Steep headwater River Style

Defining attributes of River Style (from River Styles tree): Steep, bedrock-confined river with bedrock outcrops, boulders or coarse gravel and no floodplain. The channel abuts the valley margin >90% of the time. Laterally stable channels are characterised by a highly variable assemblage of geomorphic units. An alternating sequence of bedrock step/cascade/rapid geomorphic units and pool/riffle/run/bar/island sequences occur on steep and gentle reaches respectively.

Subcatchments in which River Style is observed: Tantawangalo, Candelo, Bemboka

DETAILS OF ANALYSIS
Representative reach**:* Tantawangalo Creek ***Map sheet(s) air photographs used:. Nimmitabel 1:25,000 topoographic sheet; Bombala air photo runs ***Analysts**:* Kirstie Fryirs, Gary Brierely ***Date**:* 17.06.96 ***Upstream grid reference***: 261268 ***Downstream grid reference***: 318251

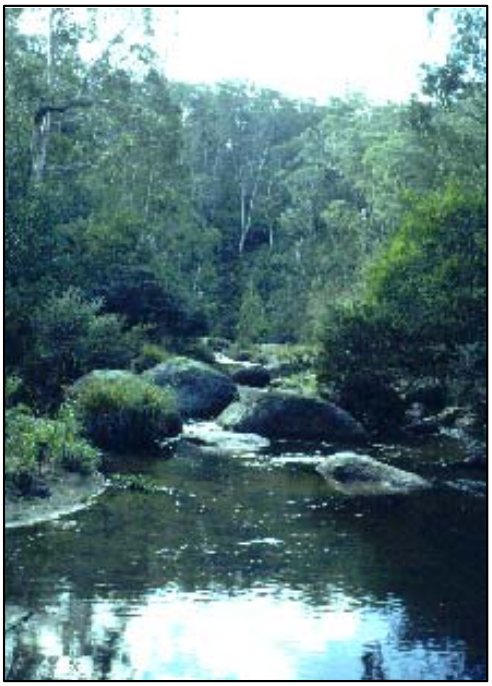
RIVER CHARACTER	
Valley-setting	Confined
River planform	Laterally stable, bedrock-controlled single channel with low sinuosity (imposed by valley alignment).
Bed material texture	Often gravel based with occasional bedrock outcroping. Sands drape many bar surfaces. Gravels and boulders are up to 1 m (b-axis). Channel banks comprise bedrock or weathered saprolite. Woody debris and coarse particulate organic matter (CPOM) are prominent in the channel and in the channel bed.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* • Channel is confined within the valley-setting. Symmetrical to irregular. Channel occupies entire valley floor.
	Instream – bedrock • **Bedrock steps** - Very steep, often vertical. Can be several metres deep. Bedrock boulders can be up to 3000 mm b-axis. • **Cascades** – Steep and often occur where accumulations of large gravels and boulders occur. Water flow is turbulent around and over these boulders. • **Rapids** – Steeper unit than a cascade but comprised of the same materials. Are largely bedrock boulder based, are continuous over the entire channel bed and are found along steeper sections of the reach.
	Instream – alluvial • **Pools** - Comprised of gravels up to 300 mm (b-axis). Often contain large amounts of organic matter. Often lined with *Lomandra sp*. • **Riffles** - Found in narrower, more confined sections, generally on locally lower slopes. Up to 200 mm (b-axis), around 100 mm (b-axis) on average. Largely unvegetated, can be reed or *Lomandra sp*. lined. . • **Runs** – Low slope and gravel based. Water flows unbroken over the surface of these features. Unvegetated, lined with *Lomandra sp*. and reed species. • **Mid-channel bars** - Often compound forms with chute channels common. Comprised largely of gravelswith a bedrock or LWD core. Colonised with *Lomandra sp*. and reeds and some shrubs. Species include Eucalypts, Acacias, Banksias and grasses. • **Bank-attached bars** - Can occur on convex side of bends (point bars). Often compound forms with chute channels common. Coarse sands and gravels up to 15 mm (b-axis). Largely unvegetated. • **Islands** –Generally less than 1 m deep. Often sand or gravel based. Confined to gentler sections of the reach where sediments can be stored behind woody debris or boulder forms. Colonised with a dense association of Eucalypts, Acacias, Lomandra and other shrub species. Often contain large amounts of organic matter. Generally occur in association with runs and secondary channels. • **Secondary channel** – area of secondary flow often behind an island or bar. Gravel and sand based with gravels up to 300 mm (b-axis). Stores large volumes of organic matter and often well shaded.
	Floodplain • Absent
Vegetation associations	*Instream geomorphic units* • Well vegetated mid-channel and bank attached bars and islands colonised largely by aquatic species and hardy shrubs (dominated by Lomandra and Melaleucas). Lomandra often lines the low flow watermark and occurs along the margins of pools and islands. Coarse particulate organic matter (CPOM) is also abundant.

RIVER CHARACTER	
	Floodplain geomorphic units • Valley margin vegetation generally contains open forest associations and in wetter areas rainforest associations.

RIVER BEHAVIOUR
Low flow stage This River Style is characterised by high variability in the assemblage of geomorphic units. Pool-riffle-run bar-island assemblages are characteristic of lower slope sections of the reach. Large woody debris (LWD) plays a significant role in the formation and location of these units with obstruction leading to deposition of sand or the trapping of coarse materials. CWD also provides a core for sedimentation in a number of bar features and at the base of the banks. Bedrock step-cascade-rapid geomorphic unit assemblages occur along the steeper sections of the River Style. At low flow stage the range of longitudinal and lateral low flow variability (and hence habitat conditions) is high. ***High flow stage*** Steep gradients but relatively small catchment areas ensure that the largest boulders only move during high magnitude events. Adjustments restricted to localised scour and/or sediment accumulation. Bedrock confinement ensures that the channel is able to throughput sediment and is laterally and vertically stable.

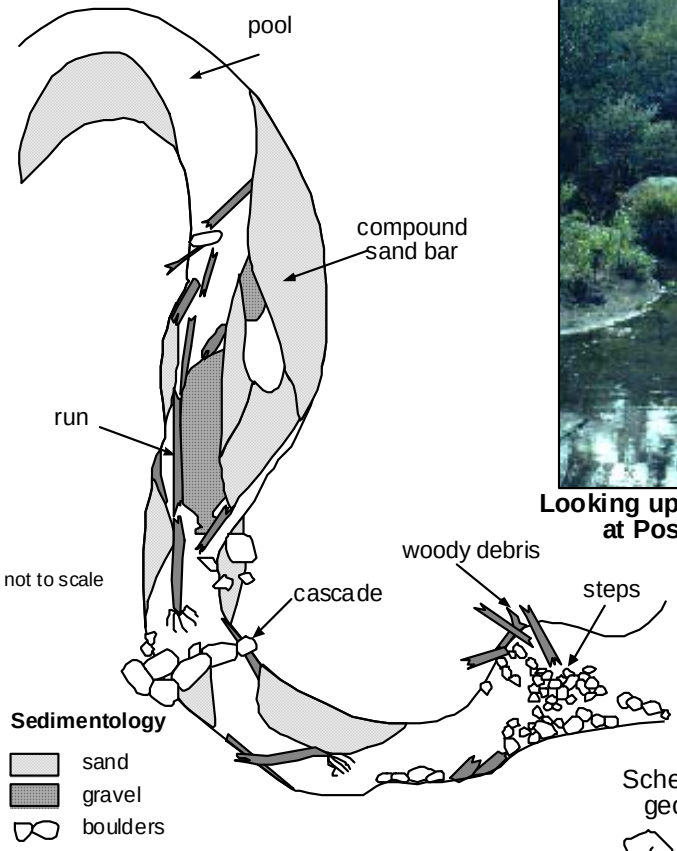
CONTROLS	
Upstream catchment area	Given that these are the most upstream River Styles, catchment areas are low (< 20 km^2)
Landscape unit and within-catchment position	Found in the rugged headwaters of first, second and third order streamlines. Set within a dissected plateau atop the escarpment.
Process zone	Sediment source – bedload dominated
Valley Morphology (size and shape)	Valley widths are narrow (around 40 m) wide with steep valley side-walls.
Valley slope	Averages 0.022 m/m
Stream power	On average 1 in 10 year: 500 W/m^2; 1 in 100 year: 390 W/m^2

Steep headwater River Style

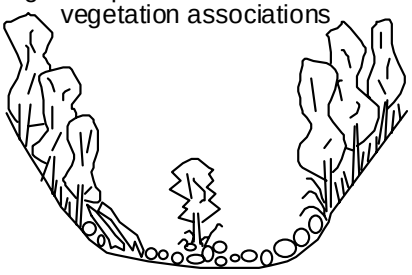


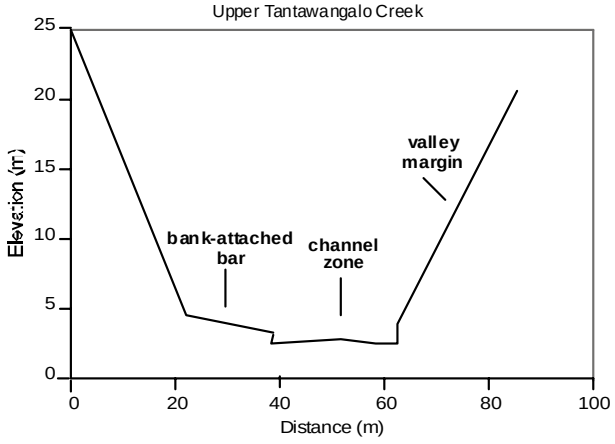
Looking upstream along Tantawangalo Creek at Postmans Track (Photo K Fryirs)

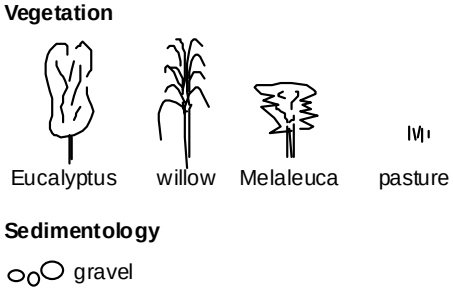
Tantawangalo Creek at Postmans Track



Schematic cross-section showing geomorphic unit structure and vegetation associations







Gorge River Style

Defining attributes of River Style (from River Styles tree): This River Style is found in a confined valley setting. The channel abuts the valley margin >90% of the time. It has a steep, confined channel with bedrock margins and no floodplain. Very coarse gravel/boulder bedload which forms a sequence of falls, cascades and rapids with occasional bedrock-induced pools and boulder bars.

Subcatchments in which River Style is observed: Greendale, Frogs Hollow, South Wolumla, Wolumla, Candelo, Towridgee, Reedy, Tantawangalo, Sandy, Colombo, Bemboka, Pollacks Flat, Numbugga, House, Double, Brogo

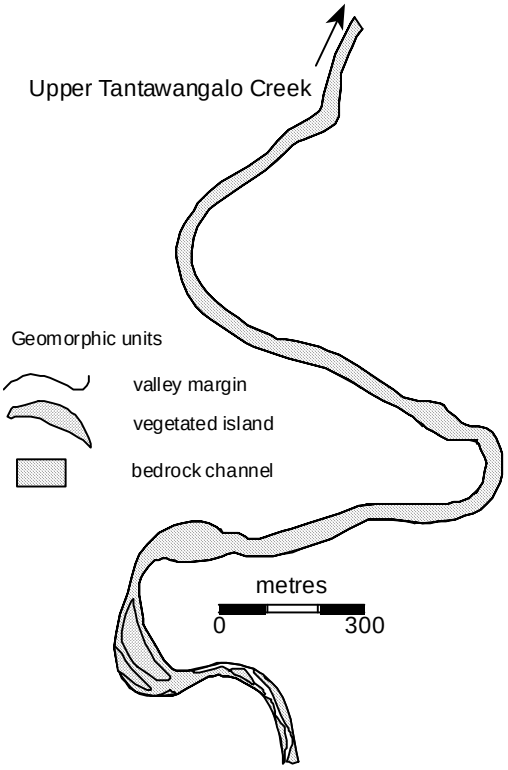
DETAILS OF ANALYSIS
Representative reach**:* Tantawangalo Creek ***Map sheet(s) air photographs used: Nimmitabel 1:25,000 topographic sheet, Bombala air photograph run ***Analysts**:* Kirstie Fryirs, Gary Brierley ***Date**:*17.06.96 ***Upstream grid reference***: 261268 ***Downstream grid reference***: 318251

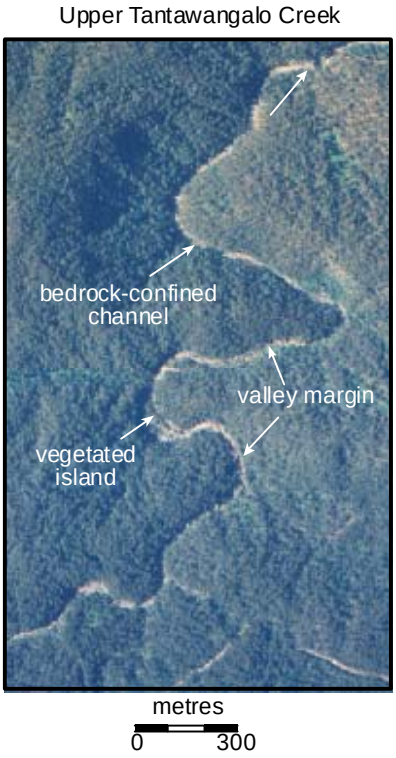
RIVER CHARACTER	
Valley-setting	Confined
River planform	Set within a v-shaped valley, with no floodplain. Stable single channel with low sinuosity. Morphology is imposed by valley shape.
Bed material texture	Bedrock, with angular boulders up to 3 m b-axis.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* • Irregular, bedrock-confined. Channels can be up to 50 m wide.
	Instream – bedrock • **Bedrock and boulder steps (waterfalls)** - Very steep, often vertical. Decrease in size downstream. Can be several metres deep. Bedrock boulders can be up to 3000 mm (b-axis). • **Runs** - Found in narrower, more bedrock confined sections, generally on locally lower slopes. Generally greater than 500 mm (b-axis). Mostly formed from outcropping bedrock. Unvegetated. • **Cascades** –Occur where accumulations of large boulders up to 1 m (b-axis) occur. Water flow is turbulent around and over these boulders. • **Rapids** – Steeper unit than a cascade but comprised of the same materials. Are largely bedrock boulder based, are continuous over the entire channel bed and are found along steeper sections of the reach. • **Bedrock induced pools** - Occur between bedrock boulders or in bedrock based scour holes in gentler sections of the reach.
	Instream – alluvial • **Boulder bars** – Localised, mostly bank-attached features formed behind a large boulder or bedrock outcrop. Comprised largely of boulders or gravels.
	Floodplain • Absent
Vegetation associations	*Instream geomorphic units* • There is little within channel vegetation given the nature of the substrate and the high stream powers generated through the reach.
	Floodplain geomorphic units • Valley margins comprise open forest associations dominated by Eucalypt spp. and some rainforest associations. Very few exotic species occur.

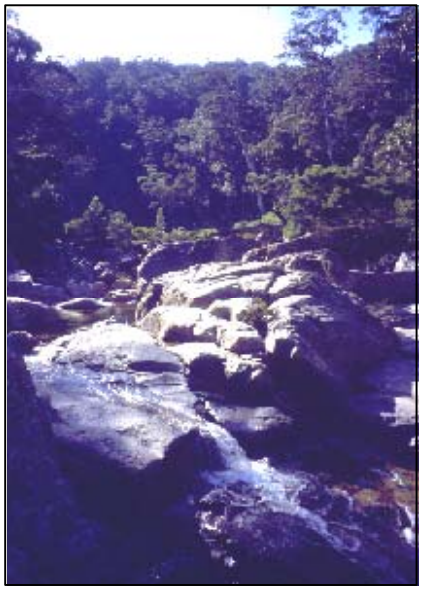
RIVER BEHAVIOUR
Low flow stage Materials supplied to the channel are either flushed downstream or are too large to be moved during anything other than extreme flood events. Heterogeneity in the assemblage of geomorphic units along the reach is a function of slope variation. This heterogeneity on the channel bed, along with the good condition of riparian vegetation, ensure significant hydraulic diversity over the channel bed. Alternating sequences of bedrock steps/waterfalls in steep sections and pools/runs on gentler slopes. Forms a stepped longitudinal profile. ***High flow stage*** Extremely stable channel setting, with limited capacity for adjustment. Steep, fast flowing bedrock confined river with limited sediment storage. As bedrock valley margins form the channel margin, there is no room for lateral movement or floodplain formation. Very high stream powers are able to move coarse bedload and re-arrange the geomorphic unit assemblage on the channel bed, however, in general the assemblage of geomorphic units is dominated by high energy bedrock features. The river acts as a sediment throughput zone, flushing sand and gravel slugs on the channel bed.

CONTROLS	
Upstream catchment area	Often found in headwater locations where catchment areas are low (<20km^2), but along Tantawangalo Creek the Gorge drains an area of >100 km^2.
Landscape unit and within-catchment position	Gorges are set within a deeply incised v-shaped, narrow valleys. Typically found in the rugged settings in upper catchment positions.
Process zone	Sediment throughput zone – bedload dominated
Valley Morphology (size and shape)	10-40 m wide with steep valley side-walls, up to 100 m+ deep
Valley slope	Steepest River Style in catchment. Ranges from 0.04-0.156 m/m with steepest gorge along Tantawangalo Creek.
Stream power	On average 1 in 10 year = 2300 W/m^2; 1 in 100 year = 2770 W/m^2

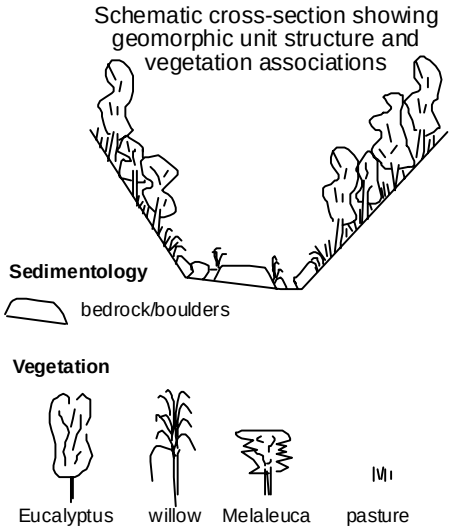
Gorge River Style







Looking upstream along Tantawangalo Creek at Tantawangalo Dam (Photo K. Fryirs)



Confined valley with occasional floodplain pockets River Style

Defining attributes of River Style (from River Styles tree): This River Style is set within a confined valley setting. The channel abuts the valley margin >90% of the time. Occasional floodplain pockets occur behind bedrock spurs or at tributary confluences where the valley is locally wider. These floodplains are generally very narrow and shallow. The channel zone generally comprises of bedrock induced geomorphic units such as pools, runs, and steps with vegetated islands locally storing gravel and sand materials. The channel bed is dominated by bedrock overlayed with a gravel or sand mix.

Subcatchments in which River Style is observed: South Wolumla, Frogs Hollow, South Wolumla, Wolumla, Towridgee, Candelo, Tantawangalo, Sandy, Columbo, Bemboka, Bega, Pollacks Flat, Numbugga, House, Double, Brogo

DETAILS OF ANALYSIS
Representative reach: Bemboka River ***Map sheet(s) air photographs used****:* Bemboka 1:25,000 topographic sheet, 1994 Bega Run 2 # 40, 41 air photographs ***Analysts****:* Kirstie Fryirs, Rob Ferguson ***Date****:* 13.03.98 ***Upstream grid reference****:* 238450 ***Downstream Grid Reference****:* 508308

RIVER CHARACTER	
Valley-setting	Confined
River planform	Channel occupies entire valley floor except where occasional floodplain pockets occur along the channel. These floodplain pockets occur where the valley is locally wider. Channel configuration is dictated by valley alignment. Single-channeled, low sinuosity, laterally stable.
Bed material texture	Bed comprised largely of bedrock, with boulders (up to 1.5m b-axis), gravel or sand occurring around bedrock outcrops, forming a range of geomorphic units. Valley margins comprise steep, bedrock walls.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* • Irregular channel geometry. Channel between 20-80 m wide dependent on location of reach in the catchment and the location of isolated floodplain pockets along the reach. Depth where floodplain pockets occur is often around 2.5 m.
	Instream – bedrock • **Pools** - Mostly bedrock floored. Occur between bedrock outcrops and mid channel bars. • **Runs** - Comprised of bedrock or boulders. • **Bedrock steps/outcrops** – cover the channel bed, steps can be up to 1 m deep.
	Instream – alluvial • **Riffles** – accumulations of gravels and boulders (up to 1.5 m b-axis) between bank attached bars or span the entire channel bed. • **Mid-channel bars** –Shallow features sitting on bedrock. Comprise coarse sands and gravels. Largely unvegetated. • **Bank attached bars** - Overlie bedrock. Primarily consists of coarse sands and gravels. Largely exposed. • **Sand sheets** – cover the entire channel bed between bedrock outcrops. Comprised of coarse sands and gravels. Surficial gravels are up to 150 mm (b-axis). • **Islands** – Elongate with coarse sands and gravels. Vegetated with willows, pasture grasses, exotic weeds. Some native Acacias and small Eucalyptus shrubs. • **Chute channels** – formed on dissect islands and bars.
	Floodplain • **Floodplain** - shallow isolated, discontinuous features. Can be up to tens of metres wide, and several hundred metres long dependant on valley width. Comprised of 2.0 - 1.5 ø massive, homogeneous sands with occasional layers containing 1.0 - 0.5 ø sands. Massive structureless units. Scatterd riparian strip. Larger pockets dominated by pasture. • **Floodchannels** – Can be several tens of metres wide, and several metres deep. They run along the valley margin. • **Scour channels** - around vegetation
Vegetation associations	*Instream geomorphic units* • Eucalyptus, Melaleuca, Casuarina and Acacia spp. trees with dense understorey of exotic weeds. • Woody debris often found at the core of islands and jammed behind bedrock outcrops.
	Floodplain geomorphic units • Floodplains and valley margins have a scattered vegetation coverage. Riparian zone comprise open forest associations dominated by Eucalyptus spp. Pasture dominates the larger floodplain flats.

RIVER BEHAVIOUR

Low flow stage

The diversity of geomorphic units found on the channel bed is dictated largely by bedrock outcrops. The deposition and trapping of gravels and sands in well vegetated islands and localised mid-channel bars is controlled by flow separation around bedrock or woody debris. Step-pool-run sequences are maintained under low flow conditions. These rivers move sediment along the channel bed via downstream propagation of sand or gravel sheets which lead to phases of aggradation and degradation on the channel bed.

Bankfull stage

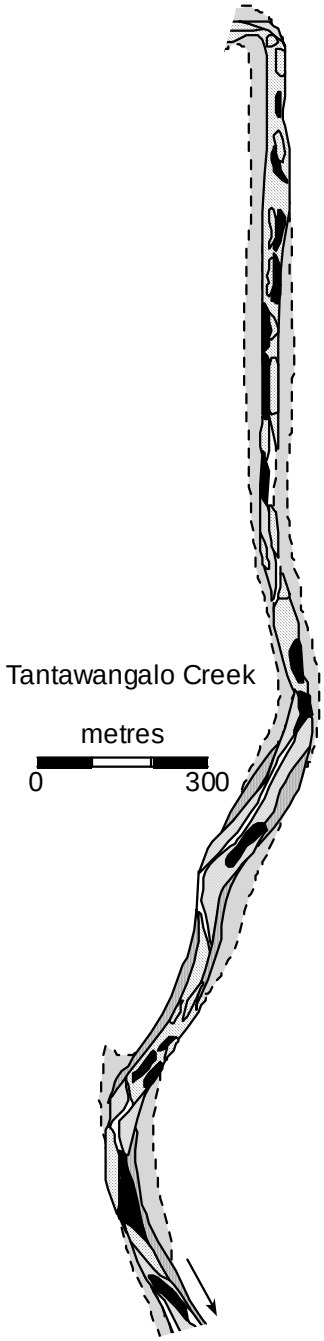
Limited scope for river adjustment given the confined nature of the valley. However, high stream powers are capable of transporting large boulders and reworking bars via bed level aggradation and degradation. Most geomorphic units found in the channel zone are high energy features, with the assemblage dictated largely by the occurrence of bedrock and boulder accumulations. Dissection of mid-channel and bank-attached bars and islands by chute channels occurs under high energy conditions.

Overbank stage

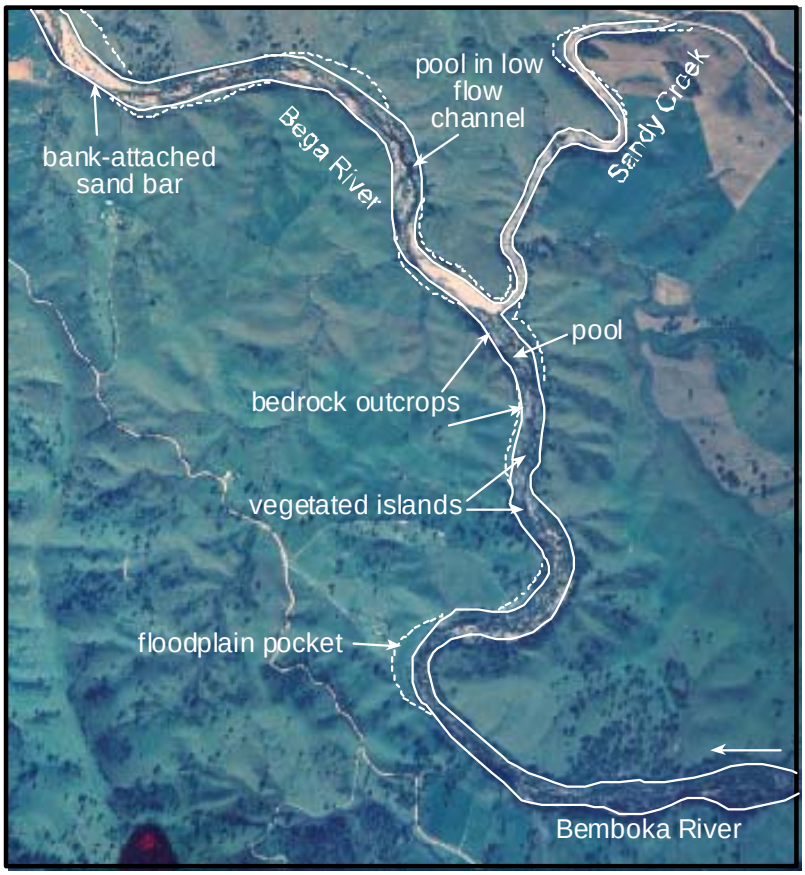
Floodplains are formed via vertical accretion processes with coarse grained material dumped under high energy conditions, and fines deposited from suspension in the waning stages. Where floodplain exists, the channel may degrade and widen under high energy conditions. Under these conditions, the floodplain is often reworked via processes of scour, floodchannel formation or stripping, as the entire valley floor acts as a channel. In some cases, islands are formed by the channel cutting through parts of floodplain attached to bedrock.

CONTROLS	
Upstream catchment area	Ranges from 100-1000 km^2 dependent on location within the catchment.
Landscape unit and within-catchment position	Found in the rounded foothills landscape unit in middle to upper catchment positions. Valley margins can be relatively shallow.
Process zone	Sediment throughput zone – bedload dominated
Valley Morphology (size and shape)	Regular, 60-240 m wide dependent on location within the catchment.
Valley slope	Ranges from 0.005 – 0.029 m/m dependent on position in catchment.
Stream power	On average 1 in 10 year = 390 W/m^2; 1 in 100 year = 730 W/m^2

Confined valley with occasional floodplain pockets River Style



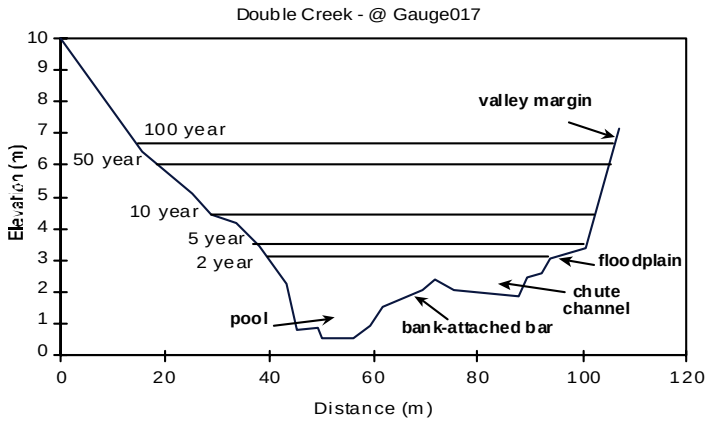
Bemboka-Bega River and lower Sandy Creek

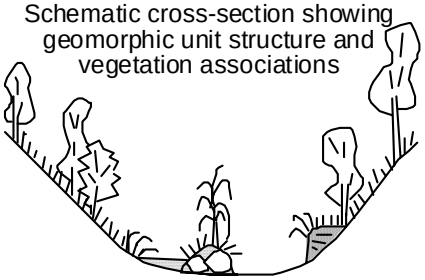


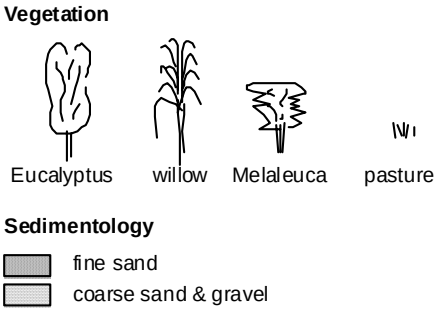
Geomorphic units

- valley fill/flood plain
- pool
- bench/point bench
- sand sheet/sand bar
- vegetated island
- bedrock outcrops
- eroding bank
- low flow channel

Confined valley with occasional floodplain pockets River Style







Looking downstream - Bemboka River at Bemboka (Photo K. Fryirs)

Looking across channel - Bemboka River just upstream of Moran's Crossing (Photo K. Fryirs)

Looking upstream - Sandy Creek just upstream of the Bega River confluence (Photo K. Fryirs)

Looking downstream along Sandy Creek (Photo K. Fryirs)

Partly-confined valley with bedrock-controlled discontinuous floodplain River Style

Defining attributes of River Style (from River Styles tree): Channel abuts valley margin >50% of the time. Hence, channel morphology and alignment are controlled to a significant degree by the sinuous or irregular valley morphology. Floodplain pockets are discontinuous and occur on the insides of sinuous bend downstream of bedrock spurs, and in irregular valleys where they locally widen behind bedrock spurs. Floodplain pockets are of variable character, but are commonly stepped in response to phases of aggradation and stripping. Hence a series of low terraces, floodplains and benches can occur.

Subcatchments in which River Style is observed: Greendale, South Wolumla, Wolumla, Reedy, Candelo, Tantawangalo, Sandy, Colombo

DETAILS OF ANALYSIS
Representative reach : Candelo Creek ***Map sheet(s) air photographs used:*** Candelo and Bemboka 1:25,000 topographic sheet, 1994 Bega Run 5 # 36, 37 air photographs ***Analysts:***Kirstie Fryirs, Rob Ferguson ***Date:***18.01.97 ***Upstream grid reference:*** 404280 ***Downstream Grid Reference:*** 414309

RIVER CHARACTER	
Valley-setting	Partly-confined
River planform	Typically single-channeled with low sinuosity, in a valley which is sinuous, producing alternating pockets of floodplain. The channel may locally divide around islands at bends. Despite channel enlargement and floodplain stripping, channel position is generally stable, as it is commonly pinned against the valley margin. Lateral stability is highly variable with significant concave bank erosion occurring on the outsides of bends.
Bed material texture	Bed materials range from sands to gravels with occasional bedrock outcropping; banks are commonly dominated by massive sand units.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* • Highly variable shape, ranging from asymmetrical compound channels with multiple floodplain surfaces on insides of bends to symmetrical in some straight sections. Channel is relatively wide and shallow. Channel can be up to 50 m wide and 3 m deep. Frequently bounded by bedrock valley margin on one side, with floodplains on the other.
	Instream – bedrock • **Localised bedrock outcrops and steps**.
	Instream – alluvial • **Pools** - Sand based and located along the concave bank. • **Compound point bars with chute channels and ridges** – Found along the convex banks of bends. Coarse sands, 0.5 - 0.0 ø with up to 5 mm clasts. Exposed and unvegetated. • **Lateral bank-attached bars** - Found along inflection points between bends. Coarse sands, 0.5 - 0.0 ø with up to 5 mm clasts. Occasionally colonised by willows. • **Islands** – localised, found along inflection points between bends. Colonised by pasture or willows. • **Sand sheets** - Cover channel bed between bars and bedrock outcrops. Coarse sands, 0.5 - 0.0 ø with up to 5 mm clasts. Unvegetated. • **Benches and point benches** - Primarily occur on convex banks and along inflection points of bends forming a channel marginal step. Interbedded sands with occasional gravels. Pasture dominated.
	Floodplain • **Floodplain pockets** – can be several hundred metres long and tens of metres wide, generally less than 4 m deep. May be multi-leveled, comprising a number of stripped floodplain surfaces and valley marginal terraces. Interbedded vertically accreted sequences of medium and coarse sands over basal fine sands. Dominated by pasture. • **Floodchannels** – generally tens of metreswide and several metres deep. Often run along the valley margin and obliquely across floodplains, often short-circuiting bends.
Vegetation associations	*Instream geomorphic units* • Largely exposed and unvegetated. Exotic weeds and pasture cover some bank-attached features.
	Floodplain geomorphic units • Dominated by pasture and occasional willows and exotic weeds.

RIVER BEHAVIOUR

Low flow stage

In events lower than bankfull, flow is concentrated on the outsides of bends and around mid-channel islands, or over a sand sheet. Material is progressively transferred from point bar to point bar producing a balance in the sediment inputs and outputs. Although high stream powers can be generated in these partly-confined valley settings, the channel is relatively stable with little capacity for lateral adjustment as it is commonly pinned against bedrock valley margins at concave banks. Under these conditions, the floodplain pockets are protected by bedrock spurs.

Bankfull stage

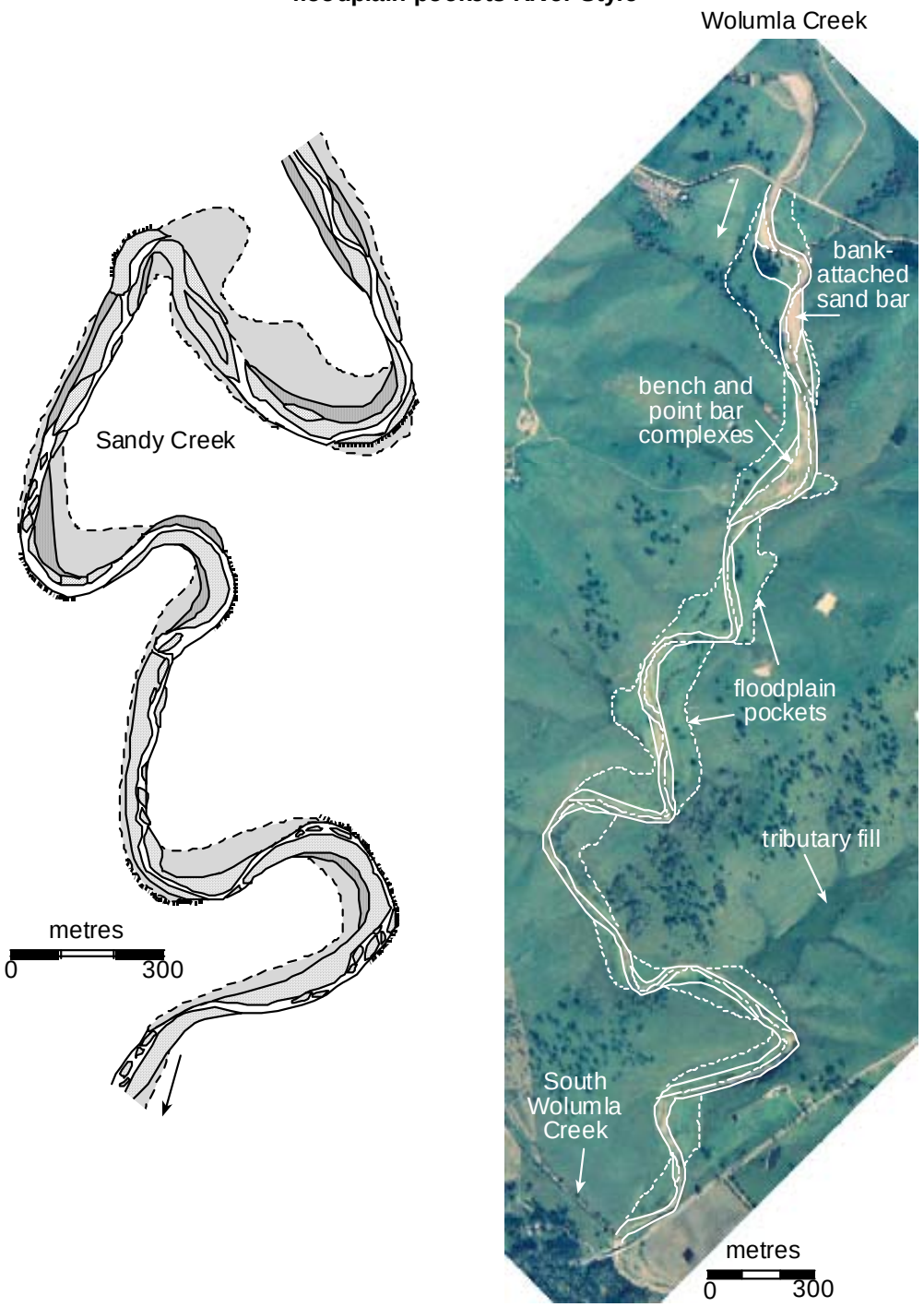
At bankfull stage, high energy conditions are produced and the channel is prone to widening (where it can locally adjust – i.e. where floodplains occur). Overwidened channels, permit extensive point bar and point bench formation. Sediment movement occurs via episodic erosion of concave banks (via planform controlled erosion processes), and deposition on point bars along the reach. Flow alignment is shifted towards the inside of the bend and erosional surfaces (for which the term 'ledge' is preferred), and point bars are formed. These point bar surfaces are often formed and reworked, leading to the formation of compound features comprising discrete assemblages of erosional and depositional features. These can include chute channels and ridges. Pockets of floodplain that are dissected and abandoned, and subsequently colonised by vegetation can form islands. Benches and point benches can reflect channel recovery/contraction after expansion with the 'plastering' of sediment along the margins of an overwidened channel. This produces a distinctly stepped feature along the channel margin. Islands which occur in mid-channel locations are dissected and pools are scoured.

Overbank stage

Fine-grained sedimentation via vertical accretion occurs on floodplains. Under these conditions, suspended load deposition around vegetation or behind bedrock spurs occurs. Massive sand units result. When high energy flows combine with devegetated conditions, floodplain scour or stripping occurs. Reworking results in the formation of floodchannels as flow short circuits a bend. Stripping occurs when the entire surface of the floodplain is removed. Terrace surfaces are rarely inundated.

CONTROLS	
Upstream catchment area	Ranges from 30-200 km^2 depending on position of reach in the catchment.
Landscape unit and within-catchment position	Found in the rounded foothills landscape unit in middle to upper catchment positions. Valley margins can be relatively shallow.
Process zone	Sediment transfer zone – bedload dominated
Valley Morphology (size and shape)	Irregular to sinuous valley which is ranges from 40-210 m wide. Produces discrete, discontinuous floodplain pockets.
Valley slope	0.005-0.012 m/m depending on location in catchment.
Stream power	On average 1 in 10 year = 410 W/m^2; 1 in 100 year = 1030 W/m^2

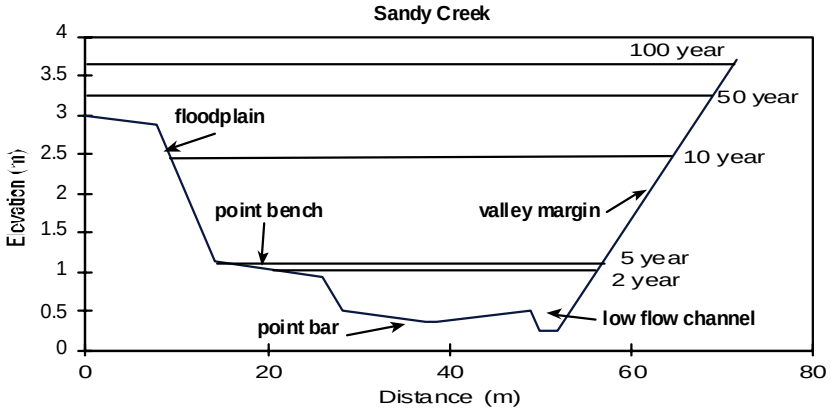
Partly-confined valley with bedrock-controlled discontinuous floodplain pockets River Style



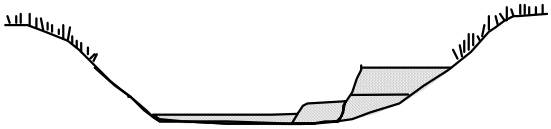
Geomorphic units

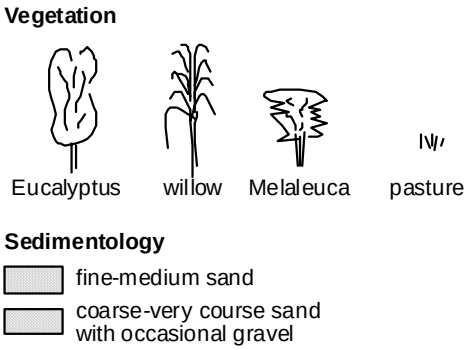
valley fill/flood plain
pool
bench/point bench
sand sheet/sand bar
vegetated island
eroding bank
low flow channel

Partly-confined valley with bedrock-controlled discontinuous floodplain pockets River Style



Schematic cross-section showing geomorphic unit structure and vegetation associations





Looking downstream - Candelo Creek near Candelo township (Photo K. Fryirs)

Looking upstream - Greendale Creek near Frogs Hollow confluence (Photo K. Fryirs)

Intact valley fill River Style

Defining attributes of River Style (from River Styles tree): Wide valley floor contains a continuous muddy swamp with no channel.

Subcatchments in which River Style is observed: Frogs Hollow, Towridgee (Ryans Swamp)

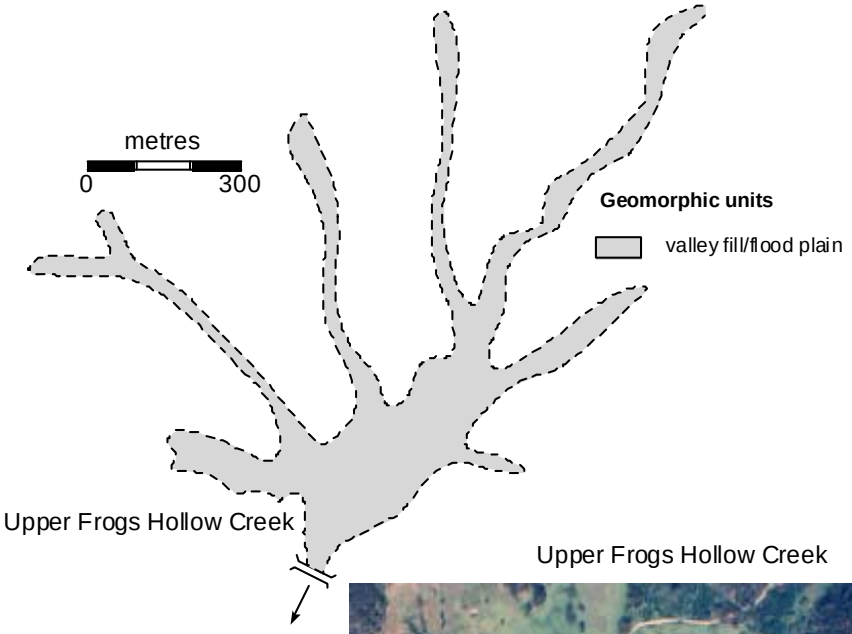
DETAILS OF ANALYSIS
Representative reach: Frogs Hollow Creek ***Map sheet(s) air photographs used:*** Wolumla 1:25,000 topographic map; 1994 Bega Run 7 # 138, 139 air photographs ***Analysts:***Kirstie Fryirs ***Date:*** 13.06.96 ***Upstream grid reference***: 492190 ***Downstream grid reference***: 497201

RIVER CHARACTER	
Valley-setting	Alluvial
River planform	Alluvial valley containing an intact valley fill surface that covers the entire valley floor. No channel is present. Swamp surface has a convex cross-profile.
Bed material texture	Valley floor texture dominantly fine sand and organic rich mud with localised drapes of 1-0.5 ø sand with occasional gravels up to 2 mm.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* Channel is largely absent. Discontinuous watercourses characterise the downstream end of the swamp. Is up to 1 m deep and 2 m wide and is located just upstream of the nickpoint (ie. at Candelo-Wolumla Road).
	Instream – bedrock N/a
	Instream – alluvial N/a
	Floodplain Intact swamp/valley fill surface - extends up to 190 m wide and 1200 m long and 9 m deep. Alternating sand and mud units. Mud units are 3.5-3 ø and up to 200 cm thick. Sand units are 1-2 ø with up to 3 mm clasts and are up to 200 cm thick. Most units are massive in structure.
Vegetation associations	*Instream geomorphic units* N/a
	Floodplain geomorphic units Predominantly pasture and tussock, but some sections contain intact vegetation associations. A distinct pattern of vegetation associations exists in this swamp. At the swamp margins and between bedrock spurs, *Melaleuca ericifolia* colonise a closed swamp scrub. In the central swamp zone, on the valley fill itself, *Juncaceae sp* and *Poaceae sp* form a hummock grassland. Exotics also colonise the central swamp zone.

RIVER BEHAVIOUR
Low flow stage Water is stored subsurface with seepage occurring along sections of the valley that lie at lower positions. Swamp maintains base flow conditions in this section of the catchment. *High flow stage* Water flows across the surface as sheet flows during high intensity rainfall events. Sediments are deposited from suspension as water spreads over the intact valley fill surface. Large quantities of organic matter become incorporated into these swamps. Occasional sand splays may occur in large flood events forming lobes on the surface. Valley fills are sites of medium to long term storage of sediments and organic rich deposits.

CONTROLS	
Upstream catchment area	<5 km^2
Landscape unit and within-catchment position	Low lying to undulating country located at the base of the escarpment.
Process zone	Sediment accumulation zone. These features remain stable for extended periods of time (1000's of years). Suspended load dominated. Frogs Hollow swamp stores over 1 million cubic metres of sediment.
Valley Morphology (size and shape)	Regular, deep, flat-bottomed valleys that decrease in width downstream. Frogs Hollow swamp is up to 190 m wide.
Valley slope	0.028 m/m - swamp surface
Stream power	Low, 1 in 10 year = 23 W/m^2; 1 in 100 year = 98 W/m^2

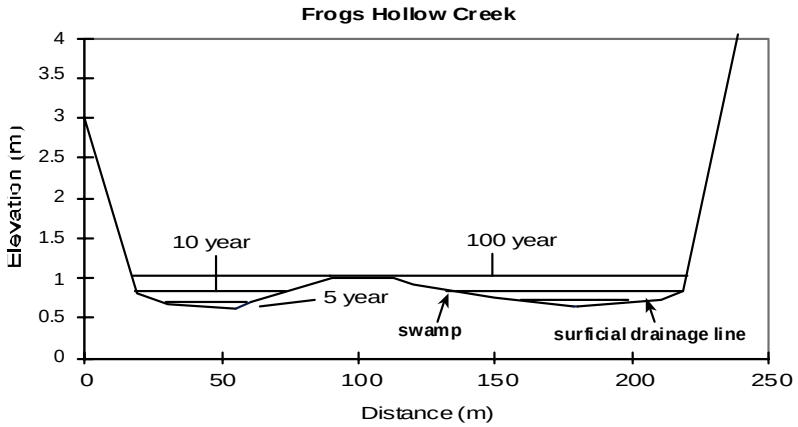
Intact valley fill River Style



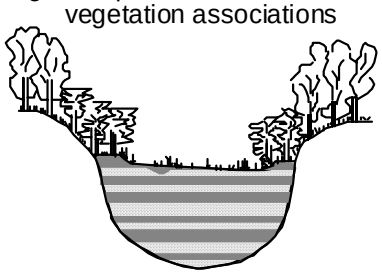
Upper Frogs Hollow Creek

metres
0
300

Intact valley fill River Style

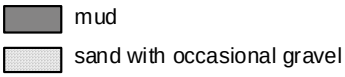


Schematic cross-section showing geomorphic unit structure and vegetation associations



Vegetation

Sedimentology



Looking upstream from Candelo-Wolumla Road at Frogs Hollow swamp (Photo K. Fryirs). Note the intact swamp vegetation association in the left middleground.

Floodout River Style

Defining attributes of River Style (from River Styles tree): Wide alluvial valley contains a continuous unincised surface over which sand sheets are deposited at the mouth of a discontinuous channel.

Subcatchments in which River Style is observed: Frogs Hollow

DETAILS OF ANALYSIS
Representative reach: Frogs Hollow Creek ***Map sheet(s) air photographs used:*** Wolumla 1:25 000 topographic sheet; 1994 Bega Run 7 # 138, 137 air photographs ***Analysts:*** Kirstie Fryirs ***Date:*** 26.06.96 ***Upstream grid reference***: 497215 ***Downstream grid reference***: 499237

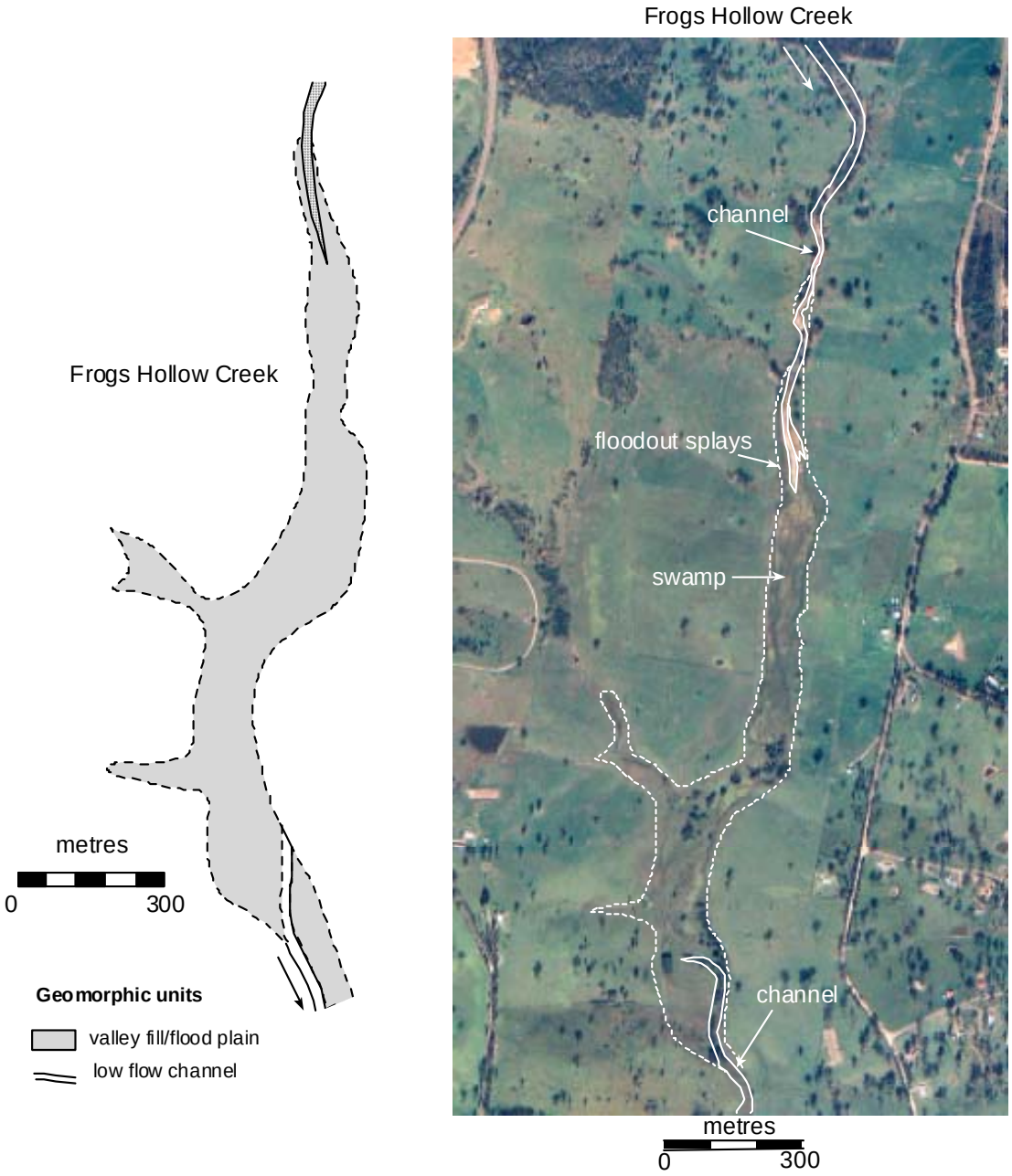
RIVER CHARACTER	
Valley-setting	Alluvial
River planform	Alluvial valley containing an unincised surface. Discontinuous gully/channel located upstream of sand lobes or fans deposited at the mouth of the channel over the valley fill surface (called a floodoout deposit).
Bed material texture	Valley floor texture characterised by sand sheet and swamp sediments. Sand sheets dominated by 1-0.5 ø with occasional gravels up to 2 mm. Swamp sediments dominated by muds < 3.5 ø.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* • Discontinuous channel often symmetrical. Width-depth ratio increases downstream as the channel terminates at the inflection point to the floodout.
	Instream – bedrock N/a
	Instream – alluvial Discontinuous channel characterised by sand sheets and lateral bars, composed mainly of sand.
	Floodplain • Intact swamp or valley fill surface extends up to 150 m wide and 1.75 km long; often sand dominated close to the mouth of the discontinuous channel and mud dominated further downstream in the seepage zone. Sand lobes/sheets extend roughly 500 m from the intersection point of the upstream discontinuous gully. Muds are deposited from suspension in seepage zones in downstream sections.
Vegetation associations	*Instream geomorphic units* N/a
	Floodplain geomorphic units • Floodout predominantly pasture and tussock, but some sections contain intact vegetation associations dominated by tall sedges and tussock grasses lined with *Melaleuca spp*. and *Acacia spp*. • Margins of discontinuous channel characterised by open forest association.

RIVER BEHAVIOUR
Low flow stage Will have a series of convex shaped lobes that extend from the mouth of the discontinuous gully. Water generally flows subsurface during low flow conditions. Generally characterised by a down-valley fining of the fan/lobe surface extending into a swampy seepage zone. In upstream sections, sand sheets/lobes are deposited on the valley fill surface in the form of a floodout. This feature stores sediment derived from the upstream incised channel. As flows are dissipated over the surface of the intact valley fill, suspended load sediments (muds) are deposited in a seepage zone downstream of the floodout sand sheets. ***High flow stage*** Water flows across the surface as sheet flows during these high intensity rainfall events. Flow that is concentrated within the discontinuous channel leaves the confines of the channel and spreads and dissipates its energy over the unconfined valley floor at the mouth of the discontinuous channel. In this zone, sediments are deposited from the flow in a fining downstream sequence. Coarse materials are deposited as bedload at the head of the floodout and fine downstream until suspended load materials are deposited in the seepage zone downstream. Large quantities of organic matter can become incorporated into these seepage zones. As individual fans/lobes build vertically the difference in elevation leads to the shifting of depositional lobes over the surface. The broad structure of floodout complexes remains stable for extended periods of time (1000's of years), but fans/lobes will shift recurrently.

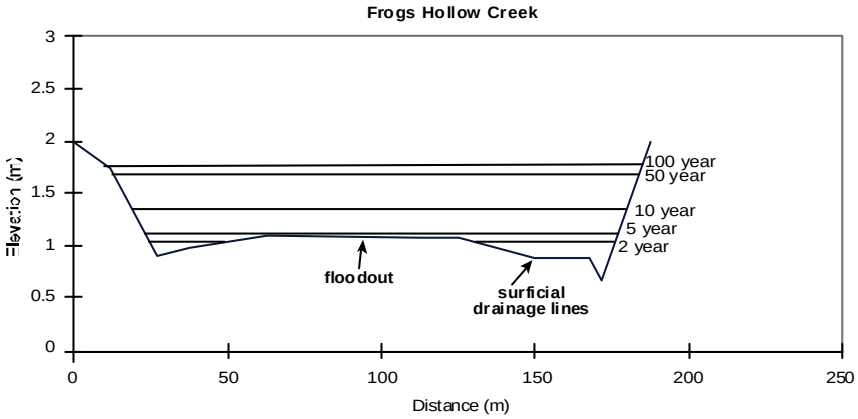
CONTROLS	
Upstream catchment area	<10 km^2
Landscape unit and within-catchment position	Low lying to rolling foothills where the floodout occurs in a mid-catchment location.
Process zone	Sediment accumulation zone. Suspended load dominated. The intact valley fill stores a large

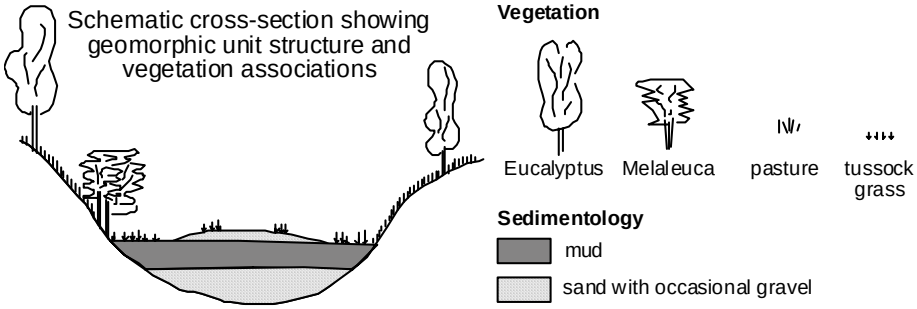
	volume of material in a mid-catchment location.
Valley Morphology (size and shape)	Regular, deep, flat-bottomed valley up to 150 m wide.
Valley slope	0.010 m/m - valley fill surface
Stream power	Low, 1 in 10 year = 25 W/m^2; 1 in 100 year = 102 W/m^2

Floodout River Style



Floodout River Style





Looking downstream from floodout splay along Frogs Hollow Creek (Photo K. Fryirs). Note sandy floodout splay and discontinuous channel in the middleground.

Low sinuosity boulder bed River Style

Defining attributes of River Style (from River Styles tree): Continuous boulder floodplains line both channel banks. The channel abuts the valley margin along <10% of its length. This River Style is a steep, high energy system which can transport large boulders in moderate to high magnitude events. The channel is laterally stable, but tributary streams shift over the fan surface. The low sinuosity channel bed comprises an array of geomorphic units including boulder bars, islands, cascades and occasional bedrock-induced pools and steps.

Subcatchments in which River Style is observed: Bemboka River

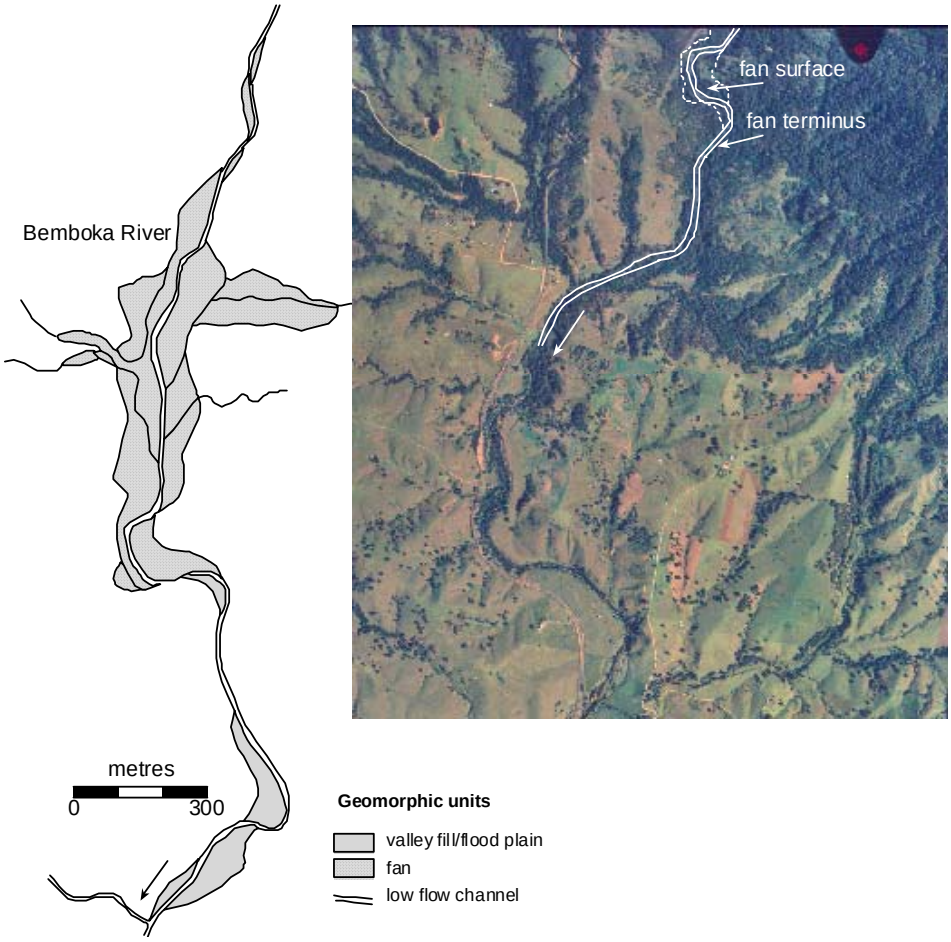
DETAILS OF ANALYSIS
Representative reach: Bemboka River at Power station ***Map sheet(s) air photographs used:*** Nimmitabel and Yankees Gap 1:25,000 topographic sheets; 1994 Bega Run 1 # 189, 190 air photographs (see also Bombala Runs) ***Analysts****:* Kirstie fryirs, Rob Ferguson ***Date****:* 15.01.97 ***Upstream grid reference***: 214469 ***Downstream grid reference***: 238450

RIVER CHARACTER	
Valley-setting	Alluvial
River planform	Single channel with low sinuosity. Often fan like in planform view. Channel is confined by the coarse nature of materials into which it has incised. Given the coarse boulder nature of materials the trunk stream is laterally stable, but there is evidence of tributary channel shifting over the fan surface.
Bed material texture	Gravel and boulders up to 1.5m (b-axis). Composite banks comprise coarse gravel/boulders forming an open famework. In places a fine-grained matrix supports large boulders and gravels.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* Symmetrical to irregular, up to 50 m wide and 4 m deep. Channel has incised into the alluvial fans which extend from the base of the escarpment. Within channel morphology is varied depending on the assemblage of bedrock and boulder geomorphic units.
	Instream – bedrock • **Bedrock controlled pools** - < 50 m long alternate with runs and cascades or occur as plunge pools below bedrock steps. • **Bedrock steps** - up to 1 m deep
	Instream – alluvial • **Runs, cascades, rapids** - consist of a continuous sequence of boulders. Extend across the channel bed and longitudinally for several hundred metres. Different flow types dependent on local slope conditions (i.e. cascades are steeper than runs). • **Gravel/boulder bars and islands** - up to 200 m long dissected by chute channels < 20 m wide. Comprised of boulders up to 1.5 m (b-axis) with a gravel and organic matter matrix. • **Boulder-induced pools** – up to 1 m deep, 3 m wide and 5 m long. Contain gravels up to 500 mm b-axis.
	Floodplain • **Fan surface** – comprised a number of coalesced fans at the mouth of valleys to form an extensive steep, convex-up surface. Comprised of subrounded and subangular boulders up to 2000 mm (b-axis) in a clast supported matrix of gravels up to 500 mm (b-axis). • **Flood channels** - 20 m wide and up to 200 m long. • **Abandoned palaeochannels** - < 20 m wide, extend from tributary valleys.
Vegetation associations	*Instream geomorphic units* • Channel vegetation largely confined to island surfaces. Casuarinas, Eucalypts and Acacias dominate with occasional *Lomandra sp*. lining pools. Woody debris often found 'stuck' on islands amongst vegetation or spanning the low flow channel.
	Floodplain geomorphic units • Floodplains largely comprise a continuous open-forest vegetation association.

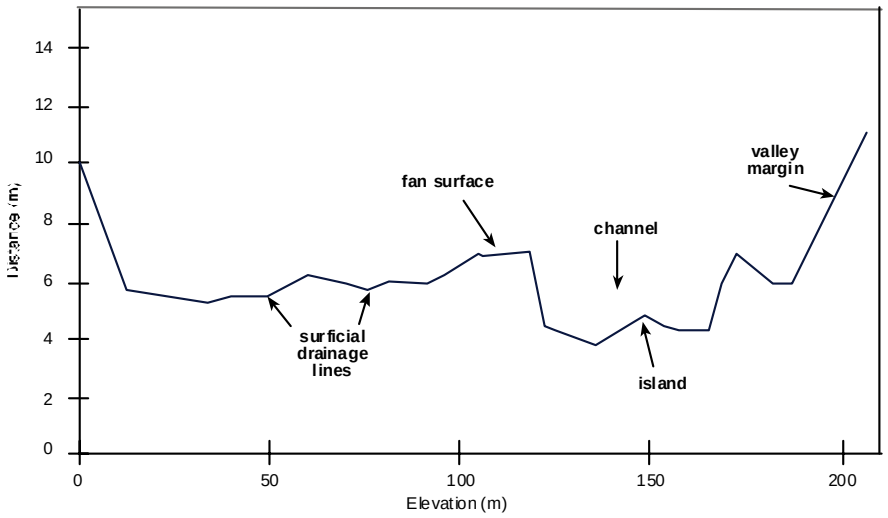
RIVER BEHAVIOUR
Low flow stage Given the material mix of the channel bed and the floodplains, material reworking or deposition is limited to the high flow regime. Low stage flow around coarse substrate and islands/bars dominates. This produces significant hydraulic diversity over the channel bed. Flow variability at low flow stage is characterised by pools between bedrock outcrops and bank attached-channel bars which dominate gentler sections of this channel, and steps and cascades occur in steeper sections. ***Bankfull stage*** At bankfull stage, flow energy is sufficient to locally move large boulders. Bars are dissected or formed behind obstructions and woody debris is moved. Steep gradients and high transport capacities means that these rivers continually throughput coarse sediments. ***Overbank stage*** Under overbank flow conditions abandoned channels are reactivated. Lobes of coarse grained material can be splayed over the floodplain surface. Given the drop in flow velocities once flow leaves the channel, coarse sediments are largely deposited along the proximal floodplain zone, building up a ridge along the primary channel. This produces a convex-up cross-valley profile.

CONTROLS	
Upstream catchment area	< 150 km^2.
Landscape unit and within-catchment position	Located at the base of the escarpment and immediately downstream of gorges on steep slopes.
Process zone	Accumulation/throughput – bedload dominated. Channel is steep and effectively flushes any material made available to it. No readily transportable sand material is stored on the channel bed. Bedload dominated by boulders.
Valley Morphology (size and shape)	Regular shaped valley up to 200 m wide.
Valley slope	0.029 m/m
Stream power	1 in 10 year = 390 W/m^2; 1 in 100 year = 1190 W/m^2

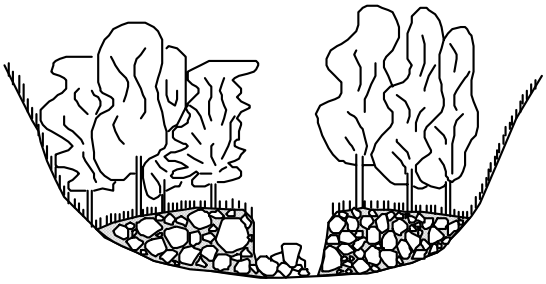
Low sinuosity boulder bed River Style



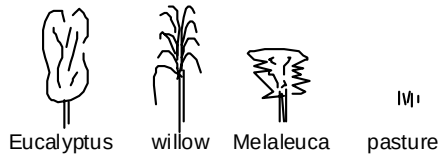
Low sinuosity boulder bed River Style



Schematic cross-section showing geomorphic unit structure and vegetation associations



Vegetation



Sedimentology

Looking upstream - Bemboka River.
Fan surface to left of photo
(Photo K. Fryirs)

Low sinuosity sand bed River Style

Defining attributes of River Style (from River Styles tree): This River Style is found in an alluvial valley setting, where the channel abuts the valley margin <10 % of the time. It has continuous floodplains along these valley margins. The macrochannel has a low sinuosity, is single thread, and is relatively stable. The channel comprises an assemblage of sand dominated geomorphic units and the floodplain comprises a levee in proximal locations, extending to backswamps in distal sections. Floodchannels short cut the floodplain. Vegetated bars and sand sheets are dissected at low flow stage, and are set within the macrochannel.

Subcatchments in which River Style is observed: Bega, Brogo

DETAILS OF ANALYSIS
Representative reach: Lower Bega River at Grevillea winery ***Map sheet(s) air photographs used:*** Bega 1:25,000 topographic sheet; 1994 Bega Run 7 # 133, 134 air photographs ***Analysts:*** Kirstie Fryirs ***Date:*** 30.01.97 ***Upstream grid reference***: 508308 ***Downstream grid reference***: 527378

RIVER CHARACTER	
Valley-setting	Alluvial
River planform	Continuous floodplains along both valley margins. Macrochannel is single-thread, laterally stable and of low sinuosity. Low flow channels divide around islands forming an anabranch type network within the macrochannel. Floodchannels short circuit the floodplain.
Bed material texture	Sand sheets line the channel bed. Dominated by 0--0.5 ø sands with gravels up to 15 mm.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* • The macrochannel has a symmetrical but irregular shape, given the assemblage of within channel ridges and channel marginal benches. The macrochannel is wide (up to 165 m) and shallow (<6 m).
	Instream – bedrock N/a
	Instream – alluvial • **Runs and shallow pools** – elongate and shallow. Coarse sands dominated by 0--0.5 ø with gravels up to 15 mm. • **Mid-channel and bank-attached lateral bars** – Elongate, several tens of metres wide and tens of metres wide. Primarily trough cross bedded sands. Unvegetated. • **Benches** – Average around 5 m deep and 15 m wide. Line the channel banks. Basal planar bedded bar sediments are overlayed with vertical and oblique accretion deposits composed of fine sands and organic silts and muds. Choked with exotics species and native species including, river oaks, ragweed, African lovegrass, basket willows, weeping willows, privet and kikuyu. • **Elongate islands** - Average around 250 m long, 40 m wide and 2.5 m deep. Can be up to 500 m long and 75 m wide. Are often elevated as high as the channel banks. Dominantly trough cross bedded sands interbedded with thin organic layers deposited via trapping of fine materials around vegetation. Basal parts consist of coarse sand and gravels. Choked with exotic and native species including poplars, ragweed, basket willows, African lovegrass, river oaks, kikuyu and privet. • **Sand sheets** - Cover the entire channel bed. Coarse sands dominated by 0--0.5 ø with gravels up to 15 mm. Unvegetated or colonised with willow seedlings.
	Floodplain • **Floodplain** – Can be up to 6 m above the channel bed at the levee crest, or a shallow as 1m where sand sheets have filled the channel. Interbedded medium sands and fine organic layers. With occasional thick coarse sand units consistent with sand sheet deposits. At depth fine organic rich muds represent the pre-disturbance floodplain. Colonised with pasture and crops with occasional willows. • **Proximal levees** – Can be to 6 m above the channel bed. Located at proximal floodplain locations. Interbedded medium sands and fine organic layers. With occasional thick coarse sand units consistent with sand sheet deposits. At depth, fine organic rich muds represent the pre-disturbance floodplain. Colonised largely by willows and other exotic species. • **Distal backswamps** - Up to 150 m wide and 300 m long. Located in distal floodplain locations. Upward coarsening, from basal muds to fine sands deposited from overbank flood events. Colonised by reeds and phragmites and *Melaleuca spp*. • **Floodchannels** - Long, thin scour feature, connected to the channel at the head, but not downstream. Cut into a swale on the floodplain. Up to 5 m deep, 15 m wide and 600 m long. Bed characterised by coarse sands (1-0.5 ø) with occasional gravels up to 25 mm. Exposed and actively eroding bedload materials in high flow. Small Casuarina and Acacia shrubs scattered along the banks. • **Sand sheets** – Up to two metres thick, fine towards the valley margin. Colonised by pasture.

RIVER CHARACTER	
Vegetation associations	*Instream geomorphic units* • Islands and benches are infested with exotic vegetation species including willows, couch, kikuyu, African lovegrass, poplars, privet and ragweed. Some native species do exist including various Acacia spp. and river oaks. A large number of willow seedlings have also colonised the large sand sheets. Sand sheets that occupy the low flow channels are unvegetated and exposed.
	Floodplain geomorphic units • Floodplains cleared for pasture. However, riparian zone is densely vegetated with willows, scattered casuarina, privet, lomandra, lantana, tobacco, kikuyu and assorted weeds. Backswamps colonised by aquatic vegetation dominated by phragmites and Melaleuca spp.

RIVER BEHAVIOUR

Low flow stage

Flow is restricted to shallow runs and pools. In many cases flow is subsurface within extensive sand sheets that cover the channel bed. Hydraulic diversity is limited.

Bankfull stage

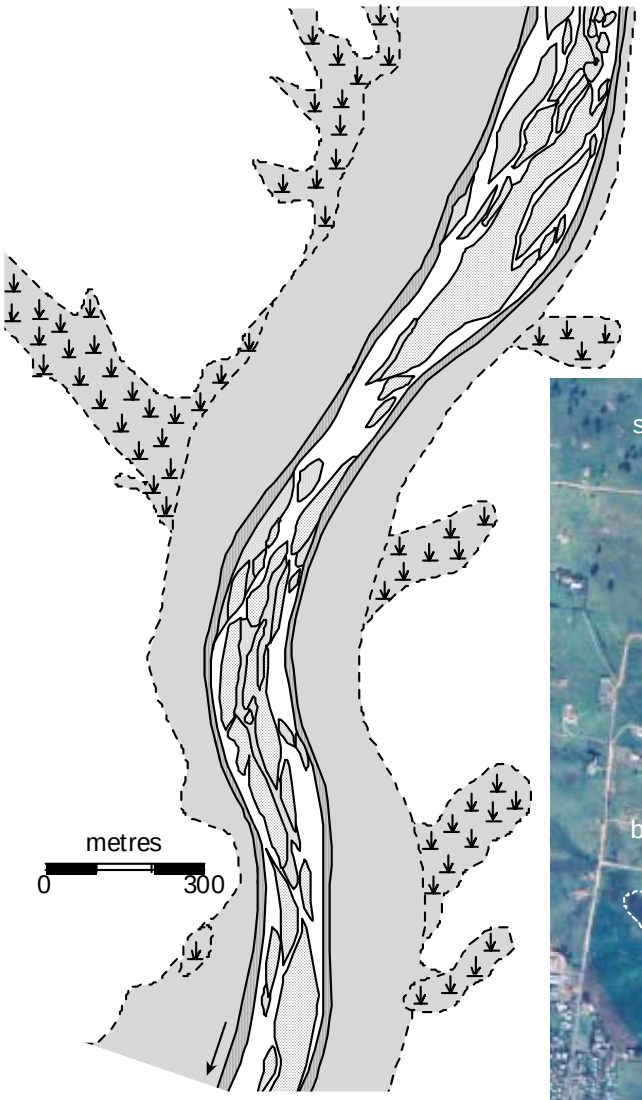
At bankfull stage island complexes and mid-channel bars are formed and reworked. Large volumes of material are moved through this reach in low-moderate flood events. Sediment is plastered against the channel margins to form obliquely accreted benches. On the falling stage of these events large volumes of sand and organic material are deposited on the islands and benches allowing them to accrete vertically and laterally. The colonisation of exotic vegetation in the within channel zone aided aggradation and initiated the formation of these large islands and channel marginal benches. Islands within the channel zone are often elevated above the channel, indicating that they are still forming as flows begin to go overbank.

Overbank stage

Shallow, wide, trench-like channel ensures that floodplain inundation occurs in 5-10 year recurrence interval flood events. Floodplains along this River Style are formed largely through vertical accretion processes. In overbank floods, levee-backswamp complexes are formed by distal fining of sediments as flows are spread over the floodplain. In highly sediment charged overbank events, extensive planar sand sheets can be deposited on the floodplain. Floodchannels indicate the potential for significant reworking of floodplain deposits during high flow stage. Alternatively, where riparian vegetation has been disturbed channel expansion is a common form of floodplain reworking along these river courses.

CONTROLS	
Upstream catchment area	Between 500-1840 km^2
Landscape unit and within-catchment position	Found in the most downstream catchment position, along the lowland plain.
Process zone	Accumulation. Bedload dominated
Valley Morphology (size and shape)	Wide, open valley-setting typically <1000 m wide. Widen downstream into Jellat Jellat Flat to several kilometres wide.
Valley slope	Range between 0.002-0.0008 m/m and lower close to the tidal limit.
Stream power	On average 95 Wm^2 for the 1 in 10 year event; 280 Wm^2 for the 1 in 100 year event

Low sinuosity sand bed River Style



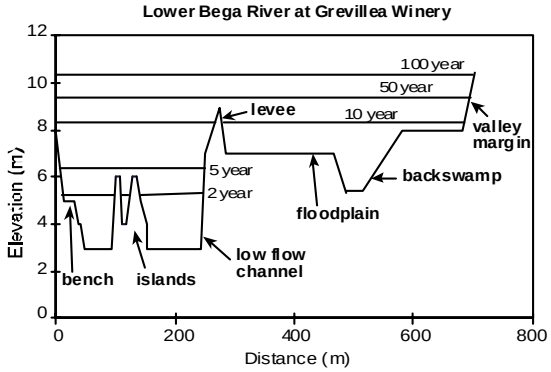
Lower Bega River at Bega township

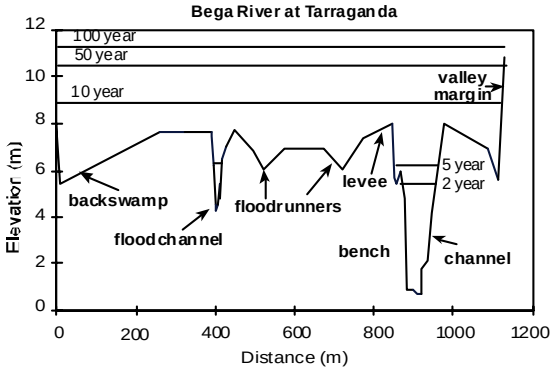
Lower Bega River at Bega township
metres
0 300

Geomorphic units

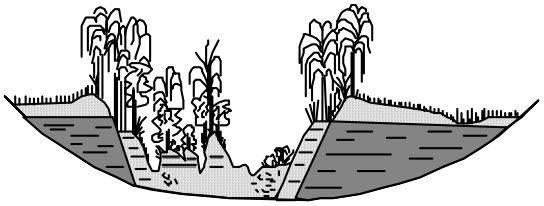
- valley fill/flood plain
- backswamp
- bench/point bench
- low flow channel
- sand sheet/sand bar
- vegetated island

Low sinuosity sand bed River Style

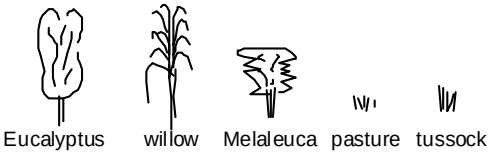




Schematic cross-section showing geomorphic unit structure and vegetation associations



Vegetation



Sedimentology

mud

medium to coarse sand

Looking upstream - Lower Bega River at Bega (Photo G. Brierley)

Lower Bega River at Grevillea Winery (Photo G. Brierley)

Backswamp - Lower Bega River at Grevillea Winery (Photo K. Fryirs)

Looking downstream - Lower Bega River at Bega (Photo G. Brierley)

Looking downstream - Lower Bega River at Princes Highway Bridge (Photo K. Fryirs)

Looking downstream - Lower Bega River just upstream of Wolumla Creek confluence (Photo K. Fryirs)

Channelised fill River Style

Defining attributes of River Style (from River Styles tree):
This River Style is found in an alluvial valley setting, where the channel abuts the valley margin <10 % of the time. It has continuous perched, flat topped valley fills along both valley margins. The incised trench has a low sinuosity, is single thread, and is aligned down the centre of the valley. When expanding the channel is laterally unstable. The channel comprises an assemblage of sand and/or mud dominated geomorphic units including sand sheets, inset features, bank-attached and mid-channel bars, and a swampy low flow channel.

Subcatchments in which River Style is observed: Greendale, South Wolumla, Wolumla, Reedy, Sandy, Colombo, Pollacks Flat, Numbugga

DETAILS OF ANALYSIS
Representative reach**:* Wolumla Creek ***Map sheet(s) air photographs used: Wolumla 1:25,000 topographic sheet; 1994 Bega Run 5 # 40, 41 air photographs ***Analysts**:* Kirstie Fryirs ***Date**:*18.06.96 ***Upstream grid reference***: 423187 ***Downstream grid reference***: 448224

RIVER CHARACTER	
Valley-setting	Alluvial
River planform	Single channel aligned down the central axis of the valley. Channel has a low sinuosity and is laterally unstable. Continuous valley flats line both margins of the valley. Valley width are generally less than 300 m wide.
Bed material texture	Continuous, exposed, loose sand sheets composed mainly of 1-0.5 ø sands. Occasional gravels up to 250 mm (b-axis). Some mud accumulates along the low flow channel. Occasional bedrock outcrops occur.
Geomorphic units (geometry, sedimentology)	*Instream - channel geometry* • Symmetrical trench-like channel. Channels can be up to 160 m wide and 12 m deep. Compound cross section consists of numerous terrace, valley fill and inset levels. Banks are characterised by alternating sequences of muds and sands.
	Instream – bedrock • **Bedrock outcrops and steps** – occasionally where channel has incised to bedrock.
	Instream – alluvial • **Sand sheets** – Cover the bed of the incised trench. Surficial gravels can be up to 150 mm (b-axis). Are poorly sorted and loose. Unvegetated. • **Bank-attached bars and mid-channel bars** - Located along the channel margins or on the floor of the trench. Can be several hundreds of metres long and tens of metres wide. Surficial gravels can be up to 150 mm (b-axis), but are largely dominated by sands and poorly sorted, loose gravels. Some colonised by tussock grasses, most are unvegetated • **Inset benches** - Between 2 m and 20 m wide and between 1 m and 6.5 m deep. Highly discontinuous, with up to four levels present in any one cross-section. Comprised of alternating, sand and thin mud units. Mud units on the surface are up to 200 mm thick and then around 30-50 mm thick down profile. Sand units are up to 200 mm thick and massive, or are thin and planar bedded. Colonised by exotic weeds such as blackberry and pasture. • **Swampy low flow channel** – Muds accumulating in the low flow channel zone form a discontinuous channel within the incised trench.
	Floodplain • **Valley fills** – Can be up to 12 m deep and 100 m wide. Continuous along both valley margins. Alternating sand and mud units. Commonly mud units are 3.5-3 ø and up to 2000 mm thick. Sand units are 1-2 ø with up to 3 mm clasts and are up to 2000 mm thick. Some sand units are planar bedded, but most are massive but poorly sorted. Up to 25 bedded units within some exposures. Poor, pasture associations exist. Weeds, eg blackberries, protect a lot of the banks. Scattered trees and exotics in the riparian zone. Localised swamp associations in trapped tributary fills located at valley margins. • **Terraces** – Localised, but can be up to 12 m deep and 30 m wide. Interbedded coarse sands and gravels, up to 200 mm (b-axis). No muds. Colonised by Eucalypts and Acacias, pasture grasses.
Vegetation associations	*Instream geomorphic units* Largely unvegetated, but inset benches and bars can be dominated by tussock or exotic weeds.
	Floodplain geomorphic units Pasture and exotic weed species are the dominant vegetation associations. Occasional trees do occur.

RIVER BEHAVIOUR

Low flow stage

This River Style is the product of the channelisation of intact fills through gully processes. In general, gullies are formed through the headward extension of a headcut. The incision of a channel through a fill alters the hydrological characteristics of the fill, by allowing water to escape the landscape at a greatly increased rate, leaving former swamp surfaces perched above the channel bed.

The within channel assemblage of geomorphic units is not highly varied, providing little variability along the channel bed and floodplain. Structure is largely homogeneous, but sediment storage in valley fill and within channel is high. For the majority of the year, a low flow channel will occur through sand sheets and around bank-attached bars. Fine grained muds may be deposited from suspension forming a veneer on the bed of the incised trench. Swampy conditions can result in the formation of a discontinuous low flow channel.

High flow stage

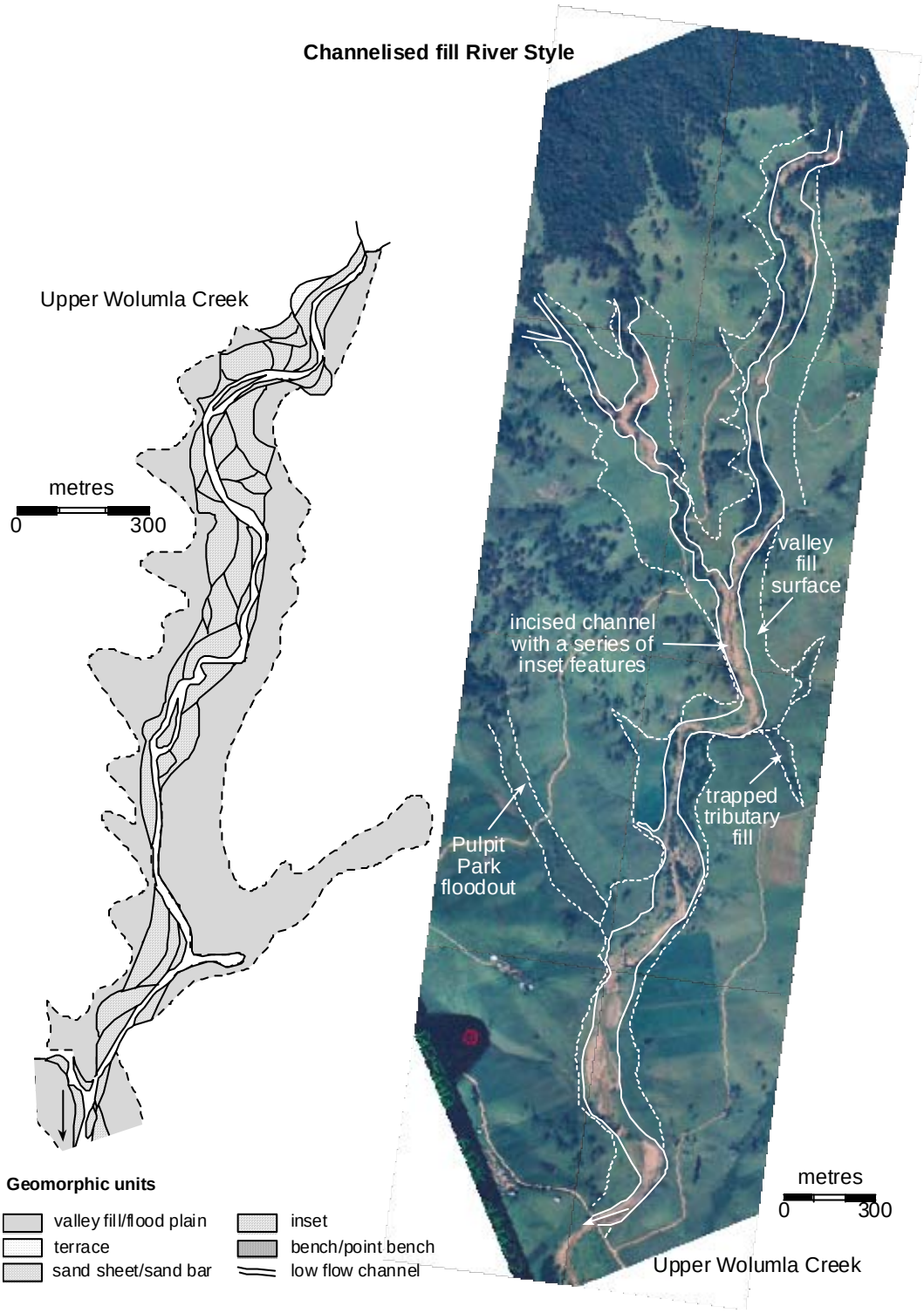
All events up to and including the 1 in 100 year events are contained within the incised channel. Along Wolumla Creek the 1 in 100 year event forms a flow depth of around 2 m. This concentration of energy within the incised channel means that high stream powers can be produced and significant volumes of sediment are reworked within the incised trench. In these cut and fill landscapes, large flood events lead to significant bed incision (often to bedrock), and subsequent lateral channel expansion via the processes of undercutting and block failure of banks. Sediment movement on the channel bed is high as large volumes of readily available sand material are stored on the bed and in inset features. In low-moderate events or the waning stages of large flood events, sediment accumulation on the channel bed and/or the formation of inset bench features occurs. These features are common in the filling phases and lead to the formation of a stepped channel cross-sectional morphology.

Overbank stage

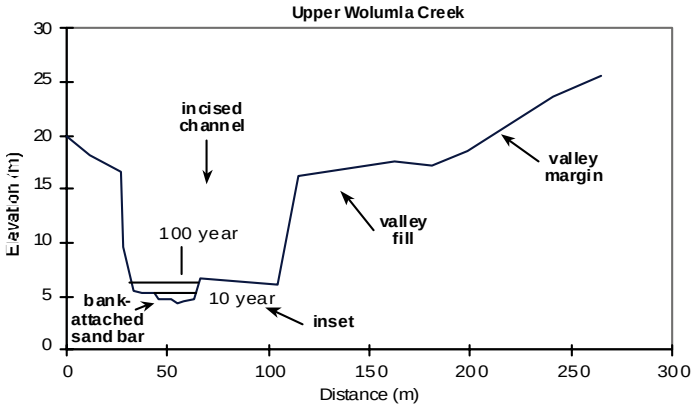
Deeply incised trench ensures that the valley flats are seldom inundated. Channel is effectively disconnected from its floodplain even in 1 in 100 year events or greater.

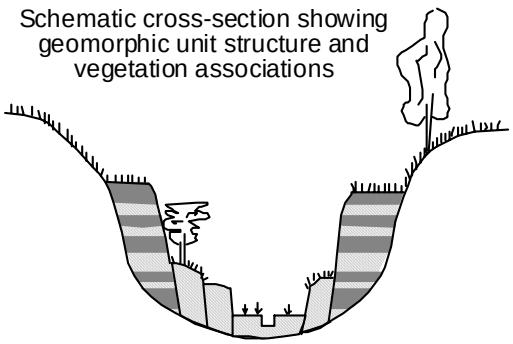
CONTROLS	
Upstream catchment area	Generally < 20 km^2
Landscape unit and within-catchment position	Low lying to undulating country at the base of the escarpment.
Process zone	Sediment source zone. In Wolumla catchment over 4 million m^3 of material has been released from this River Style following European settlement. Once incised sediment is efficiently flushed downstream through the incised trench.
Valley Morphology (size and shape)	Deep, wide valleys that decrease in width downstream to form a funnel shaped accommodation space. Valleys generally < 300 m wide.
Valley slope	Ranges from 0.005-0.03 m/m
Stream power	On average 1 in 10 year = 440 W/m^2; 1 in 100 year = 1140 W/m^2

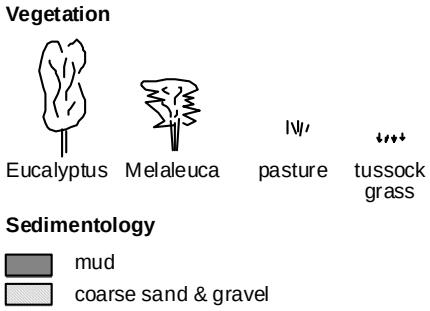
Channelised fill River Style

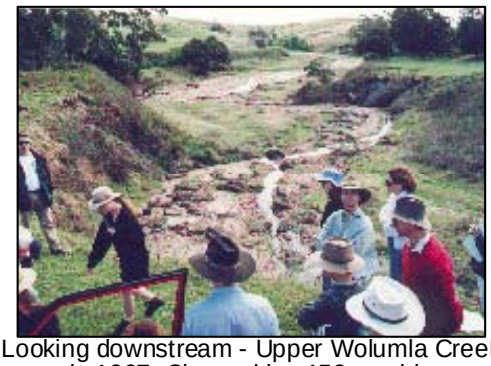


Channelised fill River Style









Looking downstream - Upper Wolumla Creek in 1997. Channel is ~150 m wide and over 10 m deep (Photo K. Fryirs)

Looking downstream - Anderson Creek (tributary of Wolumla Creek). Channel is ~50 m wide and 4 m deep (Photo K. Fryirs)

Looking downstream - Upper Wolumla Creek in 2000 (Photo K. Fryirs)

Looking downstream along Reedy Creek. Channel is ~40m wide and 9m deep. (Photo K. Fryirs)