Repairing flow: what to do at the site

CRC for Water Sensitive Cities

Strategy 1. Reduce the velocity of instream flow

Suitability of strategy: this strategy will be most effective where catchment-wide stormwater management has already been implemented.

Action	Explanation	Conditions where action is most likely to be suitable andeffective	Other references recommending action	Guidelines for implementation
1a. Encourage the channel to naturally self-adjust See Repairing geomorphology: what to do at the site and in the catchment factsheet, Strategy 3	Natural self-adjustment to flow helps to slow instream flows because high-energy water loses some of its power when it transports sediments.	Where the soil surrounding the stream is erodible (e.g. sand, clay, gravel) – not bedrock. Where there is sufficient buffer space for channel adjustment. If the waterway is lined with concrete there must be sufficient space for earthmoving machinery to access the site without doing substantial damage to riparian vegetation.		See associated factsheet
1b. Reconfigure the channel to promote sinuosity and widening	Reconfiguring the channel so that it is wider and more sinuous will increase the area available to transport water – slowing flow. Wider, sinuous channels also increase the contact between instream water with rough (turbulent) surfaces (i.e. the channel edge) which help to slow instream flow.	When rapid change in channel form is desired (i.e. waiting for natural channel adjustment is not feasible), and where earthworks will not create substantial damage to riparian vegetation (e.g. new developments or highly degraded urban sites).	[1, 2]	See river restoration manuals
1c. Add large woody debris (LWD) to the channel	LWD creates roughness and turbulence, leading to a reachscale reduction in flow velocity.	Where streams would naturally have contained wood. Where earthmoving machinery can access the site. Where the channel is narrow (< 10 m) and where a large amount of wood is being added. Where urban scouring flows have been repaired such that LWD will not be swept away and damage downstream infrastructure. Note, LWD is unlikely to increase flood risk unless wood occupies > 10 per cent of the channel cross-section. Take care with LWD placement so bank stability is not undermined. If concerns exist about the risk to urban infrastructure, we recommend using the Large Wood Structure Stability Analysis Tool <http://www.fs.fed.us/ biology/nsaec/products-tools.html> [3]. The associated resource [4] describes the process and may also be useful.	[5-8]	[2-4, 8-12]

Action	Explanation	Conditions where action is most likely to be suitable andeffective	Other references recommending action	Guidelines for implementation
1d. Use engineering structures (cross vane, w-weir, j-hook vane, check dams or side-cast weirs). See Repairing riparian function: what to do at the site, action 2g	Numerous engineered structures can be constructed instream to reduce flow velocity.	Novel waterways in new urban developments. Pre-existing urban drains where actions 1a or 1b are not appropriate – e.g. where there is no room or funding available for channel adjustment or redesign, or LWD is likely to be swept away by scouring urban flows. Care should be taken to ensure that these structures do not impact in-stream connectivity (e.g. fish movement), particulary in lower stream reaches.	[1, 7, 13]	See associated factsheet
1e. Roughen channel lining using rocks and macrophytes See Repairing riparian function: what to do at the site factsheet, action 2ce	As the roughness of the channel increases it creates more turbulent flow, which slows overall water velocity	Most sites. Rocks are most suited to sites where very scouring urban flows occur. Macrophytes should be supported during the establishment phase using geofabric, but may not be suitable at some sites.	[2, 6]	See associated factsheet
1f. Improve hydrologic connectivity between the waterway and its riparian floodplain by grading the bank, lowering the floodplain/ raising the channel, removing levees and unblocking wetland feeder creeks	Urban channels are typically incised: lowering the floodplain, grading the bank or raising the channel bed will improve the overbank flow of water from the main channel to the floodplain. This transfer of water will reduce the velocity of instream flows.	Where a series of natural floodplain wetlands or lakes exist on the urban river network. Where floodplain inundation does not pose a threat to people or urban infrastructure. Where earthworks do not create substantial damage to riparian vegetation (i.e. new development).	[14-16]	[9]
1g. Create ponds, wetlands and other topographical depressions on the riparian floodplain	The creation of wetlands and other depressions on the floodplain will increase the capacity of the riparian land to store floodwaters, slowing instream flow.	Where few wetlands and depressions currently exist. Where enough floodplain space is available for wetland creation. Where floodplain inundation does not pose a threat to people or urban infrastructure. Where earthworks do not create substantial damage to riparian vegetation (i.e. new development).	[15]	[9]
1h. Repair riparian vegetation	Revegetating the riparian buffer will increase flow roughness and slow the velocity of overbank flow.	Sites where hydrologic connectivity is good (i.e. the channel is not very incised or action 1h has been done). Where the vegetative buffer is wide > 30 m so it can absorb a large volume of flow.	[6, 9, 14]	

Strategy 2. Repair stream baseflow

Suitability of strategy: the height of the local watertable is likely to be controlled by larger off-site processes; hence actions to repair baseflow at the site scale are likely to be less effective than catchment-scale strategies.

Action	Explanation	Conditions where action is most likely to be suitable andeffective	Other references recommending action	Guidelines for implementation
Where urbanisation has led to a decrease in baseflow				
2a. Remove impermeable channel lining	An impermeable channel lining (e.g. concrete, compacted clay) prevents the inflow of groundwater.	Where the channel is lined with an impermeable material (e.g. concrete, clay).		Not applicable
2b. Lower channel to reconnect the stream with shallow groundwater (i.e. excavate a pool to create a low-flow refuge)	Lowering the channel will increase contact with a falling watertable.	Where earthmoving equipment can access the site without causing too much ecological damage. Lowering the channel could lead to further drainage and exacerbate the falling of the watertable. We recommend this approach only be undertaken in patches – i.e. to create pools that provide low-flow refuges. When creating a pool, take care to ensure the upstream end does not create a knick point that leads to upstream erosion.		
Where urbanisation has led to an increase in baseflow				
2c. Plant native deep-rooted trees in high density, particularly species with high water consumption	Deep-rooted trees that have a high evaporative demand, such that some eucalypts (e.g. blue gums) may cause a local lowering of the watertable.	Where the riparian buffer is wide enough to support a large number of trees. Where riparian vegetation would naturally have been forested.		

Supporting documents

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River restoration manuals

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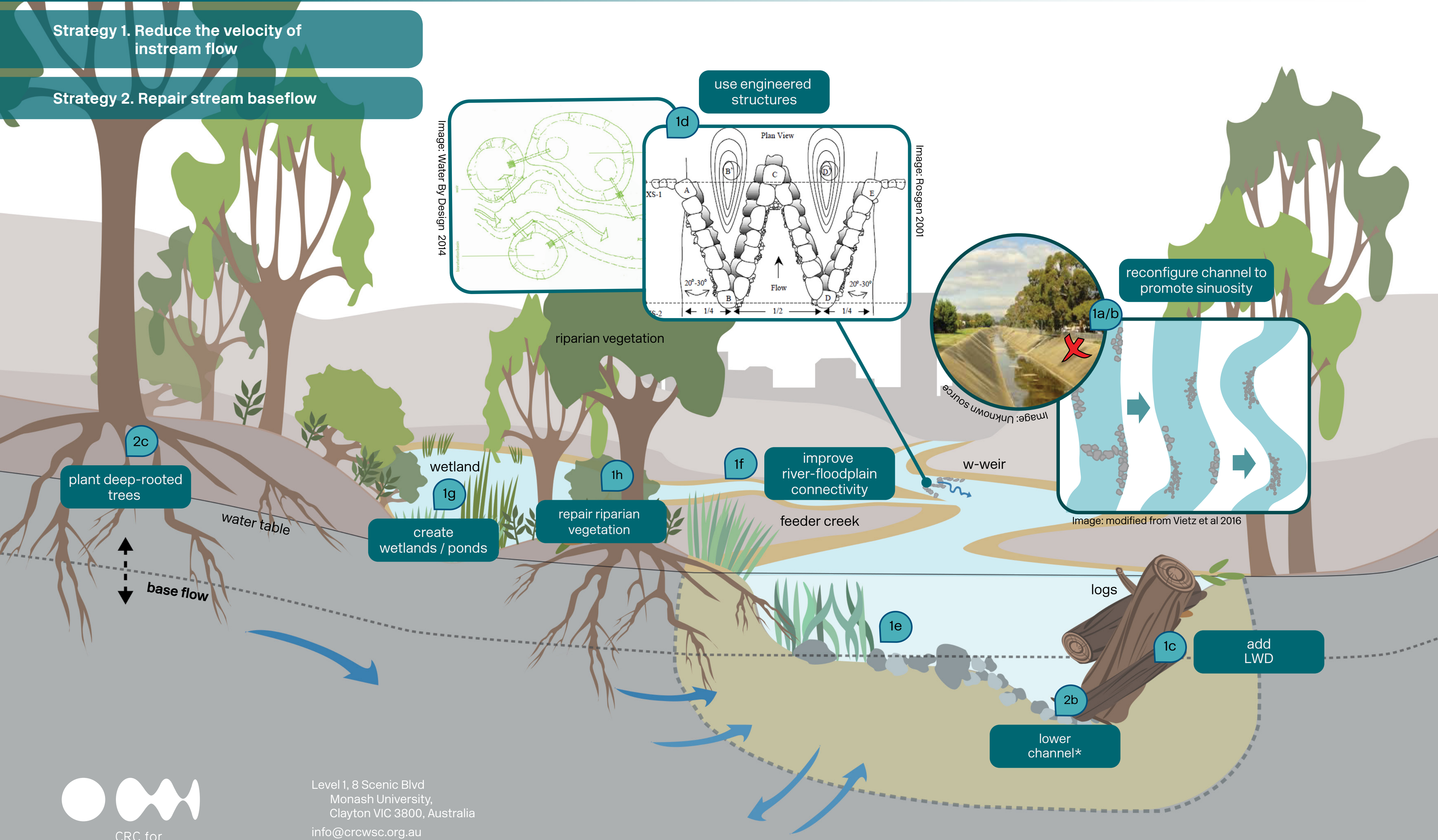
Repairing flow: what to do at the site

Strategy 1. Reduce the velocity of instream flow

Strategy 2. Repair stream baseflow



* only where urbanisation has caused the water table to fall

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