# DOWNLOAD PDF THE QUALITY OF THE SURFACE WATERS OF ILLINOIS

## Chapter 1 : IDEALS @ Illinois: Quality of surface waters in Illinois

*Illinois also has more than 91, lakes and ponds of which 1, are publicly owned (, acres). To track environmental conditions and to evaluate the efficacy of water-pollution-control programs as required by state and federal regulations, Illinois EPA has been monitoring Illinois surface water since*

The specific objectives of this study are to: Investigate, identify, and develop process-based mathematical relationships describing the components of flow base flow, tile flow, and surface runoff from a tile-drained watershed. We will develop a hydrograph separation technique and use data from a tile-drained watershed to calibrate and validate the relationships and techniques. Relate water quality parameters to the flow components identified and described. Based on data collection, we will develop a sound conceptual model or modify a watershed-water quality model to describe the hydrologic and water quality response of the LVR watershed, and extend the applicability of the model to other similar tile-drained watersheds. Investigate the relationship between water quality and flow components in central Illinois watersheds to assist in partitioning stream flow between base flow and tile flow in watersheds where direct measurements of tile flow are not available. Quantify the contributions of base flow and in-stream denitrification to the depletion of nitrate in central Illinois streams observed at the watershed-scale during summer and fall low-flow conditions, and use this information to improve our understanding of the empirical methods of estimating riverine nutrient loads. At each section, stream monitoring stations will be installed at the upstream and downstream ends and a series of piezometers will be installed on both sides of the stream to measure the water table elevation profile in the vicinity of the stream. The tile flow into each of the three representative sections will be measured, and tile flow hydrographs will be constructed. These tile flow hydrographs, as well as the hydrographs from the upstream and downstream ends of each section, will be characterized in terms of shape, total volume, and associated rainfall. In this study, events that do not have surface runoff will be selected. For each selected event, the upstream and downstream hydrographs at each experimental section will be separated into portions representing "quick" and "slow" responses based on where the break in the recession limb occurs. Once the base flow into each stream section is determined for all the selected events during the study period, relationships will be established between base flow and area draining into the tile lines, tile length, tile density, soil type, land use, topography, rainfall duration, and rainfall amount. Piezometer data will be used to construct water surface elevations on both sides of the stream. These results will be compared with the base flow estimations. We will use any differences in the values to refine estimates for the soil hydraulic properties. Once the comparisons of base flows have been made, the relationships between base flow and the variables will be validated. Since we have tile maps and soil, land use, and the topographic information for the entire ULVR watershed, we can use these relationships to estimate the base flow from the ULVR watershed. The piezometer and stream water quality samples will be analyzed. By combining water quality data and the "quick" and "slow" response components of hydrographs, total nutrient loading from tile flow and base flow will be estimated. We will also conduct studies of multiple water quality parameters at the stream-section scale to assist in partitioning stream flow between base flow and tile flow. A suite of water quality constituents pH, specific conductance, nitrate, ammonia, TKN, dissolved reactive phosphate, suspended sediments, dissolved organic carbon, cations - Ca, Mg, Na, K - and anions -- Cl and sulfate will be measured. In addition, flow partitioning will be performed by simultaneously optimizing fits of water and mass balance equations to measurements of water flows and solute fluxes. This approach may be able to help reduce the uncertainty in the measurements based on water volumes alone. The specific objectives are to quantify various hydrologic components of flow processes and to develop mathematical relationships for these components for tile-drained watersheds. During , we had installed three experimental sites in two tile-drained watersheds; however, due to conflicts with the drainage districts commissioners, the landowners wanted two installations removed from their properties. The third experimental site was selected in the Big Ditch watershed in Illinois. This site was selected based on suitability with existing drainage channels, available tile maps, and topography. This site has been surveyed and contour maps have been prepared. At this site, two parshall flumes were installed in a drainage channel in to monitor flow rates. One flume was installed at an upstream location and another one at the downstream location more than meters away from the upstream flume. Twelve piezometers were installed on each side of the stream section to monitor groundwater levels and for collecting groundwater samples. There are two tile outlets draining into this channel section in between the upstream and downstream flumes ; tile flow monitoring stations have been installed at these locations. In , another monitoring site was installed in the Embarras River Watershed. At present, all the flow components are being monitored at both of these watersheds. Water samples are being collected from the upstream flume, downstream flume, piezometers, and the tile outlets, and are being analyzed for water quality components. Papers are in progress of publication. Impacts The results from this project will enhance the basic understanding of flow and transport in tile-drained watersheds. Once flow separation techniques and mathematical relationships are validated, the estimation process for total maximum daily load TMDL to a surface water source will be simplified. Accordingly, watershed management practices can be evaluated and applied to comply with the TMDL criteria for tile-drained watersheds effectively. The specific objectives were to quantify various hydrologic components of flow processes and to develop mathematical relationships for these components for tile-drained watersheds. During the period , we had installed two successfully-conducted experimental sites in two tile-drained watersheds. All sites have been surveyed and contour maps have been prepared. At each site, two parshall flumes were installed in a drainage channel to monitor flow rates. Twelve piezometers were installed on each side of the stream section to monitor groundwater levels and for collecting groundwater samples at each site. At present, monitoring of all the flow components have been completed at both of these watersheds. Water samples were collected from the upstream flume, downstream flume, piezometers, and the tile outlets, and have been analyzed. Hydrographs were developed for storm events of different intensities for the flumes and tile outlets. A mass balance approach was used to estimate the base flow volume per unit length of the channels. Dupuit equation was also applied to determine the base flow in three transects in the stream sections during base flow periods. The mass balance approach revealed that the average percentages of base flow and tile flow additions within the channel section at one of the sites A were  It was also observed that the base flow rate was predominantly dependent on the antecedent moisture conditions, rainfall distribution, the types of soil in the watersheds and plant water uptake. NO3-N concentrations in streams, observation wells, and tile drains were monitored. There is a significant difference in the NO3-N concentrations in the stream water samples in the two watersheds. This was mainly due to the fact that in Upper Embarras site, the watershed encompasses urban areas in addition to the agricultural fields, whereas Big Ditch site mainly covers agricultural fields. It was found that the NO3-N concentration is usually higher after fertilizer application and also when there is no crop-uptake of NO3-N. NO3-N concentration was usually low when there is more crop uptake i. We observed that fertilizer application times, methods and rates played a major role in the amount of NO3-N lost from a watershed. One student has completed his Ph. Papers have been presented, published, and are being submitted for publication. Impacts The results from this project enhances the basic understanding of flow and transport in tile-drained watersheds. Once flow separation techniques and mathematical relationships are validated, the estimation process for total maximum daily load TMDL to a surface water source can be simplified. Estimation of various flow components in drainage channels in two tile drained watersheds in Illinois. Nitrate loading in streams in two tile drained watersheds in Illinois. Base flow characteristics of a subsurface drained watershed. Estimation of base flow in drainage channels in two tile-drained watersheds in Illinois. One flume was installed at an upstream location and another one at the downstream location at more than meters away from the upstream flume. At present, all the flow components are being monitored at this watershed site. Recently, we have identified two additional experimental sites within this watershed and we will soon start our experiments at these sites. Base flow separation from stream-channel flow in a tile-drained watershed. Performance of two watershed models for hydrologic simulations in an Illinois watershed. Estimation of total maximum daily load TMDL to a surface water source will be possible once our techniques and relationships are validated. Watershed management practices can then be evaluated and applied to comply with the TMDL criteria for tile-drained watersheds. Experiments are being conducted at three sites. These sites are selected based on their suitability with existing drainage channels, available tile maps, and topography. The sites have been surveyed. At each site, two parshall flumes have been installed to monitor flow rates. At each site, one flume has been installed at an upstream location and another one at the downstream location at more than meters away from the upstream flume. At each site, piezometers have been installed on both sides of the stream to monitor groundwater levels and for collecting groundwater samples. As soon as the automatic water samplers are installed, data collection will be initiated. Old drains, new challenges - Study of base flow in tile-drained watersheds. Upland drainage-watershed hydrology considerations. Surface runoff occurs only occasionally from an upland drainage watershed. This research is critical for understanding fundamental processes of how water reaches the stream networks and how much water comes from tile flow, stream bank, and runoff. This study aims to improve water quality in tile-drained watersheds. The objective is to quantify various hydrologic components and to develop mathematical relationships between these components for tile-drained watersheds. Three experimental sites have been selected for this project. The flow measurement systems flumes have been designed for all the three sites. We are in the process of constructing and installing the flumes at all three experimental sites.

## Chapter 2 : IDEALS @ Illinois: Quality of surface waters in Illinois

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Credits Drainage Issues on the Rural-Urban Fringe Soil drainage, both surface and subsurface, has been a major issue in land use throughout most of Illinois for more than years. Such drainage was used to convert wet prairie lands to crop production. The importance of drainage in Illinois is evident in state statutes addressing the drainage-related rights and responsibilities of landowners. Complexity and Caution Drainage can become one of the most controversial management issues landowners must face. It often entails complex legal and social issues. Legally, local, state, and federal laws can simultaneously apply to a given drainage situation. Sometimes this presents confusing or overlapping regulations. All levels of jurisdiction must be considered before undertaking any actions that may affect drainage. Socially, drainage disputes can strain neighbor relations. Disagreements can arise between developers, adjacent landowners, and local officials. Disputes can result in court battles. Be sure to consult proper legal counsel if you become involved in a drainage dispute. Yesterday to Today In rural areas of the state, landowners have traditionally been aware of Illinois drainage laws, their impact on drainage between neighboring property, and the importance of working together to successfully implement drainage practices. However, even with such awareness, disputes sometimes arise between farmers over drainage issues. More recently, as many parts of Illinois have experienced non-farm growth into agricultural areas, farmers have expressed concern about their own drainage rights and protecting their land from excess water problems caused by neighboring development. Often on this rural-urban fringe, non-farm landowners, developers, local officials, attorneys, and others lack the traditional awareness, understanding, or appreciation of the importance of maintaining proper drainage to and from adjacent parcels of land. When subsurface drainage tiles are damaged, they may cause water to back up into adjoining farmland. Surface water may be rerouted and discharged at new locations. Furthermore, frequency of the discharges may be altered. Without sufficient planning, the types of problems that impact farmers can cause similar problems for homeowners in neighboring developments. Many communities have local ordinances regulating the care and repair of field tiles during construction and the release of storm water. Basics of Illinois Drainage Law The basic principles of Illinois drainage law have not changed since they were originally instituted. One premise of Illinois drainage law is the law of natural drainage, which recognizes natural differences in levels of lands. The principle of the law of natural drainage is that landowners must take whatever drainage advantages or inconveniences nature places upon their land. According to the law of natural drainage, owners of lower ground, known as a servient tenement, are bound to receive surface water that flows naturally onto it from higher ground, known as the dominant tenement. Therefore, owners of land that is lower than adjoining farms must take the water that flows through natural depressions onto their land. Likewise, unless a city has adopted a system of artificial drainage, owners of lots that are lower than adjoining lots must receive the water that drains from the higher lots. In Illinois, many landowners seem to understand and accept the law of natural drainage. However, it is important to keep in mind that not all states use the law of natural drainage. For example, Wisconsin law allows landowners greater rights to restrict water movement onto their land from dominant landowners. Persons purchasing property in other states should investigate the applicable state law if drainage is a concern. Evolution of Illinois Drainage Law in Agriculture Historically, as the potential for agricultural productivity increased, so did the desire to increase the drainage of farm fields. As a result, Illinois drainage law evolved from simple application of the law of natural drainage to allowing landowners to collect surface water, discharge it, and hasten its flow to lower ground. In an early case, the court held that, in the interest of good husbandry, landowners could drain their ponds or collect surface water that would naturally be held in pools and hasten its flow by digging artificial ditches. The court specified, however, that landowners could do this only if the water was discharged at the place where it would have flowed if the ponds or pools had been filled with dirt and the water forced out into natural channels of drainage. All lands lying within a natural basin, therefore, may be drained into a watercourseâ€"whether a stream or a mere depressionâ€"that drains this basin, and the owners of lower land cannot object to this increased flow. The water can be carried by artificial ditches or by tile lines, but either system must drain only the natural basin and the drained water must enter the lower land where it would have in a state of nature. The courts have also held that substituting tile for surface drainage does not amount to an abandonment of natural drainage rights on the part of the owner. Therefore, the principle of dominant and servient landowners still applies to subsurface drainage. In addition to surface and subsurface drainage onto neighboring lands, owners of higher ground can drain land within a natural basin into a natural watercourse flowing through their land. As a practical matter, their right to drain into a stream is not often questioned because draining into a creek or stream with ample banks does no actual harm. But even if such drainage does damage lower ground, owners of higher ground have a legal right to drain into the stream so long as they do not cut through a natural divide but simply hasten the flow of water from the basin into the creek. According to this rule, overflow waters from a creek or small stream are surface waters; therefore, owners of lower land are bound to receive them. Furthermore, owners of a stream bank have the right to improve it so long as the improvements do not impair drainage. Evolution of Illinois Drainage Law into the Rural-Urban Fringe As land use in many parts of Illinois shifted from agricultural to urban development, the good-husbandry doctrine was applied in situations where land was not to be used for farming. Unfortunately, this nineteenth-century doctrine was not easily adapted to urban environments. In response to a lawsuit, the Illinois Supreme Court adopted a limitation of reasonable use, which was the first significant modification of Illinois natural drainage law since the nineteenth century. In general, the opinion specifies that urban landowners, in addition to recognizing natural drainage law limits to points of discharge and bringing water in from another watershed, cannot increase drainage flows unreasonably. In the Templeton v. Huss case, the defendants owned the dominant estate, which they subdivided and developed. The plaintiff owned the servient estate, a parcel of farmland. Obstructing Surface Water Flow Just as there are laws pertaining to owners of dominant ground and their removal of water onto servient lands, there are also laws that pertain to the acceptance of that water by the owner of the servient land. According to civil law as applied in Illinois, the owner of lower land has no right to build a dam, levee, or other artificial structure that will interfere with the natural drainage of higher land. However, constructing artificial or temporary impoundments may be allowable. On the other hand, the owner of higher land cannot compel the owner of lower ground to remove natural obstructions, such as shrubs, weeds, brush-wood, cornstalks, or other crop residues, that may accumulate and impair natural drainage. In some circumstances, the owner of the higher land has the right to enter the servient tract to make reasonable repairs and clean out the watercourse. Caution should be used when resorting to such self-helpâ€"to ensure adherence to the law, the dominant landowner should seek legal counsel before exercising these rights. Remember also that in some states landowners may have the right to restrict water movement onto their land from dominant landowners. Persons purchasing property in other states should investigate the local laws if drainage is a concern. Know All Pertinent Drainage Laws It is important to recognize that even though certain drainage practices may be allowed under the Illinois drainage code, other superceding and overlapping laws may restrict such activities. Appropriate agencies should always be consulted before altering any area that might be considered a waterway, floodplain, or wetland. Local ordinances regarding storm water and erosion should also be reviewed, especially in urbanizing areas. Improperly altering farm drainage may reduce eligibility for participation in farm programs. Seek Legal Expertise Since drainage issues between landowners can be very sensitive and can become costly problems to correct, landowners are always encouraged to consult appropriate legal counsel regarding any specific drainage problem. Farmers, developers, contractors, local officials, and others should seek legal counsel before altering any land use pattern that affects drainage. Be sure to review all potential local, state, and federal regulations. Landowners should discuss the issues of concern to them carefully before hiring an attorney. When hiring an attorney, it is important to shop around for someone with expertise in drainage law, especially for agricultural applications. Ask neighbors, local agricultural professionals, or others in the community for names of attorneys with drainage law experience. Summary This fact sheet highlights some of the major issues and laws related to drainage in Illinois, especially in light of recent land use trends. As has been discussed, all situations need to be addressed individually and with proper legal counsel if necessary. Illinois Drainage Law Circular  University of Illinois Extension. Other related reading materials from U of I Extension include: Drablos and Roger Moe. Illinois Drainage Guide Circular  Illinois Department of Agriculture. Ohio State University Extension. Other related readings include: Delaware Department of Natural Resources. Conservation Design for Stormwater Management. Reference Donald Uchtmann and Bernard Gehris. Reviewed and edited by Donald L.

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## Chapter 4 : Central Midwest Water Science Center

*In Illinois, the Illinois Pollution Control Board is the regulatory body responsible for establishing water quality standards. Results of more recent statewide assessments can be found in the following "Integrated Water Quality Report and Section d List" documents and Illinois Water Quality Mapping Tool.*

## Chapter 5 : Environmental Info for Illinois | EPA in Illinois | US EPA

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## Chapter 6 : ILRDSS - Fox River Watershed Investigation - Publication Search Results

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## Chapter 7 : USGS Surface-Water Data for Illinois

*Title: Quality of Surface Water in Illinois, Abstract: Surface water quality in Illinois has been determined by means of analysis of data from monthly water sampling programs.*

## Chapter 8 : Surface Water Quality > Quality of Streams and Lakes

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## Chapter 9 : USGS Water Data for Illinois

*The data indicate that Illinois surface waters, with but few exceptions, meet specified concentrations of mineral constituents. The analyses of water quality by statistical means present, at best, a representative pic-.*