

border, with the slope increasing gradually from the bottom to the brim.

These observations will enable us to understand how nature operates when the inequality of surface or of tenacity obliges the current to change its direction, and the river forms an elbow.

Supposing always that the discharge continues the same, and that the mean velocity is either preserved or restored, the following conditions are necessary for a permanent regimen :

1. The depth of water must be greater in the elbow than any where else.
2. The main stream, after having struck the concave bank, must be reflected in an equal angle, and must then be in the direction of the next reach of the river.
3. The angle of incidence must be proportioned to the tenacity of the soil.
4. There must be in the elbow an increase of slope, or of head of water, capable of overcoming the resistance occasioned by the elbow.

The reasonableness, at least, of these conditions will appear from the following considerations :

1. It is certain that force is expended in producing this change of direction in a channel which, by supposition, diminishes the current. The diminution arising from any cause which can be compared with friction must be greater when the stream is directed against one of the banks. It may be very difficult to state the proportion, and it would occupy too much of our time to attempt it ; but it is sufficient that we be convinced that the retardation is greater in this case. We see no cause to increase the mean velocity in the elbow, and we must therefore conclude that it is diminished. But we are supposing that the discharge continues the same ; the section must therefore augment, or the channel increase its transverse dimensions. The only question is, in what manner it does this, and what