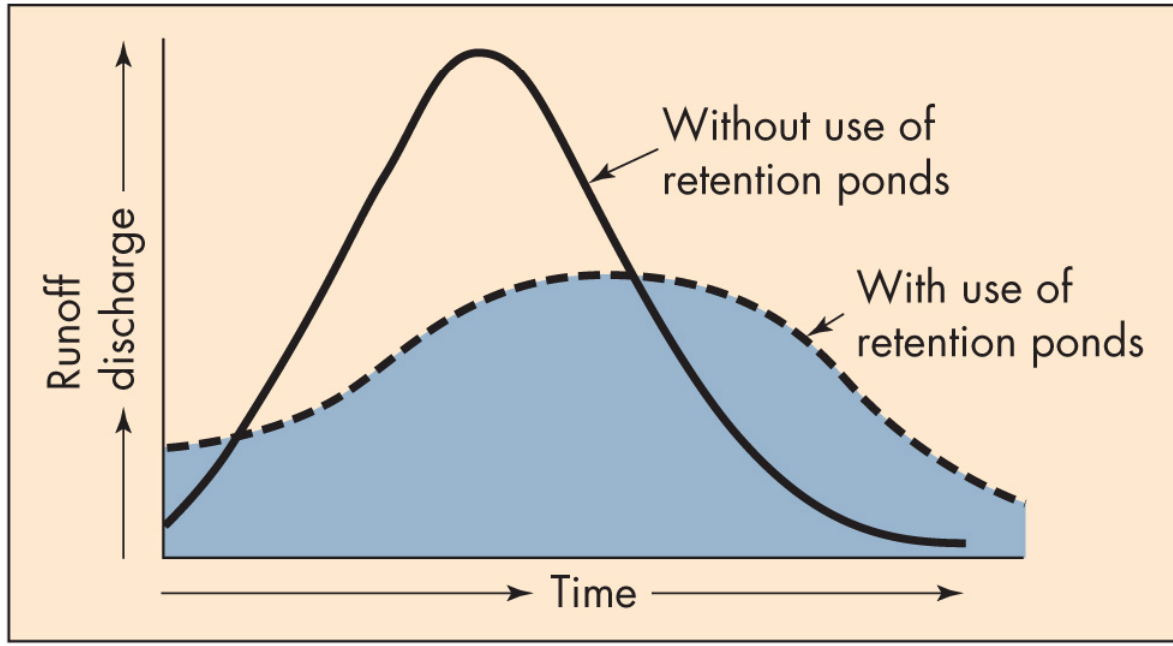
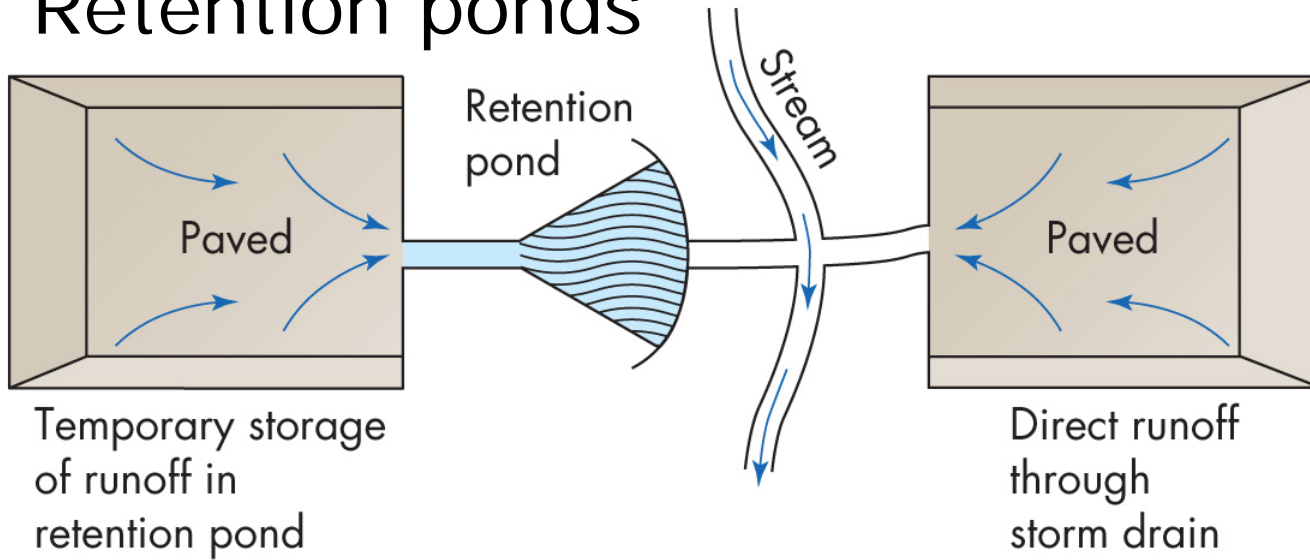


Retention ponds



Added benefit:
recharges the
groundwater

(a)

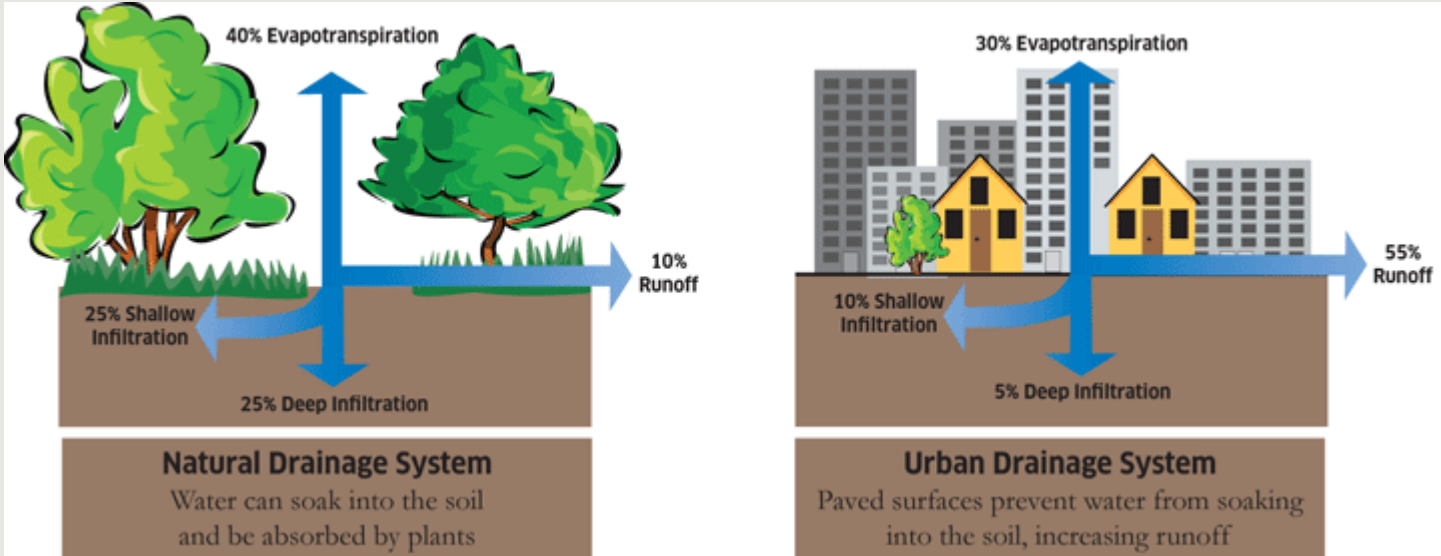
Figure 5.28a



(b)

Green parking lots

Reduce the percentage and speed of runoff

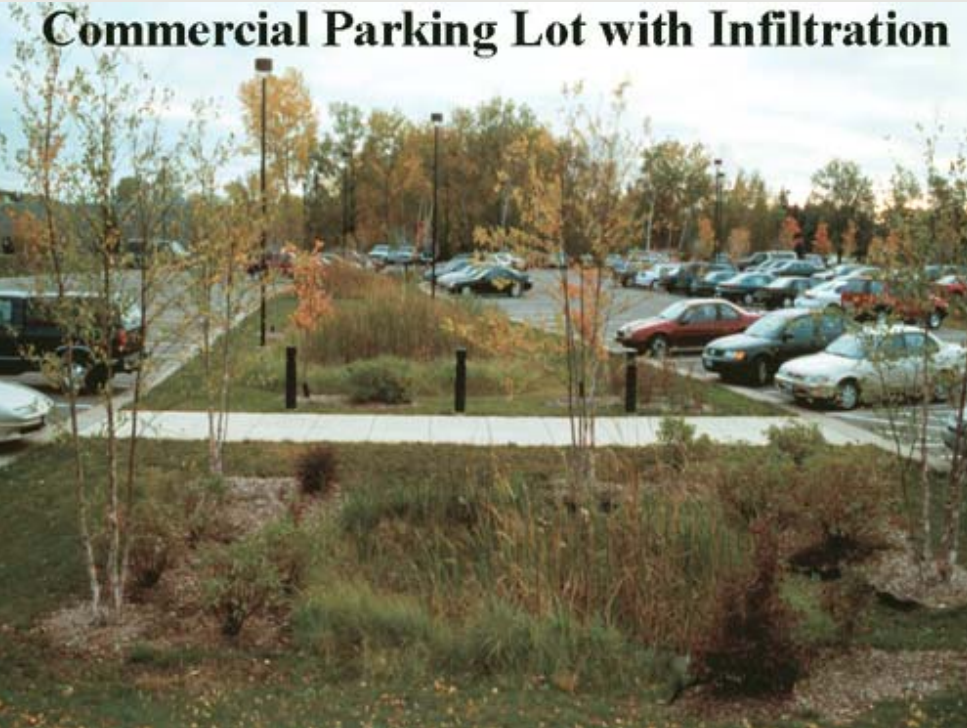


Green parking lots

Different designs



Commercial Parking Lot with Infiltration



Rain gardens

<http://www.raingardeninitiative.org/raingardens.html>

<http://www.utoledo.edu/commissions/river/>

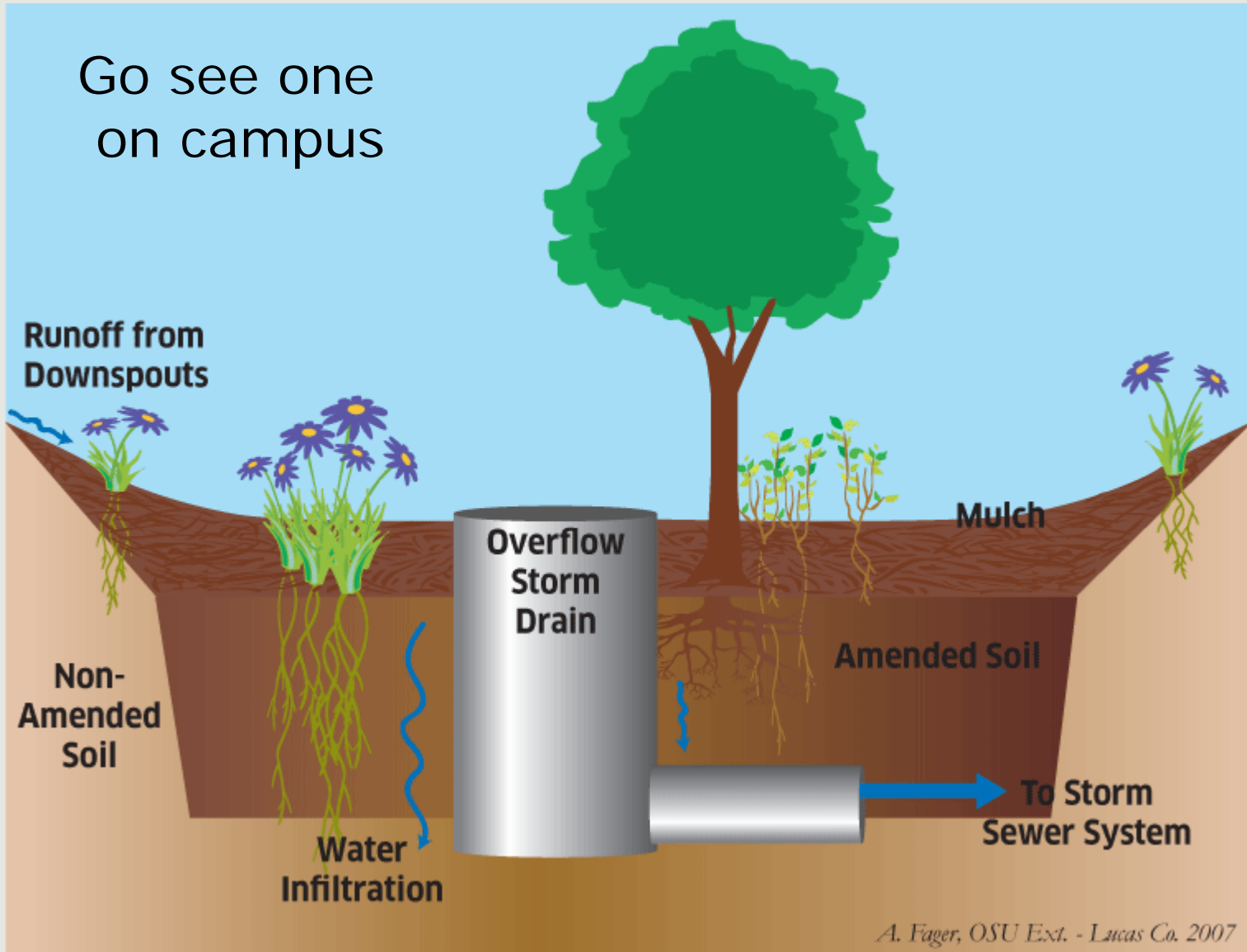
Rain gardens mimic natural conditions by:

- Slowing runoff near sources
- Maintaining natural hydrology
- Absorbing rainfall
- Filtering pollutants
- Providing habitat



Basic raingarden design

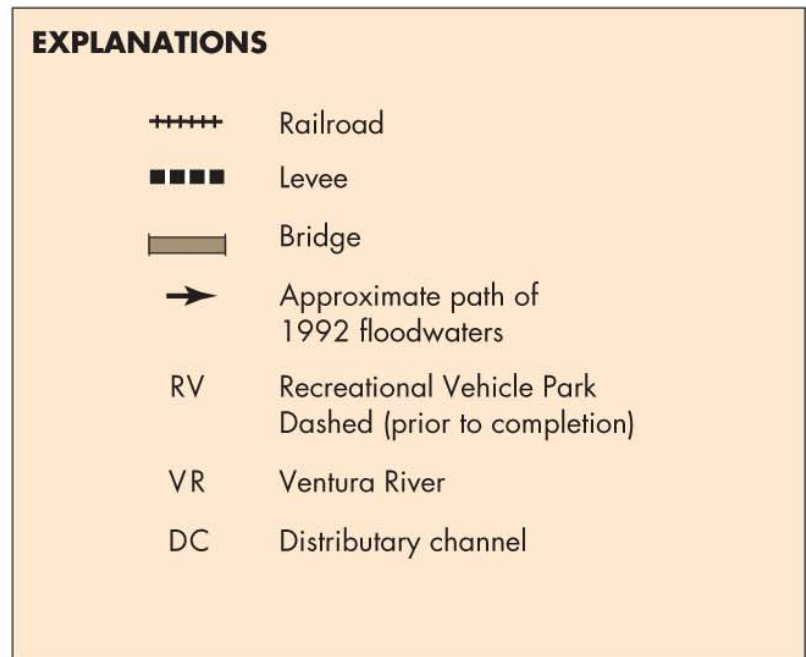
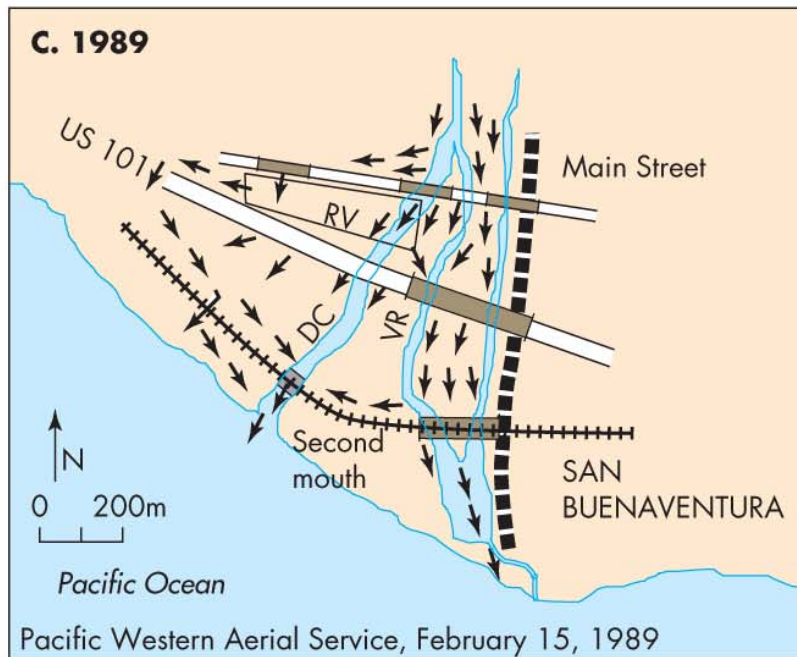
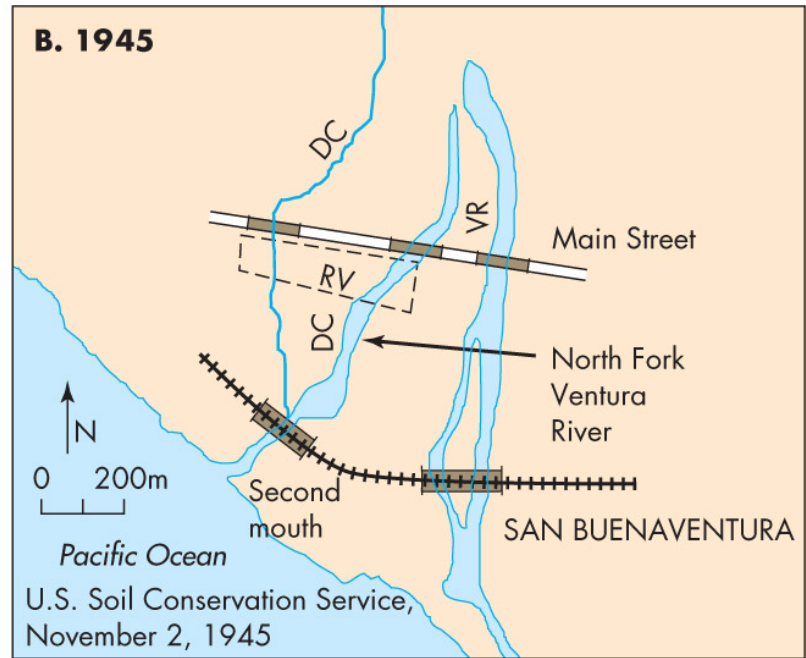
Go see one
on campus



Avoiding floods: Site selection

Figure 5.A



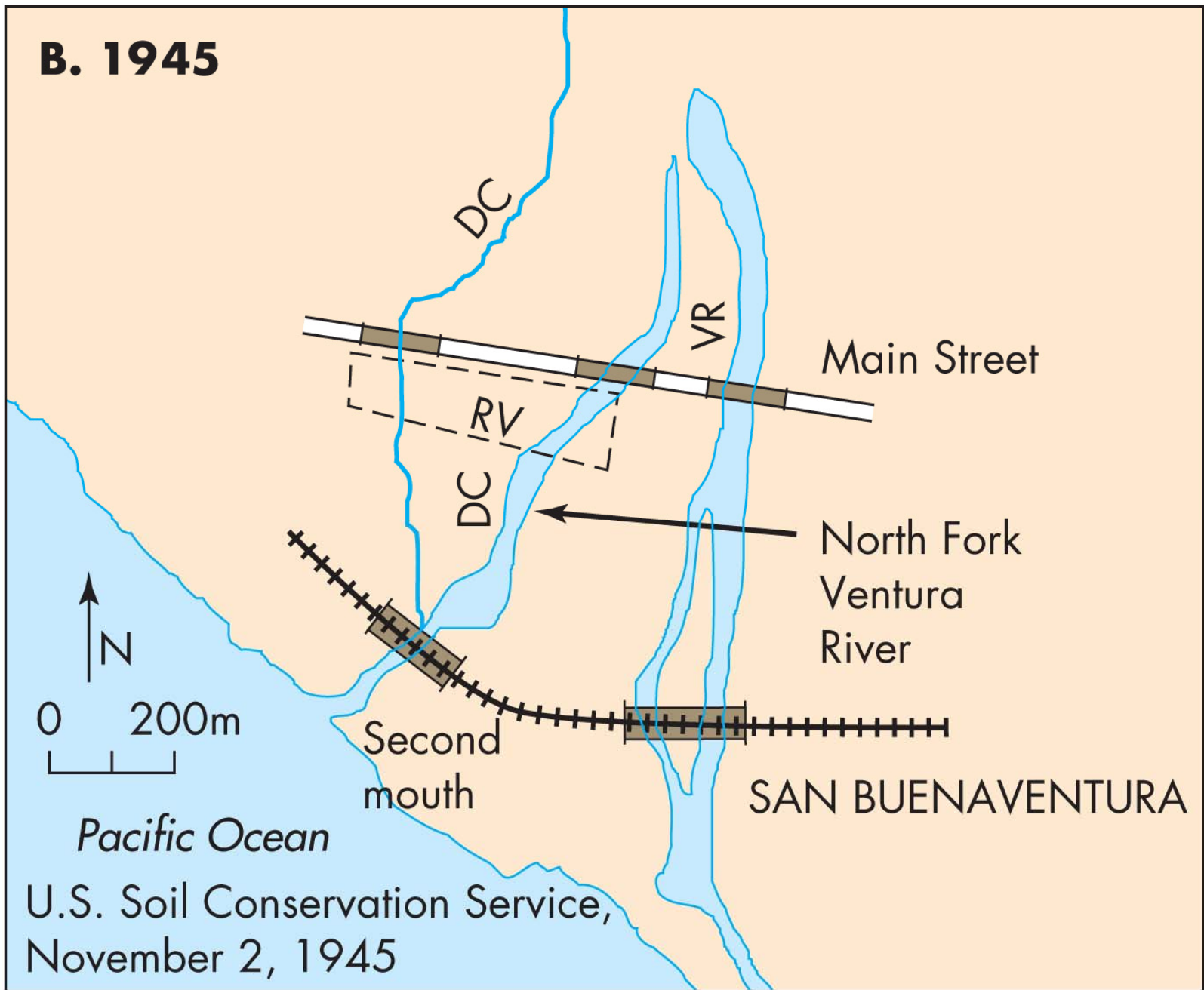


A. 1855



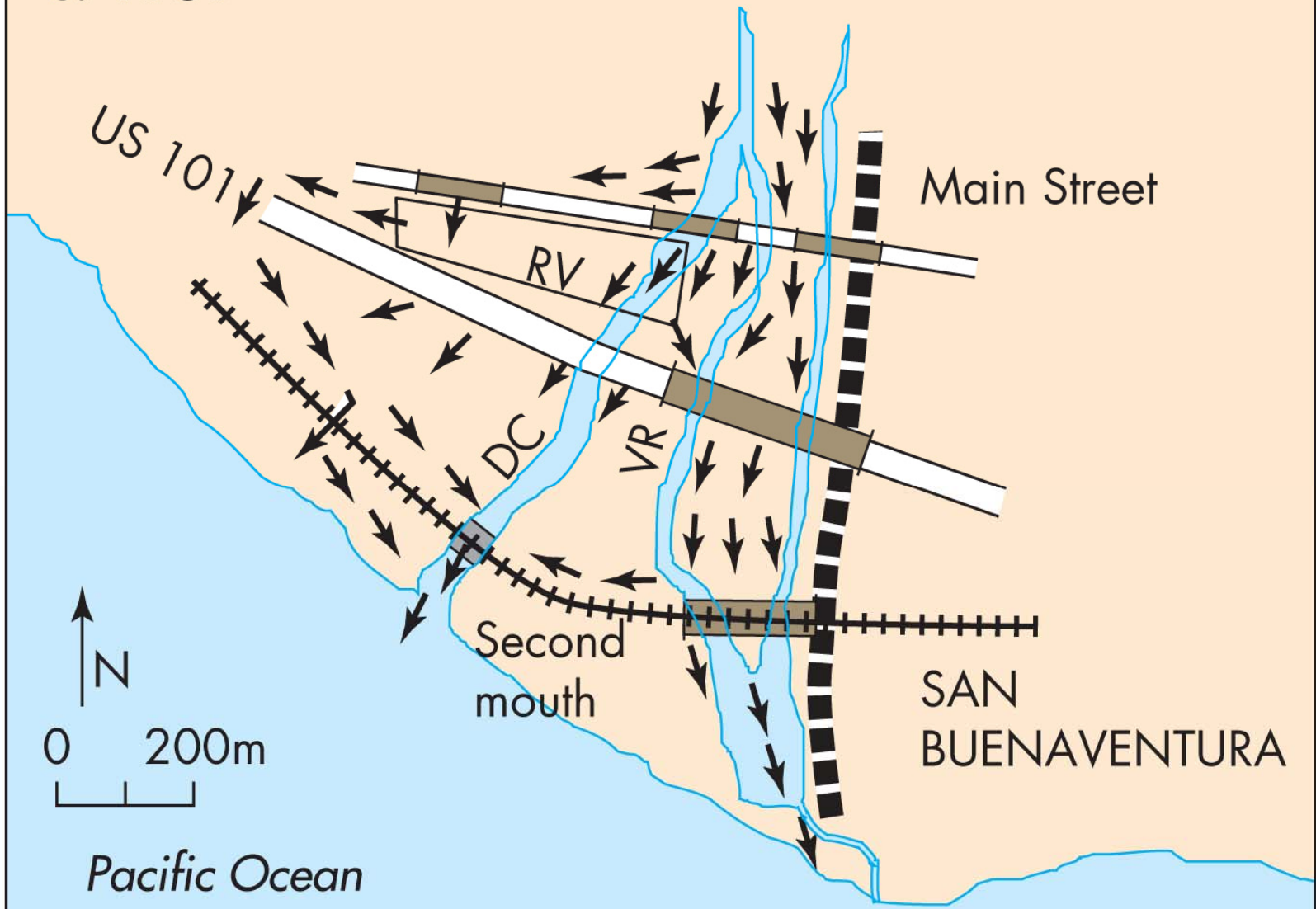
U.S. Coast Survey Map, 1855

B. 1945



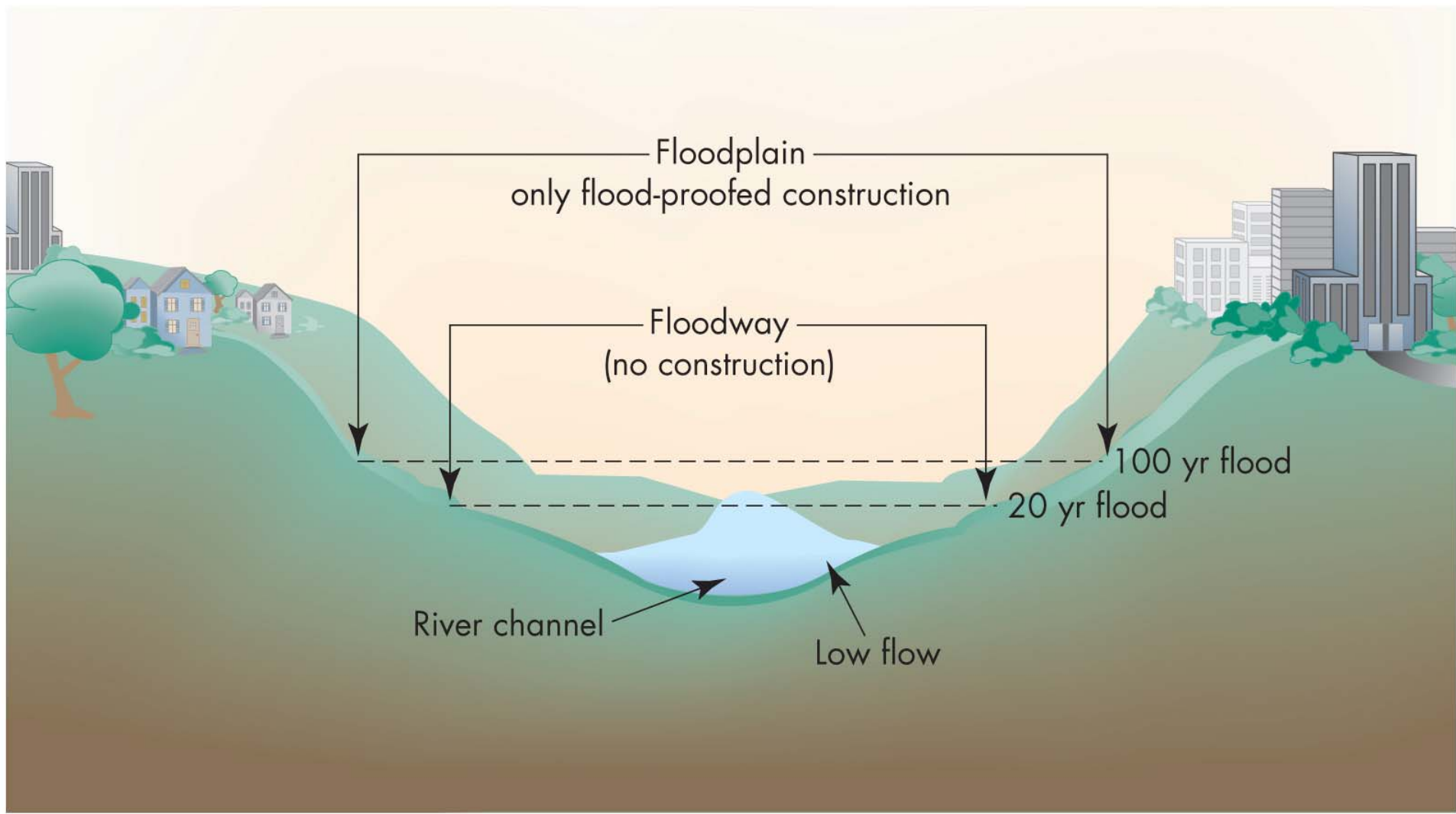
U.S. Soil Conservation Service,
November 2, 1945

C. 1989



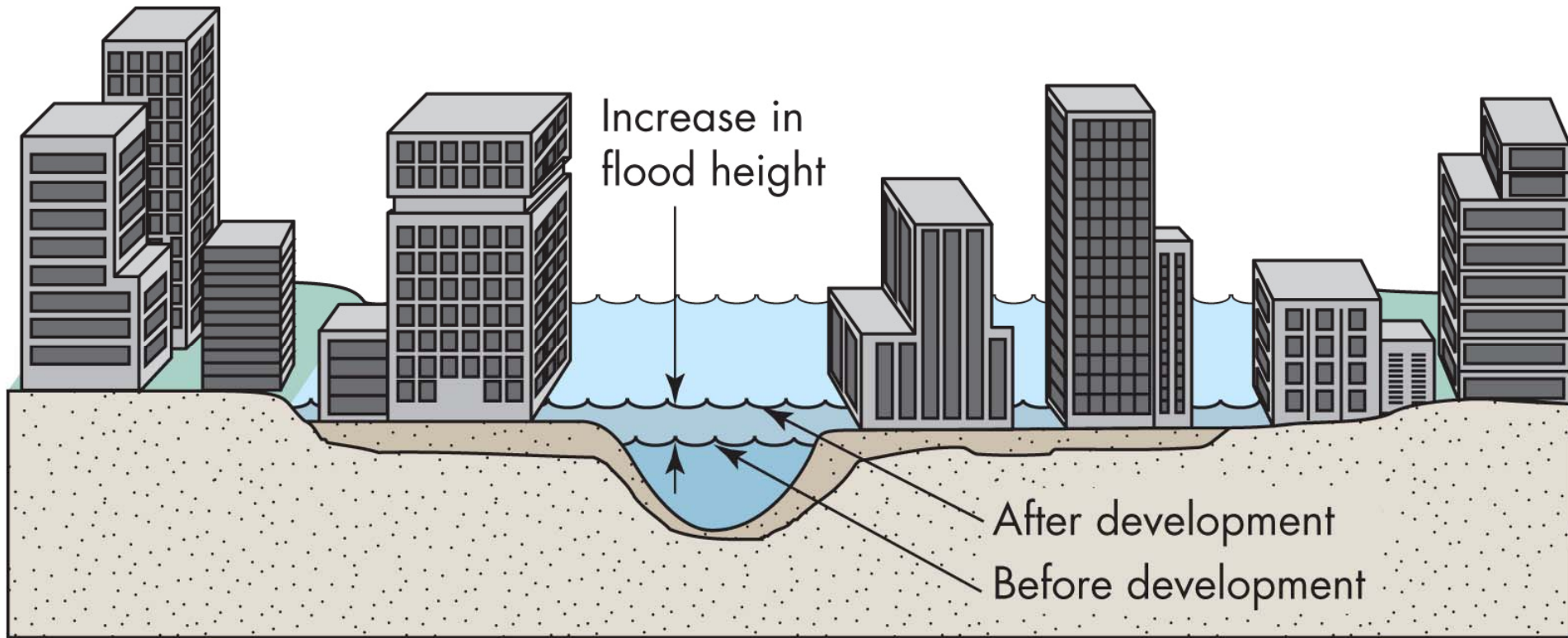
Pacific Western Aerial Service, February 15, 1989

Floodplain maps and zoning

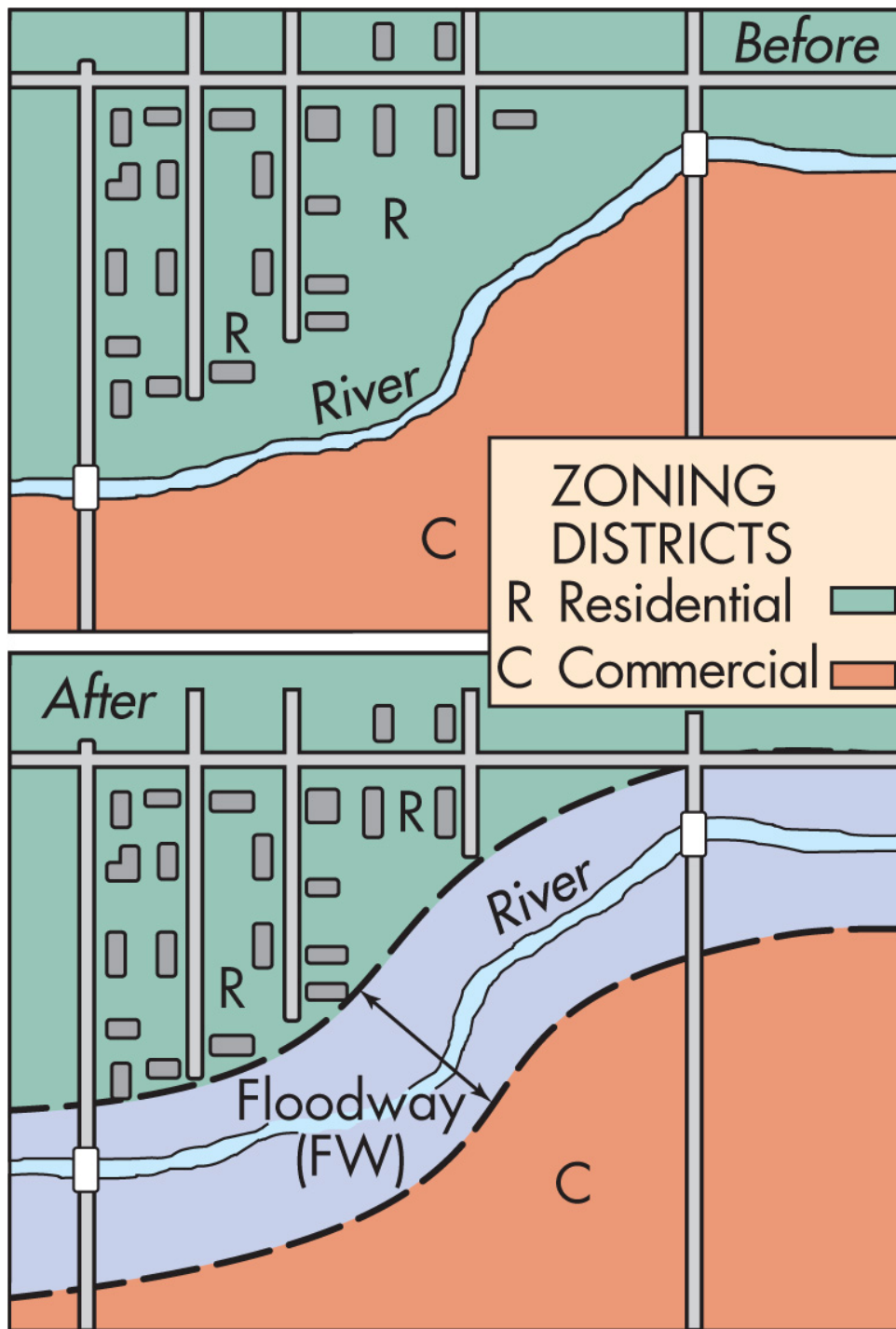


Account for changes in the watershed

Figure 5.37



Sometimes historical records may not be accurate predictors of flood hazard



Good choices for construction

Ten-Mile Creek
running through Sylvania

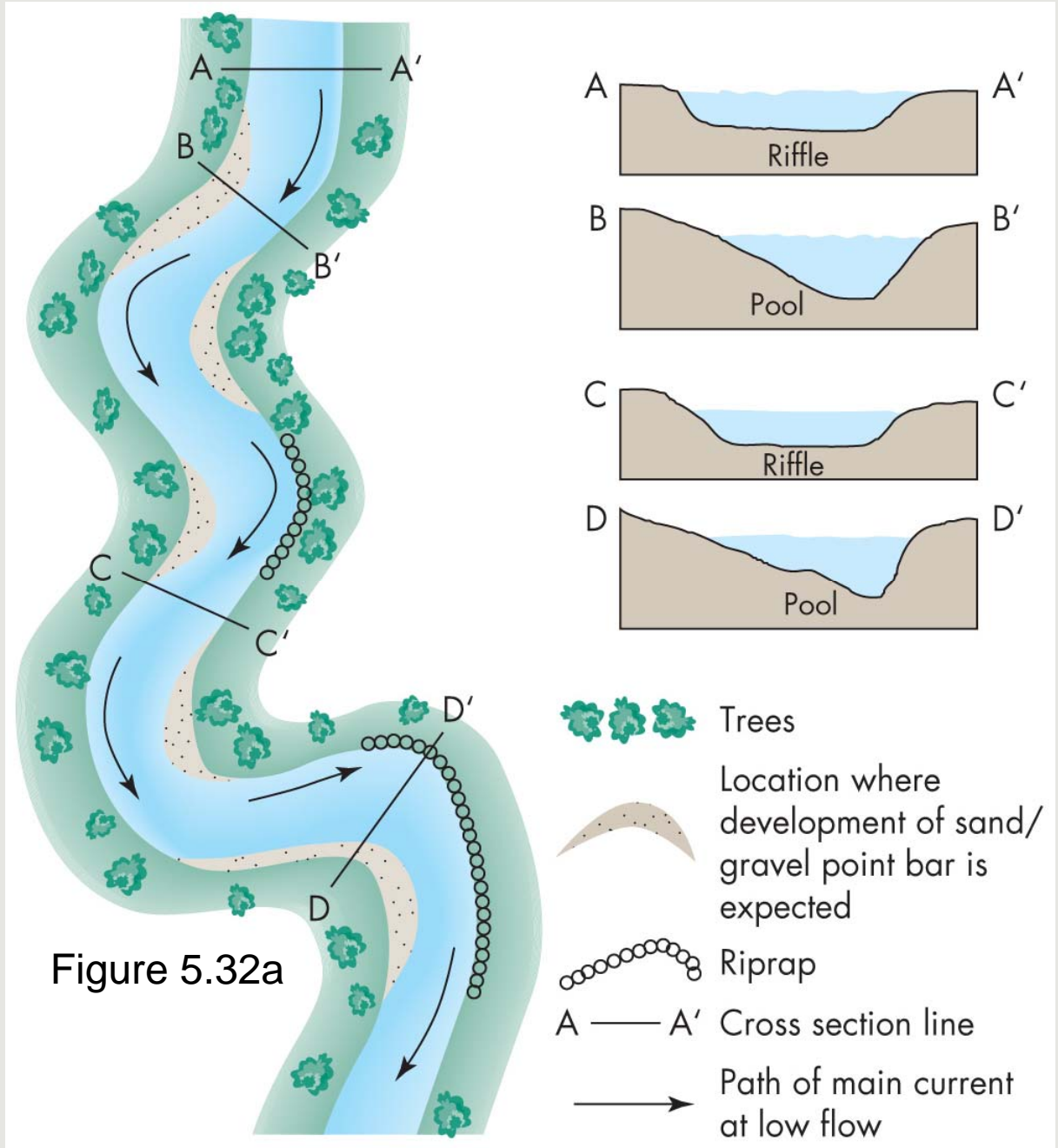


Engineered waterways & stream function



Figure 5.33a

Stream restoration





(b) Riprap

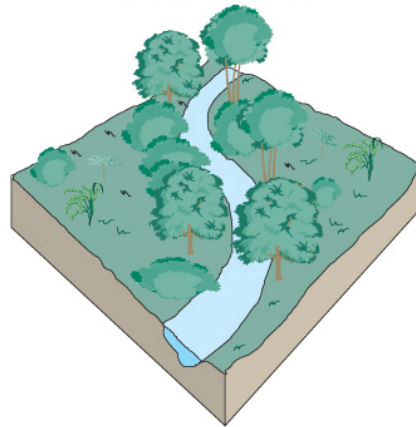


Unassisted restoration



Figure 5.34

Natural stream



Channelized stream

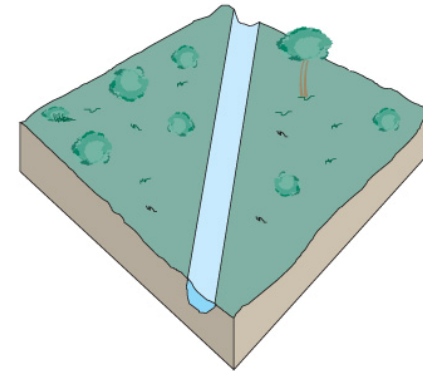


Figure 5.29

Channel conditions

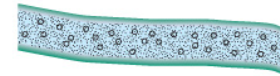
Suitable water temperatures:
adequate shading;
good cover for fish life;
minimal temperature variation;
abundant leaf material input.

Increased water temperatures:
no shading; no cover for fish life;
rapid daily and seasonal temperature
fluctuations; reduced leaf material input.

Pool-riffle sequences

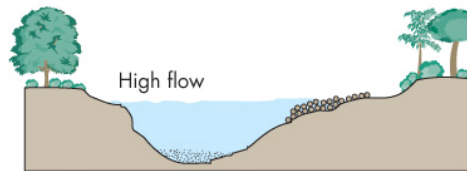
Pool: silt, sand,
and fine gravel
Riffle: coarse gravel
Sorted gravels provide diversified
habitats for many stream organisms.

Mostly riffle

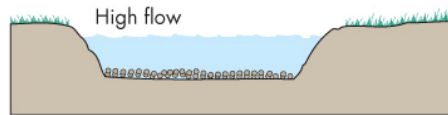


Unsorted gravels;
reduction in habitats; few organisms.

Pool environment

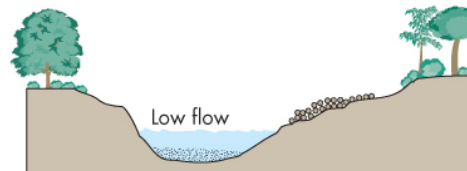


Diverse water velocities:
high in pools, lower in riffles. Resting
areas abundant beneath banks, behind
large rocks, etc.

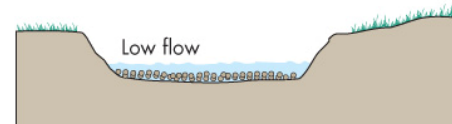


May have stream velocity higher
than some aquatic life can stand.
Few or no resting places.

Riffle environment

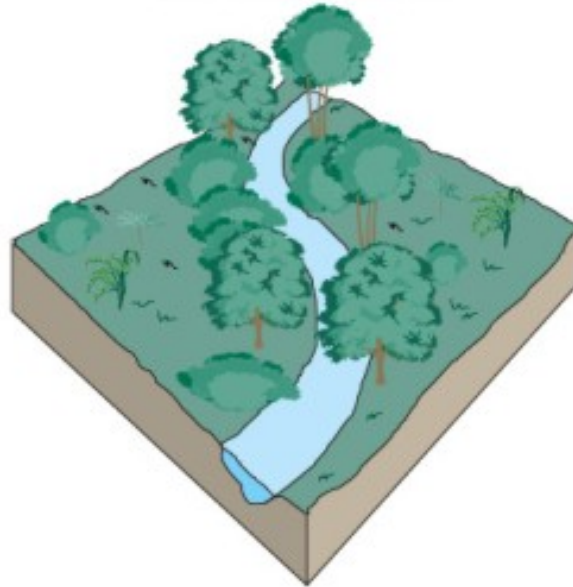


Sufficient water depth to support fish
and other aquatic life during dry season.

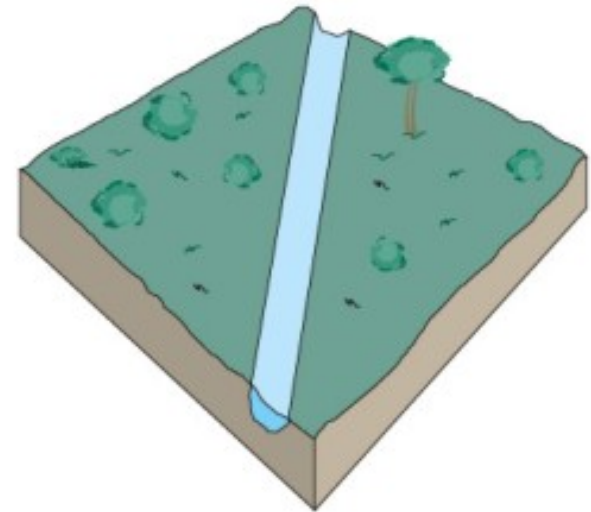


Insufficient depth of flow during dry
season to support fish and other aquatic
life. Few if any pools (all riffle).

Natural stream



Channelized stream

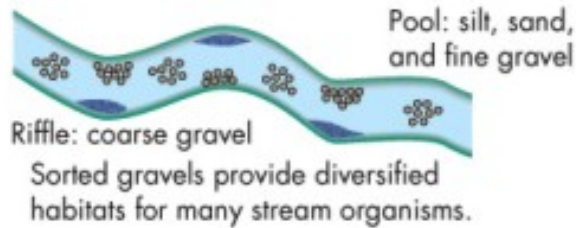


Channel conditions

Suitable water temperatures;
adequate shading;
good cover for fish life;
minimal temperature variation;
abundant leaf material input.

Increased water temperatures;
no shading; no cover for fish life;
rapid daily and seasonal temperature
fluctuations; reduced leaf material input.

Pool-riffle sequences

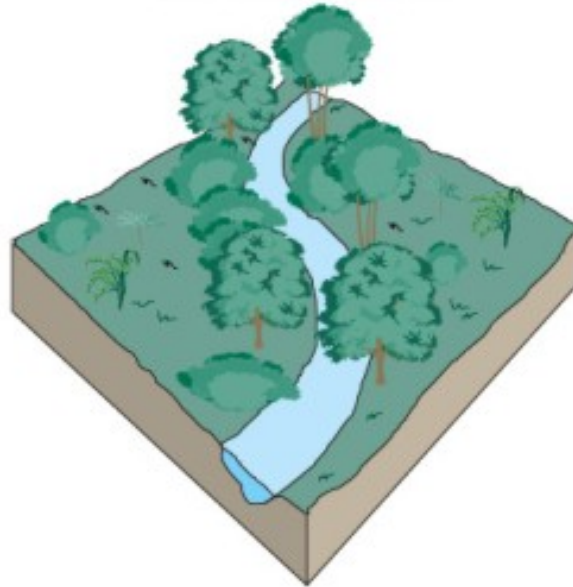


Mostly riffle

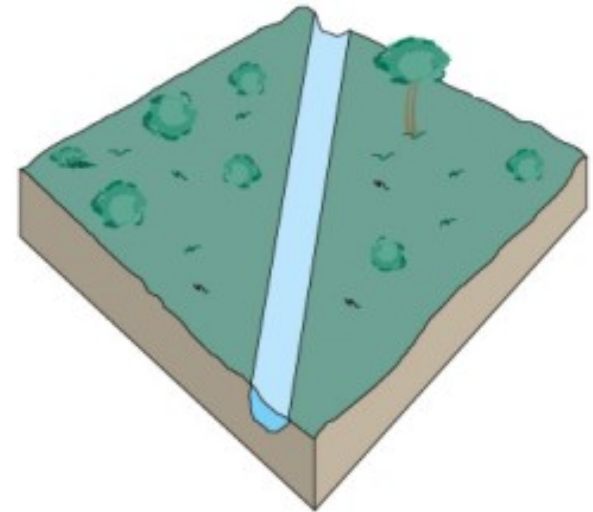


Unsorted gravels;
reduction in habitats; few organisms.

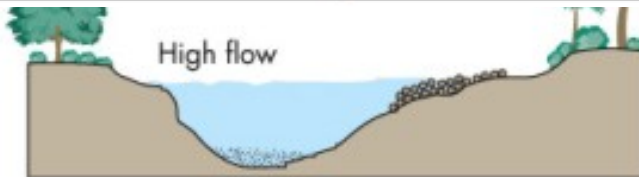
Natural stream



Channelized stream



Pool environment

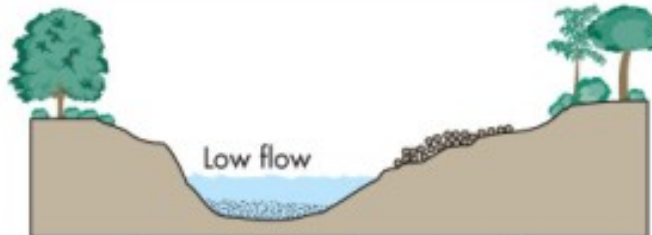


Diverse water velocities: high in pools, lower in riffles. Resting areas abundant beneath banks, behind large rocks, etc.



May have stream velocity higher than some aquatic life can stand. Few or no resting places.

Riffle environment



Sufficient water depth to support fish and other aquatic life during dry season.



Insufficient depth of flow during dry season to support fish and other aquatic life. Few if any pools (all riffle).