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Chapter 1 : NPTEL :: Civil Engineering - Water Resources Engineering

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This is the best application to remain updated on your fav. Track your learning, set reminders, edit, add favourite topics, share the topics on social media. Some of the topics Covered in the app are: Environmental concerns and recreational development in relation to public health 2. The concept of drought 3. The Ground-Water Component of Stream flow 4. Effects on crop yields in hydro-economic modeling 5. Siting and sizing the components of a regional wastewater system 6. Evaluation of the surface water quality 7. Three applications of dams in Nepal, Malaysia, and Turkey 8. Control mosquitoes in fresh water 9. Environmental concerns and recreational development Environmental indicators of healthy water resources FAO policy and strategy on food security and water development Health opportunities in water resources development Health opportunity assessment in water resource development Introduction of Reservoirs Methods of assessing impacts and quality chemical, physical , biological Principles of environmental and health impact assessment Safe management of the Ross River dam Socioeconomic and health impacts of water resources development The effect of dam construction Water resources development and health Water resources development Urban water resource problems in vector-borne disease with special reference

Chapter 2 : Irrigation Engineering & Water Resources Lectures, Notes & Classwork

Water Resources and Irrigation Engineering Lectures & Notes for Civil Engineers. Water Resource Engineering is a specific kind of civil engineering that involves the design of new systems and equipment that help manage human water resources.

Without it, neither we, nor any life as we know it, would exist. Sources of Water Water moves through the various reservoirs of the hydrologic cycle. May take thousands of years to do this. Much of it is nonrenewable on a human time scale. Water not distributed equally. Leads to confrontations between nations over access to adequate supplies of fresh water. Abundant water often located where there are few people Amazon or visa-versa Southern California Often get short periods of excess precipitation leading to flooding followed by long periods of little precipitation causing droughts: Situation getting worse as population shifts to the west and as climate warms up. This has led to numerous and protracted legal battles over water rights. Surface Water Precipitation that does not infiltrate into the ground is known as surface runoff, which flows into lakes, rivers, stream, swamps, etc. Land is divided into distinct drainage basins or watersheds. These areas drain into a specific stream or lake. Surface water is the most easily accessible where available. Often it is polluted. Groundwater This water has percolated down, filling the voids in soils, sediments, and rocks. Zone of aeration vadose zone; water and air in voids above is separated from zone of saturation only water in voids below by the water table top surface of the groundwater. This may extend down thousands of feet until voids close up. Water table may move up or down depending on the balance between the inflow recharge and outflow discharge of water. Most groundwater held in layers of high porosity and permeability. May be unconfined aquifer extends to the surface or confined aquifer bounded on top and bottom by low porosity and permeability material. Confined artesian aquifers have water under pressure. They are cut off from surface recharge and pollution by overlying aquiclude low porosity and permeability layer , except where aquifer is exposed at the surface. Known as a recharge area. These may be affected by local pollution and covering with impermeable material buildings, parking lots, etc. Value varies from place to place. Most returned to the local hydrologic cycle but often it is polluted. There are five basic ways to increase water supplies, each with their own pros and cons. Dams and Reservoirs Pros: Large year-round capacity, used for flood control, used for recreation, and can generate electricity without pollution. Some of these uses conflict with one another. Large evaporative loss, loss of habitat and displacement of people due to flooding by reservoir, may cause earthquakes, risk of collapse and catastrophic downstream flooding, blocks fish migration, traps sediment, causing increased downstream erosion and loss of beaches, and expensive to build and maintain. Intrabasin or Watershed Transfer Pros: Take water from where it is abundant to where it is scarce. This may be the only large supply of fresh, non-polluted water available to large populations. May require the construction of dams and reservoirs see above , may destroy river and lake habitats in basins where water is being taken due to reduced flows i. Withdrawal of Groundwater Pros: Largest single source of unpolluted fresh water. Lower water tables, aquifer depletion, aquifer destruction, subsidence, saltwater intrusion, increased pollution, drying up of streams and lakes. Parts of the Ogallala Aquifer source of most water for agriculture in central U. S will dry up by Withdrawing groundwater at 4X its replacement rate in the U. Done by distillation or filtration. Expensive X more than standard sources , requires large amounts of energy to make, leaves large amount of concentrated waste brines and salts behind. Improving Efficiency of Water Use Pros: Best way to cut water use is to reduce irrigation evaporation. Center-pivot and drip irrigation systems lose much less water. Also grow crops requiring less water fruits, vegetables in areas where it is scarce. Industry can recycle wastewater. Also, water needed for processing recycled metals is much less than the amount needed for processing original ores. Homeowners can use low-flow showerheads and toilets. Lawns can be replaced with plants requiring less water. Public water supplies can fix their leaks. Start-up costs may be high, but payback times are short. Usually it is much cheaper to pay for conservation than to pay for new water supply systems. Flooding Two types, coastal and stream. The former is caused by coastal storms, sea level rise, and coastal development. The latter usually caused by excess precipitation or snow and ice melt. Both are natural processes often enhanced

by human actions. Streams naturally overflow their banks and flood their adjacent floodplain. People settle there because of fertile soils due to the sediment deposited by floods , abundant water, flat land, and the stream can be used for transportation. Civilizations start along rivers, but this puts people in harms way. Human Impacts on Flooding Human activities increase frequency and severity of floods. Destroy vegetation, increasing soil erosion and surface runoff. Build levees, dams, floodwalls, and channelize streams to try to control floods and protect property. Make things worse by blocking off floodplain. Build more flood-control structures. Make things even worse. Flood-control structures are equally good at keeping water in the floodplain as keeping it out. Once breached they often prolong the flood. In many instances, solving the flooding problem in one area only makes it worse in another. Also destroying natural habitats along streams. Ultimately may be cheaper to let streams go back to their natural condition and move the people out of flood-prone areas. Practice floodplain management i. Restrict development in flood-prone areas, zone out activities not consistent with flooding, create a natural floodway, make flood insurance more expensive and harder to get in another words, stop encouraging people to live and work on floodplains. Water Pollution Any biological, chemical, or physical change in water quality that has a harmful effect on living organisms or makes it unsuitable for desired uses. Pollutant Types 1 Disease causing agents or pathogens, including bacteria, viruses, protozoa, parasites. Measured by the amount of colliform bacteria present. Cause a reduction in dissolved oxygen, suffocating oxygen-consuming organisms fish. Measured by biological oxygen demand BOD. Make water unfit to consume and use for irrigation. Also can harm organisms and cause material corrosion. Cause excessive algal and plant growth that lower oxygen levels when they decompose. Present health risks to humans and other organisms. These and many other chemicals often bioaccumulate in fish and other organisms at the top of the food chain. Disrupt photosynthesis and transports large amounts of other, adsorbed pollutants. Also silt up lakes, rivers, and reservoirs, increasing flood risk. Lowers solubility of oxygen and makes organisms more susceptible to other pollution types. All of the different pollutant type can be discharged from point specific location or nonpoint no single location; large area sources. Point-source pollution is usually easier to identify, monitor, measure, and control. Most water pollution in the U. Little has been done to control it. Stream Pollution Streams usually can recover from many types of pollution due to dilution from fresh water and bacterial decay. Takes some time and distance downstream to recover to normal conditions. Efficient if stream flow is not reduced. Nondegradable pollutants remain for long periods of time. Since , water pollution control laws have reduced pollution amounts entering surface waters from point sources in the U. Rivers such as the Hudson, Delaware, Cuyahoga, Thames, Seine, have recovered and now support robust fish and bird populations and can be used for recreation. Problems still exist in controlling nonpoint source pollution and accidental and industrial discharges.

Chapter 3 : Water Resources Engineering - Civil and Environmental Engineering

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When they are applied in excess of plant needs, nutrients can wash into aquatic ecosystems where they can cause excessive plant growth, which reduces swimming and boating opportunities, creates a foul taste and odor in drinking water, and kills fish. Farmers can implement nutrient management plans which help maintain high yields and save money on the use of fertilizers while reducing NPS pollution. Cloudy water also absorbs more sunlight than clear water. This may raise the water temperature. Silt that settles to the stream bottom is known as sediment. Fish find some of their food like aquatic insects on stream bottoms. An increase in sediment can kill aquatic insects by suffocating them. Sediment can also smother fish eggs and alter natural repopulation patterns. It can also fill in the living spaces and destroy habitat. They are generally less harmful because they can eventually be broken down and their damaging effects can be reversed. They may bioaccumulate up the aquatic food chain, exposing animals, birds, and people who eat fish to unacceptably high concentrations of chemicals. This can result in animal and human health risks and in serious environmental damage. Sources of water pollution: NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water. Runoff from urban areas is the largest source of water quality impairments to surveyed estuaries. The most common NPS pollutants are sediment and nutrients. These wash into water bodies from agricultural land, small and medium-sized animal feeding operations, construction sites, and other areas of disturbance. Other common NPS pollutants include pesticides, pathogens bacteria and viruses , salts, oil, grease, toxic chemicals, and heavy metals. Beach closures, destroyed habitat, unsafe drinking water, fish kills, and many other severe environmental and human health problems result from NPS pollutants. The pollutants also ruin the beauty of healthy, clean water habitats. Wastewater entering the treatment plant includes items like wood, rocks, and even dead animals. Unless they are removed, they could cause problems later in the treatment process. Most of these materials are sent to a landfill. The wastewater system relies on the force of gravity to move sewage from your home to the treatment plant. So wastewater-treatment plants are located on low ground, often near a river into which treated water can be released. If the plant is built above the ground level, the wastewater has to be pumped up to the aeration tanks item 3. From here on, gravity takes over to move the wastewater through the treatment process. One of the first steps that a water treatment facility can do is to just shake up the sewage and expose it to air. This causes some of the dissolved gases such as hydrogen sulfide, which smells like rotten eggs that taste and smell bad to be released from the water. Wastewater enters a series of long, parallel concrete tanks. Each tank is divided into two sections. In the first section, air is pumped through the water. As organic matter decays, it uses up oxygen. Aeration replenishes the oxygen. Grit is pumped out of the tanks and taken to landfills. Wastewater then enters the second section or sedimentation tanks. Here, the sludge the organic portion of the sewage settles out of the wastewater and is pumped out of the tanks. Some of the water is removed in a step called thickening and then the sludge is processed in large tanks called digesters. As sludge is settling to the bottom of the sedimentation tanks, lighter materials are floating to the surface. Slow-moving rakes skim the scum off the surface of the wastewater. Scum is thickened and pumped to the digesters along with the sludge. Many cities also use filtration in sewage treatment. After the solids are removed, the liquid sewage is filtered through a substance, usually sand, by the action of gravity. Water is sometimes filtered through carbon particles, which removes organic particles. This method is used in some homes, too. The chlorine is mostly eliminated as the bacteria are destroyed, but sometimes it must be neutralized by adding other chemicals. This protects fish and other marine organisms, which can be harmed by the smallest amounts of chlorine. The treated water called effluent is then discharged to a local river or the ocean. Aother part of treating wastewater is dealing with the

solid-waste material. The finished product is mainly sent to landfills, but sometimes can be used as fertilizer.

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Chapter 4 : ENVWater Resources and Pollution Lecture Notes

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University with graduate programs, primarily masters programs Course Context: This is a junior-level required course. Fluid mechanics which includes a laboratory is a prerequisite. This is a fast-paced course because of the wide range of somewhat disparate topics that are covered. This course covers the traditional topics offered in an undergraduate water resources engineering course: Contemporary issues are introduced at various points throughout the term: I want students to understand that natural hydrologic processes are spatially and temporally variable, and cannot be perfectly quantified. Students are exposed to several alternative means of quantifying the rainfall-runoff process, with the understanding that all of the techniques are empirical and should be applied with engineering judgement. I want students to be able to have a technical conversation, using the correct terminology, in areas of surface and subsurface hydrology, municipal water supply system design, open channel flow, and storm drainage. I also want students to be aware of the wide range of hydrologic data that are available on the Internet from public agencies. Students always comment on the weekly homework assignments - they are not traditional back-of-the book assignments that have a single right answer. Although these home-made multi-step questions usually do actually have a single set of correct answers, students are challenged by the real-world nature of the problems. One non-traditional assignment has students visit the USGS website to download recent streamflow data. They are asked to describe the hydrographs and comment on how their shapes meet their expectations. Exercises of this sort help students to develop a broader understanding of concepts, rather than relying on so-called plug-and-chug solution of problems. This course has evolved over the years - I taught a similar course many years ago at San Jose State University but with the advantage of also having a lab period , then started teaching it again three years ago. After such a long hiatus, I felt the need to re-educate myself on some topics and found that best to do by reading current trade journals, public agency websites, ASCE news blogs, and even articles in the New York Times. I enthusiastically shared much of this knowledge with my students in both a conversational mode during class and within the context of specific lectures and homework assignments, and the method was successful so I have retained that approach. Students admit that they are somewhat intimidated by the reputation of the heavy courseload, but they enjoy it because of my enthusiasm and the tie in to so many things they see in the real world themselves. Assessment takes place in a relatively traditional manner. Paper homework submittals are collected weekly some digital uploads of essays and spreadsheets are required and are graded with a strict point-based rubric that includes some points for presentation style, completeness of presentation, and adequacy of addressing written interpretation questions. Two longer projects are also graded on a similar basis. Three closed-book exams two during the term and one final each have two parts: Water Resources Engineering, 2nd ed. Mays The text covers too much, so I only assign some chapters. I also post all of my Powerpoint lessons online and encourage students to review them to help determine which concepts I focus on in each chapter of the text.

Chapter 5 : Lectures: PowerPoint â€" Soil and Water Conservation Management

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A slow rate of exchange on a human time scale. Therefore, water is considered a non-renewable resource in the short term. Scarcity of water often leads to political conflicts. Much of the conflict between the Israelis and the Palestinians is over water rights. Water in the zone of saturation. Lies beneath the zone of aeration vadose zone or soil moisture. The water table is the top surface of the zone of saturation. It fluctuates with topography may be higher than elevation of land such as at a lake and with rate of recharge infiltration from surface plus migration in from side versus rate of discharge loss due to pumping and migration out. Varies with changes in seasonal or daily precipitation. Ground water is the most important source of fresh water today, not surface waters lakes and rivers. Supplies 34 out of largest U. Large volumes of ground water require an aquifer that holds and transmits the water. Material has a high porosity and permeability. Usually a well-sorted sediment rock or sedimentary rock. Flow rates of meters per day for sand and sandstone and per day for gravel or conglomerate are typical. Acts as a barrier i. Water is not under any pressure. Aquifer is open to surface waters and pollution throughout its entire area. Usually is regional in extent s of square miles or more. Caused by underlying aquiclude of limited extent. Cheaper to exploit, but can be quickly depleted and is more sensitive to local precipitation and pollution. Water movement restricted to the sandwiched aquifer. Water usually under pressure due to its own weight hydrostatic head. If drilled, water will rise to the potentiametric surface. This surface decreases in altitude with distance from the recharge area because of loss of ability to due work due to friction. Most municipal water supply systems are synthetic artesian systems. Due to overlying confining layer, confined aquifers are less susceptible to pollution over most of their area. However, in the restricted recharge area, the aquifer can be greatly impacted by local pollution and the reduction of water infiltration due to urbanization. Urbanization cuts recharge rates by covering the recharge area with impermeable material asphalt, concrete , particularly for confined aquifers were recharge area is small. Problem can be corrected by building retention basins to hold the water in place for a time and allow it to percolate into the ground. This also helps in upstream flood control. Consequences of Excessive Ground Water Withdrawal If rate of water extraction is greater than rate of recharge a cone of depression develops in the water table around the extraction well. Depth of the cone is greatest at the well. The difference between the elevation of the regional water table outside the cone of depression and the water level in the well is known as the drawdown. Bigger drawdowns occur in aquifers of lower permeability. Nearby shallower wells may dry up unless they are drilled deeper. Overlapping cones of depression can cause a regional lowering of the water table causing many wells to dry up. Cones of depression may locally reverse the direction of ground water flow. May impact the contamination of local water supply. Forms a surface depression or sinkhole. Porosity and permeability may be permanently reduced. Aquifer may now become an aquitard. Causes saltwater intrusion into the aquifer. Makes aquifer and any wells tapping it useless. Polluted surface streams may now pollute ground water. However, much of this is lost because of pollution streams and surface runoff lost to surface streams and enters ocean. Also much of it falls were it is not needed. This represents approximately gallons per person per day in the U. Most of this is used for industry or agriculture. Each of us is personally responsible for about gallons per day home and work usage. Only about 1 gallon per person per day is needed to sustain human life. The rest is returned to the hydrosphere, although often in a polluted chemically, physically, or thermally form. Causes the biggest depletion of ground water supplies and lowering of water tables. An example is the Ogallala Aquifer. May have years of usable water left in some areas. There are no cheap alternative sources of water. Will make crops grown from expensive water more expensive themselves. Problem will only get worse due to global warming. Most water is returned to the hydrosphere. Use less water for many activities. Use high efficiency appliances. Cut down on irrigation or make it less susceptible to evaporation by using drip irrigation techniques. Biggest saving would come in the agricultural area. Move water from where it is plentiful, but not used to areas where it is used, but not plentiful. Often draw on very distance sources, such as the municipal

water supplies for Los Angeles and New York City. They get their water from s of miles away. May have to do this in the Midwest where water could be piped in from Canada. It will cost billions of dollars to build such an extensive water distribution system. Transfer of large volumes of water may have a very negative environmental impact on the source. For example, there is now more demand for Colorado River water than the river can supply. As a result the river dries up entirely it enters Gulf of California. Often there are legal questions as to whose water it is. Turn salty ocean water in to fresh water. Two methods to do this: Good process for individual homes or factories and small towns. Can be powered by burning fuels or solar energy. Used extensively in Saudi Arabia and other desert environments. Very expensive technology with the derived water costing times more than naturally fresh water. Food grown will cost times as much. We are reaching the limit of our water supplies in some locations in this country and around the world. Where are we going to find more and at what cost, both economically and environmentally?

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