

CHAPTER 2. GENERAL IRRIGATION AND DRAINAGE ENGINEERING TERMINOLOGIES

Target Outcomes

At the end of the chapter, students are expected to:

- a. Be familiar with the irrigation and drainage engineering terminologies; and,
- b. Apply appropriately the terminologies in the general classification, planning, design, construction and operations involved in irrigation and drainage engineering.

Abstraction

The following are the most commonly used terminologies in irrigation and drainage engineering.

access areas

areas open for public entry such as golf courses, public and private parks, playgrounds, schoolyards and playing fields, residential landscapes and industrial park landscapes

active storage

volume of water stored in reservoir between the minimum water level and normal water level

actual crop evapotranspiration

rate of evapotranspiration equal to or smaller than predicted crop evapotranspiration as affected by the level of available soil water, salinity, field size or other causes

afflux elevation

rise in maximum flood level from the original unobstructed flood level which result after an obstruction to the flow such as a dam, has been introduced

algal bloom

overgrowths of algae in water producing dangerous toxins in fresh or marine water

application efficiency

ratio of the average depth of irrigation water infiltrated and stored in the root zone to the average depth of irrigation water applied

aquifer

geologic formation which contains water and transmits it at a rate sufficient to be economically developed for pumping artificially developed well

area

cross-sectional area of the flow which is measured perpendicular to the direction of flow

basin irrigation

type of surface irrigation where water is applied to the basin through a gap in the perimeter dike or adjacent ditch; water is retained until it infiltrates into the soil or the excess is drained off

bearing capacity

maximum average contact pressure between the foundation and the soil which should not produce shear failure in the soil

border irrigation

method of irrigation which makes use of parallel border strips where the water flows down the slope at a nearly uniform depth

border strip

area of land bounded by two border ridges or dikes that guide the irrigation stream from the inlet point of application to the ends of the strip

channel bed slope

inclination or elevation drop per unit length of the channel bottom

confined aquifer

groundwater that is confined by relatively impermeable layer

contamination

introduction of substances not found in the natural composition of water that make the water less desirable or unfit for intended use

conveyance efficiency

ratio between water received at the inlet for a block of fields to that released at the project's headwork

conveyance loss

loss of water from a channel during transport due to seepage and percolation

critical depth

depth of water flow where the energy content is at minimum hence, no other backwater forces are involved

crop coefficient

ratio of the actual crop evapotranspiration to its potential evapotranspiration

crop evapotranspiration

rate of evapotranspiration of a disease-free crop growing in a large field (one or more ha) under optimal soil conditions, including sufficient water and fertilizer and achieving full production potential of that crop under the given growing environment; includes water loss through transpiration by the vegetation, and evaporation from the soil surface and wet leaves

cropping pattern

sequence of different crops grown in regular order on any particular field or fields

crop water requirements

amount of water used in producing crops which is the sum of evapotranspiration or consumptive use plus seepage and percolation losses

dam

any barrier constructed to store water

dam height

vertical distance from lowest point of the ground line to the dam crest

dead storage

volume below the intake structure; sediment volume based on 25 years of accumulation in the reservoir

depth

depth of water in the channel cross-section

designed height

actual height of the embankment after settlement

design irrigable area

maximum area which an irrigation project can serve considering the extent of arable lands and the available water supply

distribution uniformity

numerical value on the uniformity of application for agricultural irrigation systems

diversion dam

structure or weir provided across the river or creek to raise its water level and divert the water into the main canal to facilitate irrigation by gravity

diversion water requirement

the total quantity of water diverted from a stream, lake, or reservoir, or removed from the ground in order to irrigate a crop

drip irrigation

trickle irrigation

involves dripping water onto the soil at very low rates (2-20 litres/hour) from the emitters where water is applied close to plants so that only part of the soil in which the roots grow is wetted

drop

in-line canal structure designed to convey canal water from a higher level to a lower level, duly dissipating the excess energy resulting from the drop in elevation

effective rainfall

amount of rainwater that falls directly on the field and is used by the crop for growth and development excluding deep percolation, surface runoff and interception

effective rooting depth

soil depth from which the bulk of the roots of the crop extracts most of the water needed for evapotranspiration

effective size

particle diameter corresponding to a 10% sieve passing

effluent

discharges from known sources which is passed into a body of water or land, or wastewater flowing out of a manufacturing plant, industrial plant including domestic, commercial and recreational facilities

effluent standard

any legal restriction or limitation on quantities, rates, and/or concentrations or any combination thereof, of physical, chemical or biological parameters of effluent which a person or point source is allowed to delivery into a body of water or land

elevated flume

water conveying conduit or trough which is supported on abutments by piers

emitter spacing

spacing between emitters or emission points along a lateral line

emitters

applicator used in drip, subsurface, or bubbler irrigation designed to dissipate pressure and to discharge a small uniform flow or trickle of water at a constant rate that does not vary significantly because of minor differences in pressure

energy grade line

specific energy line

grade line of the water surface profile plus the velocity head in open channels

equipment crossing

provision for passing of equipment and small machinery

evapotranspiration

combination of water transpired from vegetation and evaporated from the soil, water, and plant surfaces.

farm ditch

channel which conveys irrigation water from the turnout to the paddy field

filter drain

dam component which prevents migration of small particles and screen off fine materials that flow with seepage water and prevent piping

finished height

height of the embankment to be attained during construction

farm water requirement

amount of water to replenish the crop water requirement and losses less the effective rainfall

freeboard

additional height of the dam provided as a safety factor to prevent overtopping by wave action or other causes

furrows

small parallel channels, made to carry water in order to irrigate the crop

furrow irrigation

method of irrigation where water runs through small parallel channels as it moves down the slope of the field

head ditch

supply ditch

small channel along one part of a field that is used for distributing water in surface irrigation

homogeneous embankment

dam composed of a single kind of embankment material exclusive for slope protection

hydraulic depth

ratio of flow area to the wetted top width

hydraulic grade line

hydraulic gradient

profile of the free water surface

hydraulic jump

occurs when a thin sheet of incoming flow moving at high velocity strikes water of sufficient depth

hydraulic radius

cross-sectional area of flow divided by the wetted perimeter

hydrologic frequency analysis

estimation of the chance or likelihood of occurrence of a given event by determining the frequency curves of best fit to samples of hydrologic data

inside slope

slope of the upstream face of the embankment

invert

inside bottom or sill of the conduit

inverted siphon

closed conduit designed to convey canal water in full and under pressure running condition, to convey canal water by gravity under roadways, railways, drainage channels and local depressions

irrigation period

time required to cover an area with one application of water

Karst topography

geological formation shaped by the dissolution of a layer or layers of soluble bedrock, usually carbonate rocks such as limestone or dolomite

land preparation water requirement

amount of water required in lowland rice production which includes water losses through evaporation, seepage and percolation and land soaking

land soaking water requirement

amount of water required in lowland rice production which is a function of the initial soil moisture and the physical properties of the soil

lateral spacing

spacing between irrigation laterals

leaching

deep percolation of water beyond the root zone of plants, resulting in loss of salts or nutrients

lined channel

lined canal

canals with impermeable material (usually concrete) for channel stabilization and/or reduced seepage

loading limit

allowable pollutant-loading limit per unit of time, which the wastewater generator is permitted to discharge into any receiving body of water or land.

manifold

portion of the pipe network between the mainline and the laterals

manufacturer's coefficient of variation

measure of the variability of discharge of a random sample of a given make, model and size of emitter, as provided by the manufacturer and before any field operations or aging has taken place determined through a discharge test of a sample of 50 emitters under a set pressure at 200 °C

natural spillway

spillway which is not excavated such as natural draw, saddle or drainage way

normal depth

constant flow depth along a longitudinal section of a channel under a uniform flow condition

normal storage elevation

maximum elevation the water surface which can be attained by the dam or reservoir without flow in the spillway

open channel flow

water flow that is conveyed in such a manner that top surface is exposed to the atmosphere such as flow in canals, ditches, drainage channels, culverts, and pipes under partially full flow conditions

optimal emitter spacing

drip emitter spacing which is 80% of the wetted diameter estimated from field tests

outside slope

slope at the downstream face of the embankment

pan coefficient

ratio between reference evapotranspiration and water loss by evaporation from an open water surface of a pan

pan evaporation

rate of water loss by evaporation from an open water surface of a pan

percolation

vertical flow of water to below the root zone which is affected by soil structure, texture, bulk density, mineralogy, organic matter content, salt type and concentration

permeability test

method to determine the rate of flow under laminar flow conditions through a unit cross sectional area of soil under unit hydraulic gradient

pollutant

any substance, whether solid, liquid, gaseous or radioactive, which directly or indirectly alters the quality of any segment of the receiving water body or land resource so as to affect or tend to affect adversely any beneficial use thereof, or is hazardous or potentially hazardous to health, or imparts objectionable odor, temperature change or physical, chemical or biological change to any segment of the water body or land, or is in excess of the allowable limits or concentrations or quality standards specified in contravention of the condition, limitation or restriction prescribed in these guidelines

pond

sealed section formed between earth embankments where combined seepage and percolation will be measured

potential irrigable area

area capable of being irrigated, principally as regards to availability of water, suitable soils, and topography of land

reference crop evapotranspiration

rate of evapotranspiration from a reference surface which is a hypothetical reference crop with an assumed crop height of 0.2 m, a fixed surface resistance of 70 s/m and an albedo of 0.23

reservoir

part of the system that impounds the runoff

residual moisture content

moisture left in the soil before the initial irrigation water delivery which describes the extent of water depletion from the soil when the water supply has been cut-off restricted areas

areas with limited entry such as freeway landscape, highway medians and other similar areas

re-use

taking wastewater from one industry or process, treating it and then using it in another process or industry such as for irrigation, as liquid fertilizer and for aquaculture

road crossing

conveys canal water under roads or railroads

shallow tubewell

tube or shaft vertically set into the ground at a depth that is usually less than 15 m for the purpose of bringing groundwater into the soil surface whose pumps are set above the water level

seismicity

occurrence or frequency of earthquakes in a region

seepage

water escaping below or out from water conveyance facilities such as open ditches, canals, natural channels, and waterway

seepage line

phreatic line

line with no filter arrangements where seepage occurs

setback distance

distance from the perimeter of the irrigation area to the community or area of concern that is sensitive to contamination

side slope

ratio of the horizontal to vertical dimension of the channel wall

slope of the energy grade line

slope of the water surface profile plus the velocity head in open channels

slope of the hydraulic grade line

slope of the free water surface

spillway

channel which releases surplus or flood water which cannot be contained in the active storage space of the reservoir

sprinkler irrigation

method of applying irrigation water similar to natural rainfall where water is distributed through a system of pipes by pumping and then sprayed into the air through sprinklers so that it breaks up into small water drops which fall to the ground

sprinkler spacing

distance between two sprinkler heads along the lateral

storage capacity

total capacity at normal water surface elevation

storage ratio

ratio of the storage capacity to the total earth volume required for embankment construction which indicates the relative cost of the different types of reservoir

structural height

vertical distance measured from the top of the dam down to the bedrock

surface irrigation system

application of water by gravity flow to the surface of the field. Either the entire field is flooded (basin irrigation) or the water is fed into small channels (furrows) or strips of land (borders)

top width

width of the channel cross-section at the free surface

unconfined aquifer

aquifer which has water table serving as upper surface of the zone of saturation

uniformity coefficient

ratio of the particle size at 60% passing to that at 10% passing

uniform flow

occurs when flow has a constant water area, depth, discharge, and average velocity through a reach of channel

unimodal rainfall pattern

rainfall pattern with five wet months of more than 200 mm/month, five dry months of less than 100 mm/month, two transition months of 100mm-200mm/month and total annual rainfall above 1500 mm.

unlined channels unlined canal

canals that are cut through the soil, in which the soil excavated from the bed are used to form the embankment

upstream face

side of the embankment wetted by the impounded water

waste

any material either solid, liquid, semi-solid, contained gas or other forms resulting from industrial, commercial, mining, or agricultural operations, or from community and household activities that is devoid of usage and discarded

wastewater

waste in liquid state containing pollutants

water balance

accounting of water inflows, such as irrigation and rainfall, and outflows, such as evaporation, seepage and percolation

watershed

area which contributes runoff or drains water into the reservoir

water right

privilege granted by the government to use and appropriate water

well log

record of formation stratification of an aquifer showing the depth, thickness, degree of consolidation and other aquifer physical characteristics

well-protected reservoir

reservoir where the upper reaches of the basin is shielded by high mountain barriers

wetted diameter

diameter of the circular area wetted by the sprinkler when operating at a given pressure and no wind

wetted perimeter

portion of the perimeter of the canal that is in contact with the flowing water

wetted widths

width of the strip that would be wetted by a row of emitters spaced at their optimal spacing along a single lateral line

zoned embankment

dam consisting a central impervious core flanked between zones of more pervious materials