Natural England Commissioned Report NECR140

New Forest SSSI Geomorphological Survey Overview

Annex H: Harvest Slade Bottom Restoration Plan - SSSI Unit 126

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1 Harvest Slade Bottom Restoration Plan - SSSI Unit 126

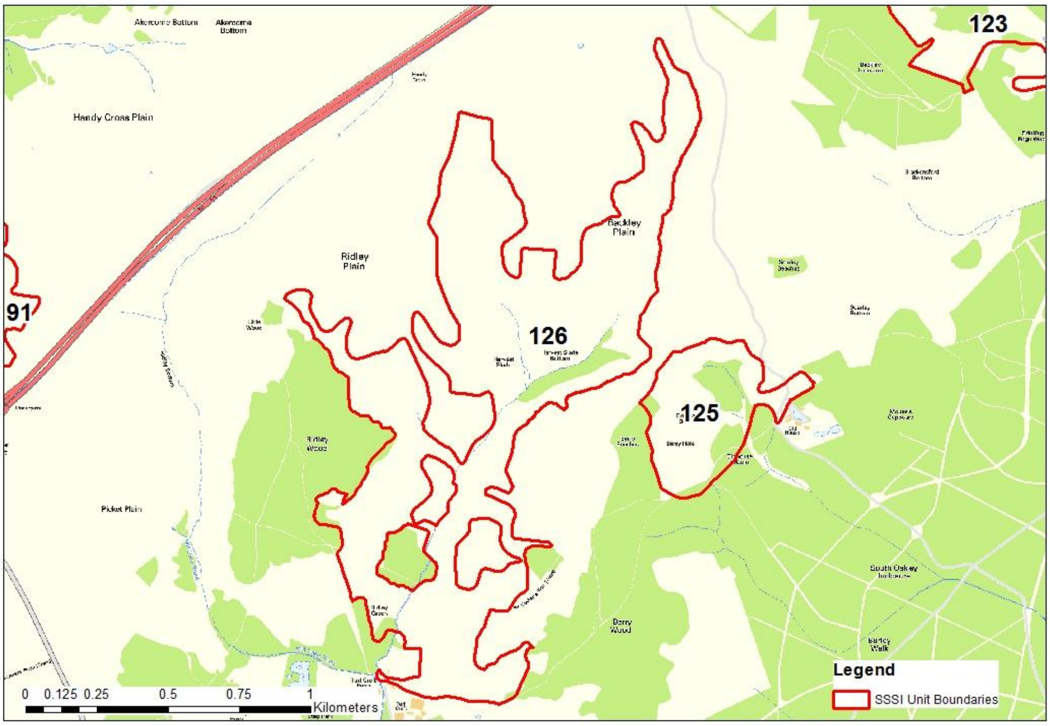
1.1 Introduction

Due to site boundary GIS errors, only the stream component of this unit was surveyed. However, brief analysis of the rest of the mire section of this unit has been undertaken using aerial photography, the LIDAR DTM and other data sources.

Harvest Slade Bottom (Unit 126) has mire and stream characteristics and eventually flows into Mill Lawn Brook, at Turf Croft Farm (Figure 1-1). It is considered to be in unfavourable recovering condition and is approximately 104.82ha in size (only a small proportion of this was surveyed).

The unit is made up of four sections of a stream which flows through predominantly wet heath and mire habitats.

Figure 1-1: SSSI Unit 126 location (flow direction is north to south)



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1.2 Current hydromorphic conditions and issues

A summary of the hydromorphic conditions of Unit 126 is given below in Table 1-1.

Table 1-1: Hydromorphic conditions of unit 126

Geomorphological Assessment Area		Harvest Slade
Site name		Harvest Slade Bottom
Size (ha)		0.3
SSSI unit(s)		126
Channel Condition	River type (s)	Mire to stream transition - active single thread (in downstream section), passive single thread elsewhere with spreading sections
	Responsiveness	Moderate - upstream incision propagation from stream could impact mire, some gravel supply to stream, moderate gradient, straightening possible below SSSI unit boundary,

		tree clearance (historic) in stream section
	Sediment delivery, type and mobility	Gravels in downstream stream section, supplied from upstream and local gravel sources (banks), alternates between gravel and silty bed in mire section in dominant channel where not spread or multi-thread
	Main source of water	Upstream source (Backley Plain) and drains
	Aquatic vegetation	In-channel aquatic vegetation includes Bog Pondweed, Common Reed, Floating Sweet-grass and Rush species
	Drainage damage	The drains look relatively straight but not embanked and a couple are only mildly incised, mostly spread across floodplain with no distinct channel
	Morphology	Embryonic pools, riffles / glides / runs in stream section. Gravel features not well developed but not expected. Spreads in mire section in some locations.
	Incision	Yes - incision in downstream stream section. Some mild incision in some of the drains upstream.
	Engineering	Channel straightening (mostly downstream of SSSI unit boundary), possible dredging with some indication of embankments further downstream. Footbridges and paths
	Bank activity	Some lateral activity in downstream stream section, also bank collapse associated to incision. Little activity in mire section as spread
	Flow type (s)	Flows impacted by upstream mire but appears relatively natural (drains may have some impact). Flood peaks concentrated in stream due to incision
Floodplain Condition	Valley type	Wide floodplain
	Main source of water	Seepage, drains / overland flow, out of bank flows
	NVC communities	W1, M25a, M16a, M21a, M29, S4
	Wetland types	Coniferous plantation woodland, Broadleaved woodland, Reedbed, Wet heath, Valley mire
	Drainage	Some drains may have been straightened but not over-deepened and one showed signs of very mild incision
	Scrub / tree encroachment damage	The channel in places is heavily encroached by Gorse
	Palaeo features	Yes - some small palaeo features in downstream section
	Floodplain connectivity	High in upstream mire section, although could be improved. Moderate to low in stream section due to incision
	Poaching and grazing pressures	Significant grazing damage
Generic restoration options		Incision in stream at the downstream end of the unit should be managed by channel blocking by debris jams in wooded section, embankment removal / drain infilling where appropriate on drains, blocking in upstream mire section to raise water levels
Additional Comments		

The stream within SSSI Unit 126 is a mainly a passive single thread channel (Figure 1-2), switching to sections poorly differentiated of multi branch / spreading networks where floodplain connectivity is improved and gradients are reduced (Figure 1-3). There are generally low inputs of gravel to the stream locally and from upstream sources, with limited bank erosion and the dominant material on the channel bed is fine sediments / silt (Figure 1-5), with only small sections of exposed gravel bed (in the single thread sections in upstream mire area). In the downstream section, the stream is more active, with evidence of incision (Figure 1-4).

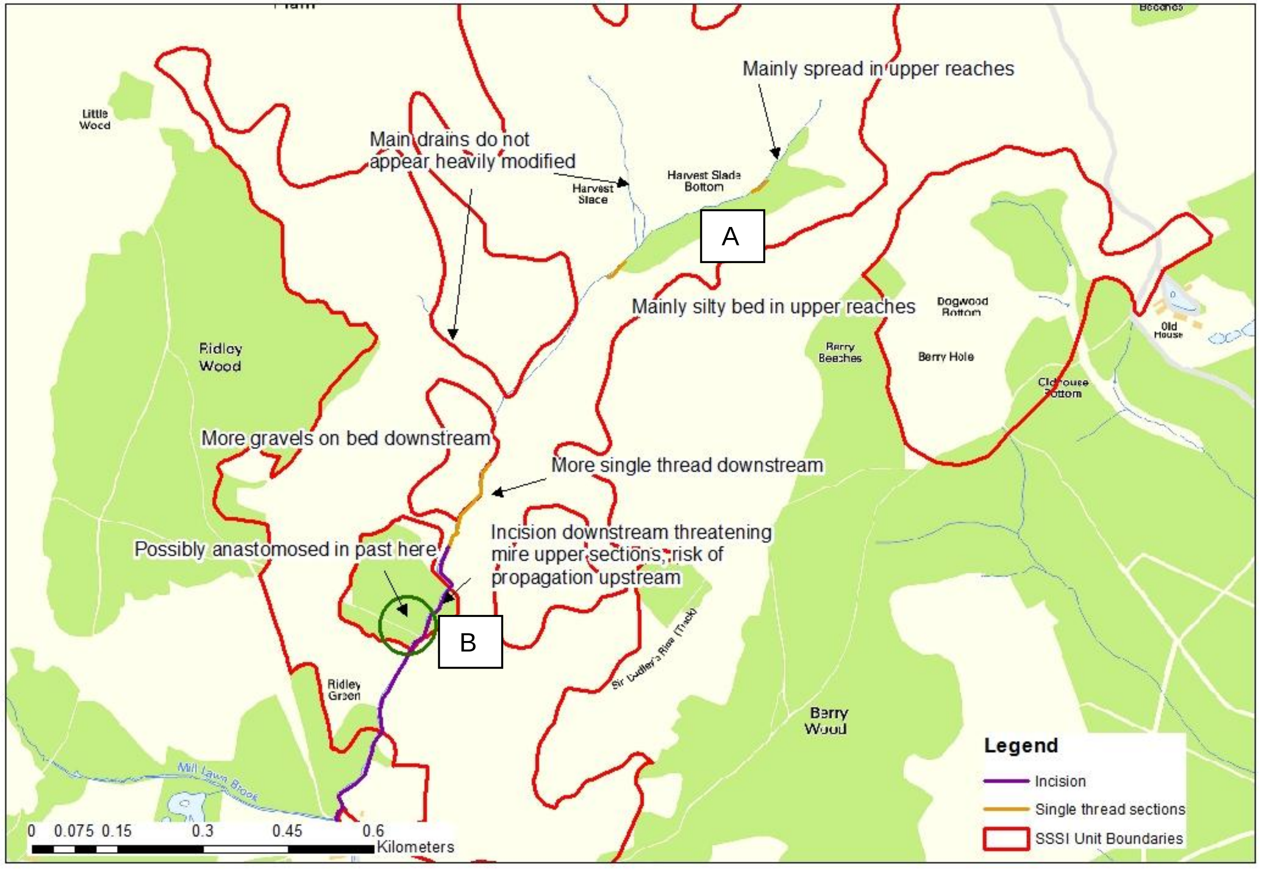
Figure 1-2: Passive single thread channel characteristics corresponding with Soakway habitat M29

Figure 1-3: Multi branch / spreading sections on valley mire M25a

Figure 1-4: Active, incised, sinuous, single thread stream section downstream

The source of the unit is Backley Plain. Figure 1-5 summarises the existing hydromorphology and pressure impacting Unit 126.

Figure 1-5: Current hydromorphic conditions and pressures



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The stream / flow route in the middle to upper reaches has a generally low gradient (Figure 1-5 - A), particularly in the multi-thread / spreading sections where there is no clear dominant channel and spreads over a wide area. In the single thread sections, the gradient is still generally low (steepening downstream). Functional riffles, where occasional gravel bed sections are exposed in the downstream single thread reaches, display a local gradient increase (Figure 1-6). This single thread section where gravels are more apparent, is likely to have been impacted by flow concentration from surrounding drains and downstream incision, maintaining the single thread characteristics at this point. Outside of these locally energetic areas, the bed is generally silt dominated due to the low gradients (Figure 1-7) and diffuse supply. As a result of the generally low gradients and in combination with little incision, bank erosion is limited. Fine sediment inputs to the channel are increased due to poaching and grazing up to the channel banks.

Figure 1-6: Small gravel bed sections downstream

Figure 1-7: Vegetated, fine sediment dominated bed in valley mire habitat (M29, M25a)

In the downstream reaches of the unit, the channel is more active with a steeper gradient and possibly some past channel straightening and deepening (there are some small sections of low level embankments in places but are not continuous, as can be seen from the LIDAR). This will have resulted in some loss of channel length leading to a steeper channel, resulting in increased flood shear stress levels and promoting erosion of the channel bed. This is linked to the incision seen in the downstream reaches (Figure 1-5 - B), particularly 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 - Figure 1-4). In some locations the single thread channel is more disconnected than others resulting in drier floodplain areas and associated impacts on vegetative assemblages (see section 1.4).

The straightening and deepening of the downstream section of this unit may have destroyed a previous anastomosed channel type as the right bank floodplain would be well connected if the incision was managed. This remnant anastomosed system now appears to be disconnected from the main channel for the majority of flows. Some possible anastomosed palaeo-channels have been identified from the LIDAR (Figure 1-5).

The LIDAR and drainage lines in Appendix A show that there is likely to have been some modification to the drainage flow routes, mainly through concentration of flows into the major drains, which then concentrate inflows to the main channel at certain location. This may be a contributing factor to the formation / maintenance of the single thread sections, where flows are concentrated at one point, giving enough excess energy to maintain a single thread channel rather than silting up to form channels similar to the spreading sections within this unit. One of the main drains, on the right bank towards the upstream end, shows signs of a knickpoint forming, which may need to be treated as part of the restoration works to prevent it migrating upstream (Figure 1-8).

Figure 1-8: Right bank drain knickpoint

There are no significant gravel shoals or features within this unit, with morphologic units limited to riffles and runs where there are minor increases in gradient locally, particularly in the downstream single thread sections where there are more local gravel sources.

There are no natural woody debris features along the channel due to the surrounding vegetation type in the middle and upper reaches. Therefore, restoration options to improve floodplain connectivity further through the single thread sections of the watercourse are likely to involve channel blocking using consolidated silty berms (which naturally occur through the reach) alongside channel infilling. These will create short lengths of impounded watercourse and multi-branched / spreading networks that will improve floodplain connectivity / wetting. Woody debris jams could be used to manage the incision in the downstream single thread reaches as these naturally occur in the wooded riparian corridor in this area (Figure 1-9).

Figure 1-9: Natural woody debris jams in downstream reach

1.3 Probable channel development

The channel in the middle and upper reaches is presently relatively stable as a result of limited incision, straightening, embanking and good floodplain connectivity. The minor incision in the right bank drain in the upper reaches may propagate upstream if not mitigated.

Incision is a continuing process in the downstream single thread reaches and threatens to migrate further upstream if not managed. This would threaten the mire areas of this unit through bed and water level lowering, groundwater lowering and consequential floodplain drying

In the middle and upper reaches, continuing processes are likely to involve further silt deposition (some of which will be flushed through during higher flows) that could lead to bed raising in the long term. Fine sediment inputs will remain heightened due to the limited buffer strip between the floodplain and the channel and as a result of inappropriate land use and grazing pressure. It is unlikely the nature and distribution of existing features will change significantly over the next decades due to the generally low energy conditions in the upper and middle reaches. The modifications to the drainage network are likely to maintain single thread channel characteristics where these concentrate flow in some locations.

1.4 Current ecological conditions

For the most part, particularly within the upstream reaches, the channel of the stream is narrow, shallow and not well defined. In the upstream reaches it flows through Purple Moor-grass *Molinia caerulea* dominated wet heath (M16a), with Bog Myrtle *Myrica gale* and Cross-leaved Heath *Erica tetralix* also abundant (M25a).

At the time of the survey, aquatic vegetation within the channel included Bog Pondweed *Potamogeton polygonifolius*, Floating Sweet-grass *Glyceria fluitans* and Rush *Juncus* species (M29). Along some sections there were also stands of Common Reed *Phragmites australis* present.

The channel was also quite heavily shaded in some sections due to encroachment by Scot's Pine *Pinus sylvestris* scrub and Gorse *Ulex europaeus.*

Figure 1-10 shows the Phase 1 Habitat Map for Unit 126.

Figure 1-10: Phase 1 Habitat Map

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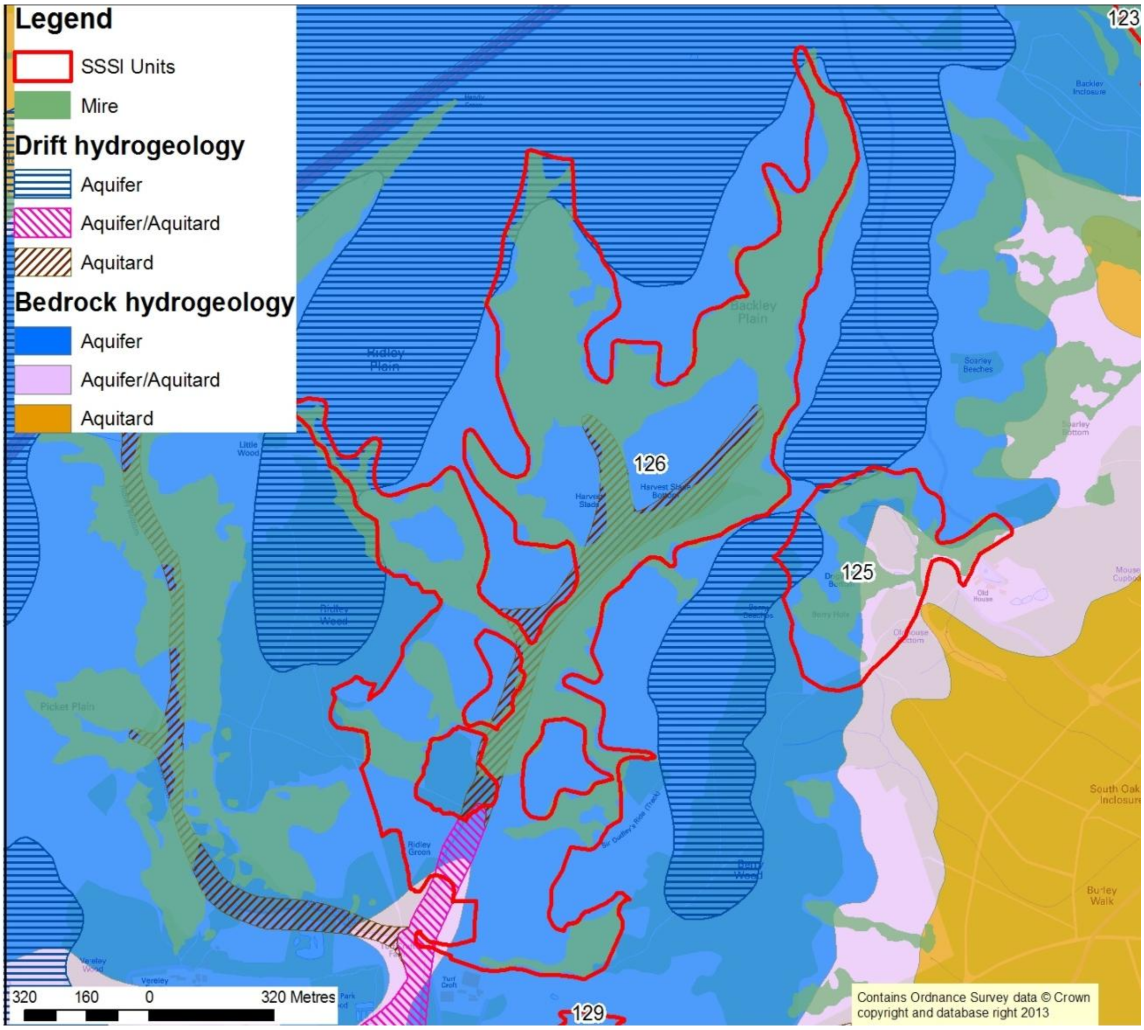
1.5 Ecohydrology

An Ecohydrological survey was not conducted across the site so the following is a desk study. Forestry Commission vegetation survey data (Figure 1-11) shows the distribution of valley and side mires across the area. They occupy the sides and bottom of the valleys and are underlain by the Becton Sands which is an aquifer. It is likely that these mires are seepage dominated; receiving water from groundwater discharges from the Becton Sands. No information is available on the distribution and nature of peat deposits with the mire areas

Figure 1-11: Ecohydrology Map of Unit 126



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Weymouth and Cooch (2000) identifies the following issues on the mires in Unit 126:

- Pine scrub encroachment
- Rhododendron present

But:

- No artificial drainage
- No Peat slumping

LIDAR DTM and aerial photographic analysis also appears to show little evidence of artificial drainage within the mires.

1.6 Restoration plan proposals

A summary of the current pressures, unmitigated impacts and restoration proposals is given in Table 1-2 and shown in Figure 1-12.

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

- Bed and water level raising through channel infilling and blocking to create spreading sections of channel and to improve floodplain diversity;
- Water level raising, as a result of channel infilling, will improve groundwater levels locally;

- Natural flow regime reinstated as a result of artificial drain infilling;
- Incision management in the downstream single thread reaches will raise bed and water levels, improving floodplain connection, helping to recreate a multi-thread system in the longer term. This will also manage the risk of incision propagation upstream into the mire areas;
- Knick point management will reduce the risk of future incision and resulting impacts on water levels and possible impacts on upstream mire habitat;
- Allowing development of a buffer strip, next to both banks of the channel, will reduce fine sediment inputs to the channel;
- Improved diversity of in-channel habitats and potential to improve the quality of adjacent mire and wet heath habitats.

Table 1-2: SSSI Unit 126 proposed restoration measures

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
Historic dredging Straightening - in downstream reaches	Long term river response, cut and fill activity. Enhanced in-channel energy levels. Disconnected sub-channels. Loss of in-channel features. Knickpoint incision	Incision management - debris jams, morphological restoration, floodplain works. Infill. Restore connectivity. Manage incision knickpoint through either debris jams, wooden dams and/or heather bailing.	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.	Reconnection of channel and floodplain would allow greater flooding frequency and occupation of former courses with a concomitant improvement in habitat diversity Debris dams will permit re-occupation of former courses and create fish laying-up areas and add habitat diversity to the watercourse. Fine sediments building behind dams will allow for colonisation by in-stream vegetation and riparian tree species further stabilising the stream.	Debris jams may form a barrier to fish, but it is unlikely that a fish pass will be required. Large amounts of material are likely to be required. Cultural objections Cost
Artificial drainage	High flows impacted. Sediment transfer impacted. Water table lowered locally.	Artificial drain infilling Knickpoint management on right bank drain	Restore a natural flow and sediment regime. Reduces flood peaks.	Re-naturalise the watercourse and riparian strip. Raise water table and promote colonisation of this by *Molinia* Mire M25a.	May require import of material. Cultural objections including loss of grazing Cost.
Floodplain drying	Reduction in wetland habitat (quality and quantity)	Channel blocking using berms and channel infilling	Further multi-branch / spreading sections. Improved floodplain	Potential to improve the quality of adjacent mire and wet heath habitats, specifically M25a, M29	May require import of material. Cost

Pressure	Impact	Restoration proposal	Hydromorphic improvement	Ecological improvement	Constraints / issues
			connectivity / wetting.	and, ideally M21a.	Cultural objections
Riparian grazing	Fine sediment production. Disruption to woody species recruitment.	Exclude livestock	Encourages riparian hydromorphic diversity	Increase development of riparian woodland and thence stability of the habitat and channel.	Some grazing is likely to be maintained. Culturally unacceptable.
Woody species	Alters floodplain species assemblage. Impacts bank stability	Removal of areas of Scot's Pine scrub and Gorse that are encroaching into the channel Ring barking Half-felling	Removal of conifer plantations would improve low flow hydrology and reinstate a natural drainage pattern. Creates riparian hydromorphic diversity.	Improve diversity of in-channel habitats through reduced shading and release of ground layer. Very beneficial to invertebrate species. Creation of standing dead wood and CWD on woodland floor and in-channel.	Large-scale removal of conifer species is unlikely to be feasible or economically viable. Cultural objections.

Figure 1-12: Proposed restoration measures for SSSI Unit 126

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1.7 Design considerations

The current hydromorphic condition of the channel is considered to be reasonable given existing processes and controls. Further improvements could be made through improved floodplain connectivity, which is likely to improve vegetative diversity associated to a wetter environment in the upper and middle reaches. The downstream incision needs to be managed to ensure this does not propagate further upstream.

Channel infilling / blocking in the upper and middle reaches should use measures suitable to existing conditions, i.e. heather bailing or berms. The impounding influences of the filled / blocked section should result in natural infilling upstream (Figure 1-12).

Woody debris jams to manage knickpoint erosion downstream must extend into the adjacent banks to ensure longer term functioning.

Targeted restoration of natural drainage paths should refer to Appendix A and identify where flow paths have been redirected into the main drainage channels.

Debris jams in the lower sections of the unit may increase flood event water levels in the floodplain which could impact properties at Turf Croft Farm. It is therefore recommended that a Flood Risk Assessment is undertaken before restoration works are installed.

1.8 Restored channel and monitoring requirements

It is anticipated that the proposed restoration works will improve floodplain connectivity. Morphologic change is likely to involve bed raising and the creation of a multi-branched / spreading channel network. Debris jams installation downstream may create a multi-thread system in the medium to long term. This pattern of development is difficult to document accurately due to the complex nature of the river network and the difficult surveying conditions. This could be monitored qualitatively with automated time lapse photography at key restoration point 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 126.

<table>
<tr><th>Parameter</th><th>Approach</th><th>Frequency</th><th>Approximate cost</th></tr>
<tr><td>Morphologic unit change</td><td>Time lapse camera / audit</td><td>Daily (Annual statistical summary)</td><td rowspan="4">Capital 4 x £200
Half yearly downloading £200
Annual summary £300
Two - yearly reconnaissance audit £500</td></tr>
<tr><td>Flow change</td><td>Time lapse camera / audit</td><td>Daily (Annual statistical summary)</td></tr>
<tr><td>Sedimentology</td><td>Time lapse camera / audit</td><td>Daily (Annual statistical summary)</td></tr>
<tr><td rowspan="3">Vegetation change</td><td>Fixed point camera survey</td><td>Biennially</td></tr>
<tr><td>Fixed point quadrat survey</td><td rowspan="2">Biennially</td><td rowspan="2">Survey £350
Analysis £500</td></tr>
<tr><td>Fixed point aquatic macrophyte survey</td></tr>
<tr><td colspan="4">NB. Costs assume downloading and site visits as part of wider field campaign.</td></tr>
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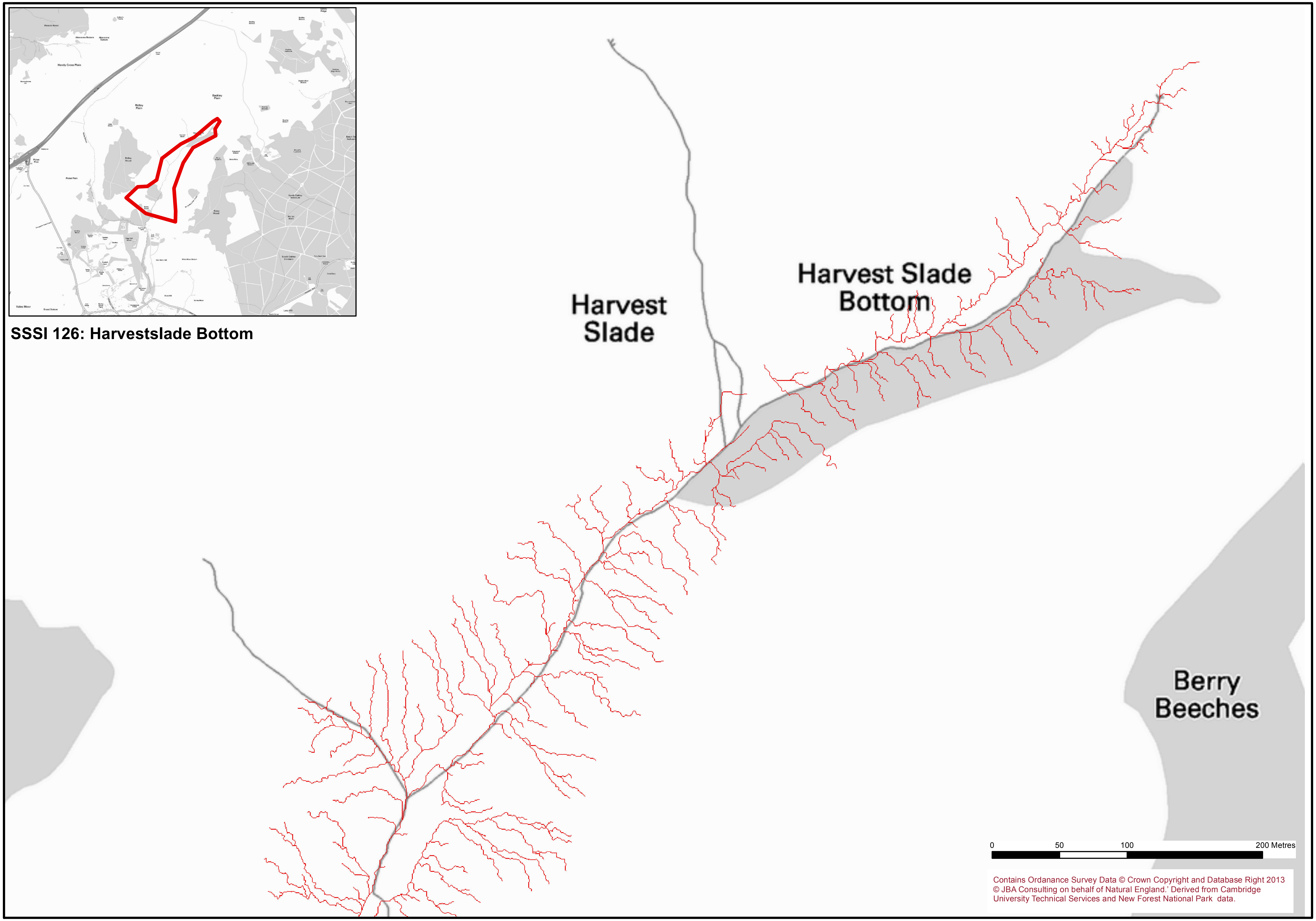
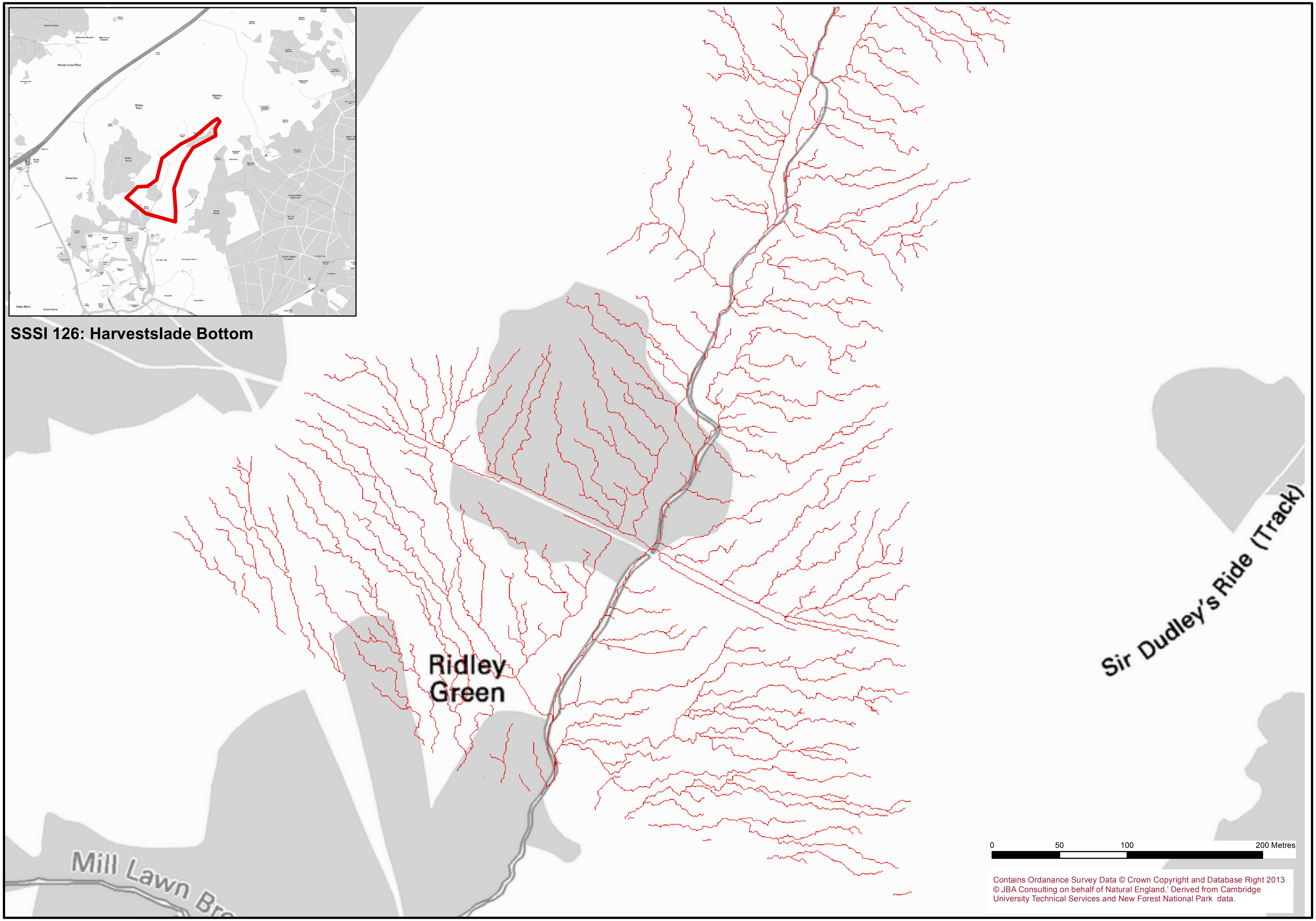
Appendix A - Artificial drains and flow lines - SSSI Unit 126

SSSI 126: Harvestslade Bottom





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