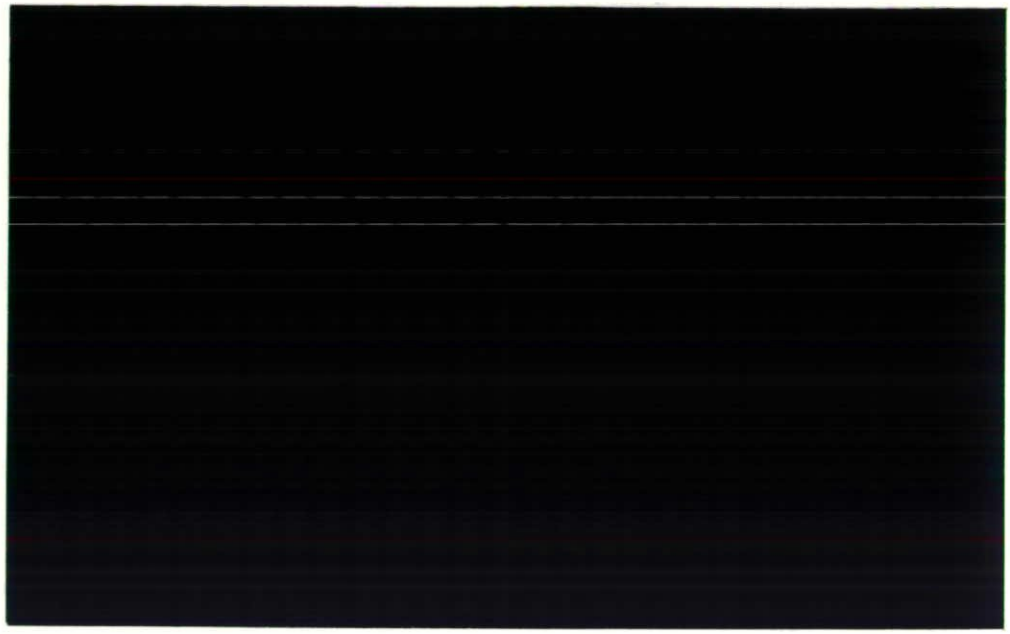
Institute of Hydrology



Natural Environment Research Council

Preliminary Hydrological Assessment
Cransley Lodge - Kettering

12/90

Preliminary Hydrological Assessment Cransley Lodge - Kettering

SUMMARY

The main aquifer in the Cransley Lodge area is the Northampton Sand. This is likely to provide the important perennial baseflow necessary to maintain the Birch Spinney/Mawsley Marsh wetland SSSI. The regional hydraulic gradient is probably to the southeast in which case the main source of this groundwater will be from the northwest of the SSSI. The development of the Cransley Lodge site is unlikely to substantially influence the quantity or quality of this groundwater supply.

A relatively small proportion of the total surface runoff into the SSSI is derived from the proposed development site. The total volume and duration of runoff from this site is as yet unquantified. Hard surface areas (roadways, pavements, roof areas, etc) will alter the quantity, duration and quality of runoff from within the development area.

With the limited information available it is not possible within the scope of this preliminary assessment to quantify adequatelythe potential impact of the proposed development on the hydrological regime of the SSSI. Further detailed investigations would be necessary before any such impacts could be quantified adequately.

INTRODUCTION

The Institute of Hydrology has been commissioned by Denis Wilson & Partners, acting on behalf of Stock Land and Estates to provide a preliminary assessment of the major hydrological features of the Cransley Lodge area, near Kettering, Northamptonshire. This assessment was to provide initial indications of the possible hydrological impact of the proposed Cransley Lodge development upon the Birch Spinney/Mawsley Lodge SSSI.

This assessment is based upon a review of available literature, records from the National Borehole Archive and a short field visit.

LOCATION

The proposed Cransley Lodge development site is situated approximately six kilometres west of Kettering, Northamptonshire. The location of the area to be developed is shown in relation to the Birch Spinney/Mawsley Marsh SSSI in Figure 1.

GEOLOGY

The Cransley Lodge area is underlain predominantly by Pleistocene glacial sediments which overlie the Jurassic Upper Lias clays, Northampton Sand and Lower Estuarine Series as shown in Figure 2. The Jurassic sequence dips gently to the south east at approximately 2-3 degrees. The distribution of outcrops of these formations is largely controlled by topographic changes associated with the local drainage system: the Pleistocene sediments occur in the more elevated areas, whilst the Jurassic sediments outcrop along the incised valleys. The Birch Spinney/Mawsley Marsh SSSI is situated in one such incised valley, and is underlain by strata ranging from the Upper Lias to the Boulder Clay.

The Upper Lias consists of bluish grey mudstones with calcareous and ferruginous nodules. The Lias was subject to erosion prior to the deposition of the Northampton Sand and therefore its contact with the Northampton Sand can be somewhat irregular. A deep borehole (SP77/10) at Harringdon Dale near Orton (794 791) intersected 11.6m of Upper Lias clays above a 2.4m thick oolite bed marking the top of the Middle Lias clays.

The Northampton Sand reaches a maximum thickness of 21.3m north of Northampton while in the Cransley Lodge area the maximum thickness preserved beneath Lower Estuarine Sequence sands is probably only of the order of 7-10m. In other parts of the study area the upper portions of the Northampton Sand have been eroded by the Pleistocene glaciation. The basal part of this formation is developed as an ironstone which is overlain by massive yellow or brown sandstone with beds of fissile calcareous sandstone. Layers of clay are interbedded within the lowest horizons.

The ironstone facies of the Northampton Sand consists of predominantly ferruginous oolites, with minor shelly debris. A borehole (SP87/33) located at the western end of Birch Spinney (8041 7635) encountered 4.8m of ironstone above blue Lias clay. These ironstones have been mined throughout the region and extensive mined out areas occur immediately to the north of Mawsley Lodge. It would appear that several of the wetland areas within the SSSI have developed where mining has lowered the ground surface below the level of the adjacent stream.

The Jurassic Lower Estuarine Sequence in the Kettering area consists largely of white sand and silt, although towards Northampton a predominantly argillaceous unit develops in the middle part of the formation. On a regional scale the Lower Estuarine Sequence may reach a maximum thickness of about 7.6m. However in the Cransley Lodge area only the basal 2-3m would appear to remain beneath the Pleistocene unconformity.

The Pleistocene Boulder Clay is locally in excess of 24m thick (White Lodge Farm, Borehole SP87/52). Within the proposed development site the Boulder Clay may be up to 18m thick near the Police Radio Mast, thinning out towards the stream valleys. On a regional scale the Boulder Clay can be subdivided into numerous alternating clay, sand and gravel units. The available geological information has distinguished a single gravel unit at the base of the Pleistocene sequence. This unit outcrops along the southern margins of Birch Spinney and is here poorly sorted, silt rich with predominantly siltstone clasts.

The thickness and distribution of this gravel unit is somewhat irregular, reflecting it fluvioglacial depositional environment. Locally this gravel is up to 5m thick.

The Pleistocene sediments are in slight angular unconformity with the underlying Jurassic sediments on a regional scale, although steeper erosional features may exist. Irregularities in the Pleistocene erosional surface may account for the deposition of these glacial sediments directly on to all three of the Jurassic formations of the area. The elevation of the base of the Pleistocene sediments varies from 110 to 130 m.O.D.

HYDROGEOLOGY

The Jurassic sands of the Lower Estuarine Sequence and the Northampton Sand form the major aquifers in the area, with the Upper Lias clay forming a basal aquiclude. The ironstone horizons and the thin clay layers reported in the basal Northampton Sand may act as local aquicludes. This preliminary assessment has not produced any evidence to suggest that groundwater may be coming from below the Upper Lias clays. Many of the springs in the region originate from the Northampton Sand.

It is likely that the regional hydraulic gradient will be approximately coincident with the regional south easterly dip of the Jurassic strata. There will be local modifications to this regional groundwater flow due to intersection of the water table along the various incised valleys. To the west of the Birch Spinney area this will result in groundwater taking on more easterly flow paths, with the possibility of a minor northerly flow component developing to the south west of the Spinney. The proposed development site is unlikely to effect this regional hydraulic gradient and groundwater flow to the southeast.

Most of the recharge to the Jurassic sands is likely to occur on a regional scale through the extensive outcrops which lie to the north of the SSSI. This recharge will not be effected by the proposed Cransley Lodge development.

On a more local scale, the Jurassic sands to the south of the SSSI will receive recharge from runoff along the northern outcrop limit of the overlying impermeable Pleistocene sediments. This very focused recharge may produce a local groundwater mound which may induce a local northerly flow of groundwater within the Jurassic sands. This mound may possibly only exist during the winter months.

Historical records indicate that a system of trenches excavated at the western end of Birch Spinney during the drought of 1934 produced a groundwater flow of approximately 2 l/s. This compares with recent (December, 1990) field estimates of flow at a rate of approximately 1 l/s occurring after another period of drought conditions. The ferruginous precipitates that occur along spring lines towards the western portion of Birch Spinney would suggest that this groundwater originates from the Northampton Sand.

The Pleistocene Boulder Clays can be considered as largely impermeable and as such there will be very limited infiltration of surface water through the thicker portions of this unit. Infiltration through these clays will occur where this unit thins out along the stream valley margins, or where there may be more permeable intercalated sandy horizons.

The more permeable Pleistocene gravels are likely to allow infiltration of both direct rainfall and runoff from the higher areas of Boulder Clay through to the Jurassic sands. The available evidence suggests that groundwater levels are approximately coincident with the base of these gravels. It is possible that groundwater flow through the Pleistocene gravels may only occur during winter periods. The irregular areal distribution of this gravel horizon(s) means that it is difficult on the basis of available information to determine whether recharge is occurring on a regional scale or is restricted to the local area. Field evidence suggests that gravels extent along the entire southern boundary of the SSSI and would receive local recharge from the proposed development site.

HYDROLOGY

The Cransley Lodge area lies within hydrometric area 32 and close to the western boundary of the catchment of the River Ise. The main divide separating this catchment from that of the River Brampt coincides approximately with the Broughton to Harrington road as shown in Figure 3. The proposed development site can be subdivided into several smaller sub-catchments, two of which will contribute surface runoff to the Birch Spinney/Mawsley Marsh SSSI. The surface flow through the SSSI enters the Cransley Reservoir approximately one kilometre east of the site.

The long term average annual rainfall in the Ise catchment is approximately 635mm. The mean annual runoff is 222 mm or 40% of the mean annual rainfall. In the Brampt catchment to the west the mean annual runoff is 162mm, or 24% of the local mean annual rainfall. The Boulder Clay covered areas probably contribute the major proportion of runoff in these catchments with the relatively high runoff in the Ise catchment possibly reflecting a higher proportion of less permeable Boulder Clay.

Across those areas of the Cransley Lodge development site underlain by Boulder Clay the annual runoff could be as high as 40-50% of the annual rainfall. Most of this will occur during the winter months and could be expected to occur as relatively flashy short term runoff events.

Subcatchments D and E represent approximately 18% and 7% respectively of the inferred total catchment area contributing runoff the SSSI, with approximately 90% and 50% respectively covered by Boulder Clay. This represents 22% and 5% respectively of the total area of Boulder Clay contributing runoff to the SSSI, and it is probable that the total runoff from each of these two subcatchments would be of a similar proportion.

Without a study involving site specific hydrological data and detailed development plans it is not possible to adequately quantify the impact of the proposed development upon the surface runoff from subcatchments D and E

upon the SSSI. It should be possible to design engineering structures to minimise the effects of this varied surface runoff response from any proposed development. However until such remedial measures have been fully described it is not possible to comment upon the final impact of the proposed development.

CONCLUSIONS

An initial appraisal of limited existing information and a short field visit indicate that the wetland SSSI is supported largely by a perennial flow of groundwater from the Northampton Sand aquifer which is thought to derive its recharge from outcrops of some considerable distances to the north of the SSSI area.

It is considered unlikely that the property development on the south east of the SSSI will have a significant effect on this southerly directed groundwater flow. There is a potential for the proposed development to effect the inferred minor northerly directed groundwater flow from south of the SSSI. There is also a local surface runoff component to the stream passing through the SSSI which is at risk from the proposed development. It is considered that this component represents only a small proportion of the total surface flow into the SSSI. Unless remedial measures are taken, there would be an impact on this surface flow to the SSSI from the proposed development. It is not yet possible to quantify this impact.

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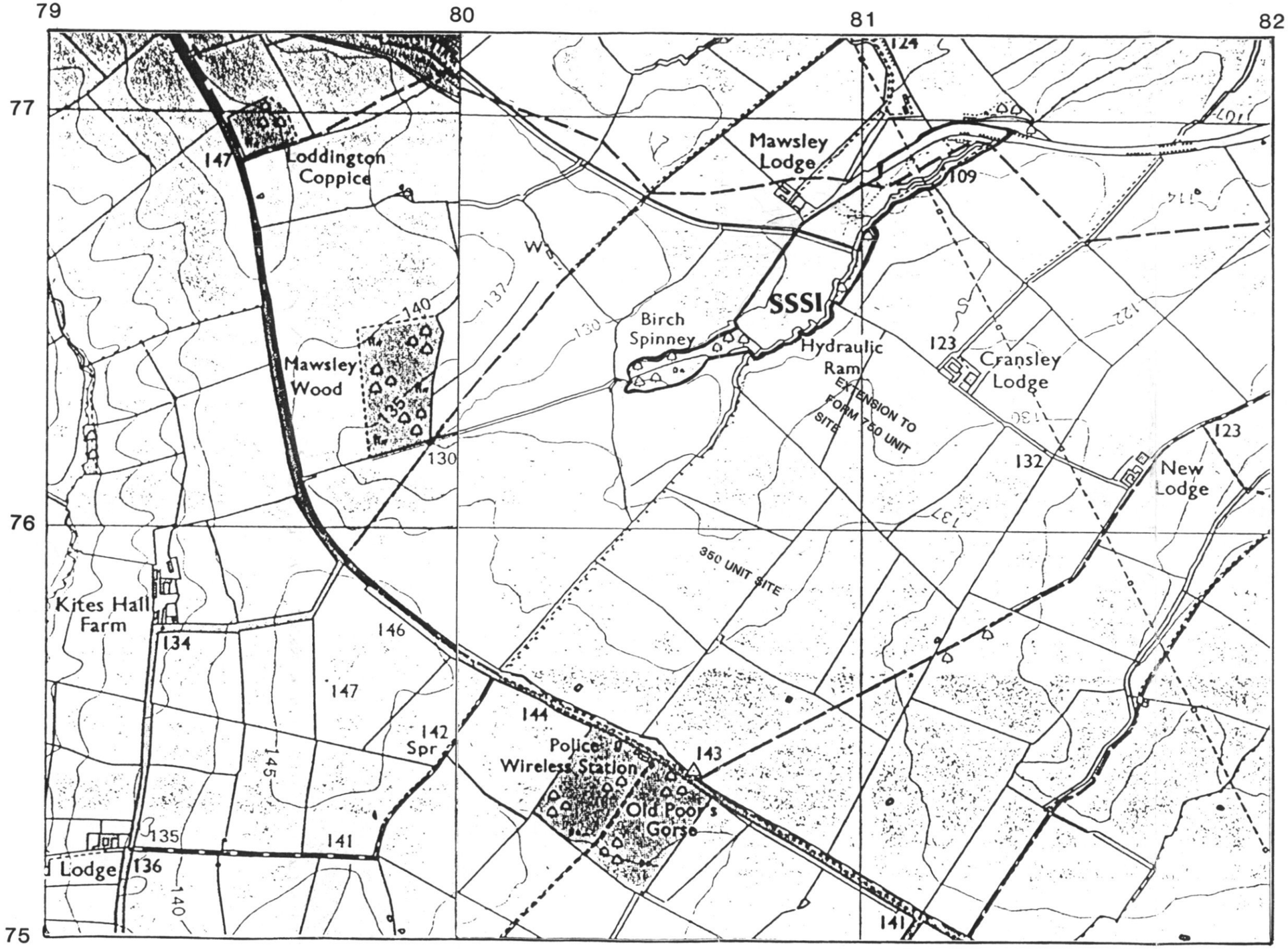
KETTERING

LOCATION PLAN

FIG. 1



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BASEPLAN FROM O.S. 67/77,87/97

PRELIMINARY

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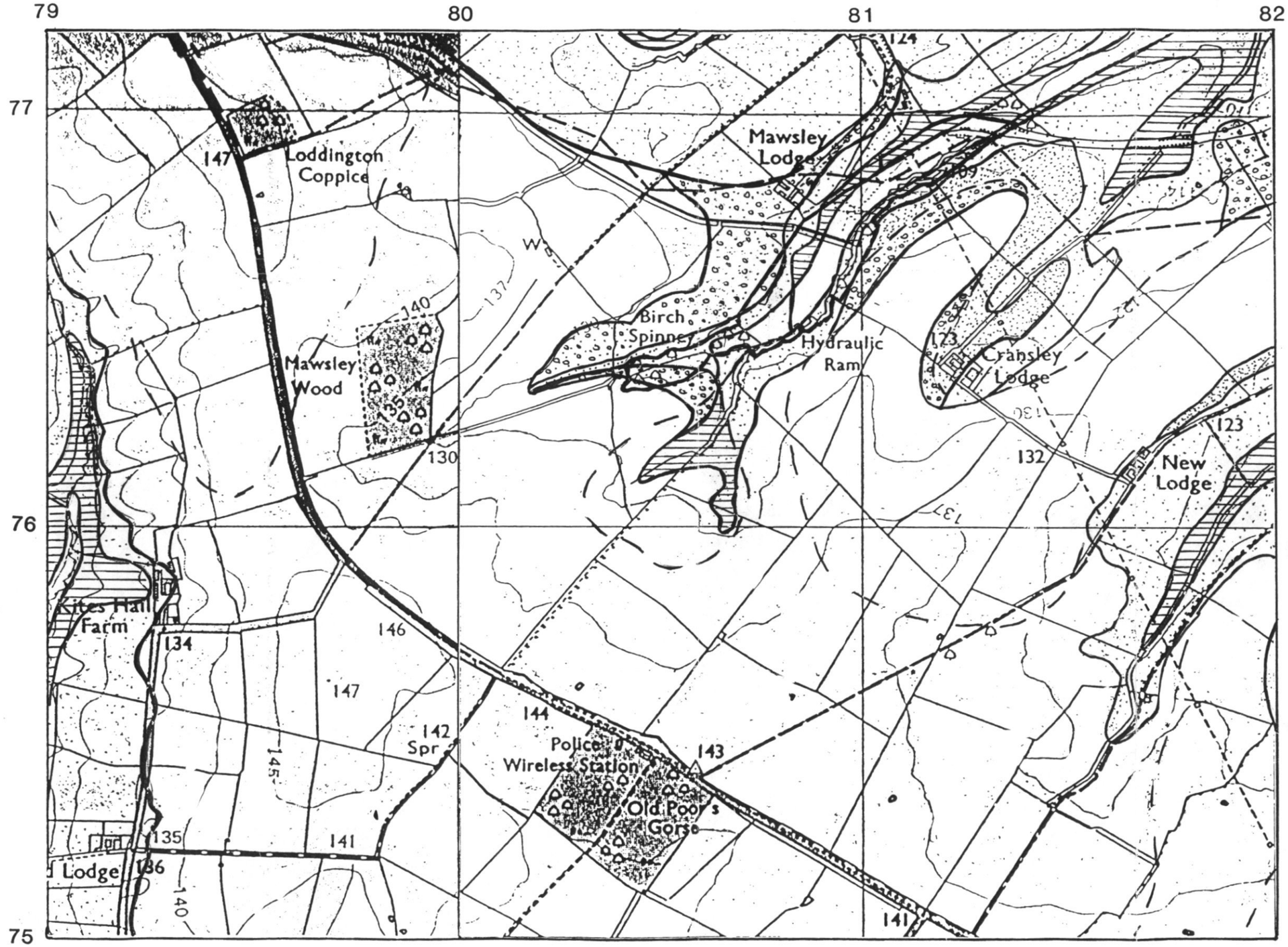
KETTERING
HYDROGEOLOGY

FIG. 2



PLEISTOCENE

BOULDER CLAY

SAND & GRAVEL

JURASSIC

LOWER ESTUARINE

NORTHAMPTON SAND

UPPER LIAS

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BASEPLAN FROM O.S. 67/77,87/97

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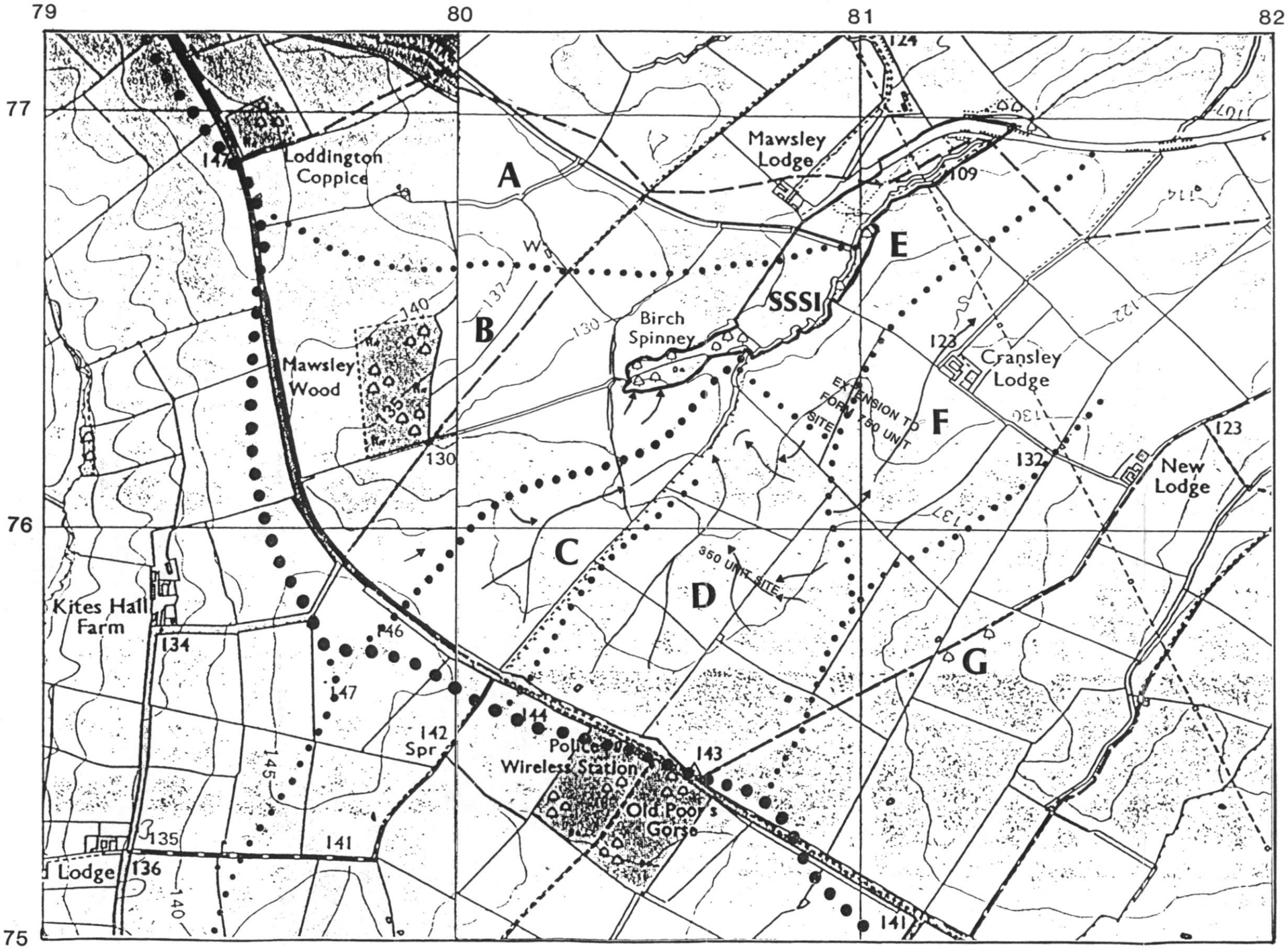
SURFACE DRAINAGE

FIG. 3



STREAMS ——→

CATCHMENT BOUNDARY ● ● • • •

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