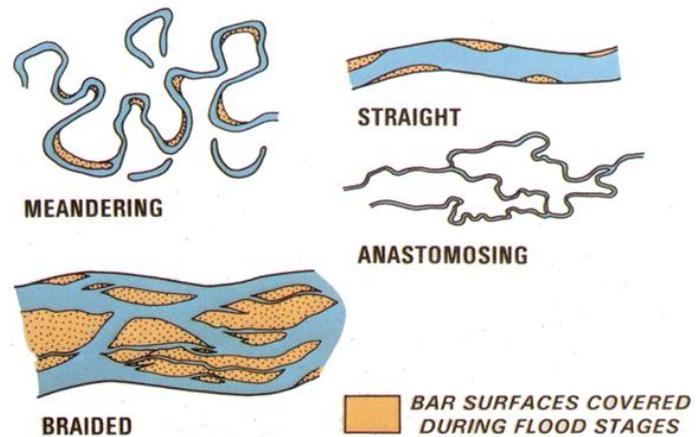


## River morphology by Kafei

This being a guide for a cartographers forum I will concentrate on the rough geomorphology of rivers. I will try to explain what rivers usually look like depending on their location and explain a little bit why they look like that.

Let's start with four principle river channel patterns:

- Meandering
- Braided
- Straight
- Anastomosing



The shape of the river is determined roughly by the type of sediment transported which is related to the

gradient of the river. The higher the gradient of the river the higher the speed and the bigger the particles are that get transported as sediment. Downstream, where the gradient is low, the speed is low, only the finest particles will get transported, they will be suspended in the water. We define:

- Bed load: Gravel and other big particles get transported by rolling etc.
- Mixed load: Both big and fine particles get transported.
- Suspended load: Only the finest particles are suspended in the water.

### Braided

Let's take a look at the Brahmaputra River: <http://tinyurl.com/d3gadc6>

Obviously a braided river, it runs from the Himalayas south-west to the Indian ocean. When you zoom out you can see that the river itself follows a pretty straight path.

Braided rivers get characterized by:

- Mixed load transport
- Low sinuosity
- High gradient, close to the mountains, steep descent.
- Fluctuating run-off, melt water from mountains or heavy rainfall
- The whole channel overflows with high run-off

### Meandering

Let's take a look at the Chulym river: <http://tinyurl.com/d3vqnav>

A meandering river, highly sinuous, with a special feature: avulsion. I won't go into the details but splitting and returning is possible!

- Bed load, mixed or suspended transport
- High sinuosity
- Low gradient
- Stable discharge

## Adding rivers to your world

The best way to come up with 'original', let's just say not-so-boring rivers is to look at the real world, open up Google maps and explore! Most maps usually consist of slightly meandering rivers connecting to the main branch which slightly meanders to the sea, but look at these examples:

### *The Amazon River*

<http://tinyurl.com/8qwpmm2>

Very sinuous in the south-west, anastomosing in the center. Look how the different flow rates and gradients produce different sinuosities.

### *The Rakaia River*

<http://tinyurl.com/cc8hk22>

A very straight braided river, it runs directly to the sea.

### *The Rhine*

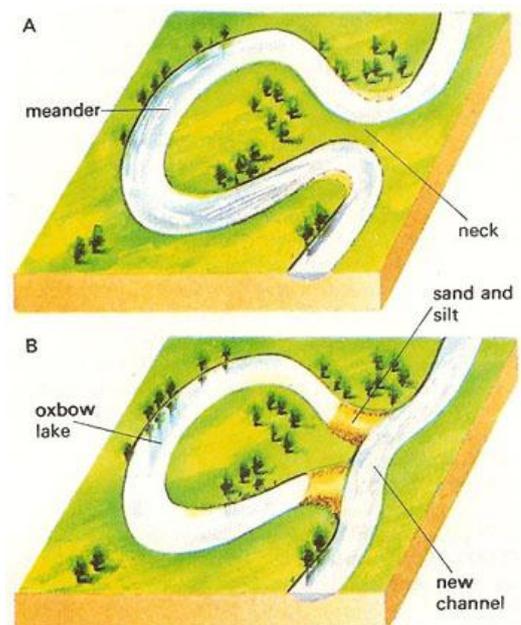
<http://tinyurl.com/ck8pa19>

Graciously swirling through the European Megapolis the Rhine follows a simple meander, constant in width. Keep in mind that it is this way because people live near it, levees on both sides keep the river in its place.

## Special Features: Oxbow Lakes

When avulsion occurs (breaking of a levee near a river) the river can reconnect, forming a quicker path and leaving meander, forming an oxbow lake. Although less usable in creating maps you'll get features like this:

<http://tinyurl.com/d5c9rof>



## Deltas

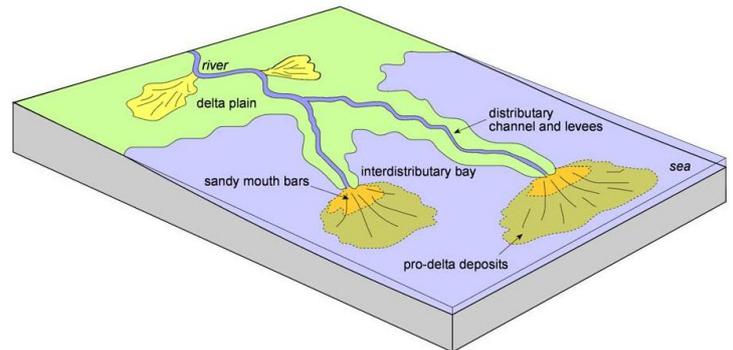
Unique deltas are an easy feature to use in your maps, usually the river just ends up flowing into the ocean but you can think of so much more! Eventually the river will end up in the ocean where it can form a river delta; the main shapes that can occur are related to the interaction between the river and the ocean. Three main forms are defined:

- River dominated delta
- Tide dominated delta
- Wave dominated delta

### River dominated

When the outflow of the river dominates, the ocean does not have that much influence, the delta protrudes very far into the sea. A beautiful example is the Mississippi Delta:

<http://tinyurl.com/d397oqn>



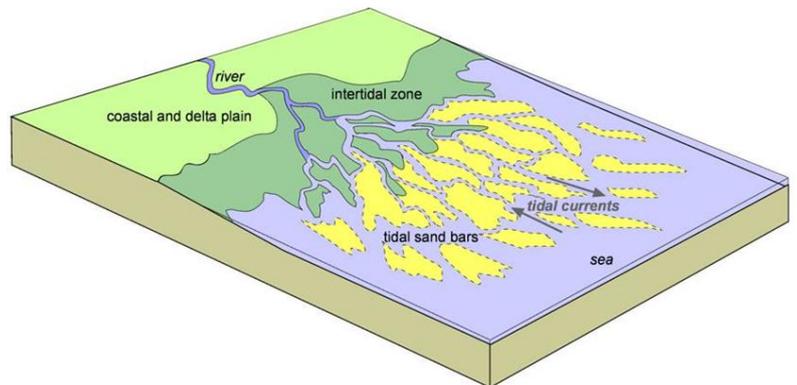
### Tide Dominated

In a tide dominated delta the in-and-outflowing of the tides will form structures parallel to the coast, as can be seen in the Brahmaputra river delta:

<http://tinyurl.com/9owofbm>

Another example on the CG's forum:

<http://tinyurl.com/csfacq2>



### Wave Dominated

The wave dominated delta is the standard Nile-delta, a  $\Delta$ -shaped fan occurs:

<http://tinyurl.com/c9u7qab>

