53:171 Water Resources Engineering
Lesson 2: Water Resources Planning Concepts

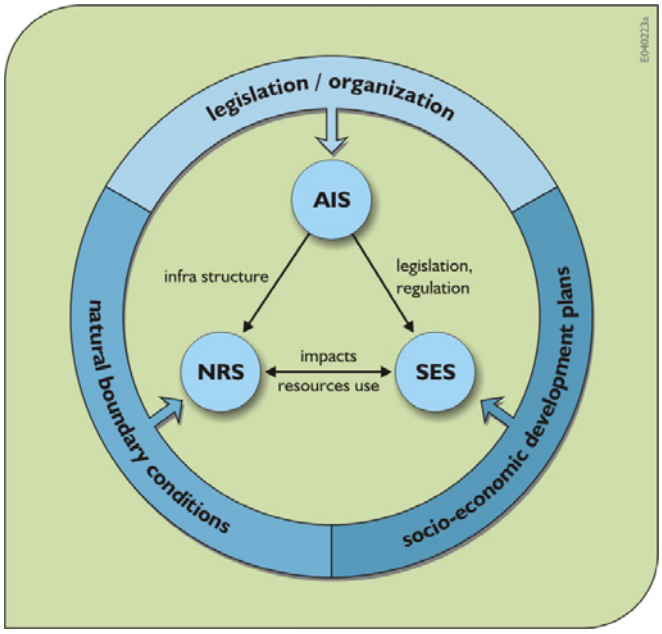

Figure 1.19: Interactions among subsystems and between them and their environment. [WRSP&M]

TABLE 1.1
Problems of water-resources engineering

Studies and facilities required	Control of excess water				Conservation (quantity)				Conservation (quality)
	Flood mitigation	Storm drainage	Bridges, culverts	Sewerage	Water supply	Irrigation	Hydro power	Navigation	Pollution control
How much water is needed?	—	—	—	—	×	×	×	×	×
How much water* can be expected?									
Minimum flow*	—	—	—	×	×	×	×	×	×
Annual yield*	—	—	—	×	×	×	×	×	×
Flood peaks	×	×	×	—	×	×	×	×	
Flood volume	×	×	—	—	—	—	—	—	×
Groundwater*	—	×	—	×	×	×	—	—	×
Who may use the water?	—	—	—	—	×	×	×	×	×
What kind of water is it?									
Chemical	—	×	—	×	×	×	—	—	×
Bacteriological	—	×	—	×	×	×	—	—	×
Sediment	×	×	×	×	×	×	×	×	×
What structural problems exist?									
Geology	×	×	×	×	×	×	×	×	×
Dams	×	—	—	—	×	×	×	×	×
Spillways	×	—	—	—	×	×	×	×	×
Gates	×	×	—	×	×	×	×	×	×
Sluiceways	×	—	—	—	×	×	×	×	
Intakes	—	—	—	—	×	×	×		
Channel works	×	×	×	×	—	—	—	×	
Levees	×	×	×						
Pipelines	—	×	—	×	×	×	×	—	×
Canals	×	×	—	—	×	×	×	×	
Locks	—	—	—	—	—	—	—	×	
Pumps	×	×	—	×	×	×	×	×	×
Turbines	—	—	—	—	—	—	×		
Purification	—	×	—	×	×	×	—	—	×
Does project affect wild life or natural beauty?	×	×	×	×	×	×	×	×	×
Is the project economic?	×	×	×	×	×	×	×	×	×

* Available water must be expressed in terms of the probability that it will be available in any year.

Table 1.1: Problems of water-resources engineering [WRE]