CHAPTER 1

Solutions for Review Questions

Question	Answer
1	C
2	E
3	A
4	A
5	D
6	A
7	B
8	B

1-1

On a small forested lot, interception would be important for small storms. Forested areas also have greater potential for infiltration (i.e., soil storage) than urban areas. The surface runoff and channel processes would be relatively unimportant.

1-2

For the forested condition, infiltration and interception are the primary processes. In a cleared-watershed state, overland flow will be a dominant hydrologic process. The influence of infiltration will be much less than for either the forested or developed states. After the residences have been built, roadway and pipe drainage will be more important. Grass-covered areas will have some infiltration potential.

1-3

For the portion of the watershed devoted to the shopping center, rooftop and parking lot runoff will be the most important processes. Depression storage will be a minor factor. Infiltration and interception will not be important.

1-4

If the shopping center is in the upper portion of the watershed, then the runoff from developed portion of the watershed will be partially smoothed by the rural land cover. Thus, the hydrologic effect of the shopping center would be minimized. If the shopping center is near the outlet of the 500-ac watershed, the runoff from the shopping center will pass out of the watershed before the runoff arrives from the rural portion of the watershed. Thus, the shopping center will only have a minor effect on the characteristics of the flood runoff.

1-5

The runoff will be dominated by the surface runoff from the paved surfaces. The cross-slope of the highway will direct runoff to the shoulder. If the shoulder is bordered by a curb, then the runoff will collect in the gutter and flow to the nearest inlet. Flow from the grassed right-of-way will have a minor impact on the total flow.

1-6

Generally, where basements are wet, topography directs runoff towards the house. There it is trapped by the house and infiltrates into the ground. The cracks in the basement floor are the easiest path for the water to take. One possible solution is to grade the surface area around the house so that the water drains away from the house.

1-7

The erosion is the result of the high-velocity surface runoff. The greater the land slope, the higher the rate of the erosion. To reduce the erosion potential, the land could be graded to reduce the slope along the flow path. The flow path should be graded in a meandering pattern and seeded with vegetation that would increase the roughness of the flow path.

1-8

In the analysis case, an experiment would be designed where the headloss and velocity could be measured for given values of the length and diameter. Then f can be computed, and the roughness is estimated from the Moody diagram.

In the synthesis case, f would be obtained from the Moody diagram and be used to compute the headloss.

1-9

The pump equation is $P_o = \gamma QH/e$ where P_o = power output, γ = specific weight of the fluid, Q = flow rate, H = the total head, and e = efficiency. The efficiency could be estimated by measuring the flow rate and the power output for a given head. In the synthesis case, the efficiency will be indicate on the pump, while Q and H can be measured.

1-10

$$V_p = 1 \text{ in. } (25 \text{ ac}) \left(\frac{1\, ft}{12\, in.} \right) = 2.083 \text{ ac-ft}$$

$$= 2.083 \text{ ac-ft} \left(\frac{43560\, ft^2}{1\, ac} \right) = 90{,}750 \text{ ft}^3$$

depth = V_p/A_s = 90,750/25,000 = 3.63 ft

1-11

$$V_p = 9\, in. (200\, mi^2) \left(\frac{1\, ft}{12\, in.} \right) \left(\frac{43560\, ft^2}{ac} \right) = 235950\, P_i$$

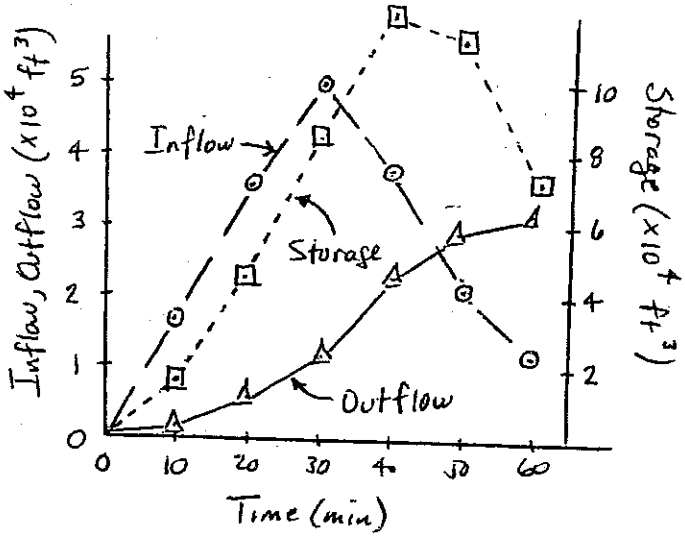
$V_s = 0.2\, V_p$ = 19,200 ac-ft

1-12

$$P = P_i (65\, ac) \left(\frac{1\, ft}{12\, in.} \right) \left(\frac{43560\, ft^2}{ac} \right) = 235{,}950\, P_i \text{ [=] ft}^3$$

$$R = R_i (10 \text{ min}) \left(\frac{60 \text{ sec}}{\text{min}} \right) = 600\, R_i \text{ [=] ft}^3$$

t	P_i	P	R_i	R	P - R	$\sum$(P - R)
10	0.07	16517	2.1	1260	15257	15257
20	0.15	35392	9.5	5700	29692	46209
30	0.21	49550	18.9	11340	38210	84419
40	0.16	37752	37.3	22380	15372	99791
50	0.09	21234	48.8	29280	-8044	91746
60	0.05	11798	52.6	31560	-19762	71984



The storage increases as long as the inflow is greater than the outflow. Maximum storage occurs just prior to the point in time when outflow exceeds inflow.

1-13

(1) Before a hydrologist makes an analysis or design, he or she should have both the educational background and the experience necessary to competently perform the work. As an example, the hydrologist should know the limitations of a model, the basis on which the design model was developed, and constraints on its application. A professional would not accept the assignment if he or she lacked the proper education or experience.

(2) A hydrologist has responsibilities and obligations to his or her employer and to the client. The professional also has responsibilities to society. These responsibilities must be balanced where they conflict.

(3) Professionals have obligations to the employer, the client, the profession, and society. These obligations must be balanced. Many responsibilities involve human and societal values, not just technical concerns. Standards of conduct, such as codes of ethics, outline these value issues and address the way that a professional should approach them.

(4) Registration, such as a professional engineer licence, is important to ensure that only those who have the proper education and experience practice in the field. It discourages unqualified people from performing the specific responsibilities of the professional and possibly damaging the reputation of those in the profession who are qualified.

(5) A person who fails to recognize the obligations that he or she has to the profession is more likely to be swayed by selfish motives. Thus, support of the profession encourages altruistic practice (while not ignoring legitimate responsibilities to oneself).

(6) Confidentiality is an important character trait of a professional. It reflects one's recognition of the responsibilities that a professional has.

1-14

The technical basis of hydrologic analysis and design is not static. New knowledge arises just as new problems arise. In order for a hydrologist to be capable of solving these new problems, he or she must continue to educate him or herself. Failure to maintain competency will put the firm at a disadvantage. It also means that a client is not getting the best possible analysis or design. Failure to maintain competency may lead to projects that are not the safest possible or the most aesthetically pleasing.

A professional can maintain competency by taking classes at a local university, attending professional workshops/short courses, reading professional journals, attending conferences where papers are presented, and pursuing self-study activities.

1-15

beauty/aesthetics:	Projects should not aesthetically degrade the local environment. Including vegetation around a storm detention basin will keep the basin from degrading the community.
diligence:	A professional must be diligent so projects are completed on time, which will prevent delays of project implementation.
efficiency:	A professional has a responsibility to both an employer and the client to be efficient in completing work.
honor:	A professional must honor the profession; this encourages competent professional practice.

knowledge:	Lack of sufficient knowledge can prevent a professional from providing the client with the best project.
loyalty:	A professional should be loyal to the company as long as it does not prevent him or her from meeting his or her responsibilities to the client or society.
public health/safety:	Professional projects should he completed in a way that they do not put public health or safety at unnecessary risk.
respect:	A professional must respect the environment. A professional must respect obligation to the employer, the client, the profession, and society.
truth:	The professional must be truthful in all activities, both in personal and professional matters.

1-16

This is a conflict between the values of truth, honesty, and efficiency on one side of the dilemma and happiness and security on the other side. The individual or firm may do this to provide personal happiness in getting the contract as well as providing (job) security for the employees. But the individual is not being totally honest with the client and will reduce the efficiency of the clients' work activities. In this case, the selfish motives are less important that truthfulness and efficiency, so greater weight should be given to the values of honesty and efficiency.

1-17

Assuming that the computer is being used for personal gain or pleasure and against company policy, then the hydrologist is not being honest with the employer. The activity may also reduce the efficiency of the firm. The individual is placing personal happiness and (financial) security above the responsibilities that he or she has to the firm. While obligations to a company do not always outweigh obligations to oneself, in this case, truthfulness should be given more weight than the selfish motives.

1-18

Probably the single most common reason for professionals having their licence revoked is because of failing to properly supervise their subordinates.