings. The railway station is a fine example of coursed Small Carr. Since the late 20th century, there has been a revival in the use of carr in construction, and many new houses in the town are faced in the stone.

Figure 7: Church of St Mary the Virgin, Wimbotsham. Cinderstone and Big Carr with Lincolnshire Limestone and Totternhoe Stone dressings.

The third area of the Fens NCA lies between the Rivers Wissey and Little Ouse, south-west of Downham Market. It is a transitional landscape between the Brecks and the Fens. It was a focus for early settlement from the Palaeolithic period to Iron Age and Roman times. During the medieval period, the area was exploited as part of extensive, largely fenland parishes, such as Methwold, Northwold and Feltwell. Villages (West Dereham, Wereham and Stoke Ferry, for example), farmsteads and manors were sited on the higher land on the edge of the floodplain, or on higher 'islands' within the valleys, for example Southery and Fordham villages and Santon House on the Little Ouse. Those to the eastern margin, such as Northwold, Methwold and Feltwell, fall within the Brecks NCA, although their parishes are largely within the Fens.

Flint, chalk and brick were often used in the east of the area. Chalk was frequently employed as coursed blocks on a flint plinth in farm buildings and cottages. From the 18th century, cottages were often built of flint with brick dressings. Carstone was commonly used in settlements that lie near to the outcrop on the northern side of the area. Medieval churches, such as the Church of St Mary Magdalene at Wereham and the Church of All Saints at Stoke Ferry, have sized flint rubble in regular courses, galleted with carstone chips. The chancel walls of the church at Wereham were built of uncoursed flint rubble with random carstone nodules. At St Andrew's Church at West Dereham, the tower below the brick octagonal belfry features large roughly dressed and coursed ironbound conglomerate and cinderstone. St Mary's Church at Southery was built of block Small Carr (carstone slips), with Bath Stone dressings.

North West Norfolk

This NCA extends from east of Downham Market to the edge of the Fens, east towards Castle Acre, and skirts Fakenham before sweeping eastwards adjacent to the Central North Norfolk NCA. It includes Hunstanton, Heacham, Burnham Market, Dersingham, Snettisham, Castle Rising and Little Walsingham.

The area provided much building stone for local use. The Lower Cretaceous strata furnished carstone and red chalk, and the Upper Cretaceous chalk provided hard chalks and Quarry Flint nodules, particularly in the west and north of the NCA. The Quaternary sands and gravels were a source of flint cobbles and ironpans throughout the area, with the use of flint becoming predominant in the east. Each type of local stone has a relatively confined, overlapping distribution, focused on the source and falling away with distance.

The use of flint was dominant in the area. It is less commonly employed in settlements on the slopes overlooking the Fens and along the eastern shore of The Wash. Quaternary Flint is present as nodules, water-worn pebbles and cobbles. Flint was used in medieval and post-medieval buildings in a wide variety of ways, including random, rough-coursed, neatly coursed, diagonal and herringbone fashions or as assorted or selected pebbles and

cobbles. Well-rounded cobbles, with yellow brick dressings, dominate along the north coast. Quarry Flint and Quaternary Flint were used in Roman villas and forts (such as Branodunum), medieval castles (such as Castle Rising Castle), monasteries, churches and medieval and post-medieval houses and farms. Flint round towers dating to the 10th and 11th centuries are characteristic of many churches of the area. Layer coursing is often found in flint rubble walling of the 11th to 13th centuries. Galleting with flint chips was also commonplace. Ornamental flushwork and proudwork, composed of knapped blocks of flint and carved Lincolnshire Limestone freestone, were used in many later medieval churches. From the 18th century, cleft flint with brick was employed in place of timber frame in vernacular buildings such as cottages, barns and farm buildings. Flint and brick were used for village and estate walls. Galleting, using a range of materials including shingle pebbles, brick fragments and carstone, became common.

Figure 8: Greyfriars, King's Lynn. Carstone facing with Lincolnshire Limestone dressings.

Carstone is employed throughout the North West Norfolk NCA. It is found in buildings along the north coast as far as Sheringham and in a wide belt around King's Lynn, reaching west into the Fens and to Southery, near Downham Market. The carstone belt produced two forms: Big Carr and Small Carr.

Big Carr is the dominant form of carstone and it was used close to the source area. It was employed in medieval churches in the chalklands to the east and in the eastern area of the Fens NCA. It was also used along the north coast, including at Wells-next-the-Sea. Big Carr has been employed in a wide range of buildings from the 10th century to the present day. It was used in church buildings from the 10th to the 19th centuries, often with other materials, including Small Carr, chalk, flint and brick. However, it was not widely employed in churches until the 13th century. In the 19th century, Big Carr was used extensively in church restoration and in new churches. It became fashionable from the 18th century to the early 20th century for grand landowners to use local carstone for estate buildings, instead of bringing in stone from outside the county. Generally, Big Carr was not employed for major buildings or for those of higher status until the 19th century, when it was used extensively in Hunstanton, Downham Market and the surrounding villages. From the mid-19th century, the material was favoured for Gothic Revival buildings, such as schools, chapels and railway buildings.

Figure 9: Primary school, Snettisham. Big Carr with Lincolnshire Limestone dressings.

Within the area, there are distinctive distributions of the use of different forms of Big Carr. These are described further in the 'Imported building stones' section of this guide.

Small Carr was generally less favoured than Big Carr, even near to its source. However, the use of Small Carr is dominant in two areas: Downham Market and Denver, and north-east of King's Lynn as far north as Dersingham. Buildings were constructed from this material from the 13th century onwards, and its use reached a peak in popularity in the middle of the 19th century. It was employed in a wide range of structures, including boundary

walls, agricultural buildings, housing, chapels, meeting houses, churches, and public and railway buildings. After 1862, when the Prince of Wales acquired the Sandringham estate, much use was made of the stone in the villages of the estate. It was revived towards the end of the 20th century for new houses built in Denver and Downham Market.

Leziate Quartzite seems to have been extracted only from around Castle Rising, north-east of King's Lynn, and it was transported by boat along the North Norfolk coast. It was used in buildings in two distinct clusters of settlements close to the source: between Ringstead and Wormegay and, more rarely, between Warham and Holme-next-the-Sea. It is well seen at Brancaster. The earliest known use of Leziate Quartzite is in the Roman Branodunum at Brancaster and for a fort at Reedham in the Broads. It was employed as high-quality dressed facing to walls built mainly of flint. The keep at Castle Rising is faced in roughly squared and coursed Leziate Quartzite blocks, between pilasters and quoins of Lincolnshire Limestone.

Leziate Quartzite was also used in several Norman churches as random blocks, and as rubble or coursed blocks in numerous post-Norman churches. At Brancaster, it was reused from the nearby Roman fort in six churches of the area. It can be seen in several 19th-century churches, such as the Church of All Saints at Roydon by G E Street. Here, the dressings are of imported Red Mansfield Stone. Leziate Quartzite was sometimes employed during the post-medieval period in farm and domestic buildings, outbuildings and boundary walls in several villages on the Fen edge north of King's Lynn, in the area east of King's Lynn and north of Dersingham.

Ironpans have been employed in buildings across the NCA, although their use is relatively rare and often confined to parish churches or monastic buildings. There are concentrations of buildings that use this stone: from King's Lynn to Downham Market, and in the Nar, Babingley and Stiffkey valleys. Cinderstone, ironbound sandstone and ironbound conglomerate are plentiful in the west. In the north-east, ironbound conglomerate and sandstone predominate. The use of ironbound conglomerate alone, or combined with ironbound sandstone, was largely confined to the northern part of North West Norfolk. The use of cinderstone spread further south into the Fens, either alone or with other ironpans.

Ironpans were used in many 10th to 12th-century round towers, often for footings and dressings to predominantly flint structures. The use of ironpans was common in many churches and monastic buildings of the Norman period. They were mainly employed as randomised rubble or were roughly dressed and coursed. Sometimes, very large blocks were used, particularly for footings. Most post-Norman churches in the ironpan area contain one of a mixture of ironpans, including ironbound conglomerate and cinderstone. In the 19th century, many churches were restored or rebuilt using some ironpan with reused limestone. Farm and domestic buildings constructed solely of ironpan are uncommon until the 19th century. More often, such buildings are made from a mixture of materials, including cinderstone, ironbound conglomerate, carstone and chalk, often with brick dressings.

Hard chalk for building purposes was largely obtained from the Lower Chalk and from occasional hard beds in the Middle Chalk. Chalk buildings are closely associated with the linear outcrop of the Lower and Middle Chalk, including areas such as the Nar Valley, the north coastal slope and the valleys of the Burn and Stiffkey. In villages on the outcrop, it was sometimes the dominant material.

Where employed, chalk can be seen as irregular rubble or as dressed blocks. Irregular rubble tends to have been used in areas further from the outcrop. It was employed in garden walls and the external fabric of buildings, and occasionally it featured as a decorative material internally. Dressed clunch was used in a small number of medieval establishments, including Greyfriars at Little Walsingham and All Saints' Church at Shouldham. Rubble clunch was far more widely used. From the early 19th to the early 20th century, dressed clunch was employed in a considerable number of buildings, including cottages, houses, farmhouses and outbuildings in numerous villages on the outcrop. Chalk block was often used in combination with other materials, such as red chalk, ironpans, carstone, flint and brick. Sometimes, it was employed in rough chequerwork. It was frequently galleted with a mixture of materials, including red chalk, carstone, ironpan and even clinker. Rubble was rarely employed for housing, but it was used for outbuildings and boundary walls. From the late 20th century onwards, there has been a revival in the use of chalk rubble and block for housing in the villages of the north coast, including Heacham, and in Burnham Market.

Figure 10: St Andrew's Church, Little Massingham. Flint and limestone rubble with Lincolnshire Limestone dressings. The clerestory is faced with Red Chalk, Lincolnshire Limestone and Quaternary Flint.

Red chalk was not much used for buildings, except very locally on the northern part of the outcrop, from Hunstanton to Snettisham. The rock does not weather particularly well, and it was usually employed in combination with other materials. It is found in a few late medieval churches in the NCA, such as the ruined St Edmund's Chapel at New Hunstanton, St Mary's Church at Snettisham and St Andrew's Church at Little Massingham.

Red chalk was also occasionally employed in 18th and 19th-century farm and domestic structures. There are several buildings in Old Hunstanton and Ringstead that exhibit galleted courses of red chalk and carstone. The church wall and tower of St James' Church at Runcton Holme contain small quantities of Inoceramus Bed Stone, along with red chalk and 'normal' white chalk.

Figure 11: Cottage, Old Hunstanton. Chalk, Red Chalk and Big Carr.

North Norfolk Coast

This NCA occupies a narrow strip of land between the North West Norfolk NCA and the Central North Norfolk NCA to the south, and the shallow coastal waters of the North Sea and The Wash. The southern boundary is the A149 coastal road.

The majority of the NCA consists of coastal grazing, salt marshes and the spit systems of Blakeney Point and Scolt Head. Settlement in the area is primarily clustered in small coastal villages and former ports that are now largely isolated from the sea. The ports of Blakeney, Cley, Morston, Burnham Overy Staithe and Wiveton have declined due to silting caused by the westwards progress of the spits. In the medieval period, these thriving ports exported grain to Europe and the Baltic and imported timber and iron, and later coal. Occasionally, imported ballast was reused in buildings, in Wells-next-the-Sea, for example.

Flints are a common feature in the upper layers of the chalk and a major component of the river and beach gravels of the area. Flint was the dominant material used in medieval churches and monastic foundations of the area. Lincolnshire Limestones were often employed for dressings. Several medieval monastic estates developed along the coast, including Burnham Norton Priory, Blakeney Friary and Weybourne Priory. Occasionally, ironbound conglomerate was used for quoins, as in the 12th-century nave of St Margaret's Church at Burnham Norton, for example. Flint flushwork and fretwork are found at St Margaret's Church at Cley-next-the-Sea, in the south aisle parapet and porch.

Flint with brick and pantile roofing are the dominant building materials found in the secular historic buildings of the area. Along the coast, flint has largely been used with the rounded and often white exterior showing, with red brick dressings. Inland, walls more commonly consisted of knapped flints that display a cut black face outwards. Flint walls were often galleted with flint flakes. Flint was laid random or coursed. Squared flint was used less frequently, but it is found in Quay House, Blakeney, for example. Erratic cobbles were also often employed in walls, with chalk, brick and scattered flint, in Burnham Norton, for example, and in buildings in Wells-next-the-Sea, Holme-next-the-Sea, Blakeney and Cley.

Local chalk and a little red chalk were used in the west of the area, including in the Burn Valley. Chalk was extracted from quarries to the south of Holme-next-the-Sea and Thornham. In the 19th and early 20th centuries, dressed chalk was used in cottages, houses and farm buildings in the west of the area. Red chalk was used either coursed or as rubble in cottages at Holme-next-the-Sea. In Burnham Norton, rubble chalk is often employed with nodular Quarry Flint, cobbles and brick.

Figure 12: Cottage, Holme-next-the-Sea. Chalk and Red Chalk with flint, carstone and brick dressing.

In the extreme west of the area, carstones, ironpans and chalk from the adjacent North West Norfolk NCA are used. At Holme-next-the-Sea, Vine Cottage has dressed chalk and carstone in rough chequers. Big Carr was also employed in the village. The Church of St Mary the Virgin at Holme-next-the-Sea was extensively rebuilt in 1778: the north wall is built of Big Carr and a range of various exotic pebbles and cobbles. In the late 19th and early 20th centuries, some use of Big Carr was made in Wells-next-the-Sea. Several houses, the post office and the extension to the Friends' Meeting House are faced in 'normal' randomised Big Carr. The Harbour Office is built of snecked Big Carr, with Holkham white brick dressings.

Figure 13: Church of St Mary the Virgin, Holme-next-the-Sea. Quaternary Flint, Quarry Flint, Lincolnshire Limestone, carstone and ironbound conglomerate.

Central North Norfolk

This NCA stretches from Norwich in the south, north to the coast at Mundesley, then west along the coast to Sheringham. The northern suburbs of Norwich fall within the NCA. The area includes several relatively isolated market towns, such as Aylsham and Holt, the coastal settlements of Cromer and Sheringham, and former coastal ports such as Cley-next-the-Sea and Salthouse.

Timber frame was the dominant form of vernacular building during the medieval period, whereas flint was the main material used for churches and monastic buildings. There are several monastic sites in the area, including the Priory of St Mary in the Meadow, Beeston Regis, and Mountjoy Priory, Haveringland, near Norwich. The NCA is unusually rich in medieval churches. Round towers are numerous, particularly between Holt and Aylsham. They were usually constructed of whole or knapped flint. In the 10th to 11th-century churches, large flints were often used for the footings and dressings, and sometimes for jambs. The flintwork can be random or coursed. Lincolnshire Limestones were employed for dressings, too.

Ironbound conglomerate is often found within the fabric of round towers. Such material was used frequently for quoins and dressings. Sometimes, it was employed more extensively. For example, the nave of All Saints' Church at Gresham is built largely of this conglomerate. The tower of St Mary's Church at Roughton has large ironbound conglomerate blocks and smaller blocks laid in a herringbone pattern.

Flint flushwork is found in 14th-century churches and as additions to earlier structures. For example, flushwork battlements were added to the round tower at St Andrew's Church at Wickmere. The tower includes unusually white, rough-squared flint and ironstone blocks. Rough-squared flint was used from the 14th century, whereas carefully squared flint was employed from the 15th century, for example in the Church of SS Peter and Paul at Cromer.

Figure 14: Houses, Holt. Flint walls.

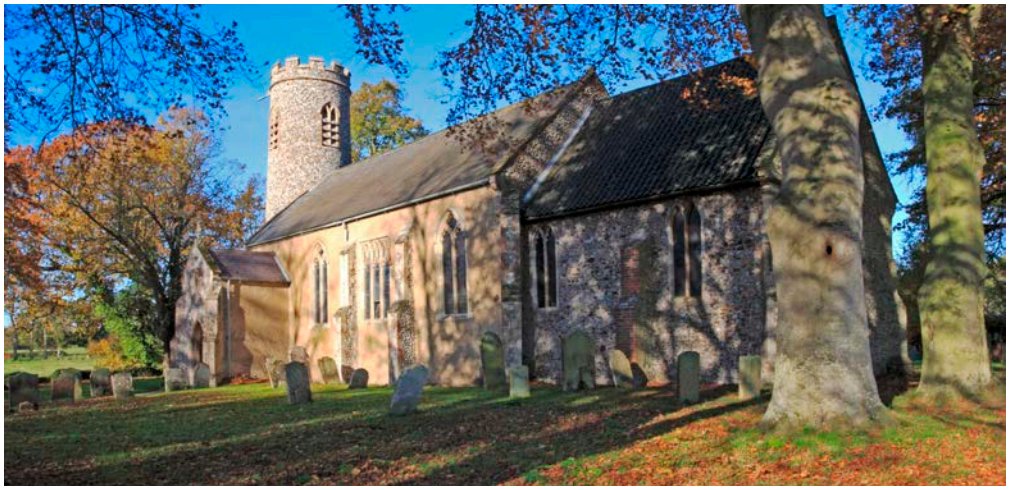


Figure 15: All Saints' Church, Gresham. Ironbound conglomerate.

A rich abundance of minor country house estates developed in the 17th and 18th centuries, including Blickling Hall and Felbrigg Hall. Most houses were built of brick, and flint was often used for estate buildings. Rationalisation and further enclosure of fields took place in the later 18th century. Many isolated farmsteads were constructed or rebuilt. Flint with red brick dressings and steeply pitched thatched or pantile roofs replaced timber frame as the dominant material used in such farms.

The arrival of the railway to Norwich in the 1840s and to Cromer and Sheringham in the 1870s and 1880s led to the further importation of building materials. It also signalled the beginning of mass tourism, and the coast became a fashionable resort area. Several Arts and Crafts architects built holiday homes for rich businessmen using local materials on or near the coast. Sheringham and Cromer developed as holiday resorts. Much new building was carried out in flint and red brick. Occasionally, carstones from North West Norfolk were also employed.

The use of coursed and uncoursed Quaternary Flint cobbles became widespread in 19th and early 20th-century buildings in Sheringham, Clay-next-the-Sea and Holt. The use of flint ovals was also popular, particularly in Sheringham. In some cases, each oval is meticulously ringed with white flint gallets. Galleting was rare until the late 19th century. In the early 20th century, the use of flint flakes as a facing applied to the surface of buildings became fashionable for a short period, particularly in Overstrand, West Runton and Crossdale Street.

North East Norfolk and Flegg

The coast forms the north-eastern boundary to this NCA, which extends from Gorleston-on-Sea in the south to Mundesley in the north. To the west, the NCA is bounded by the flood plains of the five major rivers that form the Broads NCA.

The area includes the settlements of North Walsham, Stalham, Worstead, Bradwell, Burgh Castle, Filby, Hemsby, the Ormesbys, Martham and West Caister, along with the market town of Acle, the enlarged commuter villages of Brundall and Blofield, and rural villages such as Little Plumstead,

Hemblington, Strumpshaw and Upton. The NCA also includes Great Yarmouth and the seaside resorts of Gorleston-on-Sea, Caister-on-Sea and Winterton-on-Sea.

Flint and red brick were the dominant building materials used. Colour-washed render was also common. Roofs were of Norfolk reed thatch or pantiles. In the larger settlements, many buildings exhibit a distinct Flemish influence, reflecting the influx of Flemish weavers in the 14th century. Brick became more dominant in the 19th century. Locally sourced building materials have included Quaternary beach and fluvio-glacial flint and ironpans, such as ferricrete and ironbound conglomerate.

Churches are generally built of flint, often with thatched roofs. Flint round towers are found in many places. The use of uncoursed flint and flint quoins in such towers was characteristic of the Saxon period. Some flint and early brick jambs survive. Octagonal brick belfries were often added in the 13th and 14th centuries. Ironpans were employed in several round towers, including at the Church of St Margaret at Witton, where conglomerate is used for quoins and as scattered pieces in the tower's fabric. In the 14th to 16th centuries, several fine churches were built, funded by the wealth generated from the wool industry. St Mary's Church at Happisburgh is of flint with ashlar dressings. It has fan arrays of bricks and knapped flint above windows, proudwork to the base frieze of the tower and flushwork to the battlements.

Outside of Great Yarmouth, there were few monastic establishments. At Bromholm Priory, Bacton, the ruins of the priory church and chapter house and the 15th-century gatehouse survive. The effects of the Dissolution were quite limited due to the relatively sparse distribution of monastic settlements in the area.

Figure 16: St Mary's Church, Happisburgh. Flint with ashlar dressings.

Enclosure in the 18th century resulted in the loss of common land/heathland and led to further prosperity and the rebuilding of many farmsteads. A high concentration of pre-1750 farm buildings remain in the isolated farmsteads scattered across the area. They were often built of flint and brick, such as Manor Farmhouse, Bacton, and sometimes featured ashlar dressings, such as Paston Great Barn. In the 17th and 18th centuries, halls and minor parklands developed, including at Rollesby Hall and Ashby, situated above the Broads valleys. Other small houses are relatively frequent, such as Little Ormesby Hall near Ormesby St Michael, Scratby Hall, Old Hall at Ormesby St Margaret (with its associated 17th-century red brick perimeter wall) and Caister Old Hall. Nearly all are built of brick, although flint was sometimes used in ancillary and garden buildings. Norfolk's only canal, between North Walsham and Great Yarmouth, was opened in 1779.

Figure 17: Great Barn, Paston. Flint cobbles, brick and Lincolnshire Limestone dressings.

Several Arts and Crafts Movement houses were built at the turn of the 20th century. For example, Happisburgh Manor (now St Mary's) and St Anne's at Happisburgh were designed by Detmar Blow. Both use Quaternary Flint pebbles and cobbles, with brick dressings and scattered patterning and chequerwork.

The Broads

The Broads NCA lies between the peripheral urban areas of Norwich in the west and Great Yarmouth and Lowestoft in the east. It comprises the wide valleys of the Rivers Waveney, Yare, Wensum, Bure, Ant and Muck Fleet. In the north-east, the NCA is bordered by the North Sea along the 14km stretch of coast between Happisburgh and Winterton-on-Sea.

A large estuary occupied today's river valleys in Roman times, until it silted up during the Anglo-Saxon period. By the late 11th century, eastern Norfolk was one of the most densely populated areas in Britain, with Norwich the second largest city in England after London. The demand for fuel was so high that peat was dug from the river valleys. The Broads are the result of the large-scale extraction of peat during the Middle Ages. The lakes that characterise the area formed in the abandoned and flooded peat workings as sea levels rose in the 13th and 14th centuries.

Settlements mainly developed around a parish staithe, riverside common, ferry or bridge. The area's wool, weaving and agricultural produce was exported throughout the world from the port of Great Yarmouth. Access to the river-based transport network was critical. Crossing points became established, including at Ludham, Potter Heigham, Wroxham and Wayford as well as near Acle.

The predominant vernacular building materials used in the area were flint, pebble and brick, with pantiles and, occasionally, Norfolk reed thatch roofs. The Romans used flint extensively as rubble in mortar for the core of the massive walls to the coastal fort at Gariannonum (Burgh Castle), at the mouth of the Waveney. The walls were faced in flint, with brick banding courses. Leziate Quartzite was transported 130km from North West Norfolk for a fort at Reedham, built to guard the then estuarine approach to Venta Icenorum, the regional centre located near to the later site of Norwich.

Monastic sites were established in Broadland, with parishes appropriated to provide livings. They included Hickling Priory, the Priory at Horsham St Faith, Langley Abbey near Loddon and St Benet's Priory, Horning. At St Benet's, the earliest Benedictine foundation in Norfolk, the remains of the 14th-century gatehouse of knapped flint, with ashlar flushwork and red brick, and parts of the knapped and galleted flint perimeter wall and church survive.

The Waveney Valley and Yare Valley were particularly well populated at the time of the Norman Conquest. They contain many 10th to 12th-century round tower churches, including those at Hales, Hassingham, Moulton St Mary, Freethorpe, Burgh Castle, Clippesby, Rollesby, Repps and Potter Heigham. Some are thatched, and the majority are built of uncoursed flint. Often, flint was used for window dressings, but some churches employed an uneven mixture of anything hard that could be found locally. The Church of St John the Baptist at Reedham is built of a considerable range of materials. Leziate Quartzite is dominant in the 15th-century tower, in rough chequers with knapped rounds or roughly squared flint. The base has squared knapped flint flushwork. Roughly coursed blocks of Leziate Quartzite, chalky hardpan, ironpan, Lincolnshire Limestone, roughly knapped Quaternary Flint nodules and other stone types, together with much reused Roman brick, are found in the remainder of the fabric. Imported Northamptonshire and Lincolnshire Limestones were used for dressings. Roman opus signinum (tile) is also reused in the north wall in places, in a herringbone fashion.

Leziate Quartzite is also seen to a lesser extent in a few other churches nearby, including St Mary's Church at Hassingham, St Botolph's Church at Limpenhoe and St Andrew's Church at Wickhampton, where it is also found rarely in the Norman chancel. The stone is used in other churches in the area in the 13th to 15th-century elements of their structures, particularly in their towers. Examples include St Margaret's Church at Cantley and SS Peter and Paul's Church at Halvergate.

During the 12th and 13th centuries, large-scale drainage and enclosure of the marshlands took place, usually carried out by monastic institutions.

Figure 18: Church of St John the Baptist, Reedham. Leziate Quartzite, Quaternary Flint, Chalky Hardpan, Ironpan and Lincolnshire Limestone.

The resultant increasing wealth of the area led to the rebuilding or addition of porches and clerestories to many churches, although the round towers were often retained. Fortified manors were also built, such as Claxton Castle, constructed of brick with limestone dressings. Here, part of the precinct wall and hall survives.

By the 16th century, there was a move towards cattle production in preference to sheep grazing in the many areas that had been reclaimed. Many farmsteads were rebuilt or developed into courtyard plans around barns. In the Wensum Valley and Yare Valley, merchants, lawyers and financiers built a significant number of new brick halls. Some enclosure took place from the 16th century to the 18th century, with substantial amounts of enclosure caused by the Parliamentary Act in the early part of the 19th century. Around 1840, steam drainage pumps were introduced.

The reclamation of the marshland saw an increase in grazing cattle. New buildings were added to some surrounding farms, and new farms were built in the drained areas, generally in brick and sometimes with flint plinths. The use of brick in village houses became commonplace, although flint with brick was often employed at the rear or for outbuildings. In the west of the

area, brick with flint was particularly used for cottages close to where chalk was extracted in the Waveney Valley and Yare Valley, such as on the Coleman estate. Knapped flint and brick were used in municipal buildings, such as the library at Loddon.

Figure 19: Library, Loddon. Quaternary Flint with brick and limestone dressings.

Suffolk Coast and Heaths

This NCA lies on the North Sea coast between Great Yarmouth in the north and the port town of Harwich in the south, forming a long narrow band that extends between 10 and 20km inland. Only a very small part of the NCA, south of Great Yarmouth around Bradwell and the eastern outskirts of Gorleston-on-Sea, is within Norfolk.

In addition to Bradwell, now greatly expanded by modern development, there are a few scattered hamlets and farmsteads and associated cottages. A range of vernacular building materials, including red brick and clay pantile, was used in the area. Timber frame was employed during the medieval period and into the 19th century for farm buildings, in particular, often with brick plinths and gables.

St Nicholas' Church at Bradwell has a 12th-century round tower with a 14th-century nave, aisles and chancel. It is built of knapped and Quaternary Flint pebbles, with Lincolnshire Limestone blocks, rough and random coursed, with ashlar dressings and some brick. The porch gable end is faced in knapped flint rounds with Lincolnshire Limestone dressings. The buttresses were repaired with roughly squared flint and areas of brick.

Much of the area was common land until it was enclosed and improved in the 18th and 19th centuries. Small 18th-century country houses and their parklands, such as Caldecott Hall, Hobland Hall and Bradwell Hall, are characteristic of the area. All were built of brick with Welsh Slate roofs. Red brick was used for farms and cottages associated with the estates.

Figure 20: St Nicholas' Church, Bradwell. Flint and limestone.

South Norfolk and High Suffolk Claylands

This NCA occupies a large area of central East Anglia, stretching from just below Norwich in the north to the River Gipping in the south. It includes small market towns such as Attleborough, Wymondham, Diss, Harleston and Scole, located in the river valleys on the major transport routes. A wide range of historic buildings survive within these towns. By the Saxon period, a dispersed pattern of settlement was already established on the plateau that forms a large part of the NCA. The area retains much of its medieval character: there are farmsteads, moated manorial sites and groupings of farmsteads around the margins of former common pastures, which are known as greens or commons.

The area was more wooded than much of Norfolk and timber frame was the dominant material used for buildings in the early medieval period.

Such frames are often concealed under colour-washed plaster. Significant numbers of houses, cottages, barns and occasional cattle housing (locally termed 'neathouses') as well as other farm buildings built before 1750 survive. As the area's woodlands were cleared, timber became an increasingly scarce resource, and it was gradually replaced by flint and brick. From the 1790s, the area gained a national reputation for its barns. In the south of the area, where woodland remained more extensive, timber framing continued to predominate into the 18th century, at Wymondham, Diss and Harleston, for example.

Flint was commonly used for the construction of medieval churches and monastic buildings. Indeed, this NCA has the greatest concentration of round towers in the country, particularly in the south-east in the Yare Valley and the Waveney Valley. Most churches were built of irregular field flint nodules and pebbles set in mortar, either uncoursed or as rough-coursed rubble. Dual coursing is found occasionally. Flint was often used for jambs and arches. Imported Lincolnshire Limestone was generally preferred for dressings and quoins from the 12th century. Occasionally, chalk and ironpans were employed, particularly in the footings of west towers. From the late 13th century, the use of knapped flint and galleting became commonplace in the area.

Monastic establishments included Old Buckenham Priory, and the Chapel of the Holy Cross and the College of the Holy Cross, both at Attleborough. At Wymondham the abbey church was built in flint and Caen Stone. Chalk was used for a carved arch in the Chapel of St Thomas à Becket, now Wymondham Arts Centre.

Planned settlements were established in the 12th century, including New Buckenham and Wymondham, in association with the construction of a new castle at New Buckenham and the Priory Abbey at Wymondham. The castle keep is the oldest circular keep in England. It was built of roughly coursed

Figure 21: Wymondham Abbey. Flint with Caen Stone dressings.

flint nodules. Expanding populations from the 11th to the 14th century led to the establishment of secondary settlements on the central plateau, often on the edges of large grazed commons or greens, such as at Old Buckenham. The mixed arable and dairying economy that evolved made wealthy lesser gentry and yeoman farmers and many sizeable moated farmhouses were established. In the mid-14th century, significant number of churches and settlements were abandoned as a result of economic decline and the Black Death. However, with the economic revival in the late 14th century, farm sizes grew. Brick started to be used in the more prestigious buildings, often with flint or terracotta. In the 15th century, fortified manor houses, such as Baconsthorpe Castle, near Holt, became popular. It was built of knapped and galleted flint with brick.

From the 13th century, the valleys of the Waveney and Little Ouse became the main centre for linen weaving in Norfolk. The wealth generated by the industry in the later 14th century and the 15th century helped fund the embellishment of numerous churches. Octagonal belfries were added to many round towers, naves and chancels were rebuilt, and porches, chapels and clerestories were added. From the 15th century, flushwork became commonplace in churches, including at St Peter's at Hedenham and St Mary's at Pulham St Mary, for example. Proudwork also became popular. At Wymondham Abbey, the two eastern bays of the clerestory are in proudwork and the remaining five are in flushwork.

After the Dissolution, monastic lands were sold off and their new owners often built new houses, particularly around Norwich. From the 15th century, the use of brick became commonplace in vernacular buildings. Many earlier houses were rebuilt from the 17th century. Brick stepped gables and Dutch-style gables were frequently adopted from the 16th to the 18th century. From the 16th to the 19th century, estates and parks developed, particularly in the north of the area where there was easy access to Norwich. In the 18th and 19th centuries, timber-framed buildings were often re-faced or encased in brick, both in the countryside and in the market towns.

From the late 18th century, brick was the predominant material used for new buildings, although clay lump was also quite commonly employed for farm buildings, cottages and some farmhouses in the south of the area in the first half of the 19th century. From the 19th century, the use of pantiles became commonplace, imported from the Netherlands, or a little later from Humberside. In the south-east of the area, Welsh Slate was used from the early 19th century, imported by boat along the Waveney. After the construction of the railways, the use of such material became commonplace. Other building stones were imported for use in commercial and municipal buildings in the area's towns. In the 19th century, there was a revival in the use of flint in church restoration and construction. For example, the Church of St Margaret at Kirstead made much use of coursed flint ovals laid lengthways. The Church of St Andrew at Framingham Pigot was largely faced in coursed, squared flint. The offset tower was built of coursed limestone blocks with limestone dressings, surmounted by a steeple. It is one of the most ornate Gothic Revival churches in the county.

Figure 22: Church of St Andrew, Framingham. Limestone and flint.

Mid Norfolk

This NCA occupies the northern section of the East Anglian Plain between Swaffham in the west and Norwich in the east. The landscape consists of a flat plateau that is dissected by the upper reaches of the Rivers Wensum, Tud and Yare and their numerous tributary stream valleys that flow east to Norwich and the headwaters of the Nar that flow west to the Great Ouse. The NCA also includes much of the historic centre of the city of Norwich and its south and south-western suburbs. East Dereham and Fakenham are the only significant market towns within the area, which also includes large villages such as Hingham, Reepham and Watton.

Flint, red brick and black-glazed pantiles are the predominant materials used in the historic buildings of the area. In Fakenham and East Dereham, brown, orange and yellow flint and chert are dominant, generally used with brick. There are some rare survivals of earlier timber frame.

By the time of the Norman Conquest, the area was prosperous as a result of farming and wool production. The cloth industry sustained the region's wealth into the 19th century. The economy and buildings of the area were significantly influenced by religious establishments, including those located just outside the NCA, such as Little Walsingham, Castle Acre, Wymondham,

Thetford and Norwich, and foundations within, such as Great Massingham Priory, Hempton Priory, Normansburgh Priory, Sporle Priory and Wendling Abbey. Most of the parishes of the Wensum Valley and those around Thetford and Norwich provided livings to such establishments.

The area is rich in medieval churches. A few early Saxo-Norman round towers are present, including at West and East Lexham. They are built of uncoursed flint with flint quoins. The internal walls are faced in chalk. Ironpans are often found in churches of the upper Wensum Valley, south of Fakenham, including at the Church of St Nicholas at Shereford, the Church of St Andrew at Great Ryburgh and the now ruinous Church of St Margaret at Pudding Norton. The bishop's chapel at North Elmham has well-laid blocks of ironbound conglomerate, ironbound sandstone and a little cinderstone. There is a particularly notable cluster of later medieval churches around Reepham. For example, the Church of SS Peter and Paul at Salle is a particularly fine 15th-century 'wool' church, built of flint with high-quality flushwork. Proudwork is characteristic of churches in the Tud Valley.

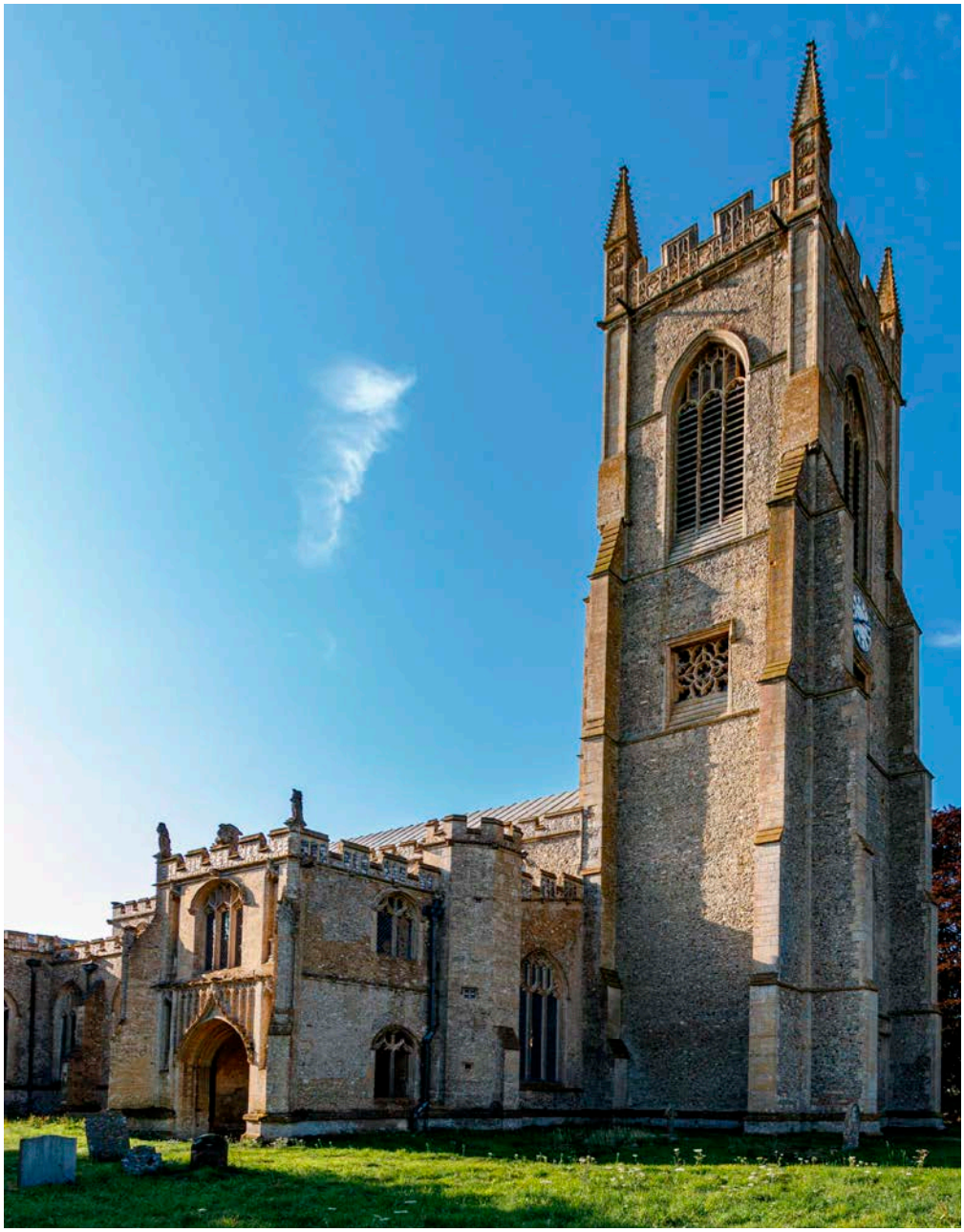


Figure 23: Church of SS Peter and Paul, Salle. Flint flushwork.

Brick was used increasingly from the 16th century for vernacular buildings, although during the 17th century growing wealth led to the building of many timber-frame farmhouses and barns. Medieval manors formed the basis of the large number of 17th and 18th-century country house estates of various sizes that can be found throughout the area. Country houses from the 17th century were mostly built in red brick, but white or grey brick became popular later. Raynham Hall near Fakenham is the paramount house of its date in Norfolk. It was built of brick with Ketton Stone dressings supplied in 1621.

Late 18th-century enclosure, particularly in the west of the area between Swaffham and Fakenham, was associated with large estates, such as Raynham and Elmham. The estates often built their own churches and villages, such as at Heydon, part of the Heydon Hall estate. Many new estate buildings were constructed in the period, generally in red brick. During the 18th and 19th centuries, older timber frames were often re-faced in locally produced brick, both in the countryside and in the market towns.

In the 19th century, there was a revival in the use of flint in church restorations, such as the Church of St Michael the Archangel at Booton, where dressed flint was used, unusually with some flint scales. St Mary's Church at North Elmham was re-faced in flint in 1864. Flint and brick were used occasionally for 18th-century non-conformist chapels, such as Mattishall, although brick was more common.

In the south of the area around Watton, clay lump was employed for cottages, farmhouses and farm buildings in the mid-19th century.

The arrival of railways from the mid-1800s connected Norwich, Fakenham, Dereham, Great Yarmouth and King's Lynn to London, the Midlands and the North. Much of the area experienced rural depopulation. Norwich and Dereham, in particular, grew rapidly. The opening of the railways enabled the importation of building materials, such as Welsh Slate, brick and some stone. In Dereham, Edward Boardman's Cowper Congregational Church and Trinity Methodist Church are faced in imported Kentish Rag with Bath Stone dressings. The use of light-coloured bricks, mainly in the major towns such as Fakenham and Norwich, became common after the opening of the rail network.

The Brecks

The Brecks occupy much of south-west Norfolk and north-west Suffolk, together with a small part of north-east Cambridgeshire. Thetford and Swaffham are the main towns of the area. There is little settlement in the middle of the Brecks: villages are clustered along the river valleys to the north and south and the Fen edge to the west. Thetford is the largest settlement in the Little Ouse Valley. Villages in the north, in the Wissey Valley, include Ickburgh, Cockley Cley, Gooderstone, Oxborough, the Cressinghams, Bodney and Hilborough. A small part of the Nar Valley falls within the area, including West Acre and Castle Acre, as do the Fen edge communities of Methwold, Northwold and Feltwell.

Flint and brick, sometimes with chalk, had become the dominant materials used for vernacular buildings by the 17th century. Few medieval timber-framed buildings survive from before *c* 1700. Those that do are mostly located towards the margins of the area. Large nodule flint occurs in the chalk exposed close to the Fen edge. Elsewhere, flint was usually obtained from the surface, often from the glacial drift. Irregular flint nodules or pebbles were largely used as random rubble or, less frequently, they were rough coursed. The latter is more common in the Fen edge communities.

Flint was the dominant material used in the construction of monastic foundations in the area, such as Castle Acre Priory in the Nar Valley and Slevesholm Priory, Methwold, and St Winwaloe Priory, Wereham, in the Fen margins. By the 11th century, Thetford was among the largest and most important towns in England, and the Priory of Our Lady of Thetford was one of the largest and richest religious foundations in medieval East Anglia. Flint was used for most of its buildings, with Lincolnshire Limestone dressings. Rubble chalk is also found in the surviving walls of some of the buildings.

Many medieval churches in the Brecks are small and they are built in a simple style that reflects the relative poverty of their parishes. Larger churches are found in the then more prosperous Fen edge settlements. They are mainly constructed of flint. Round towers are relatively scarce, except to the north-east of the area, at Threxton, Stanford and Breckles, for example. By the late 14th century, sheep farming had become extremely profitable. Several churches were built, rebuilt or embellished, often with new west towers, clerestories or porches funded by wealthy patrons. Knapped, cut flint and flushwork became common. New or largely rebuilt churches include the Church of SS Peter and Paul at Swaffham and the Church of St James at Castle Acre. Both are constructed largely of flint, with Lincolnshire Limestone dressings and some reused materials. The tower at Swaffham is of Lincolnshire Limestone ashlar.

In domestic and farm buildings, random or rough-coursed flint was the most frequently used material before 1700. Coursed cobbles projecting from the mortar are found in many barns and farmhouses in the area. Flint with brick was most commonly employed towards the west of the Brecks. Buildings of flint alone are rather more widely distributed.

In the 18th to 19th centuries, there was an expansion in enclosure and in the number and extent of landed estates. Many estate farm buildings and cottages were built in flint and brick. Buildings of brick and flint are more widely dispersed. Coursed flint was less common and tended to be found in buildings lying towards the west of the Brecks. Galleting became popular in the 19th century, although its use is largely restricted to the Fen edge settlements in the Brecks. Carstone chips are occasionally used for galleting flintwork, including in cottages in Northwold and Beachamwell. Unusually, the Beachamwell estate also built several cottages in Big Carr with brick dressings.

Figure 24: Church of SS Peter and Paul, Swaffham. Lincolnshire Limestone.

New flint mines around Brandon, just over the border in Suffolk, were developed in the 19th century to support the gunflint industry, particularly during the Napoleonic Wars. They produced significant quantities of black knapped flint that was used for building. Knapped flint was employed extensively in church restoration work from the 17th century, for example in the very early Gothic Revival restoration of All Saints' Church at West Acre. In the 19th century, restorations became far more common and include St Andrew's Church at Brettenham, for example.

Chalk was used rarely in medieval churches in the area, such as at the Church of St Mary the Virgin at Beachamwell in the north of the area and the Church of St George at Methwold in the Wissey Valley. Flint-faced, mortared, chalk rubble and, occasionally, dressed chalk were used in Castle Acre Castle, one of the largest motte and bailey castles in England. Weeting Castle was built of chalk rubble, with Lincolnshire Limestone ashlar. The oldest examples of vernacular chalk buildings date from the 17th century. They are

found in the Fen edge villages west of Thetford, in particular, including at Hockwold cum Wilton and Methwold. Most surviving buildings date from the 18th or 19th centuries.

On the Fen edge and in the Nar Valley, ironpans were sometimes employed with chalk in early churches. The remnants of the Church of St Nicholas at Feltwell have much ironpan in the tower, with chalk and flint. Castle Acre Priory has alternating courses of rubble chalk and Big Carr, with unusual spirals of the two materials in piers.

The use of brick trickled down to larger vernacular houses from the 16th century. The production of off-white and yellow shades of brick started in the 18th century and became the dominant and characteristic building material of the area.

Figure 25: House, Castle Acre. Flint rubble.

3 Local Building Stones

Lower Cretaceous

Group not defined, Sandringham Sands Formation

Leziate Quartzite (Blue) Sandringham Carstone, Silver Carr, Sugar Stone

The Leziate Member, the source of Leziate Quartzite, occurs only in western Norfolk, with an outcrop extending from near Heacham southwards to Downham Market. Leziate Quartzite has correspondingly seen only localised and minor use, especially in comparison with local types of carstone. The stone itself, often referred to as (Blue) Sandringham Carstone, Silver Carr or Sugar Stone, is an off-white to pale grey-coloured, fine to medium-grained quartzitic sandstone that is poorly cemented with quartz. It weathers to a distinctive iron-grey colour. The alternative name 'Sugar Stone' is very apt, because the individual block faces appear granular and tend to sparkle, particularly in direct sunlight.

Leziate Quartzite was employed mainly in ecclesiastical, farm and domestic buildings at various locations, usually close to its source.

Figure 26: St Lawrence's Church, Castle Rising. Carstone and Leziate Quartzite with Lincolnshire Limestone dressings.

Figure 27: St Lawrence's Church, Castle Rising. Leziate Quartzite.

Group not defined, Dersingham Formation

Small Carr (Shell Carr, Block Carr, Carstone Slips)

Small Carr is a hard, fine to coarse-grained, ferruginous sandstone that varies in colour from very dark purplish-brown to yellowish-brown. This colour variation appears to be continuous and it may be exhibited in a single wall or building. Small Carr is invariably employed in the form of small, tabular blocks. They are usually of uniform thickness, varying from 20 to 30mm, although blocks up to 80 or 100mm thick are also encountered. The blocks are traditionally laid in a coursed manner that resembles drystone walling. Each overlapping 'plate' (or 'slip') of Small Carr is pitched slightly downwards and outwards to minimise rainwater penetration. The stone is durable and weathers well, in many instances better than Big Carr.

Small Carr is used quite extensively in buildings between Dersingham and Downham Market in north-western Norfolk, but occasionally it is encountered as far east as Sheringham and East Dereham in Norfolk and as far west as March in Cambridgeshire. In Norfolk, particularly fine examples of its use can be seen in the Sandringham area and in the town of Downham Market.

Figure 28: Estate wall, Sandringham. Small Carr.

Figure 29: Railway station, Downham Market. Small Carr.

Figure 30: St Mary Magdalene Church, Sandringham. Small Carr with Lincolnshire Limestone dressings.

Figure 31: St Mary Magdalene Church, Sandringham. Small Carr.

Group not defined, Carstone Formation

Big Carr (Snettisham Carr, Puddingstone)

Big Carr is a rich orange-brown or dull orange to yellowish-brown ferruginous sandstone that typically exists as larger blocks than Small Carr. Big Carr also commonly exhibits irregular veins and joint coatings of brownish-black ironstone. The grain size varies from medium to coarse, and the stone often weathers well. However, the coarsest, dull-coloured variety (called puddingstone), which contains well-rounded small pebbles of vein quartz, has relatively poor weathering properties.

Big Carr has been much used in a wide variety of forms in Norfolk. Coursed Big Carr is employed extensively in north-west Norfolk. Big Carr dressings are seen north of King's Lynn towards Old Hunstanton and Holme, and further east towards Anmer. Snecked Big Carr has a more restricted occurrence than this, and it is largely confined to villages and towns north and north-east of Dersingham, such as Brancaster, Snettisham, Heacham and Hunstanton. Randomised Big Carr was used in two different sizes: giant, as seen in 19th-century cottages in Dersingham, and normal, as seen in the post office at Wells-next-the-Sea. The normal size occurs quite widely across the more general area of use, but the giant variant is mostly restricted to larger settlements, such as Hunstanton, Heacham and Snettisham. Chronologically, the use of randomised Big Carr began after the snecked form, and it became increasingly popular in the late 19th century and during the Edwardian period, particularly for housing. The use of Big Carr declined in the early 20th century. However, from the late 20th century, it has been employed frequently in new housing developments, notably between Downham Market and Holme-next-the-Sea.

Figure 32: 'Randomised' blocks of Big Carr.

Figure 33: Tabular blocks of Big Carr with galletting.

Figure 34: The Old Bakehouse, Snettisham. Big Carr.

Figure 35: Dressed and coarsed tabular blocks of Big Carr.

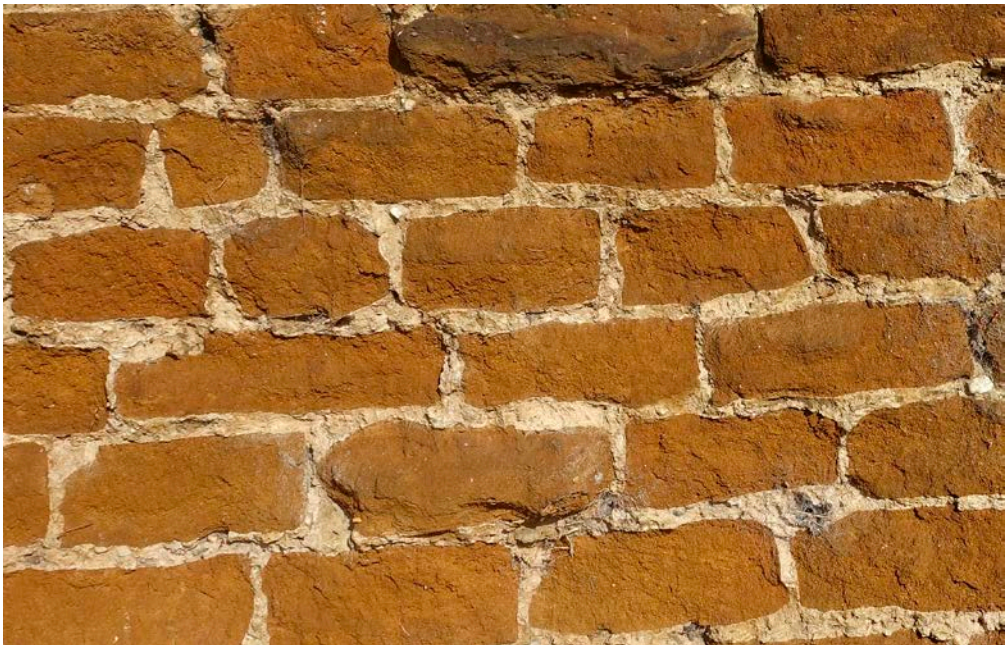


Figure 36: James Street, Hunstanton. 'Snecked' Big Carr.

Carstone (Carr Stone, Carstone, Gingerbread Stone)

Carstone is the general name applied here for a distinctive orange-brown or dark purple-coloured, ferruginous sandstone that has been widely used as a building stone in western Norfolk, and occasionally elsewhere. It has been employed in several forms along the entire outcrop length of the Dersingham and Carstone formations, although the paucity and degraded state of the quarry exposures present today seriously hamper detailed identification of the stone.

Cromer Knoll Group, Hunstanton Formation

Red Chalk (Hunstanton Chalk, Red Clunch)

The red chalk is a very distinctive geological unit that extends for approximately 15km from Hunstanton cliffs south to near West Newton and the River Babingley. As its name implies, the stone is a uniform, brick red-coloured form of chalk, which can be nodular and shelly in places. The use of red chalk as a building stone is only common in Old Hunstanton and neighbouring villages, such as Holme-next-the-Sea. Otherwise, it is

rarely encountered. It is not particularly durable and weathers relatively easily. Where seen, it tends to have been employed as a roughly dressed rubblestone in walls. However, its attractive appearance means that it has also been used decoratively alongside other materials, often white chalk.

Figure 37: Cottages, Kirkgate, Holme-next-the-Sea. Red Chalk and White Chalk.

Figure 38: Wall, Sea Lane, Old Hunstanton. Red Chalk and White Chalk.

Upper Cretaceous

Chalk Group, Grey Chalk Subgroup, Lower Chalk

Lower Chalk Hardgrounds (Paradoxica Bed Stone, Inoceramus Bed Stone)

Several prominent beds of relatively hard, gritty, chalky limestone occur in the Lower Chalk sequence of north-western Norfolk, especially in the King's Lynn district. These beds typically comprise pale grey to pale buff-coloured, bioturbated, shell debris-rich chalk. Glauconitised and phosphatised chalk pebbles occur at some levels, and erosion surfaces (hardgrounds) are commonplace.

These Lower Chalk hardgrounds are used only very occasionally and locally as building stones. Where they do occur, they are generally employed as scattered rubblestone blocks in church walls, as at the Church of St James at Runcton Holme, for example.

Figure 39: Church of St James, Runcton Holme. Inoceramus Bed Stone.

Figure 40: Church of St James, Runcton Holme. Inoceramus Bed Stone.

Totternhoe Stone

Totternhoe Stone is a distinctly harder unit within the Grey Chalk Subgroup. It typically comprises creamy to pale brownish-grey, fine-grained calcarenite. It often appears sandy due to the presence of coarse fossil fragments.

It has been used occasionally in Norfolk, and the Norman doorway at the Church of St Mary at Wimbotsham provides a particularly fine example of Totternhoe Stone.

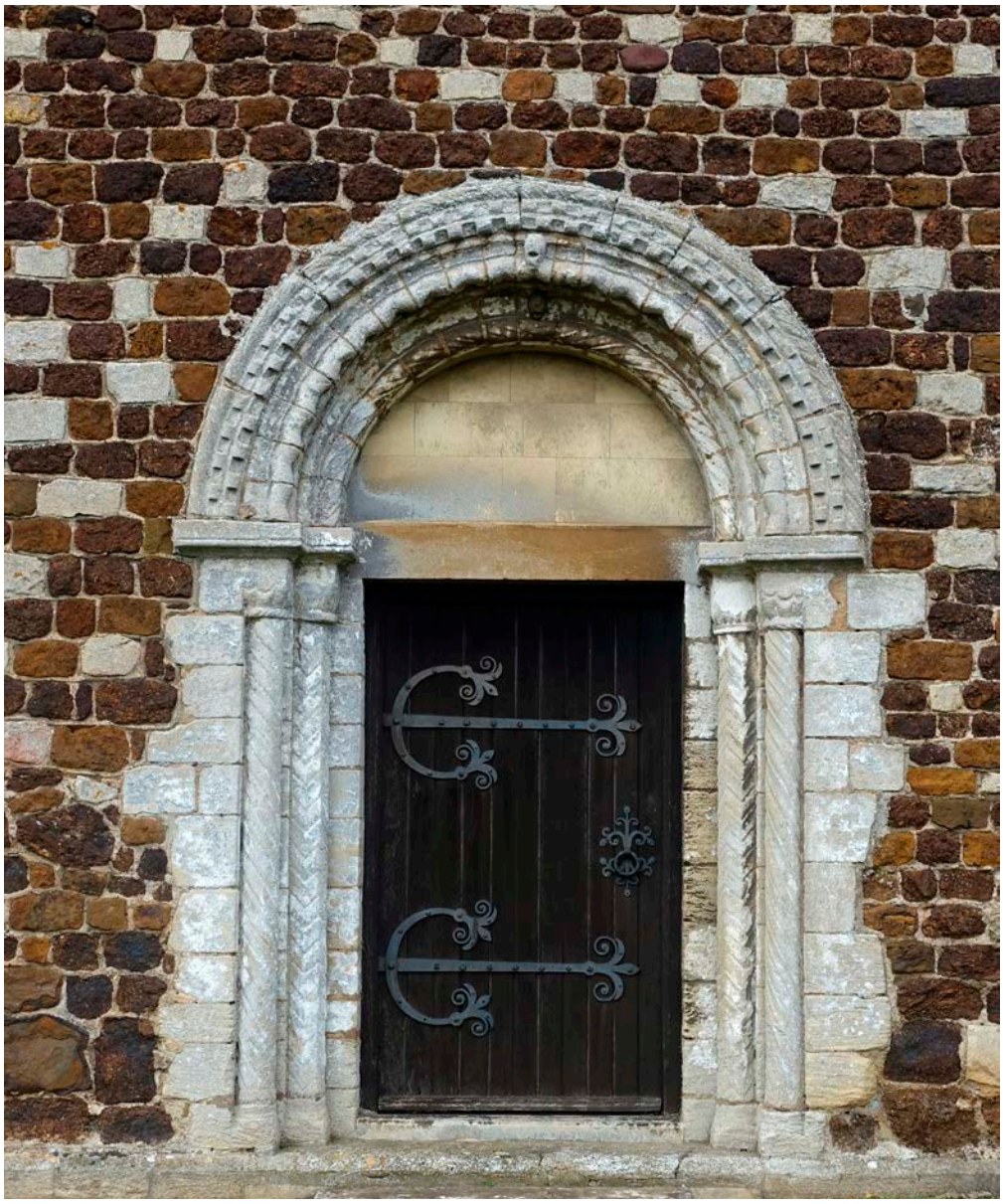


Figure 41: Church of St Mary, Wimbotsham. Totternhoe Stone doorway. Carstone with Chalk Block wall.

Chalk Group, White Chalk Subgroup, Middle Chalk and Upper Chalk

Chalk (Clunch, White Clunch)

The white chalky limestones of the Upper Cretaceous White Chalk Subgroup are among the most distinctive and easily recognised building stones employed in Norfolk. They are white to very pale grey or pale buff, typically structureless limestones, which, in places, contain fossil oysters (inoceramids) and echinoids, and occasionally crinoids, brachiopods and

belemnites. When freshly quarried, chalk is easily worked. It is generally unsuitable for exterior stonework because repeated wetting and drying, coupled with frost action, causes the relatively soft rock to powder and disintegrate into small angular brash. Softer forms of the stone, when used externally, may show concave weathering away from mortar lines.

In Norfolk, chalk is typically used as a rough walling stone, often accompanying other stone types, especially Big Carr, Quarry Flint and Quaternary Flint, and occasionally red chalk and chert pebbles and cobbles. Further details regarding the form and geographical extent of its use are provided in 'The use of stone in Norfolk's buildings' section of this guide.

Particularly fine examples of the use of chalk, as coursed blockwork and rubblestone, can be seen in several of the villages located along the north-western Norfolk coast, notably Old Hunstanton, Holme-next-the-Sea and Thornham. Where the chalk is employed in a coursed blockwork fashion, it is often accompanied by dressings of red brick.

Figure 42: Cottages, Kirkgate, Holme-next-the-Sea. Chalk on a Big Carr plinth.

Figure 43: House wall, Kirkgate, Holme-next-the-Sea. Chalk.

Quarry Flint (Fresh Flint, Nodule Flint)

Quarry Flint occurs as bands or isolated nodules within the chalky limestone beds of the White Chalk Subgroup. It is an extremely fine-grained (cryptocrystalline) and hard form of silica, containing microscopic quartz-crystal aggregates. Quarry Flint usually occurs as irregularly shaped nodules that are 100 to 200mm across, or as (sub-)rounded pebbles or cobbles. Occasionally, it is also found as weakly banded tabular sheets or layers up to 200mm thick. The colour is very distinctive: fresh nodules have a white outer cortex with a black or dark grey interior.

Quarry Flint breaks with a characteristic conchoidal fracture, producing razor-sharp fine edges. The cleaved surfaces may exhibit banding, resulting from the alternation of layers of slightly different composition. Flint nodules may contain cavities lined with translucent botryoidal chalcedony or small transparent quartz crystals. Some nodules contain well-preserved fossils, with echinoids, sponges, bivalves, burrow structures and occasionally belemnites being found.

Quarry Flint is one of the most commonly encountered and extensively used building stones in Norfolk. It is often seen in association with Quaternary Flint. Quarry Flint was employed in a wide variety of ways, including as knapped, faced, trimmed or cleaved-faced stone and sometimes in squared chequerwork and flushwork.

The extremely hard and resistant nature of Quarry Flint-type nodules has resulted in them having been recycled by natural processes into younger deposits.

Figure 44: Cottages, Magdalen Street, Thetford. Quarry and Quaternary Flint.

Figure 45: Wall, Magdalen Street, Thetford. Flint.

Quaternary

Ironpan (ferricrete, ironbound conglomerate, ironbound sandstone, cinderstone)

Ironpans are an important group of closely related building stones that formed in geologically recent times as the result of iron-rich groundwaters cementing various sands, gravels and conglomerates.

The three most common varieties of ironpan are ironbound conglomerate, ironbound sandstone and cinderstone, which are intergradational in character. Ironbound conglomerate and ironbound sandstone are yellowish, reddish or purplish-black-coloured stones, due to the presence of dark iron cement. Flint pebbles predominate in the conglomerate, but other lithologies are also present. With the decline in the proportion of pebbles, ironbound conglomerate grades sequentially into pebbly ironbound sandstone and then cinderstone. The ferruginous quartz sand matrix ranges from fine to coarse grained. Cinderstone is also dark coloured, typically appearing blackish-purple, and it is massive in form. It is generally a finer grained stone than ironbound conglomerate and ironbound sandstone, although small, scattered flint clasts may be present. Cinderstone typically exhibits closely spaced, irregular cavities of 5 to 15mm in size, which have near-black linings of iron oxide-cemented coarse silt or sand.

All three varieties of ironpan are typically hard, durable and tough stones that possess excellent weathering properties. Consequently, ironpan has been quite widely employed for building purposes, although nowhere is it common and its use decreased significantly post 19th century. Ironpan is mainly encountered in buildings in northern and western Norfolk in an area defined by Hunstanton, Sheringham and Downham Market. Sporadic use is also made of the stone between Norwich and Great Yarmouth. Typically, ironpan occurs in wall fabrics as large masses (commonly larger than Big Carr), but it can also be found as small, irregular lumps. Slabby forms are very rare because ironpan tends to lack bedding structures.

Figure 46: Ruined chapel, North Elham. Ironbound conglomerate and cinderstone.

Figure 47: All Saints' Church, North Runcton. Ironbound conglomerate, ironbound sandstone, Cinderstone, carstone and Quaternary Flint.

Figure 48: All Saints Church, North Runcton. Cinderstone and ironbound sandstone.

Figure 49: St Mary's Church, Fordham. Lincolnshire Limestone and ironbound sandstone.

Figure 50: St Mary's Church, Fordham. Ironbound conglomerate.

Chert Pebbles and Cobbles

Accumulations of Quaternary fluvio-glacial deposits in Norfolk encompass a diverse range of poorly sorted, relatively soft and unconsolidated sediments. These vary in composition, but they sometimes contain harder pebbles and cobbles that mainly comprise orange-brown to brown-coloured chert and quartzite. The latter is typically encountered in walls as hard, rounded, ovoid pebbles that may have derived from the Triassic Chester Formation of the West and East Midlands.

Norfolk's fluvio-glacial deposits were formerly exploited for construction materials on mainly a local scale, and the harder chert pebbles and cobbles yielded as a by-product of this activity served as a convenient source of stone for nearby buildings and other walling. The use of chert pebbles and cobbles in walls in Norfolk (especially churchyard walls) is not particularly common, but it is quite widespread, nonetheless. Where seen, such pebbles have often been used in association with Quaternary Flint. The churchyard wall at Shipdham provides a particularly fine example.

Figure 51: Church of All Saints, Shipdham. Chert pebbles and cobbles.

Figure 52: Churchyard wall, Church of All Saints, Shipdham. Chert pebbles and cobbles with some Quaternary Flint pebbles.

Quaternary Flint (Beach Flint, Fluvio-glacial Flint, Field Flint)

Quaternary Flint typically occurs as irregularly shaped nodules that are found lying on the surfaces of fields or within deposits of clay-with-flints, or as pebbles within fluvio-glacial sands and gravels. The size of the nodules typically ranges from 100 to 300mm. The colour is variable: less weathered flint nodules or pebbles have a cream outer cortex with a darker coloured (greyish) interior; weathered flints, in contrast, or those that have lain in soil or superficial deposits for a long period of time, may be variously discoloured or bleached, and often have brown-stained interiors due to the precipitation of iron hydroxides from percolating ferruginous waters. Mottled flint is not uncommon in Norfolk. The weathered appearance of Quaternary Flint helps distinguish it from the much fresher looking Quarry Flint.

A combination of its hardness, durability and resistance to weathering has resulted in Quaternary Flint being much used as a building stone wherever it is encountered in Norfolk. Many walls and buildings across the county include Quaternary Flint in one form or another, and the stone has been used extensively in numerous towns and villages.

As a walling stone in Norfolk, Quaternary Flint was mainly employed as little-dressed nodules or pebbles laid randomly or roughly to course. Knapped, faced, trimmed or cleaved-faced forms of Quaternary Flint, used in a random fashion or as part of decorative arrangements, are also encountered with some regularity. The stone can be seen in many churches and walls in towns and villages throughout the county. Particularly fine examples of a range of uses of Quaternary Flint can be seen in the Guildhall in Norwich, the Church of St Mary at Roughton and various sections of walling in Blakeney village.

Figure 53: Guildhall, Norwich. Quaternary Flint.

Figure 54: Guildhall, Norwich. Quaternary Flint.

Figure 55: Church of St Mary, Roughton. Quaternary Flint and ironbound conglomerate.

Figure 56: Entrance porch, St Mary's Church, Roughton. Quaternary Flint.

Figure 57: Cottages, High Street, Blakeney. Quaternary Flint pebbles.

Figure 58: Cottage wall, Blakeney. Quaternary Flint pebbles.

Figure 59: Priory, Castle Acre. Quaternary Flint and Lincolnshire Limestone.

Chalky hardpan

Chalky hardpan is pale grey or off-white-coloured hardened clay containing numerous rounded chalk pebbles and sub-angular Quaternary Flint clasts. Occasional rounded pebbles of whitish quartzite and brownish chert flakes are also present. The individual pebbles and clasts typically range from 10 to 50mm in diameter. The geological origin and geographical source of chalky hardpan is uncertain, but this material may represent the 'cemented interface' between the top of a chalk deposit lying on a weathered crag surface. One example of the use of chalky hardpan is the Church of St John the Baptist at Reedham where it exists as rare, isolated, rounded blocks in the nave walls. It is seen in association with irregularly shaped blocks of Leziate Quartzite.

Figure 60: Church of St John the Baptist, Reedham. Chalky hardpan.

Figure 61: Church of St John the Baptist, Reedham. Chalky hardpan and Leziate Quartzite.

4 Examples of Imported Building Stones

Although the Cretaceous bedrock succession and younger sedimentary deposits of Norfolk have yielded a variety of indigenous building stones, ready supplies of good quality building stone are limited in some areas. Extensive use has, therefore, been made of stones imported into the county from other parts of England, and also France.

Sedimentary building stones

Lower Carboniferous

Peak Limestone Group, various formations

Carboniferous limestone, Derbyshire

A dark grey-coloured, bioclastic limestone that is distinctively packed with fossil corals (up to 30mm across in section) and smaller crinoid ossicles and stem fragments. The fossil debris is typically white or pale cream in colour and contrasts strongly with the grey limestone matrix, especially on polished surfaces.

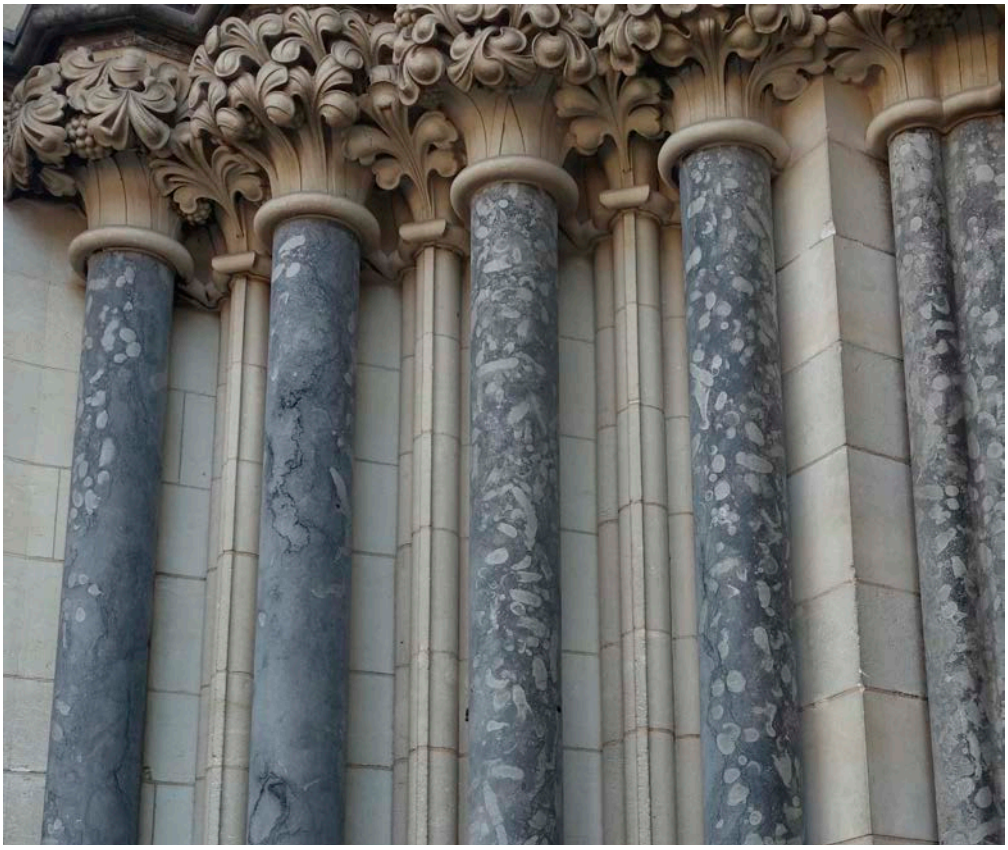


Figure 62: West entrance porch, Cathedral of St John the Baptist, Norwich. Fossil-rich Carboniferous limestone columns.

Figure 63: Carboniferous limestone fossils.

Upper Carboniferous

Pennine Coal Measures Group, Elland Flags

York Stone (general sense), West/South Yorkshire

Buff to pale grey or greenish-grey, typically fine-grained sandstones that are often micaceous and laminated, but occasionally show small-scale cross-bedding features. York Stone usually weathers evenly, but it may separate along mica-rich horizons. In Norfolk, it is employed mainly as flagstones, paving stones and plinths.

Figure 64: Paving stones, Purfleet Quay, King's Lynn. York Stone.

Permian

Zechstein Group, Cadeby Formation

Red Mansfield Stone, Mansfield, Nottinghamshire

A distinctive, uniform, red-brown, dolomitic sandstone that has seen very occasional use in Norfolk as a facing or decorative stone.

Figure 65: Doorway, 38 St Giles Street, Norwich. Mansfield Red Stone.

Middle Jurassic

Ravenscar Group, Saltwick Formation

Whitby Sandstone (Saltwick Sandstone, Aislaby Sandstone), North Yorkshire

Pale yellow-grey to yellowish sandstones that commonly display shallow-angle cross-bedding, laminations and other channel-fill structures. Fossil plant remains and rootlets are common in blocks. This stone is only very rarely encountered in Norfolk, and the best example of its use is the Church of St John the Evangelist at King's Lynn.

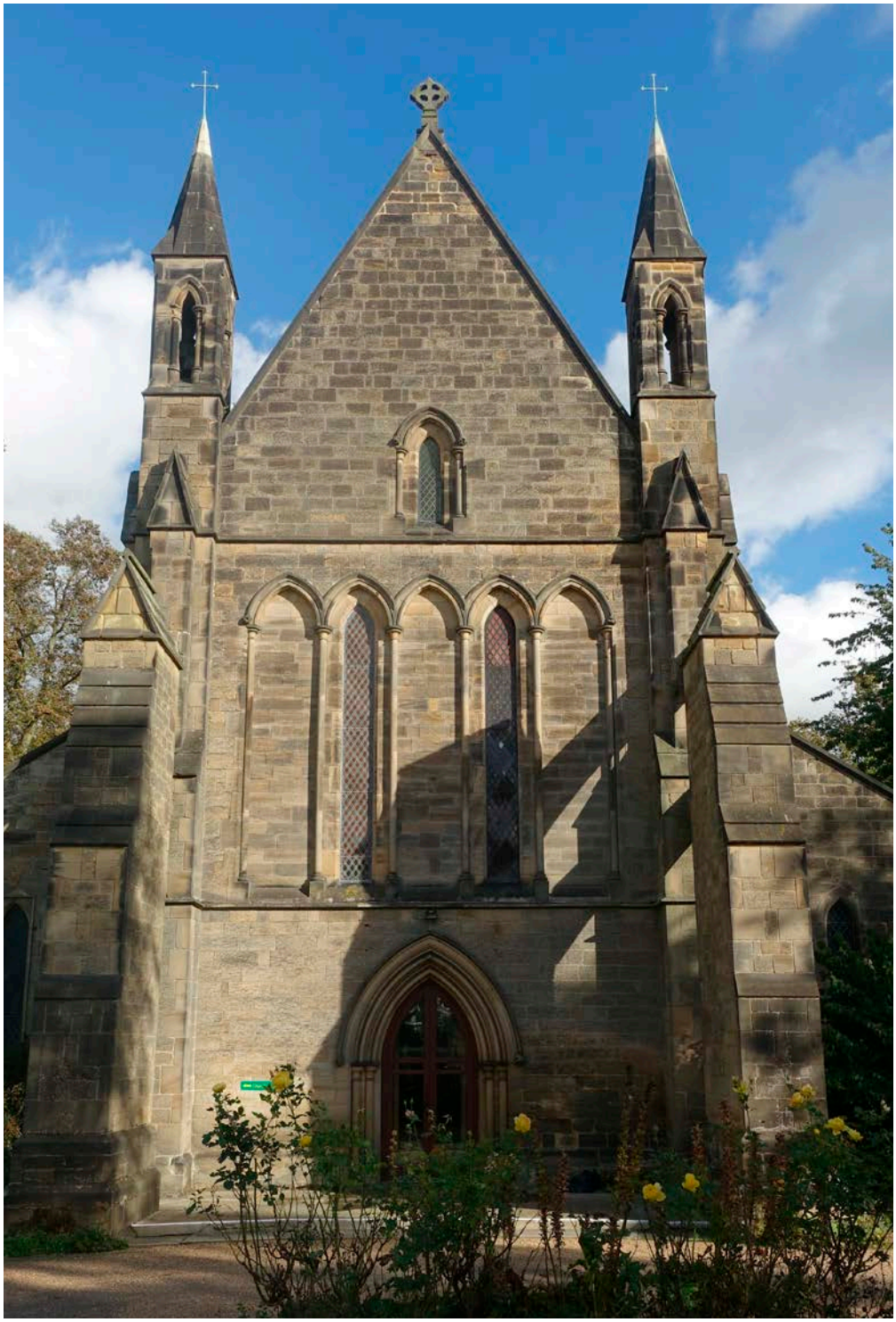


Figure 66: Church of St John the Evangelist, King's Lynn. Whitby Sandstone and Bath Stone dressings.

Inferior Oolite Group, Lincolnshire Limestone Formation

Lincolnshire limestones

Several varieties of Lincolnshire limestones are used in Norfolk, including Weldon Stone, King's Cliffe Stone, Stanion Stone and Casterton Stone, which cannot reliably be distinguished for a number of reasons.

The Lincolnshire limestones are a continuum of pale cream to pale grey-coloured limestones, which weather to shades of buff-yellow. Textures may be ooidal and/or bioclastic. The stone may or may not display cross-bedding features, and it is variably porous. It has seen common use throughout Norfolk, especially for the dressings and quoins of churches.

Figure 67: South Gate, King's Lynn. Restored with Lincolnshire limestone. Originally built with Barnack Stone.

Ketton Stone, Northamptonshire

Ketton Stone is a porous, cream to pale yellow-coloured (occasionally pale pink-stained), ooid-rich limestone with a well-sorted texture. It lends itself to being quarried in large blocks and is regarded as a high-quality freestone. It has been described as the 'perfect oolite' because of its uniform texture. It is seldom encountered in Norfolk, but a good example of its use is the former Customs House in King's Lynn.

Figure 68: The Custom House, Purfleet Quay, King's Lynn. Ketton Stone.

Ancaster Stone, Ancaster, Lincolnshire

A medium to coarse-grained, creamy-white to pale yellow-coloured (although rather ochreous in places), ooidal and bioclastic limestone. Weathered surfaces commonly display a distinctive ‘streaky bacon-like’ patterning. In Norfolk, Ancaster Stone, along with other types of Lincolnshire Limestone, tends to have been used in the construction of prestigious buildings, especially cathedrals, churches or chapels.

Figure 69: Cathedral of St John the Baptist, Norwich. Ancaster Stone, Clipsham Stone and Beer Stone.

Great Oolite Group, Chalfield Oolite Formation

Bath Stone, Bath, NE Somerset and possibly Corsham area, Wiltshire

A creamy-white to buff-yellow, ooidal limestone (freestone). This stone has been used occasionally in Norfolk for prestigious administrative buildings and in connection with Victorian new-build and church refurbishment schemes, especially as ashlar and window and door mouldings. A particularly noteworthy example of its use as ashlar is St Giles House in Norwich, which dates from 1906.

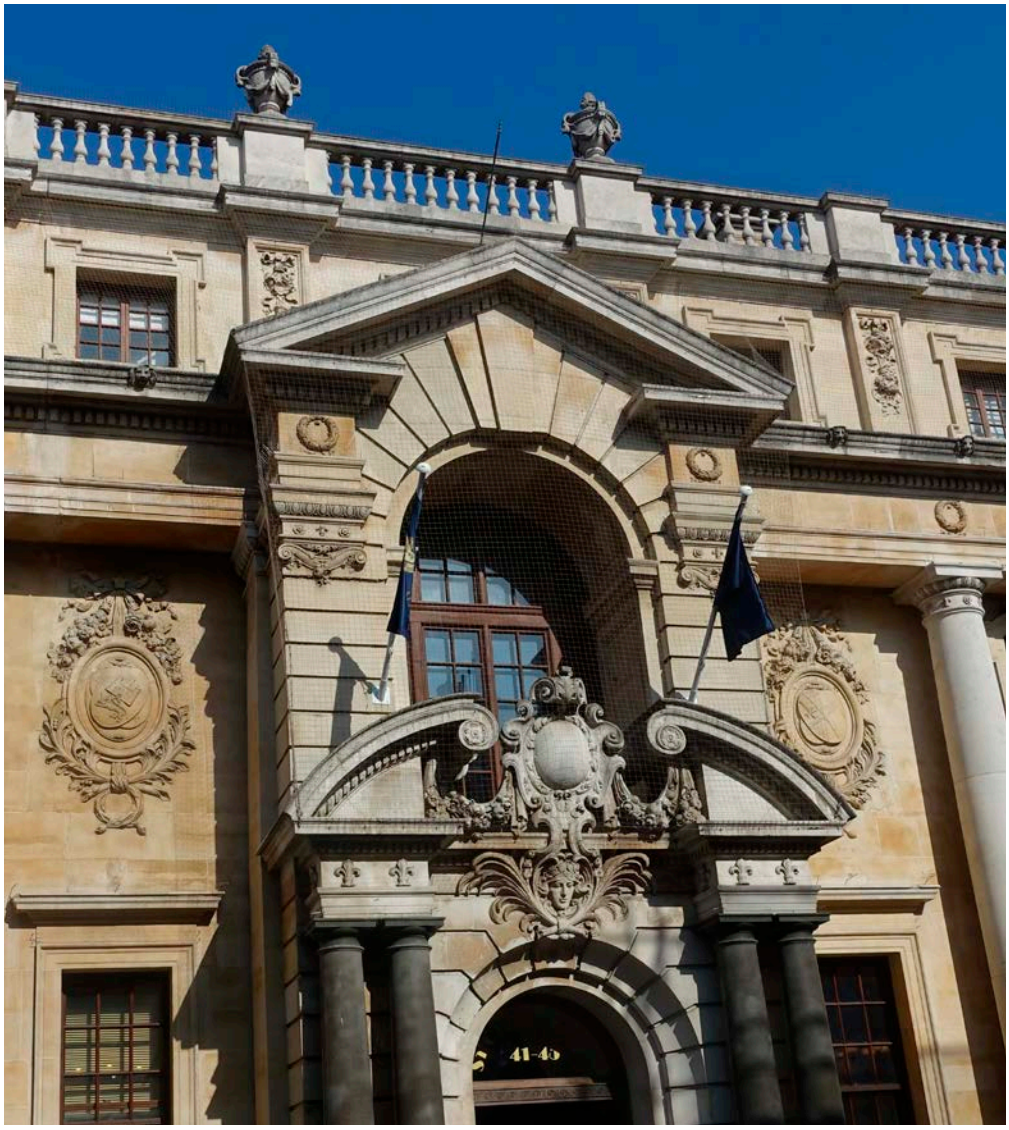


Figure 70: St Giles House, St Giles Street, Norwich. Bath Stone with Portland Stone and marble dressings.

Calcaire de Caen Formation

Caen Stone, Normandy, France

An off-white to pale creamy-yellow-coloured limestone with a fine-grained texture and few large fossils. It may exhibit spalling, and individual blocks of Caen Stone may also show uneven weathering. It has been employed only occasionally in Norfolk, in ecclesiastical buildings or fortifications dating to Norman times.

Figure 71: Cathedral of St John the Baptist, Norwich. Caen Stone and Barnack Stone.

Upper Jurassic

Portland Group, Portland Stone Formation

Portland Stone, Isle of Portland, Dorset

A near-white or very pale limestone that (in its 'basebed' guise at least) is typically a fine and even-grained freestone. It has seen widespread use across Norfolk, especially in urban areas in carved form. It has been used for monuments, war memorials, gravestones, fountains and columns. Portland Stone is also employed as high-quality walling, notably in civil, administrative and financial buildings.

Figure 72: 16 Gentleman's Walk, Norwich. Portland Stone.

Lower Cretaceous

Lower Greensand Group, Hythe Formation

Kentish Ragstone, Weald of Kent

A medium to coarse-grained, pale greenish-grey or pale brown limestone that contains greater or lesser amounts of quartz, glauconite and fossil shell debris. Kentish Ragstone has been employed only occasionally in Norfolk, and usually for the walling of ecclesiastical buildings. It may be found as dressed (typically rock-faced) tabular blocks or forming irregular random rubblestone patterns.

Figure 73: Trinity Methodist Church, Dereham. Kentish Ragstone with Bath Stone dressings.

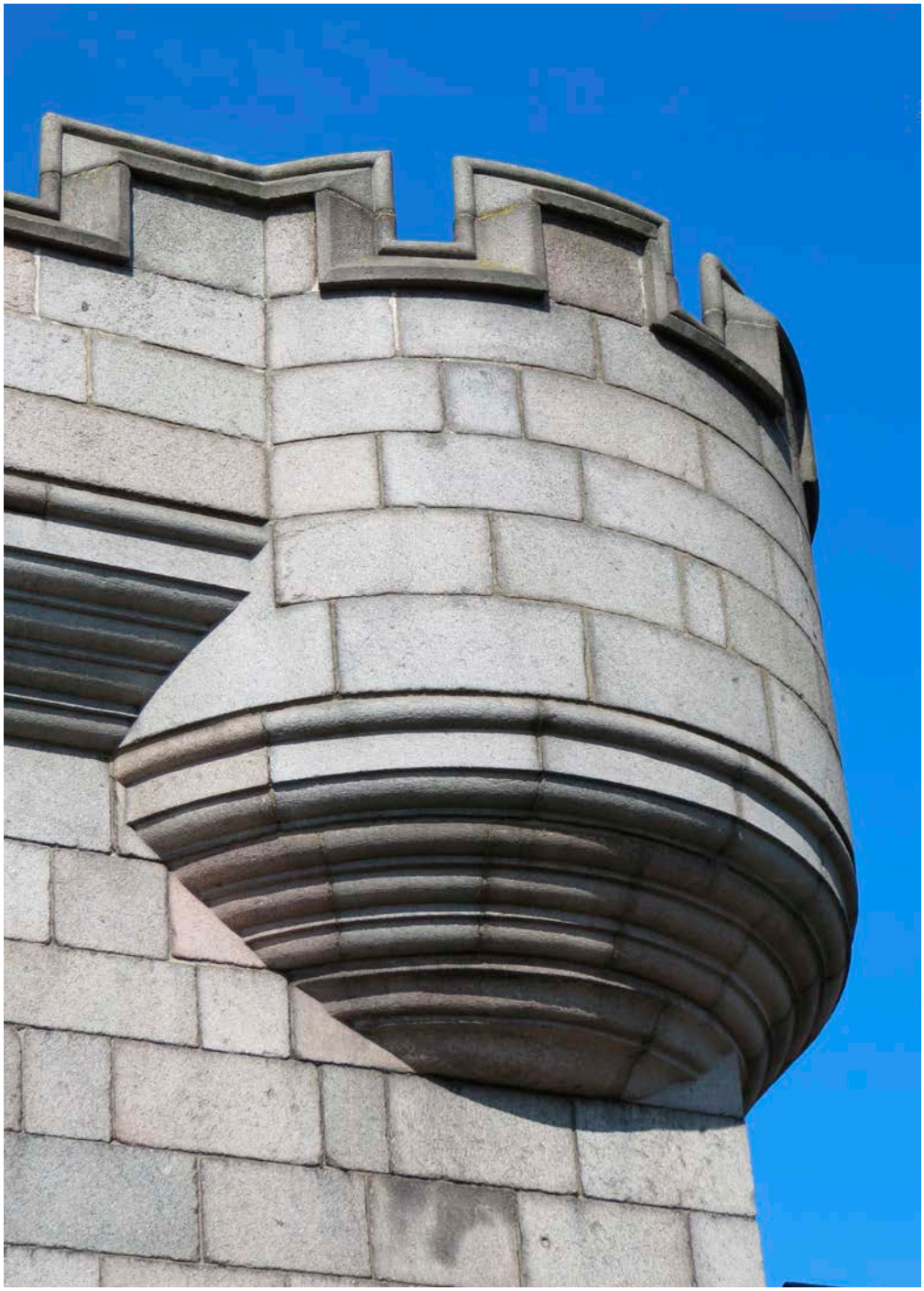
Igneous and metamorphic building stones

Granite (including Devon and Cornwall granites)

A coarse-grained igneous rock, often pale grey coloured (but other coloured varieties occur), comprising an interlocking network of grey quartz and white (sometimes pink) feldspar crystals. The latter may form distinctly larger sizes (termed phenocrysts), which display good crystal shapes. Smaller amounts of darker iron- and magnesium-bearing minerals and glinting flakes of mica are also usually present. Granite is very durable, and different types are employed in Norfolk. They have been put to various uses and can be seen in dressed and polished form as a facing stone (on buildings such as banks, offices and so forth) or roughly dressed as paving setts, kerb stones and memorial stones.

Figure 74: Paving and road setts, Purfleet Quay, King's Lynn. Granite.

Figure 75: Norwich Castle. Aberdeen Granite.



Exotic pebbles, cobbles and ballast

A wide variety of exotic pebbles and cobbles are seen in the wall fabrics of many buildings, notably churches and inns (especially those in coastal areas). The range of different stones typically includes igneous granites, syenites and dolerites, metamorphic gneisses and schists, along with sedimentary quartzites and well-indurated limestones. Some of these pebbles and cobbles, which sometimes approach small boulder size, are likely derived from the extensive deposits of boulder clay and other superficial deposits that mantle Norfolk. Others, however, given the common use of these stones in coastal areas, likely represent pieces of off-loaded ballast. Particularly fine examples of exotic pebbles and boulders can be seen in walls at Holme-next-the-Sea (Church of St Mary), Wells-next-the-Sea (Stearman's Yard) and Great Yarmouth (The Mariners public house).

Figure 76: The Mariners public house, Great Yarmouth. Exotic pebbles and cobbles (including granite, dolerite and quartzite).

Roofing slates

Several different types of roofing slate have been imported into and used across Norfolk, especially since mid-Victorian times. Purple and grey Welsh Slate, for example, has been widely employed in many of the county's villages and towns. Other types of roofing slate, such as green Westmorland Slate, are less commonly encountered.

Figure 77: School, Happisburgh. Welsh Slate and (possibly) Westmorland Slate roof.

5 Further Reading

The Further Reading, Online Resources and Contacts guide provides general references on:

- Geology, building stones and mineral planning
- Historic building conservation, architecture and landscape.

There is also a separate glossary of geological terms.

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Figures

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