Natural England Commissioned Report NECR140

New Forest SSSI Geomorphological Survey Overview

Annex L: Parkhill Lawn (Pondhead) Restoration Plan - SSSI Unit 386

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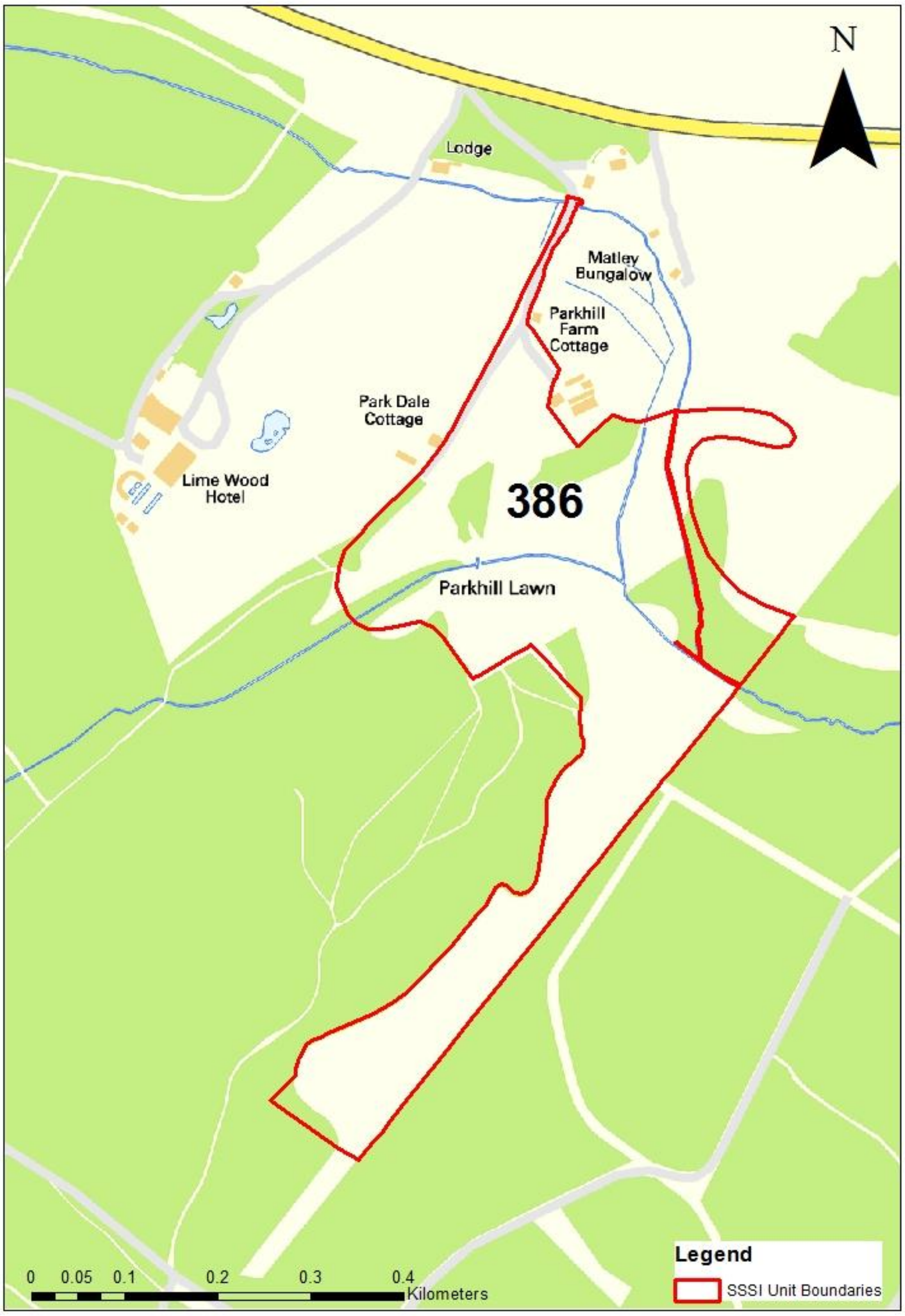
1 Parkhill Lawn (Pondhead) Restoration Plan - SSSI Unit 386

1.1 Introduction

Parkhill Lawn (Pondhead) (Unit 386) has a stream flowing from west to east that eventually joins the Beaulieu River at the rail line close to King's Passage. It is considered to be in an unfavourable recovering condition and is approximately 15.85ha in size.

The unit consists predominantly of an area of improved grassland lawn which has been heavily grazed. This grassland area is intersected by four drains which merge in the centre of the site. The unit is surrounded by broadleaved woodland to the north-east and areas of mixed woodland are present to the east and south of the site. Scrub encroachment in the form of scattered Bracken *Pteridium aquilinum* and Gorse *Ulex europaeus* can be found across the improved grassland sections in the west of the site. A small area of 'wet lawn' is also present in the eastern area of the unit with some characteristic mire species present.

Figure 1-1: SSSI Unit 386 location (flow direction is left to right)



1.2 Current hydromorphic conditions and issues

A summary of the hydromorphic conditions of Unit 386 is given below in Table 1-1.

Table 1-1: Hydromorphic conditions of unit 386

Geomorphological Assessment Area		Parkhill Lawn
Site name		Parkhill Lawn (Pondhead)
Size (ha)		15.9
SSSI unit(s)		386
Channel	River type (s)	Active single thread, passive single thread

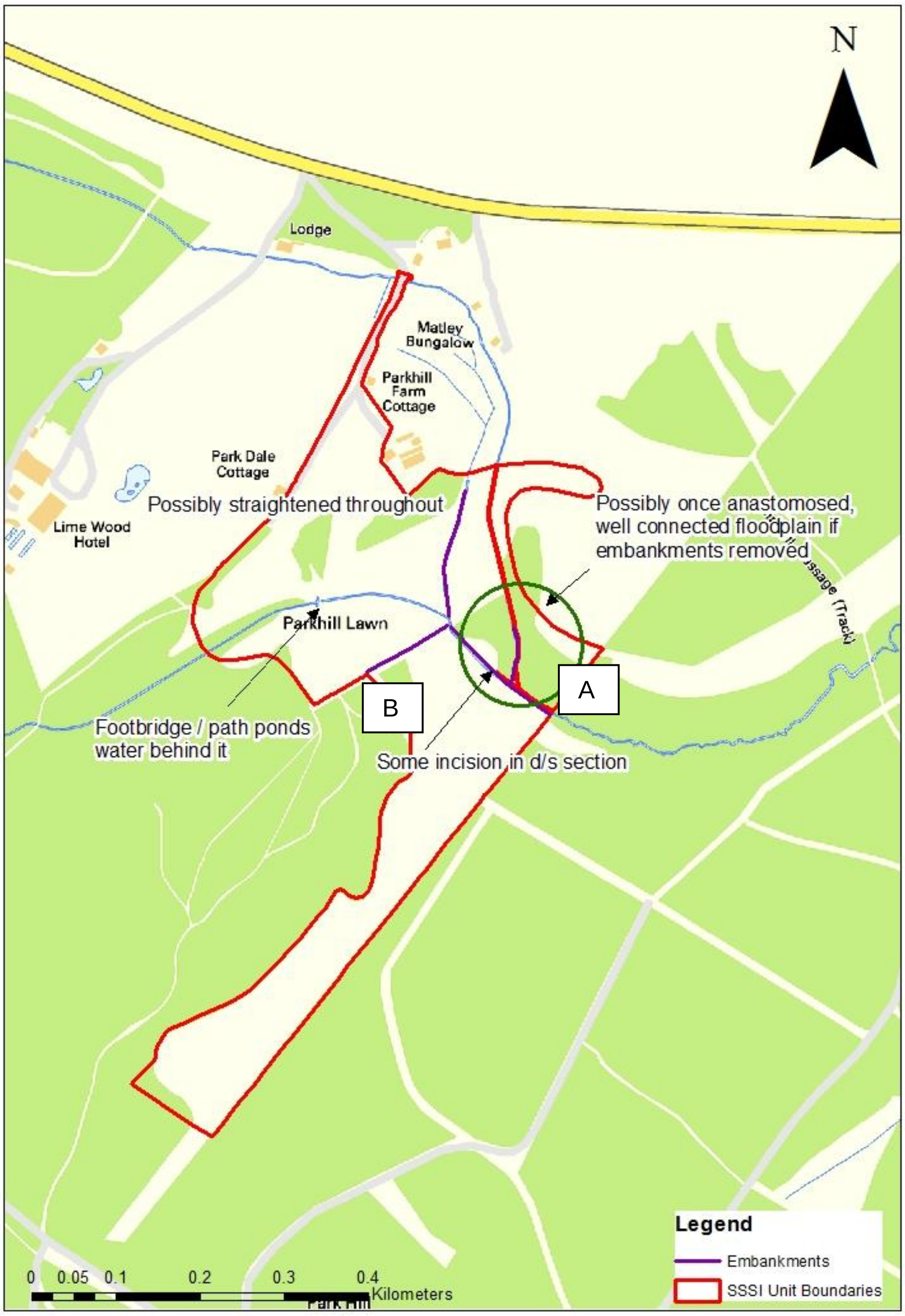
Condition	Responsiveness	Moderate - moderate gradient, modified flow regime (drains), straightening, some gravels, tree clearance (historic)
	Sediment delivery, type and mobility	Moderate gravel supply, not many gravel features but those present are mobile, few fines, some local gravel sources (banks)
	Main source of water	Upstream source (Parkground Inclosure, Pondhead Inclosure), drains and overland flow
	Aquatic vegetation	At the time of the survey the channel was flooded, however Floating Sweet-grass, Branched Bur-reed and Reedmace were recorded
	Drainage damage	Drains over both banks incised, over-deepened, straight and embanked
	Morphology	Pools, riffles, runs, point bar, lateral bar, mid-channel bar, transverse bar - all of which are poorly developed
	Incision	Yes - incision in main channel, particularly d/s below the confluence and in drains at downstream end, attributed to straightening, dredging, embankments.
	Engineering	Channel straightening. Dredging. Embankments - in main channel and drains. Right bank set back embankment preventing overland flow into southern field, directing water into stream
	Bank activity	Minor - some lateral activity, particularly downstream of confluence of northern stream. Some bank collapse associated to incision
	Flow type (s)	Flows impacted by upstream drainage network. Flood peaks concentrated in channel, particularly downstream of confluence where embanked. Floodplain flow routes impacted by embankments
Floodplain Condition	Valley type	Wide floodplain
	Main source of water	Seepage, drains / overland flow, out of bank flows
	NVC communities	U4, M24, H2, M16a, W11, W4b
	Key habitat types	Dry grassland, Marshy grassland, Acid dry heath, Broadleaved woodland, Wet heath
	Drainage	Swamps / ponds where embankments on channel bank and in the floodplain. Natural drainage impacted through artificial drainage network.
	Scrub / tree encroachment damage	Gorse and tree encroachment into wet grassland and heath
	Palaeo features	Minor
	Floodplain connectivity	Moderate - better in section upstream of confluence with northern stream but restricted downstream of confluence where incised and embanked.
	Poaching and grazing pressures	Significant grazing damage
Generic restoration options		Debris jams or improved gravel features to manage incision in wooded section (would help to reconnect floodplain), may promote multi thread channel development. Remove embankments on main channel and drains, and remove embankment on right bank. Lower path level to improve flow route over it (to minimise backing up).
Additional comments		

The stream within SSSI Unit 386 is a combination of an active single thread and passive single thread channel subject to moderate gravel inputs (Figure 1-2). Gravel features are generally embryonic and poorly developed.

Figure 1-2: General channel characteristics in flood conditions

The source of the stream is at Parkground and Pondhead Inclosures. Figure 1-3 summarises the existing hydromorphology and pressure impacting unit 386.

Figure 1-3: Current hydromorphic conditions and pressures



The stream has a moderate gradient in most places and looks to have suffered some straightening and deepening in the past, particularly when compared to the more sinuous sections downstream of the SSSI unit boundary. This will have resulted in some loss of channel length leading to a steeper channel and resulting in increased flood shear stress levels. This will promote erosion of the channel bed and is linked to the mild incision seen in the downstream reaches. This is particularly the case where the channel banks are stronger (due to the presence of more resistant boulder clays (rather than fluvio-glacial gravels) or where riparian woody vegetation is dense enough to provide a coherent resistant root mat).

The straightening, deepening and embanking of the downstream section of this unit (Figure 1-3 - A) may have disrupted a previous anastomosed channel type as the left bank floodplain would be well connected if the embankments were removed and incision managed (Figure 1-4). The left bank floodplain is also wooded which lends itself to anastomosed channel development. However, no clear palaeo-channels have been identified from the LIDAR.

Figure 1-4: Downstream channel conditions - showing embanking and left bank wooded floodplain

The embankment located over the right bank, upstream of the confluence with the first drain (Figure 1-3 - B) prevents any water spilling out of the channel from flowing into the fields beyond it (Figure 1-5). This is concentrating flow back into the main channel, which is likely to be a factor causing the mild incision in the downstream section of the stream, in combination with the other artificially modified channels.

Figure 1-5: Right bank embankment providing obstacle to natural overland flow route

Artificial drainage modification will have impacted on the flood flow regime of the watercourse creating a more responsive system where flood peaks are concentrated and increased and water enters the main channel more efficiently. The degree of artificial drain creation is shown in Appendix A and is impacting significantly on the flow regime. This effectively creates a higher energy system more capable of erosion and sediment transport. The two major drains within the unit have been artificially modified through straightening, dredging and embanking. This is having a significant impact on the natural flow regime (Figure 1-6).

Figure 1-6: Left bank drain showing straightening and embanking

Groundwater levels have also been altered as a result of the minor incision and spoil dumping (embankment creation). Sections of the immediate floodplain have become drier than natural as a result.

Gravel supply is considered to be moderate and the present mildly incised channel is acting to transport the majority of delivered sediment through the reach.

At present, gravel features are restricted to embryonic features, with some riffle - pool - run development. Improved floodplain connection should see the development of more significant gravel deposits as a result of reduced flood shear stress levels within the channel where flows are spread across a wider area rather than concentrated in the channel.

Poaching and grazing is significant in this unit, and this is impacting vegetative colonisation of the river banks resulting in a lack of a buffer strip to minimise fine sediments entering the channel.

The footbridge crossing is impacting natural overland flow routes as this is raised above surrounding ground levels.

1.3 Probable channel development

The process of adjustment to the channel straightening, dredging, flow regime alteration and floodplain vegetation disruption is continuing despite the historic nature of many of the changes. As such the river remains responsive in nature.

Incision is likely to continue in the main channel as a result of the straightening, dredging, embanking and modified drainage network, which concentrate flows in the main channel, providing erosive, gravel transporting conditions.

Floodplain drying will also remain an issue as a result of modifications to the natural flow regime and poor floodplain connectivity (embankments and incision impacts).

1.4 Current ecological conditions

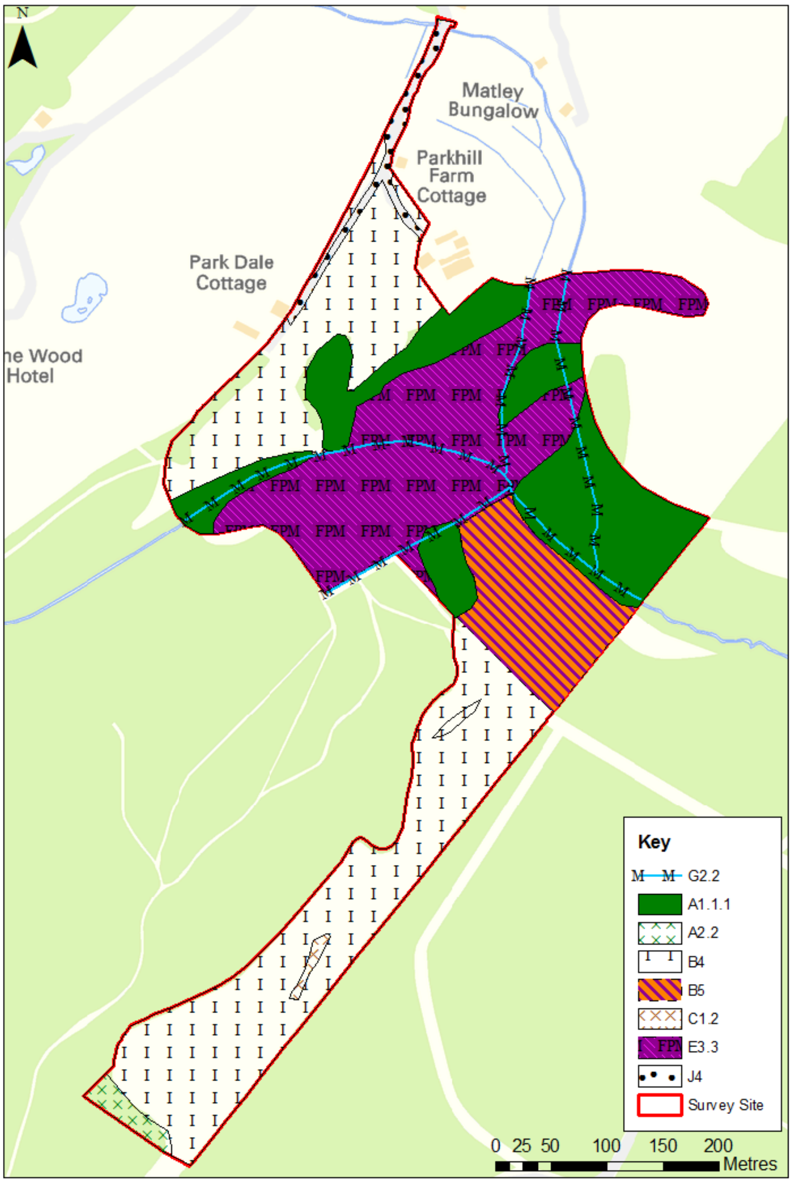
The unit consists predominantly of an area of improved grassland lawn which has been heavily grazed. This area has a tree hedgerow (mainly Oak *Quercus robur* and Downy Birch *Betula* *pubescens*) across the centre of it, with a scrub layer underneath consisting mainly of Bramble *Rubus fruticosus agg.* with patches of Gorse and Bracken scattered across the central Parkhill Lawn section of the unit. Figure 1-7 shows the Phase 1 Habitat Map for Unit 386.

The northern section of the unit consists of broadleaved woodland with Oak *Quercus* sp. and Willow *Salix* sp. The areas immediately surrounding the watercourse were wet woodland habitat with Goat Willow *Salix caprea* being the most dominant species.

Four large drains cut across the site, which due to the high water levels had flooded the majority of the unit making access difficult. The areas surrounding the drains contained aquatic vegetation including Branched Bur-reed *Sparganium erectum,* Common Reedmace *Typha latifolia* and Soft Rush *Juncus effusus.*

In the eastern area of the site the two drains merge into one. The area immediately south of the merged drain consists of a wet lawn area containing *Sphagnum* tussocks, Deer-grass *Trichophorum cespitosum* and Purple Moor-grass *Molina caerulea*. This indicates the area is usually wet, but in previous times may have been wetter due to the characteristic mire vegetation recorded. This area of wet lawn is not extensive and does not continue into the southern area of the site. The long southern section of the site is bordered by mixed woodland with semi-improved grassland present in the centre. This area of the unit is drier and contains areas of Bracken scrub encroachment and scattered trees throughout.

Figure 1-7: Phase 1 Habitat Map



1.5 Restoration plan proposals

A summary of the current pressures, unmitigated impacts and restoration proposals is given in Table 1-2 and shown in Figure 1-8.

The key hydromorphological and ecological gains associated to the proposed restoration measures are:

- Improved hydromorphic diversity through floodplain reconnection, which may encourage multi-thread channel development in the wooded section downstream and improved gravel features, which will also enhance and potentially expand the areas of wet woodland;
- Debris jams will improve floodplain reconnection and may create a more dynamic channel through impacts on erosive and depositional characteristics;
- Restoring a natural drainage pattern will give a more natural flow regime and reduce flow concentration in the main channel through infilling of artificial drains;

- Embankment removal will improve the species diversity of floodplain habitats through increased inundation and potentially expand wetland areas:
- An increase in floodplain area combined with a reduction in grazing pressure will improve the floristic diversity and wetland habitat across the floodplain.

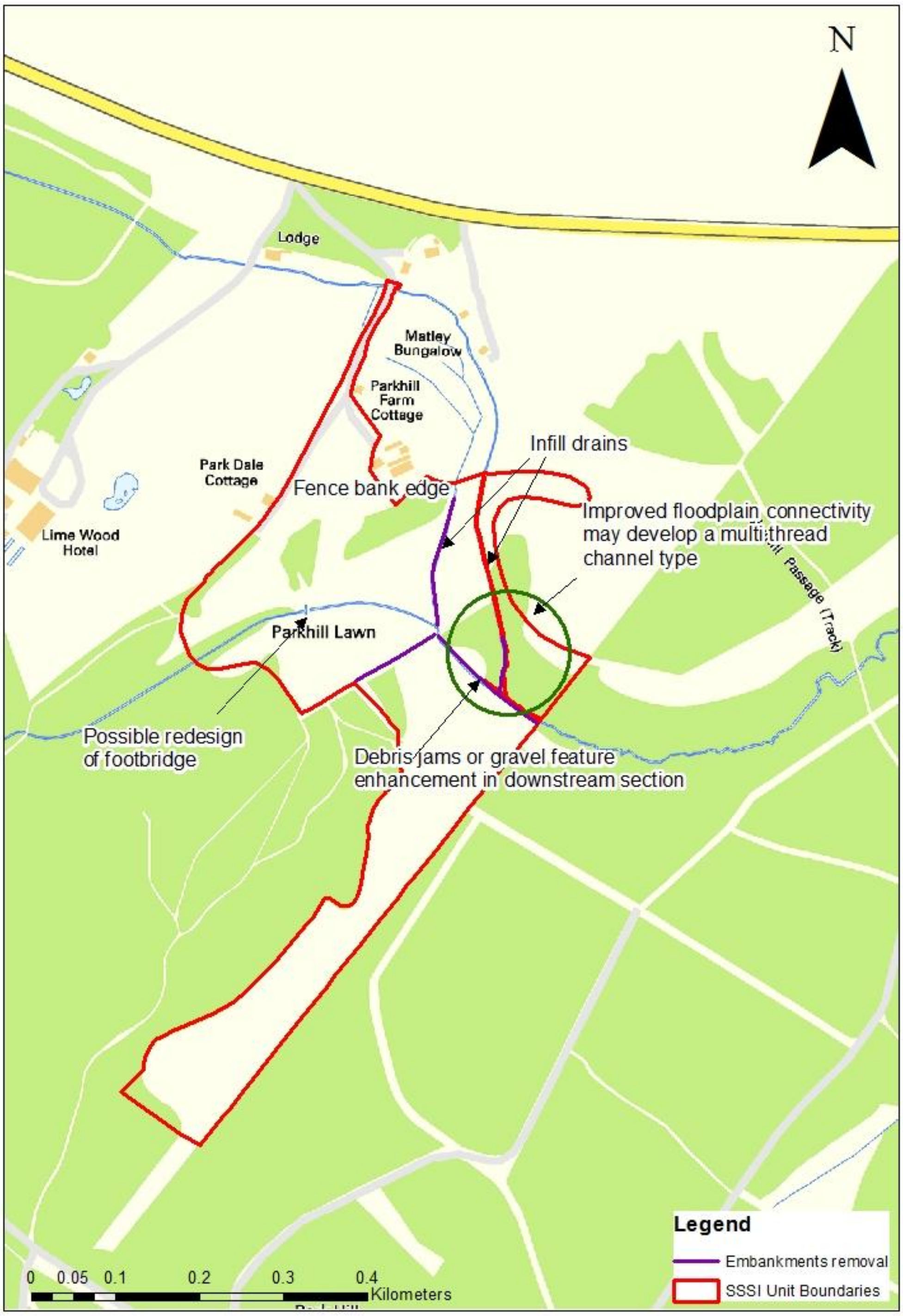
Table 1-2: SSSI Unit 386 proposed restoration measures

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
Historic dredging Straightening	Long term river response, cut and fill activity. Enhanced in-channel energy levels. Disconnected sub-channels. Loss of in-channel features.	Incision management - debris jams, morphological restoration, floodplain works. Infill. Restore connectivity.	Reconnecting the floodplain will improve in-channel hydromorphic condition and will reduce incision. Debris jams would naturally occur along the reach, use local materials. Morphological enhancement to raise bed and water levels will help improve floodplain connectivity. Encourages anastomosing channel development. Reduces fine sediment inputs. Slows gravel movement. Stabilises in-channel features.	Improvement of in-channel habitats Improvement of floodplain habitats through restored connectivity Debris dams increase the niche availability within the watercourse and lead to greater species diversity Anastomosed channel allows for wetter and drier areas of habitat increasing diversity Increases availability of gravels and spawning areas Gravel bars can become vegetated leading to a series of seral communities developing This can be enhanced by the growth of riparian trees, especially Alder.	Debris jams may form a barrier to fish, a fish pass may be required. Large amounts of material are likely to be required. Local objections to trees alongside watercourse Possible reductions in grazing (mainly temporal in nature).
Embanking	Enhanced in-channel energy levels. Disconnected sub-channels.	Embankment removal - main channel and drains	Reconnect the floodplain, reducing incision rates and improving in-channel hydromorphic conditions. Drain embankment material could be used to infill drains.	Opportunities to increase size and diversity of wetland habitats on floodplain leading to an increase in overall species diversity Stabilised in-channel features encourages the growth of trees that	Drains may also require infilling to restore natural flow regime and reduce incision. Loss of grazing during times of increased flow due to flooding and inaccessibility of sections of the

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
			Slows gravel movement. Stabilises in-channel features.	perpetuate the process. Increased nutrient input at times of flood.	floodplain
Artificial drainage	High flows impacted. Water table lowered locally.	Drain infilling	Restore a natural flow regime, reducing incision in the drain and channel network. Reduces flood peaks. Reduces fine sediment inputs. Slows gravel movement. Stabilises in-channel features.	Would create a reduction in flow allowing more aquatic and wetland vegetation species to colonise the both the banks and watercourse itself. The increase in the water table near the watercourse will lead to recovery of the adjacent wetland areas (especially of grazing levels are reduced) promoting growth of M25a in particular Stabilised channels promoter growth of vegetated bars and eventually colonisation by riparian trees	May require import of material. Loss of grazing quality and areas during times of high water. For greatest biodiversity improvement will need to be combined with a reduction in the grazing pressure.
Riparian vegetation removal	Loss of bank stability. Loss of shading. Loss of organic inputs to the watercourse.	Reduced tree clearance at bank edge. Replant or allow to naturalise through reducing grazing pressure.	Will help to stabilise and alongside bed restoration to minimise incision, could improve floodplain connectivity Creates riparian hydromorphic diversity. Acts as fine sediment trap. Allows woody debris accumulation.	Opportunities to improve and expand wet woodland habitat alongside watercourse and create W6 Alder woodland, or, in specific areas, W2a Alder-Meadowsweet woodland. Once trees are established, woodland will act as self-perpetuating feature and promote anastomosing	Tree clearance is a necessity in some locations. If trees are to be planted measure will need to be implemented in tandem with a reduction in grazing. CWD in watercourse is unpopular traditionally in the New Forest

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
				of the channel.and input CWD to watercdourse.	
Riparian grazing	Fine sediment production. Disruption to woody species recruitment.	Exclude livestock	Encourages riparian hydromorphic diversity	Restoration of wet grassland, potentially to mire habitats. Increased floristic diversity of ground flora on floodplain, especially mire habitats M25a and M29 habitats Increase in riparian woodland habitats	Some grazing is likely to be maintained. Cultural objections to reductions in grazing pressures and riparian trees with associated impacts on the watercourse.
River Crossings	Footpath / bridge crossing impacts natural floodplain flow routes as extends into the floodplain	Replace with more suitable structure - raise footpath on stilts on floodplain Gate and fence vehicle crossing points	Removes floodplain flow route obstacle	Improve diversity of in-channel habitats. Will limit ponding around structures allowing more natural wetland vegetation to be restored in these localised areas. Reduce impact of livestock at/near crossing points	Structures will need to be fit for the purposes of vehicle crossings in some cases Vegetation around crossing points is often poached and over-grazed excessively but gates/fences are culturally unacceptable

Figure 1-8: Proposed restoration measures for SSSI Unit 386



1.6 Design considerations

Removing embankments and improving floodplain connectivity may result in enhanced gravel deposition and lateral erosion rates. Retaining some dynamism should be an objective of the restoration plan.

Constructed debris jams must extend into the adjacent banks to ensure longer term functioning.

Fencing the bank edge will allow woody species colonisation and reduce fine sediment inputs to the channel.

Local flood risk could be increased as a result of the proposed restoration works and it is recommended a Flood Risk Assessment is undertaken to ensure there is no increase in flood risk to surrounding properties.

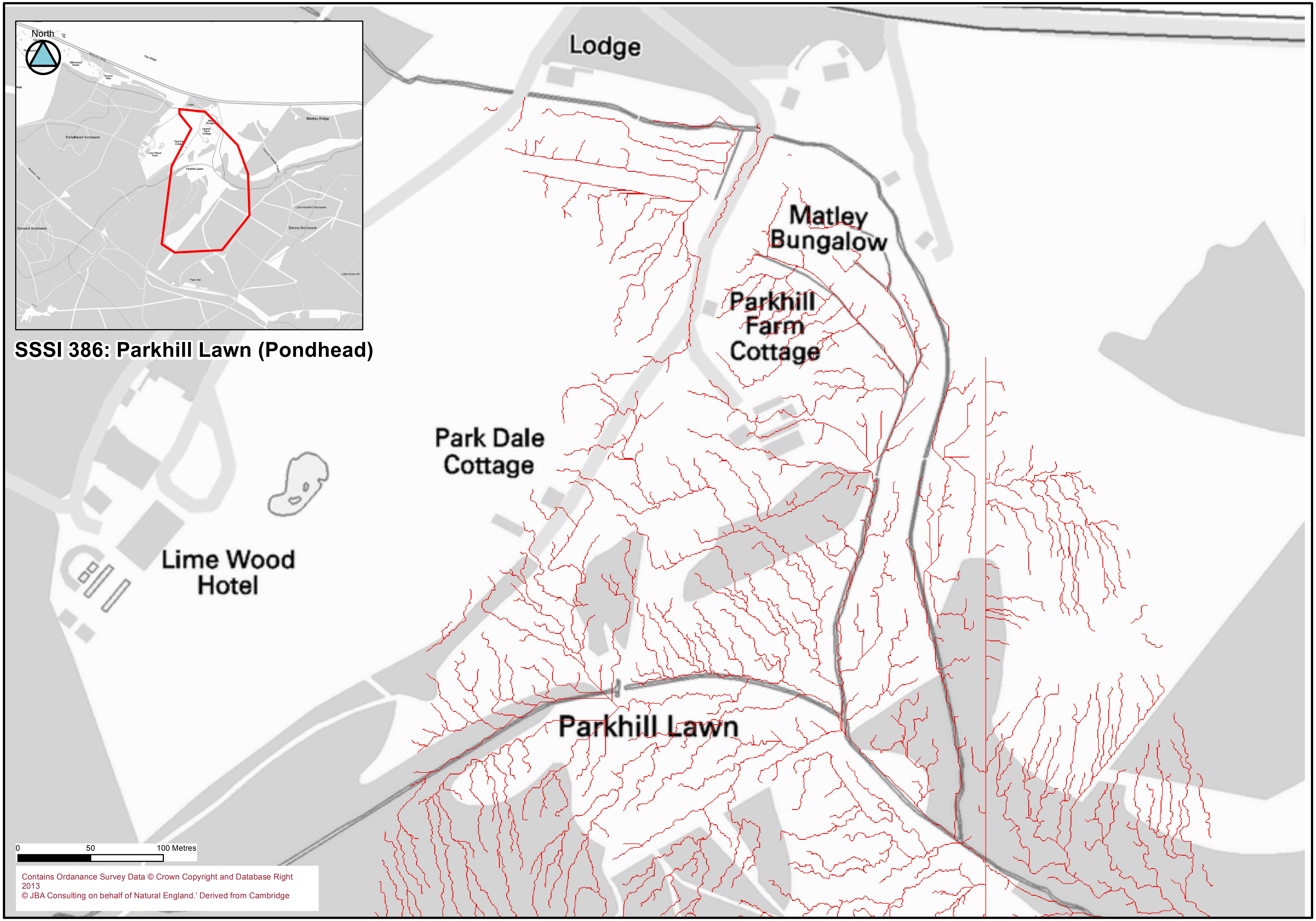
1.7 Restored channel and monitoring requirements

It is anticipated that the proposed restoration works will create a dynamic, sinuous channel, maybe with some multi thread channel development in the wooded section downstream, and improved floodplain connectivity, with frequent overbank flooding. This pattern of development is difficult to document accurately due to the complex nature of the river network and the difficult surveying conditions. As such a qualitative monitoring approach is recommended with automated time lapse photography employed at key restoration points to record daily images of flow types, morphology and vegetation character. This could be undertaken alongside two-yearly reconnaissance audits to determine hydromorphological change over the entire reach, which fixed point photography will not cover. The daily photographic records should be analysed to estimate and record the parameters detailed in Table 1-3.

Table 1-3: Monitoring parameters, frequency and suggested approaches for the Unit 386.

Parameter	Approach	Frequency	Approximate cost
Morphologic unit change	Time lapse camera / audit	Daily (Annual statistical summary)	Capital 3 x £200 Half yearly downloading £200 Annual summary £300 Two - yearly reconnaissance audit £500
Flow change	Time lapse camera / audit	Daily (Annual statistical summary)	
Sedimentology	Time lapse camera / audit	Daily (Annual statistical summary)	
Vegetation change	Fixed point camera survey	Biennially	
	Fixed point quadrat survey	Biennially	Survey £350 Analysis £500
	Fixed point aquatic macrophyte survey		
NB. Costs assume downloading and site visits as part of wider field campaign.			

Appendix A - Artificial flow lines and drain lines SSSI Unit 386


North
SSSI 386: Parkhill Lawn (Pondhead)
Lodge
Matley Bungalow
Parkhill Farm Cottage
Park Dale Cottage
Lime Wood Hotel
Parkhill Lawn
0
50
100 Metres
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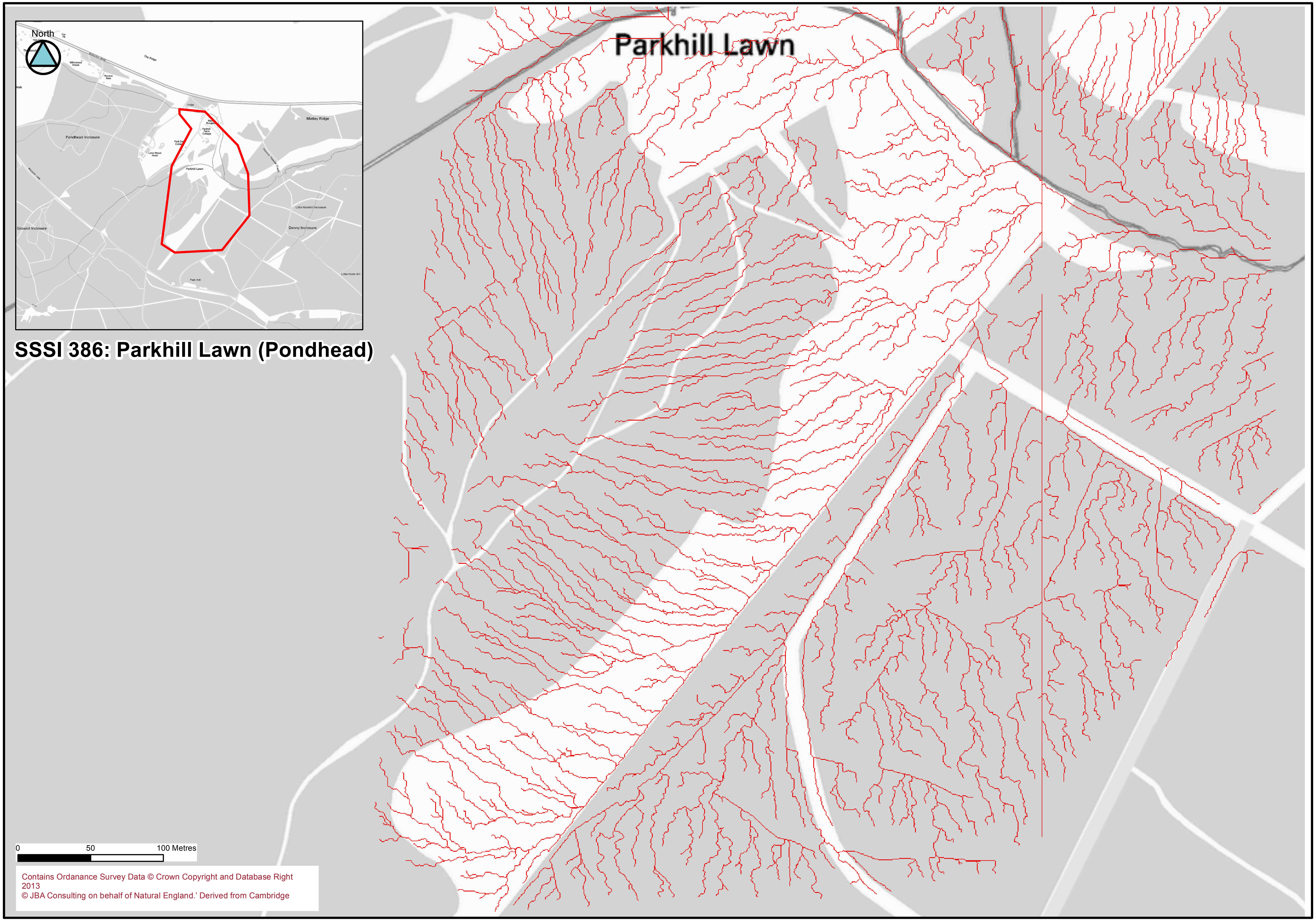

SSSI 386: Parkhill Lawn (Pondhead)