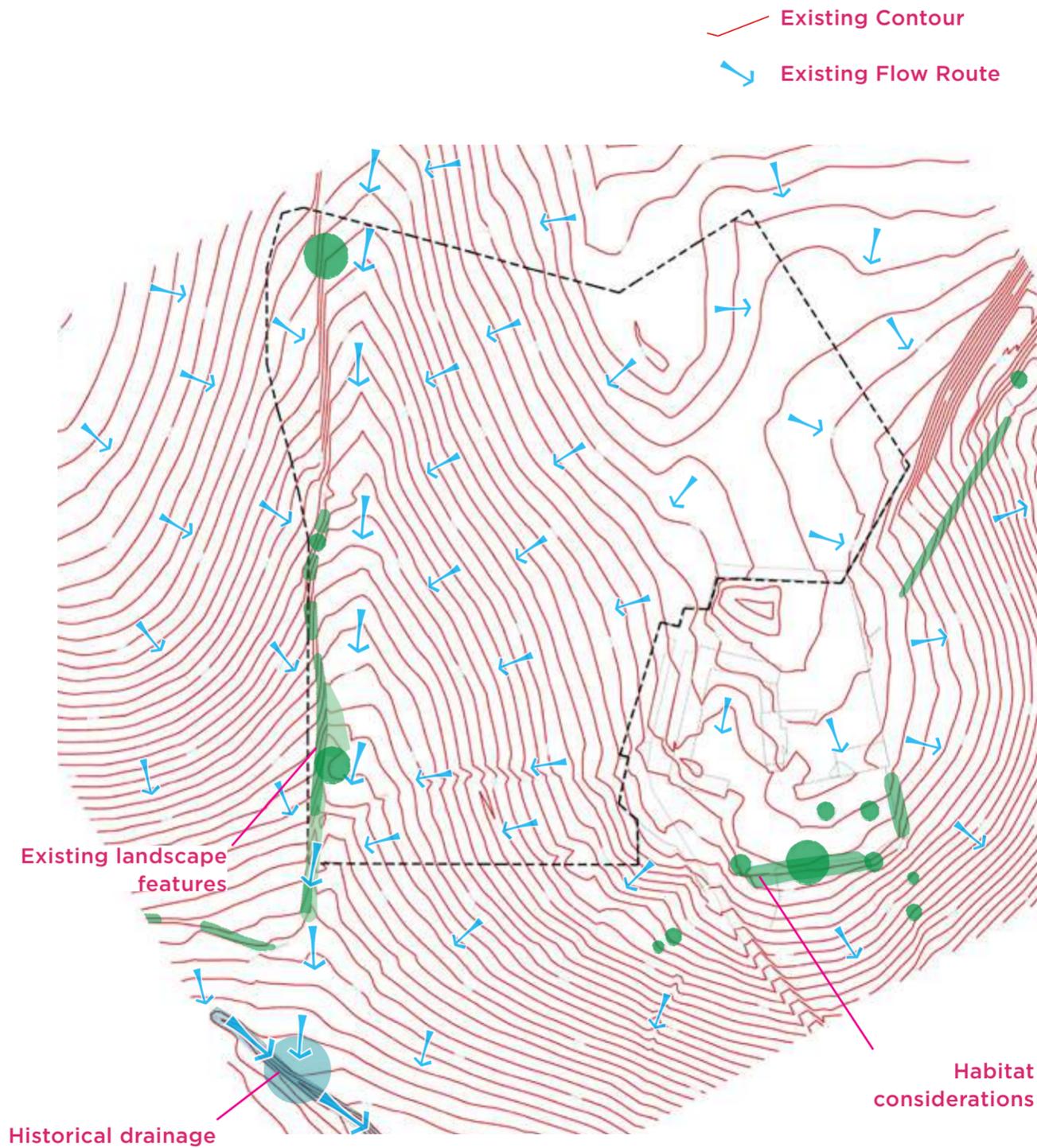


Step 1 - Existing Flow Route analysis

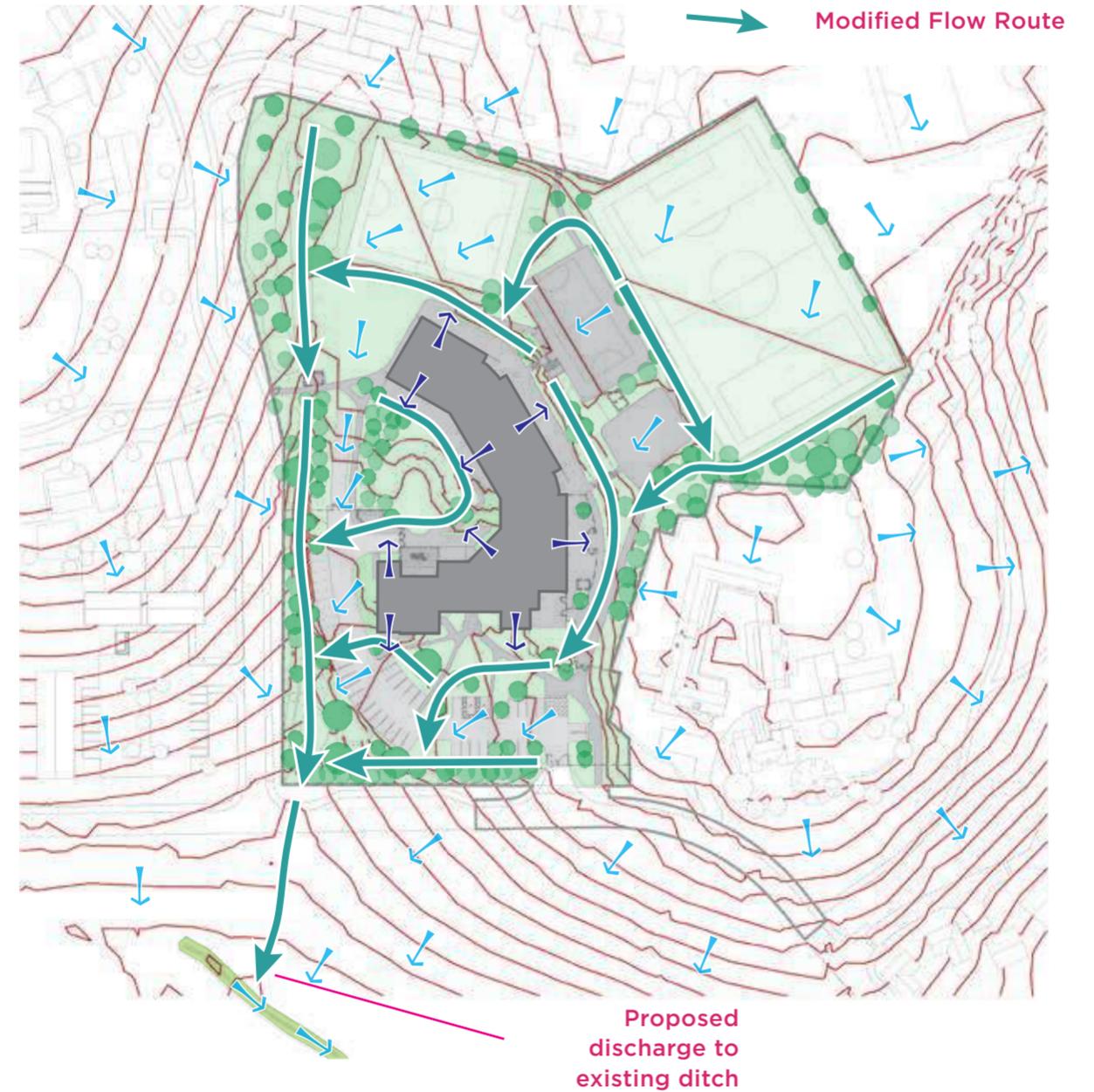


Flow Route Analysis for Holyoakes School, Robert Bray Associates.

Step 2 - Modified Flow Route analysis

The modified flow route analysis is the basis for low flow conveyance through the site, overflow arrangements and exceedance routes when design criteria are exceeded.

Once the modified flow routes have demonstrated that runoff can flow predictably through the site, the arrangement of runoff collection, source control, site control, regional control, conveyance, storage and final release from site can be designed.



Modified Flow Route Analysis for Holyoakes School, Robert Bray Associates.

7.4.2 Building the Management Train

A successful management train begins with source control, and uses surface conveyance, wherever possible, to link subsequent SuDS components in series. Integration of the management train should be considered from the Concept Design stage and throughout the design process.

The management train provides potential for 'interception losses' along its whole length, as well as through soakage into the ground, evaporation, and transpiration through the leaves of vegetation. It also reduces the rate at which runoff flows through the site, and provides treatment of runoff as it passes through each SuDS component.

Selecting SuDS components within the management train:

- **Source Controls:** green and blue roofs, permeable surfaces, filter strips, protected filter drains, together with some swales and basins, provide the first stage of treatment, intercepting primary pollution and reducing runoff flow rates.
- **Site Controls:** these features will normally be preceded by source controls, and meet remaining storage requirements. Permeable surfaces will often store the whole attenuation volume. Where there is insufficient storage at source, additional open conveyance and storage structures, such as basins and protected wetlands or ponds, will manage remaining runoff volumes on most sites.
- **Regional Controls:** where it is difficult to store all the runoff within a development boundary, clean water can be conveyed to open storage features within public open space or other parts of a development to contribute to open space amenity.

Flow Controls can be incorporated in green roofs to manage volumes and provide source control, transforming them into 'blue roofs'.



7.4.3 Collection of runoff from hard surfaces

The way that runoff is collected from roofs, roads, car parks and other hard surfaces is a critical consideration in any SuDS design.

Conventional drainage techniques such as gully pots and pipes, promote the concentration of flows and mobilisation of pollutants, forcing runoff deep underground, so that management of runoff at or near the surface is difficult to achieve.



Surface collection in channels, gutters and permeable pavements, or as sheet flow onto grass surfaces, keeps runoff at or near the surface, enabling cost-effective and visually legible design.

Collection of runoff at or near the surface also reduces maintenance costs, and allows for simple removal of blockages.

Highway runoff is intercepted using a chute gully and taken into a conveyance swale at this retrofit SuDS project. Devonshire Hill, Haringey.

Permeable paving and planted open channels collect runoff from hard surfaces at Bewdley School, Worcestershire.

