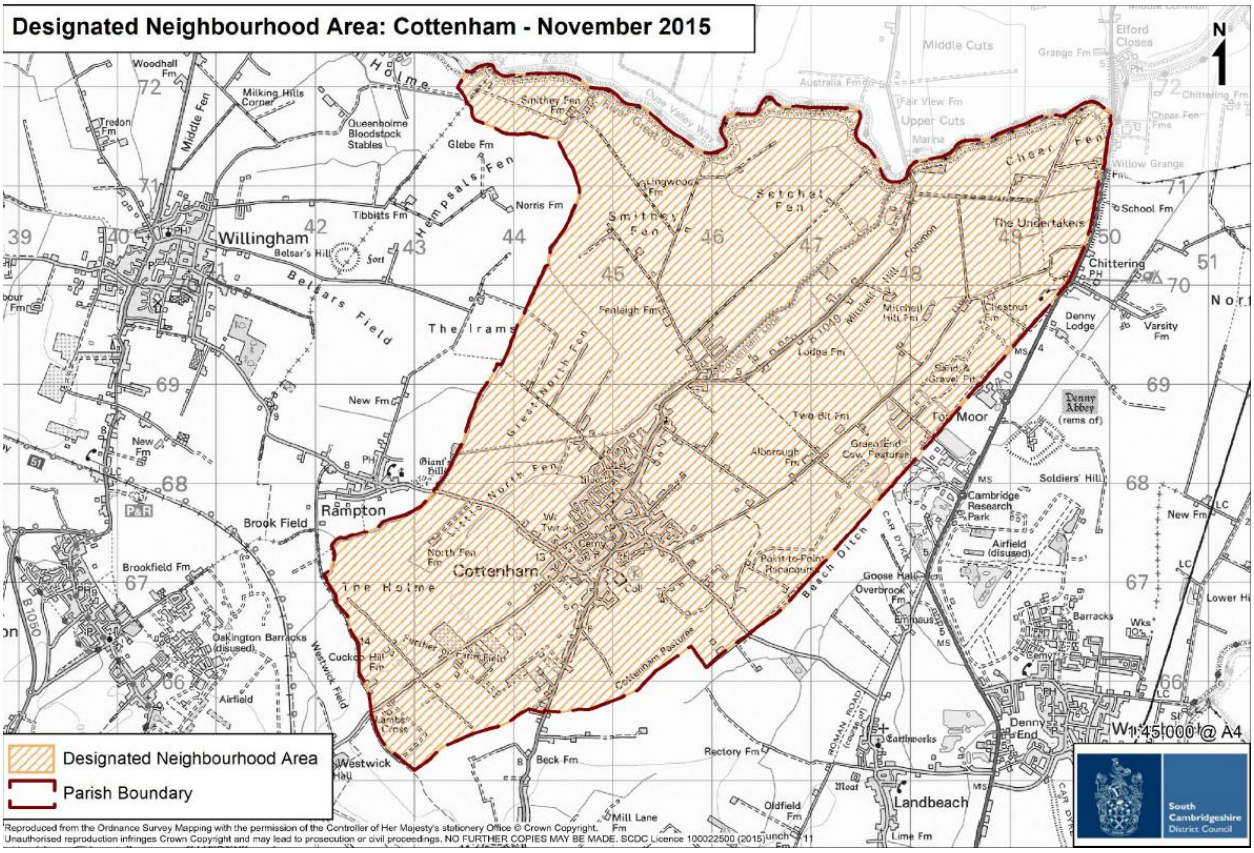
Cottenham Civil Parish

Neighbourhood Development Plan

2017 to 2031



Cottenham Parish Council

NP Evidence E11 – Drainage & Flooding

December 2018

In 2031 Cottenham will still be an attractive safe rural village, proud of its character and retaining its sense of community with improved amenities and facilities, reduced impact of traffic, especially in the centre of the village, and having more affordable housing for the next generation of residents.

1 Summary

1.1 Cottenham is vulnerable to surface water flooding exacerbated by an increasing number of housing and road development.

1.2 This paper was prepared as background to development of Cottenham's Neighbourhood Plan which mostly focuses on measures needed within developments within Cottenham, where to maintain safety, new developments need planning conditions or obligations to ensure:

a) adequate surface water is retained on-site with run-off rates below 1.1 litres / second / hectare of developed land (based on the post-war upgrade to IDB pumping capacity requirement).

b) further hardening of the development site under future permitted development is allowed for

c) the technical design should be approved independently by the Chief Engineer of the local Internal Drainage Board before any works start

d) an "enduring party" is contracted and funded to maintain the system in perpetuity, before any development starts.

1.3 However, there are wider drainage and flood risk concerns affecting Cottenham due to the vital roles performed by the Catchwater Drain, Cottenham Lode and Great Ouse in transporting surface water from a wide catchment area from the west and south-west of Cottenham across the parish and on towards the Wash. That catchment area is subject to massive development, not least Northstowe and the A14 upgrade projects.

1.4 Improvements to embankments, capacity and maintenance all seem overdue.

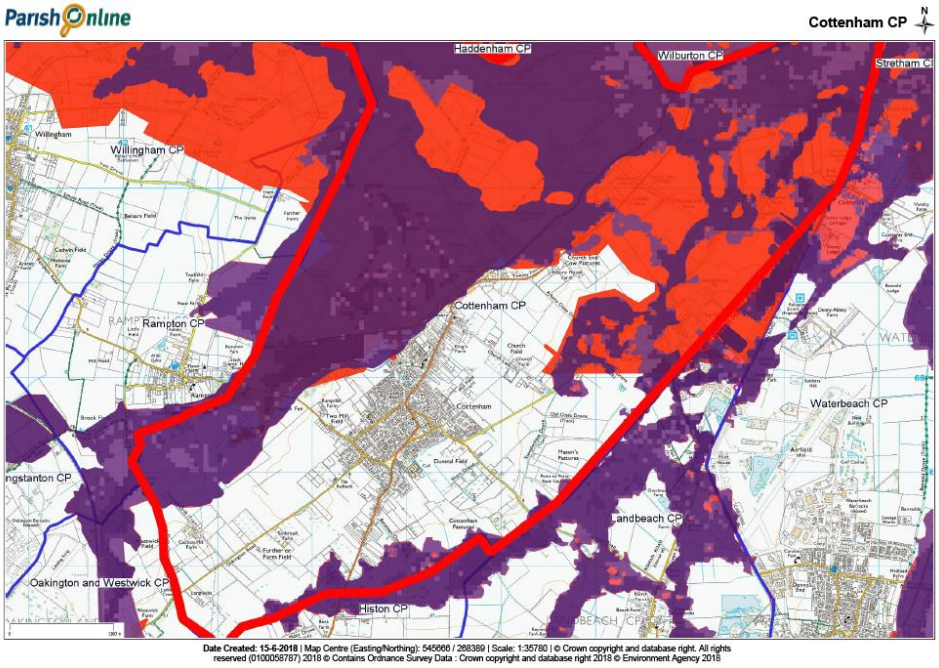


Figure 1: Cottenham Civil Parish showing proximity to flood plain

Contents

2 Background

2.1 Cottenham village is surrounded by land lying at or below 5 metres creating challenging conditions for surface water drainage via the Ely Ouse along its northern boundary. Much of the surface water from the surrounding fields and the higher land in the village is drained into the River Ouse using pumps that extract water from the surrounding ditches and keep their water levels low.

2.2 Surface water from villages to the south-west is also brought through the parish in what is effectively an aqueduct – the Cottenham Lode – which also collects some surface water by gravity from the Church end of the village before flowing by gravity into the Ouse.

2.3 It is imperative to avoid flooding that the relative levels in the Ouse, Lode and feeder ditches are managed carefully. The sluices of the Environment Agency and Pumping Stations of the Old West Internal Drainage Board are critical to that management.

2.4 All development hardens the ground surface allowing surface water to run off faster than in the undeveloped "green" field. To avoid flooding, measures are necessary to store water on a developed site during a storm event, only allowing the water to run off at or below the pre-development rate. In Drainage Board districts, pumping capacity was raised after the 1947 flooding to handle run-off rates of 350 gallons per hour per acre of developed land (equivalent of 1.1 litres per second per hectare of developed land) based on experience developing runways in World War II and research at the Cambridge University Farm and elsewhere.

2.5 It is possible that rainfall levels have increased significantly since the 1930s research and it is now imperative that runoff rates from new developments in the fen-edge area are held below 1.1 litres per second per hectare (the metric equivalent of 350 gallons per hour per acre) by a combination of on-site retention storage and off-site run-off restrictors, such as hydrobrakes, with enough margin to compensate for further site hardening due to urban drift (usually 10%) and increased rainfall caused by climate change (possibly as much as 100%).

2.6 Studies supporting planning applications have often sought to allow less arduous limits for run-off rates to make a plan more acceptable. The flood risk is increased if the designs are not validated as meeting the tougher criteria before construction commences and exacerbated further if long-term measures are not put in place to secure adequate maintenance.

2.7 This paper demonstrates how the measures suggested on three proposed developments in Cottenham may be inadequate to prevent a significant flood event.

3 Introduction

3.1 Cottenham village lies scarcely 10 metres above sea level. Most of the surrounding area is at or below 5 metres above sea level.

3.2 A once in 100 year storm event (fig.1) could cut Cottenham off from its neighbouring villages as waters from the Great Ouse and/or CottenhamLode inundate the low-lying areas all round Cottenham.

a) Families could individually be safe but marooned apart with children at school – youngsters in Cottenham, teenagers in Cambridge or Impington – and parents out of the village.

b) Communications and power cannot be depended on – the mobile communications on which we depend would probably fail within a few hours if power is also lost.

3.3 In 2016, Cottenham Parish Council's Drainage & Flood Working Party identified the risk and prepared an informative postcard for residents.

Cottenham Parish Council

Flood Care

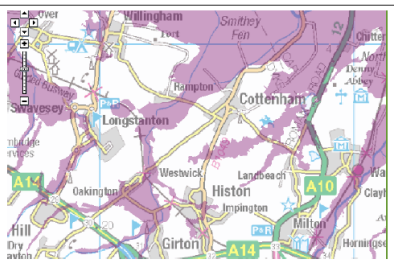
Floods may be unlikely but:

Have a plan:

- Improve your flood-proofing
- Decide what you'd do if you and family were separated by a flood
- Make sure your family knows the plan

Know who to contact:

If **life is at risk ALWAYS** contact emergency services **999**, otherwise:



Source of problem	Responsible Agency	Contact number
Great Ouse or Cottenham Lode	Environment Agency	0800 807060
Public Highways gullies etc	Cambridgeshire County Council	0345 0455212 (office hours; or 0845 988 1188)
Foul or surface water Sewers	Anglian Water Services	03457 145145
Unknown source	South Cambs District Council	03450 450 063 (office hours or 0845 988 1188)
Water supply pipes	Cambridge Water	01223 706050

Fig. 1: "Flood Care" information postcard

3.4 Further work on a Flood Plan has recently been completed with assistance from the Environment agency.

4 The challenge

4.1 The fen-edge landscape is essentially flat, creating "big skies" but making drainage challenging as water is likely to meander from low to slightly lower points on its journey over several days to the sea.

4.2 Surface water drainage from around Cottenham to the Wash relies on three elements:

a) Gravity – the main rivers and watercourses that discharge to the Wash at King's Lynn

b) High level flood storage – the South and Middle levels introduced by Vermuyden in the 17th Century

c) Low level systems of Main Drains and Pumping Stations, managed by Internal Drainage Boards (IDBs), discharging into the Environment Agency's embanked Main Rivers

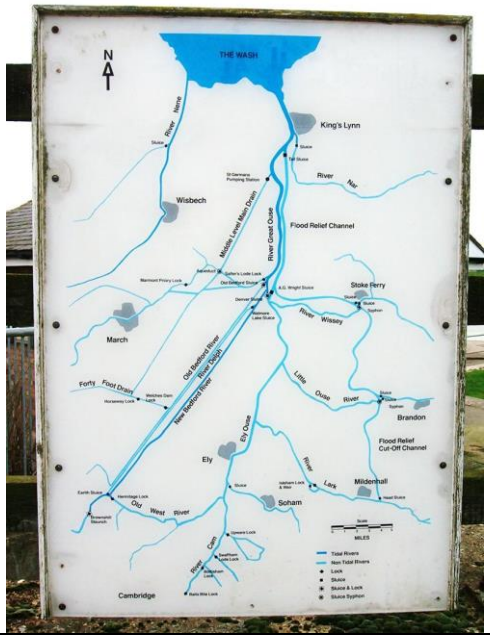


Fig. 2: Surface water from Cottenham (in SW) has a long way to travel northwards to the Wash

4.3 Adequate on-site water storage combined with controlled outflow systems and long-term maintenance are essential if surface water from new developments is not to inundate the area.

5 Topology & Hydrology

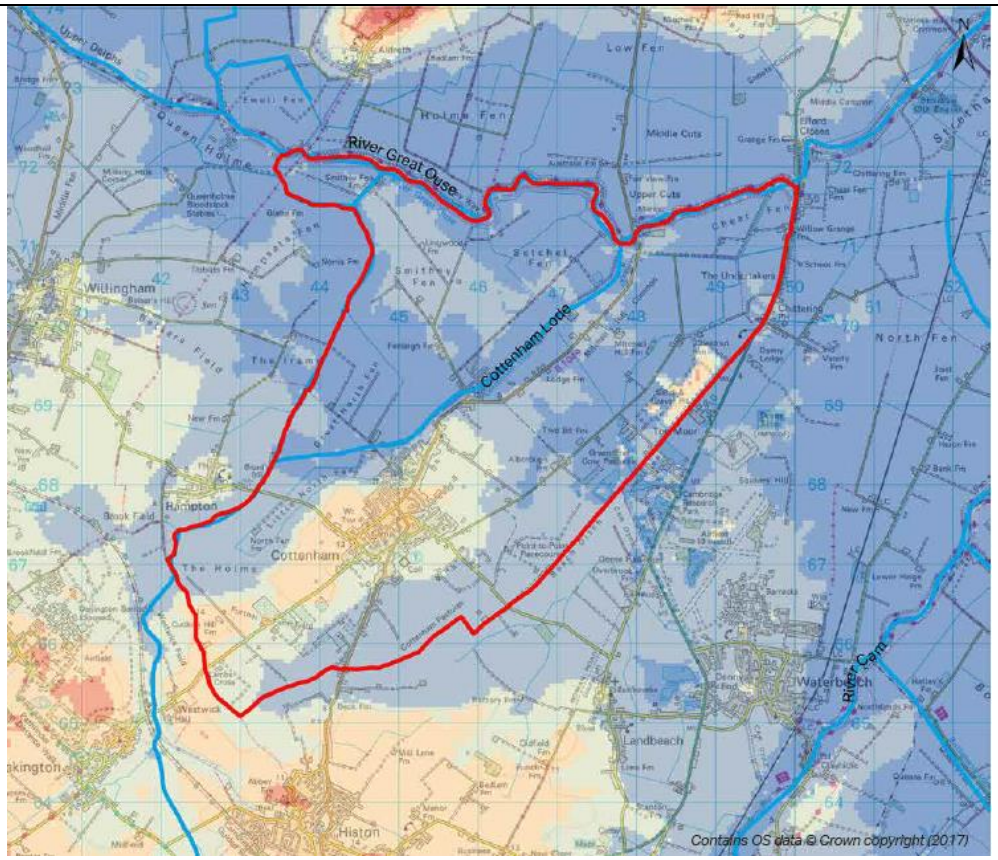


Figure 3: Cottenham's Topology & Hydrology

6 Problems experienced

6.1 Persimmon's Tenison Manor development applied SUDS which was neglected

Fig 4: SUDS need continual maintenance

- Surface water collected from street-side drains flows into open ditches on Tenison Manor and on, via regulating systems, to Cottenham Lode
- Ditch culverts alongside Broad Lane became blocked without regular clearing.
- Retention ponds intended to store storm surges became weed-bound, losing capacity
- Hydrobraking systems and flap valves limiting the discharge rate became choked and/or failed

6.2 Although the estate is not yet adopted some 15 years after its completion, recent restoration work has secured operation of the SUDS after the neglect (Fig.4) since installation around 2001. This demonstrates the importance of an enduring party being responsible for the system maintenance.

6.3 Problems with the installation itself are believed to have caused a flooding event (Fig.5) in 2001

.

Fig.5: Flooding of Cottenham Lode in 2001

6.4 Cottenham village may lie on relatively high land around 10 metres above sea level but it is the IDB Pumping Station at Queenholme that removes run-off water from the ditches draining the "lowlands" to the west of Cottenham, and the Station at Chear Fen that removes run-off water from the ditches draining the "lowlands" to the east of Cottenham.

6.5 The Lode itself mostly carries water in its embanked channel by gravity from higher villages in the southwest to the Old West River (or Great Ouse).

7 The Drainage Board

7.1 The **Old West Internal Drainage Board** was originally constituted in 1842 and its District is located to the north west of Cambridge. The District has the Old West River (Ely Ouse or Great Ouse) forming the northern boundary.

7.2 A considerable area of "highland" (above the 20 ft contour), including Cottenham, is drained to and depends upon, the Board's pumped "lowland" catchment.

7.3 The Pumping Stations have capacity limited to the equivalent of 1.1 litres / second / hectare of ground they drain or about 350 gallons per acre per hour. The capacity figure arises from a review after the 1947 floods concluded that the installed pumping capacity was not enough to keep the water levels in the drains. The limit appears to be based on peak run-off rates measured by Bailey Denton and on arable, heavy soil land at the Cambridge University Farm in the 1930s with about 300 mm of seasonal rain (about 3,000 m^3 per hectare). Today's long term average rainfall is around 600 mm in the east of England, implying that the Pumping Stations may need another upgrade.

7.4 Catchwater Drain flows northward UNDER the Cottenham Lode in a culvert and, via the Engine Drain to the IDB pump at Queenholme where it is lifted into the embanked Great Ouse. These under-Lode culverts (there are two) allow water to be drawn from the lowland ditches and drains to the south of the Cottenham Lode and pass underneath the Lode and on to the pumping stations adjacent to the Ouse. Their presence limits the degree to which the Lode can be dredged to increase capacity and have an inherent risk of catastrophic failure if not properly maintained.

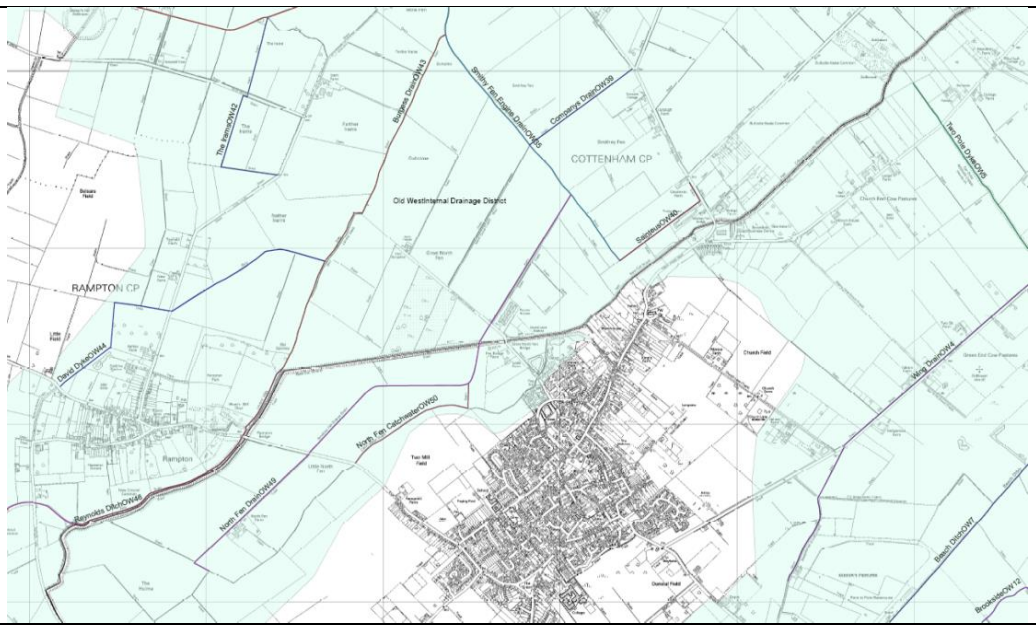


Fig. 6: Old West Main Drains

7.5 Catchwater Drain is drained northward into Engine Drain which passes UNDER Cottenham Lode in a culvert

	
Engine Drain coming from distance Cottenham to pass under Cottenham Lode in the foreground	Engine Drain heading to distant Queenholme after passing under Cottenham Lode in the foreground

Fig. 7: Engine Drain passing UNDER Cottenham Lode in a culvert

7.6 Engine Drain is pumped into the Old West River (Great Ouse) by the IDB Pumping Station at **Queenholme**

8 The major local developments

Gladman

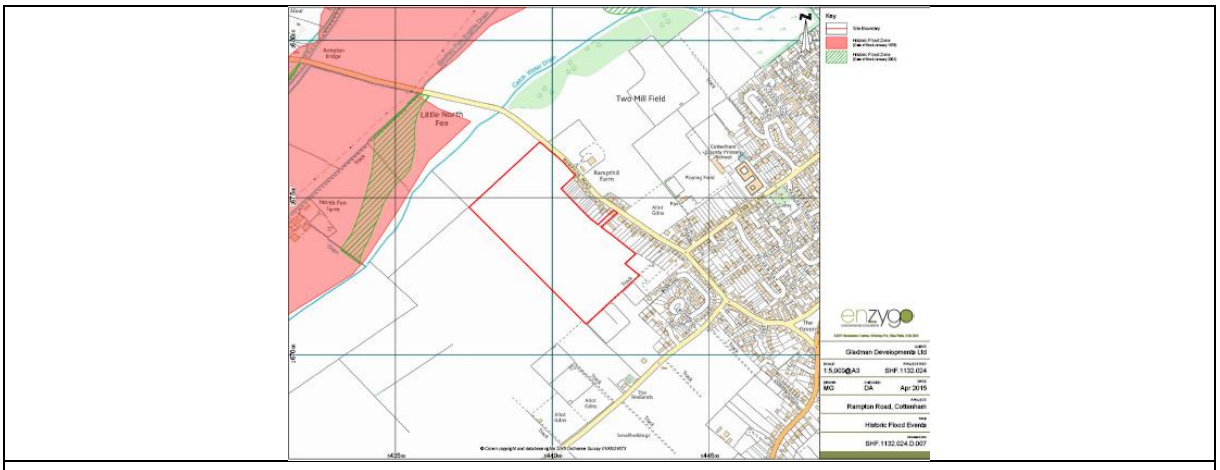


Fig.8: Gladman Development's application site

8.1 The **Gladman** site (Application S/1818/15/OL or S/1411/16/OL or S/2413/17/OL allowing up to 200 homes and up to 70 homes with residential care) lies close to the flood plain.

8.2 N-W run-off from the site flows into the IDB's Catchwater Drain flowing from SW to NE

8.3 Outflows into the Drain must be restricted to the IDB limit of 1.1 litres / second / hectare of developed land (around 5 litres / second in this case).

County Estates

Fig9: County Farms' application site

8.4 The **County Farms** site (S/2876/16/OL recently allowed at appeal to build up to 154 homes) also lies close to the same flood plain.

8.5 N-W run-off from the site flows into the IDB's Catchwater Drain flowing from SW to NE and Engine Drain flowing northward.

8.6 Outflows into the Drain must be restricted to the IDB limit of 1.1 litres / second / hectare of developed land (also around 5 litres / second in this case)

Gladman

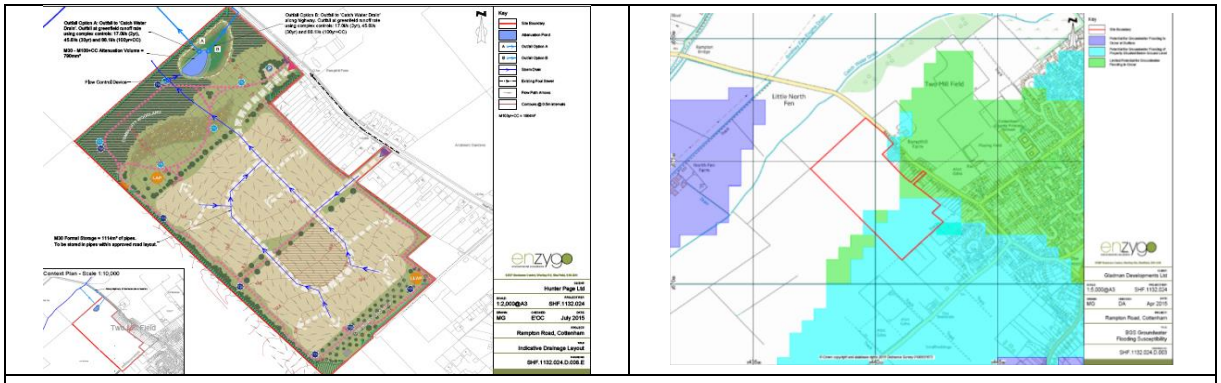


Fig.10: The Gladman site

8.7 Developing 3.7 hectares of the **Gladman** site (S/1818/15/OL and S/1411/16/OL or S/2413/17/OL) will increase surface water run-off. This is acknowledged to need storage and attenuation to bring run-off below the IDB's permitted 1.1 litres / second / hectare run-off rate.

8.8 This appears to need a minimum long-term assured pond capacity of nearly 5,000 m^3 to limit flow towards Catchwater Drain in the NW. Assuming levels are retained at no more than 1.2 metres, this requires around 4,000m^2 (0.4 hectare) of surface area. A pond of this size would sacrifice a substantial portion of the land designated for woodland. The on-site pond capacity appears to be only around 2,400m^3.

8.9 Nearly half of the surface water flows SE, yet there appears to be minimal attenuation of flows towards an area known (EA Surface Water Flood Risk map) to be vulnerable to surface water flooding.

8.10 The pond and the hydrobrake necessary to limit flow into the Catchwater Drain will also require a long-term maintenance arrangement with an enduring party.

Persimmon

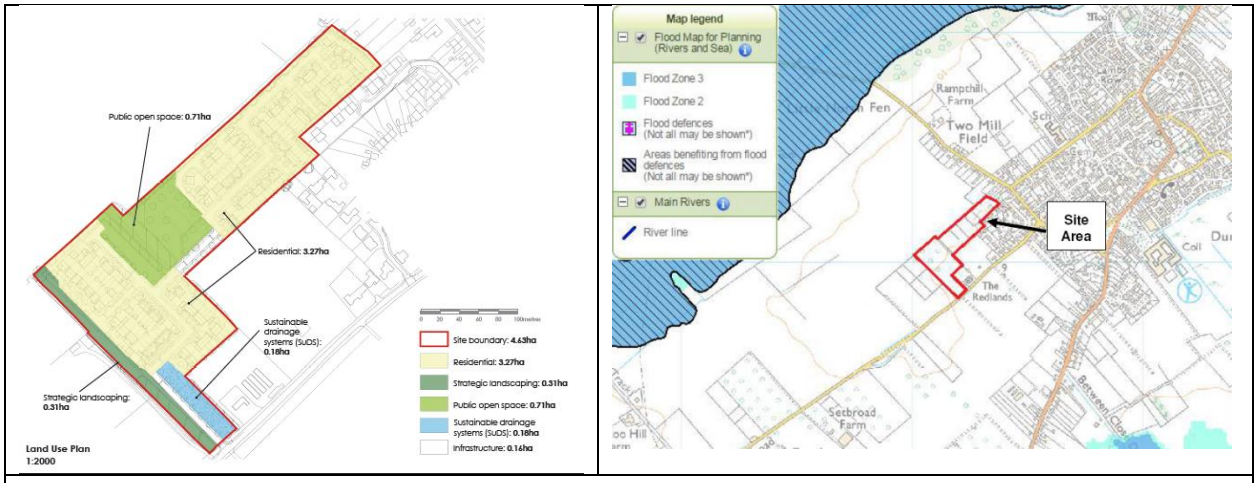


Fig. 11: The Persimmon site

8.11 Developing 4.5 hectares of the **Persimmon** site (S/1606/16/OL) will increase surface water run-off. This is acknowledged to need storage and attenuation to bring run-off below the IDB's permitted 1.1 litres / second / hectare run-off rate.

8.12 This appears to need a minimum long-term assured on-site surface water storage capacity of around 1,800 m^3 (assuming 100y + 40%) to limit flow off-site.

8.13 The site design includes a total of around 1,000m^2 of 0.6m depth soakaways or infiltration basins, which appears inadequate.

8.14 RSK appears to misunderstand (3.4) the role of the Environment Agency's Cottenham Lode in relation to the Old West Internal Drainage area. Much of Cottenham's surface water is drawn, via lower level ditches, the IDB's Catchwater Drain and Engine Drain, to the IDB pumping station at Queenholme, not the Smithy Fen engine. That pumping station lifts the water into the Ouse.

8.15 An extensive array of sustainable drainage techniques is proposed on-site, although it is not clear how these can be maintained in perpetuity, especially against urban creep as householders develop property in future. The "last resort" overflow appears to be an uncontrolled flow into the ditch alongside Oakington Road. This is outside the Internal Drainage Board (IDB) area but run-off eventually flows into IDB drains and requires limitation to the equivalent of 1.1 litres / second / hectare to allow this water to be recovered into the Great Ouse via IDB Main Drains and Pumping Stations. The Reserved Matters application (S/0907/18/RM) for this site was recently withdrawn apparently due to surface water management concerns.

8.16 The pond and the hydrobrake necessary to limit flow into the Catchwater Drain will also require a long-term maintenance arrangement with an enduring party.

County Estates / This Land

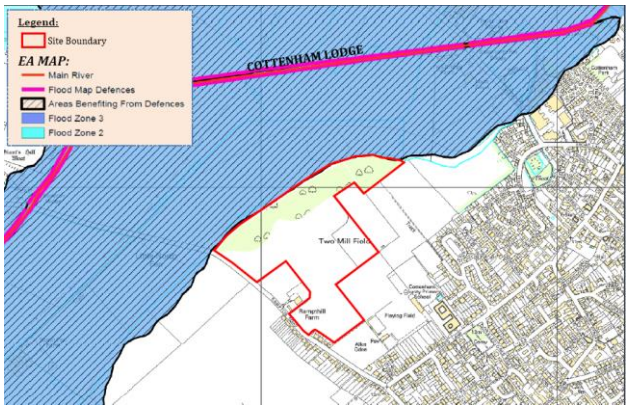


Fig. 12: County Farms

8.17 Surface water flows naturally through Les King Wood, a community woodland, that forms and screens the north-west boundary of the site, into the IDB's Catchwater Drain along the north-west site boundary.

8.18 Developing 6.3 hectares of the **County Farms** site (S/2876/16/OL – approved at appeal for 154 homes) will increase surface water run-off.

8.19 This appears, due to the poor infiltration conditions, to need a minimum long-term assured pond capacity of around 2,500 m^3 requiring some form of storage and attenuation to bring it below the IDB's permitted 1.1 litres / second / hectare run-off rate.

8.20 Assuming water depths are retained for safety at no more than 0.6 metres, this requires around 5,000m^2 (0.5 hectare) of pond surface area at least 9 metres distant from the IDB Drain. A pond of this size would sacrifice a substantial portion of the Les King Wood, with woodland a scarce resource in fen-edge countryside.

8.21 The planning application for Reserved Matters on this site brings particular tensions:

a) Adequate SUDS is likely to remove some woodland capacity
b) Development close to the village edge is not liked by Planning officers
c) Development in the south of the sire permanently limits availability of recreation land which is already under-provided in a village facing a 25% population expansion.

Appendix A: General References

Reference	Paper
B1	Cottenham Neighbourhood Plan Survey – Final Report (NPS)
B2	Cottenham draft Pre-submission Neighbourhood Plan v2.1
B3	Cottenham draft Pre-submission Neighbourhood Plan v3.1
B4	AECOM Housing Needs assessment
B5	AECOM Site assessment
B6	AECOM Heritage & Character assessment
B7	Evidence Paper E1 Housing need and supply
B8	Evidence Paper E2 Brownfield sites
B9	Evidence Paper E3 Rural Exception Sites and Community Land Trust
B10	Evidence Paper E4 Recreation Ground
B11	Evidence Paper E5 Village Hall
B12	Evidence Paper E6 Nursery
B13	Evidence Paper E7 Medical and Drop-in & Chat Centre
B14	Evidence Paper E8 Village heritage and character
B15	Evidence Paper E9 NP Golden thread
B16	Evidence Paper E10 Burial ground extensions
B17	Evidence Paper E11 Drainage & Flooding
B18	Evidence Paper E12 Village Design Statement 2007
B19	Evidence Paper E13 Traffic & Transport Strategy
B20	Evidence paper E14: Community Transport
B21	Evidence paper E15: Play
B22	Evidence Paper E16: Open Space
B23	Cottenham draft Pre-submission Neighbourhood Plan v4.2
B24	Strategic Environment Screening Opinion
B25	Consultation statement
B26	Cottenham Submission Neighbourhood Plan v5
B27	Strategic Environment Assessment
B28	Basic Conditions Statement