DOWNLOAD PDF DRAINAGE CHANNEL AND WATERWAY

Chapter 1 : Landscaping for Water Drainage | This Old House

Download Drainage Channel And Waterway written by George P. Brown (engineer.) and has been published by this book supported file pdf, txt, epub, kindle and other format this book has been release on with Chicago Drainage Canal categories.

History of turnpikes and canals in the United States The modern canal system was mainly a product of the 18th century and early 19th century. It came into being because the Industrial Revolution which began in Britain during the midth century demanded an economic and reliable way to transport goods and commodities in large quantities. By the early 18th century, river navigations such as the Aire and Calder Navigation were becoming quite sophisticated, with pound locks and longer and longer "cuts" some with intermediate locks to avoid circuitous or difficult stretches of river. Eventually, the experience of building long multi-level cuts with their own locks gave rise to the idea of building a "pure" canal, a waterway designed on the basis of where goods needed to go, not where a river happened to be. The claim for the first pure canal in Great Britain is debated between "Sankey" and "Bridgewater" supporters. The Sankey Brook Navigation , which connected St Helens with the River Mersey , is often claimed as the first modern "purely artificial" canal because although originally a scheme to make the Sankey Brook navigable, it included an entirely new artificial channel that was effectively a canal along the Sankey Brook valley. He commissioned the engineer James Brindley to build a canal for that purpose. This was an engineering wonder which immediately attracted tourists. It opened in and was the first major British canal. The boats on the canal were horse-drawn with a towpath alongside the canal for the horse to walk along. This horse-drawn system proved to be highly economical and became standard across the British canal network. The canal boats could carry thirty tons at a time with only one horse pulling [21] - more than ten times the amount of cargo per horse that was possible with a cart. Because of this huge increase in supply, the Bridgewater canal reduced the price of coal in Manchester by nearly two-thirds within just a year of its opening. The Bridgewater was also a huge financial success, with it earning what had been spent on its construction within just a few years. This success proved the viability of canal transport, and soon industrialists in many other parts of the country wanted canals. After the Bridgewater canal, early canals were built by groups of private individuals with an interest in improving communications. In Staffordshire the famous potter Josiah Wedgwood saw an opportunity to bring bulky cargoes of clay to his factory doors and to transport his fragile finished goods to market in Manchester, Birmingham or further away, by water, minimizing breakages. The period between the s and the s is often referred to as the "Golden Age" of British canals. For each canal, an Act of Parliament was necessary to authorize construction, and as people saw the high incomes achieved from canal tolls, canal proposals came to be put forward by investors interested in profiting from dividends, at least as much as by people whose businesses would profit from cheaper transport of raw materials and finished goods. In a further development, there was often out-and-out speculation, where people would try to buy shares in a newly floated company simply to sell them on for an immediate profit, regardless of whether the canal was ever profitable, or even built. During this period of " canal mania ", huge sums were invested in canal building, and although many schemes came to nothing, the canal system rapidly expanded to nearly 4, miles over 6, kilometres in length. For many years, a dispute about tolls meant that goods travelling through Birmingham had to be portaged from boats in one canal to boats in the other. Canal companies were initially chartered by individual states in the United States. These early canals were constructed, owned, and operated by private joint-stock companies. The Erie Canal opened was chartered and owned by the state of New York and financed by bonds bought by private investors. The Erie Canal with its easy connections to most of the U. By cutting transportation costs in half or more it became a large profit center for Albany and New York City as it allowed the cheap transportation of many of the agricultural products grown in the mid west of the United States to the rest of the world. From New York City these agricultural products could easily be shipped to other U. Assured of a market for their farm products the settlement of the U. The profits generated by the Erie Canal project started a canal building boom in the United States that lasted until about when railroads started becoming seriously competitive in price and convenience. The Blackstone Canal finished in in Massachusetts and Rhode Island fulfilled a similar role in the early industrial revolution between and Power canal A power canal refers to a canal used for hydraulic power generation, rather than for transport. Nowadays power canals are built almost exclusively as parts of hydroelectric power stations. Parts of the United States, particularly in the Northeast , had enough fast-flowing rivers that water power was the primary means of powering factories usually textile mills until after the American Civil War. The output of the system is estimated at 10, horsepower. Competition, from railways from the s and roads in the 20th century, made the smaller canals obsolete for most commercial transport, and many of the British canals fell into decay. Yet in other countries canals grew in size as construction techniques improved. In the United States, navigable canals reached into isolated areas and brought them in touch with the world beyond. Settlers flooded into regions serviced by such canals, since access to markets was available. The Erie Canal as well as other canals was instrumental in lowering the differences in commodity prices between these various markets across America. The canals caused price convergence between different regions because of their reduction in transportation costs, which allowed Americans to ship and buy goods from farther distances much cheaper. Ohio built many miles of canal, Indiana had working canals for a few decades, and the Illinois and Michigan Canal connected the Great Lakes to the Mississippi River system until replaced by a channelized river waterway. A family rides a boat in one of the canals of Amsterdam. Three major canals with very different purposes were built in what is now Canada. The first Welland Canal , which opened in between Lake Ontario and Lake Erie, bypassing Niagara Falls and the Lachine Canal , which allowed ships to skirt the nearly impassable rapids on the St. Lawrence River at Montreal , were built for commerce. The Rideau Canal was built as a result of the War of to provide military transportation between the British colonies of Upper Canada and Lower Canada as an alternative to part of the St. Lawrence River, which was susceptible to blockade by the United States. A proposal for the Nicaragua Canal , from around Canal traffic doubled in the first decades of the 20th century. In the 19th century, a number of canals were built in Japan including the Biwako canal and the Tone canal. These canals were partially built with the help of engineers from the Netherlands and other countries. Large-scale ship canals such as the Panama Canal and Suez Canal continue to operate for cargo transportation, as do European barge canals. Due to globalization , they are becoming increasingly important, resulting in expansion projects such as the Panama Canal expansion project. The expanded canal began commercial operation on 26 June The new set of locks allow transit of larger, Post-Panamax and New Panamax ships. In some cases railways have been built along the canal route, an example being the Croydon Canal. A movement that began in Britain and France to use the early industrial canals for pleasure boats, such as hotel barges , has spurred rehabilitation of stretches of historic canals. In some cases, abandoned canals such as the Kennet and Avon Canal have been restored and are now used by pleasure boaters. In Britain, canalside housing has also proven popular in recent years. Canals have found another use in the 21st century, as easements for the installation of fibre optic telecommunications network cabling, avoiding having them buried in roadways while facilitating access and reducing the hazard of being damaged from digging equipment. Canals are still used to provide water for agriculture. An extensive canal system exists within the Imperial Valley in the Southern California desert to provide irrigation to agriculture within the area. Cities on water[edit].

Chapter 2 : Canal - Wikipedia

Drainage channel and waterway; a history of the effort to secure an effective and harmless method for the disposal of the sewage of the city of Chicago, and to create a navigable channel between Lake Michigan and the Mississippi River.

All houses in the major cities of Harappa and Mohenjo-daro had access to water and drainage facilities. Waste water was directed to covered gravity sewers , which lined the major streets. Geotextiles are synthetic textile fabrics specially manufactured for civil and environmental engineering applications. Geotextiles are designed to retain fine soil particles while allowing water to pass through. In a typical drainage system they would be laid along a trench which would then be filled with coarse granular material: The geotextile is then folded over the top of the stone and the trench is then covered by soil. Groundwater seeps through the geotextile and flows through the stone to an outfell. In high groundwater conditions a perforated plastic PVC or PE pipe is laid along the base of the drain to increase the volume of water transported in the drain. Alternatively, a prefabricated plastic drainage system made of HDPE called SmartDitch , often incorporating geotextile, coco fiber or rag filters can be considered. The use of these materials has become increasingly more common due to their ease of use which eliminates the need for transporting and laying stone drainage aggregate which is invariably more expensive than a synthetic drain and concrete liners. Over the past 30 years geotextile and PVC filters have become the most commonly used soil filter media. They are cheap to produce and easy to lay, with factory controlled properties that ensure long term filtration performance even in fine silty soil conditions. The project focuses on designing a system "to provide drainage that more closely mimics the natural landscape prior to development than traditional piped systems". An emphasis on non curbed sidewalks allows water to flow more freely into the areas of permeable surface on the side of the streets. Because of the plantings, the run off water from the urban area does not all directly go into the ground, but can also be absorbed into the surrounding environment. Monitoring conducted by Seattle Public Utilities reports a 99 percent reduction of storm water leaving the drainage project [3] Drainage has undergone a large-scale environmental review in the recent past in the United Kingdom. Sustainable Urban Drainage Systems SUDS are designed to encourage contractors to install drainage system that more closely mimic the natural flow of water in nature. Since local and neighbourhood planning in the UK is required by law to factor SUDS into any development projects that they are responsible for. Slot drainage has proved the most breakthrough product of the last twenty years as a drainage option. As a channel drainage system it is designed to eliminate the need for further pipework systems to be installed in parallel to the drainage, reducing the environmental impact of production as well as improving water collection. Both stainless steel and concrete channel slot drainage have become industry standards on construction projects. Drainage in the construction industry[edit] Piping being placed for a sink The civil engineer is responsible for drainage in construction projects. They set out from the plans all the roads , street gutters , drainage, culverts and sewers involved in construction operations. Civil engineers and construction managers work alongside architects and supervisors, planners, quantity surveyors , the general workforce, as well as subcontractors. Typically, most jurisdictions have some body of drainage law to govern to what degree a landowner can alter the drainage from his parcel. Drainage options for the construction industry include: Point drainage, which intercepts water at gullies points. Gullies connect to drainage pipes beneath the ground surface and deep excavation is required to facilitate this system. Support for deep trenches is required in the shape of planking, strutting or shoring. Channel drainage, which intercepts water along the entire run of the channel. Channel drainage is typically manufactured from concrete, steel, polymer or composites. The interception rate of channel drainage is greater than point drainage and the excavation required is usually much less deep. The surface opening of channel drainage usually comes in the form of gratings polymer, plastic, steel or iron or a single slot slot drain that runs along the ground surface typically manufactured from steel or iron. Drainage in urban vegetation[edit] Research evaluating drainage quantity and quality in urban mixed landscapes vegetation is limited. Insufficiencies and obstacles in understanding soil water conditions particularly in urban landscape environs undermine a sound judgement of urban soils. A research in South Australia investigates the relative impact of landscape variation on drainage and solute leaching in a public park containing heterogeneous urban-landscape vegetation that is irrigated with recycled wastewater. For this purpose, two pan lysimeters were designed and installed in two different land-scape zones. Note that protuberances create turbulent water, preventing sediment from settling in the channel. Wetland soils may need drainage to be used for agriculture. In the northern United States and Europe, glaciation created numerous small lakes which gradually filled with humus to make marshes. Some of these were drained using open ditches and trenches to make mucklands , which are primarily used for high value crops such as vegetables. The largest project of this type in the world has been in process for centuries in the Netherlands. The area between Amsterdam , Haarlem and Leiden was, in prehistoric times swampland and small lakes. Turf cutting Peat mining , subsidence and shoreline erosion gradually caused the formation of one large lake, the Haarlemmermeer , or lake of Haarlem. The invention of wind-powered pumping engines in the 15th century permitted drainage of some of the marginal land, but the final drainage of the lake had to await the design of large, steam powered pumps and agreements between regional authorities. Coastal plains and river deltas may have seasonally or permanently high water tables and must have drainage improvements if they are to be used for agriculture. An example is the flatwoods citrus -growing region of Florida. After periods of high rainfall, drainage pumps are employed to prevent damage to the citrus groves from overly wet soils. Rice production requires complete control of water, as fields need to be flooded or drained at different stages of the crop cycle. The Netherlands has also led the way in this type of drainage, not only to drain lowland along the shore, but actually pushing back the sea until the original nation has been greatly enlarged. In moist climates, soils may be adequate for cropping with the exception that they become waterlogged for brief periods each year, from snow melt or from heavy rains. Soils that are predominantly clay will pass water very slowly downward, meanwhile plant roots suffocate because the excessive water around the roots eliminates air movement through the soil. Other soils may have an impervious layer of mineralized soil, called a hardpan or relatively impervious rock layers may underlie shallow soils. Drainage is especially important in tree fruit production. Soils that are otherwise excellent may be waterlogged for a week of the year, which is sufficient to kill fruit trees and cost the productivity of the land until replacements can be established. In each of these cases appropriate drainage carries off temporary flushes of water to prevent damage to annual or perennial crops. Drier areas are often farmed by irrigation , and one would not consider drainage necessary. However, irrigation water always contains minerals and salts , which can be concentrated to toxic levels by evapotranspiration. Irrigated land may need periodic flushes with excessive irrigation water and drainage to control soil salinity.

Chapter 3 : Drainage - Wikipedia

*Drainage Channel and Waterway: A History of the Effort to Secure an Effective and Harmless Method for the Disposal of the Sewage of the City of Between Lake Michigan and the Missippi River [George P. Brown] on theinnatdunvilla.com *FREE* shipping on qualifying offers.*

Approximate length of culvert, in meters. Allowable headwater depth, in meters. Headwater depth is defined as the vertical distance from the culvert invert flow line at the entrance to the water surface elevation permissible in the approach channel upstream from the culvert. Type of culvert, including barrel material, barrel cross-sectional shape and entrance type. If grade is given in percent, convert to slope in meters per meter. Allowable outlet velocity if scour or fish passage is a concern. Convert metric units to english units for use with the nomographs. Multiply cm by 0. Multiply meter by 3. Refer to the inlet control nomograph for the culvert type selected. Raising the embankment height or using a pipe arch and box culvert which allow for lower fill heights is more efficient hydraulically than using the multiple culvert approach. Given equal end areas, a pipe arch will handle a larger flow than two round culverts. Selection should be based on an economic analysis. Find headwater HW depth for the trial size culvert: HW depth by use of the appropriate inlet control nomograph. Tailwater TW conditions are to be neglected in this determination. Check outlet velocities for size selected: In computing outlet velocities, charts and tables such as those provided by U. Try a culvert of another type or shape and determine size and HW by the above procedure. Record final selection of culvert with size, type, outlet velocity, required HW and economic justification. A good historical record of culvert design, installation, and performance observations can be a valuable tool in planning and designing future installations. Instructions for Usinq Inlet Control Nomographs 1. To determine headwater HW: To determine culvert size: To determine discharge Q: Continue as in 2a. Good installation practices are essential for proper functioning of culverts, regardless of the material used in the construction of the culvert Figure Flexible pipe such as aluminum, steel, or polyethylene, requires good side support and compaction, particularly in the larger sizes. It is recommended that the road be constructed to grade or at least a meter above the top of the pipe, the fill left to settle and then excavated to form the required trench. The foundation dictates if bedding is needed or not. Proper foundation maintains the conduit on a uniform grade. Most times, the culvert can be laid without bedding, however; a few centimeters of bedding helps in installation of the culvert. When bedding is required, the depth should be 8 cm if the foundation material is soil and 30 cm if it is rock. Backfilling is the most important aspect of culvert installation. Ten percent of the loading is taken by the pipe and 90 percent is taken by the material surrounding the pipe if backfilling is done correctly. Backfill material should consist of earth, sand, gravel, rock or combinations thereof, free of humus, organic matter, vegetative matter, frozen material, clods, sticks and debris and containing no stones greater than 8 cm 3 in in diameter. Sample work sheet for culvert dimension determination. Velocities as read from charts are about the same for each size, indicating change in size has little effect. Size selected would be based on accuracy of flood estimate. Note that TW must be greater than This points out that accuracy in estimating TW depths is unnecessary in some cases. Nomograph for concrete pipes inlet control U. Nomograph for corrugated metal pipe CMP , inlet control. Nomograph for corrugated metal arch pipe CMP , inlet control. Nomograph for box - culvert, inlet control. Nomograph for corrugated metal pipe CMP , outlet control. Proper pipe foundation and bedding 1 ft. Past experience has shown that channel crossings have failed not because of inadequate design to handle unanticipated water flows, but because of inadequate allowances for floatable debris which eventually blocked water passage through the culvert. Therefore, each channel crossing has to be analyzed for its debris handing capacity. When upstream organic debris poses an immediate threat to the integrity of the culvert, several alternatives may be considered. Cleaning the stream of floatable debris is risky and expensive. Since many of the hydraulic characteristics of the channel are influenced by the size and placement of debris, its removal must be carried out only after a trained specialist, preferably a hydrologist, has made a site-specific evaluation of channel stability factors. Various types of mechanical structures Figures 76, 77 and 78 can be placed above the inlet to catch any debris that may become entrained. A bridge may be substituted in place of a culvert.

Debris control structure--cribbing made of timber. Debris control structure--trash rack made of steel rail I-beam placed over inlet. Inlet and outlet protection of culvert with rip-rap. Rocks used should typically weigh 20 kg or more and approximately 50 percent of the rocks should be larger than 0. Rocks can also be replaced with cemented sand layer 1 part cement, 4 parts sand. Under high fills, inlets can be provided with upstream protection by rock riprap up to the high water mark Figure Cambering may also be necessary to ensure the proper grade after fill settlement. Bridges Bridges often represent the preferred channel crossing alternative in areas where aquatic resources are extremely sensitive to disturbance. However, poor location of footings, foundations, or abutments can cause channel scour and contribute to debris blockage. Bridges have been designed using a variety of structural materials for substructure and superstructure. Selection of a bridge type for a specific site should take into consideration the functional requirements of the site, economics of construction at that site, live load requirements, foundation conditions, maintenance evaluations, and expertise of project engineer. Some arbitrary rules for judging the minimum desirable horizontal and vertical stream clearances in streams not subject to navigation may be established for a specific area based on judgment and experience. In general, vertical clearances should be greater than or equal to 1. Horizontal clearance between piers or supports in forested lands or crossings below forested lands should not be less than 85 percent of the anticipated tree height in the forested lands or the lateral width of the year flood. US Environmental Protection Agency, Of course, longer bridge spans will require careful economic evaluations since higher superstructure costs are often involved. Subaqueous foundations are expensive and involve a high degree of skill in the construction of protective cofferdams, seal placement and cofferdam dewatering. In addition to threats to water quality that can occur from a lost cofferdam, time and money losses will be significant. Subaqueous foundations often limit the season of construction relative to water level and relative to fish spawning activity. Thus, construction timing must be rigidly controlled. It is suggested that the maximum use be made of precast or prefabricated superstructure units since the remoteness of many mountain roads economically precludes bridge construction with unassembled materials that must be transported over great distances. However, the use of such materials may be limited by the capability to transport the units over narrow, high curvature roads to the site, or by the horizontal geometry of the bridge itself. Another alternative is the use of locally available timber for log stringer bridges. An excellent reference for the design and construction of single lane log bridges is Log Bridge Construction Handbook, by M. The reader is referred to this publication for more detailed discussions of these topics. If, for practical reasons, water velocity cannot be reduced, surfaces must be hardened or protected as much as possible to minimize erosion from high velocity flows. This is especially true for unpaved, gravel, or dirt roads. Water moves across the road surface laterally or longitudinally. Lateral drainage is achieved by crowning or by in- or out- sloping of road surfaces Figure Longitudinal water movement is intercepted by dips or cross drains. These drainage features become important on steep grades or on unpaved roads where ruts may channel water longitudinally on the road surface. Road cross section grading patterns used to control surface drainage.

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Chapter 4 : Drainage Channel: Building Materials & Supplies | eBay

Drainage is the natural or artificial removal of a surface's water and sub-surface water from an area. The internal drainage of most agricultural soils is good enough to prevent severe waterlogging (anaerobic conditions that harm root growth), but many soils need artificial drainage to improve production or to manage water supplies.

Mark a straight cutline across the corner of the driveway to indicate the position of the channel drain. Cut through the asphalt with a water-cooled circular saw fitted with a diamond-impregnated blade. Pry up and remove the severed piece of asphalt with a shovel. Use a small sledgehammer and brick-set chisel to chop out any rocks along the edge of the just-cut driveway. Dig a 6-inch-deep trench along the end of the driveway. Shovel the excavated dirt into a wheelbarrow. Glue an offset outlet and a degree elbow onto one end of the channel drain. Glue a short section of 4-inch-diameter plastic pipe and a degree elbow onto the degree elbow. Glue an end cap onto the opposite end of the channel drain. Mix up a bag of concrete in the wheelbarrow. Fill the trench with wet concrete. Smooth the concrete with a pointed brick trowel. Tap down the drain with a rubber mallet. Use the trowel to spread an angled wedge of concrete against the back of the drain. Dig a inch-deep trench out from the channel drain and across the yard. Use a reciprocating saw to cut plastic pipe to extend from the drain along the trench. Glue the pipe and fittings together. Backfill the trench with soil to conceal the drainpipe. Line the end of the drainpipe with flat stones to deter erosion. Sprinkle some asphalt cold patch between the channel drain and the driveway. Compact the patch with the small sledgehammer, then add more asphalt and compact it again. Repeat until the patch is flush with the surface of the driveway. Plant grass seed along the backfilled trench.

Chapter 5 : How to Install a Channel Drain | This Old House

Home Drainage Center Standing water in your basement, driveway or yard? NDS quickly identifies drainage problems and selects the right solution to resolve issues at home.

Chapter 6 : CHAPTER 4 DRAINAGE DESIGN

The Pro Series Channel Drains are a Pre-assembled Channel Drain System. They are efficient, easy to use and will decrease installation time. They quickly remove water from hardscapes as perimeter drains and direct it away from building structures or any other area requiring surface drainage.

Chapter 7 : Drainage Channel and Waterway

The application of this class of drainage channels is widened by low profile channels for shallower ground depths, pre-sloped channels to speed up water flow and slot drains for a more discrete finish.

Chapter 8 : Download [PDF] drainage channel and waterway

- 4-inch channel drain, to collect excess water - End cap and offset outlet, for attachment to channel drain - 4-inch-diameter plastic drainpipe and assorted fittings, to carry water away from.

Chapter 9 : Hydraulic Design Manual: Roadside Channel Design

4-inch channel drain, to collect excess water End cap and offset outlet, for attachment to channel drain 4-inch-diameter plastic drainpipe and assorted fittings, to carry water away from channel drain.