

CHAPTER 1

HISTORY OF COMMON LAW

Prepared By:
Karl Hausler, Chairperson
Mike Gregg
Steve Shine

1:1 INTRODUCTION

The climate and physiography of Michigan impose on landowners an interdependent relationship creating the need for provision of artificial surface water drainage. The legal rights, duties and liabilities that govern this interdependence are defined under common law as the natural flow rule or civil law doctrine, and by statutory rule in the Drain Code P.A. 40 of 1956, as amended. This chapter presents the origins of both common and statutory law and traces their development from pre-statehood to present. Considerable legal research is presented which indicates that the ability of individual landowners to provide extensive artificial drainage improvements is severely restricted under common law. The impact that these restrictions have on land development and public health are discussed.

The statutory rules of the Drain Code were originally designed to provide a positive, administrative procedure to overcome common law restrictions for developing drainage limited land. This discussion will show how the statutory rules structure opportunities to utilize the procedures to shift the cost of providing drainage facilities from impacted lowlands to flowage generating uplands. Key performance variables are transactional cost and political externalities created by decision rules.

1:1.1 Legal Definition of Surface Waters

The main focus of the office of Drain Commissioner is that of managing surface drainage water, which are waters that are usually unwanted or excess. Their origin is precipitation that falls on the land, from melting snow or arises in springs and diffuses over the surface of the ground. These waters initially do not flow in a defined course or channel or from any definite body of water other than marshes or bogs and are lost by being diffused over the ground, through percolation, evaporation, or natural drainage (93 C.J.S. sec. 112).

In Michigan, the Supreme Court in *Fenmode vs. Aetna Casualty and Surety Co.*, 303 Michigan 188 (1942), has defined surface water as:

Waters on the surface of the ground usually created by rain or snow, which are of a casual or vagrant character, following no definite course and having no substantial or permanent existence. Such waters lose their character by percolation, evaporation or by reaching some definite body of water in which they are accustomed to, and do, flow with other waters.

Diffuse surface waters, then, may move across and flow from land on which they originate and obeying the law of gravity flow onto lower land into a natural basin from which they disappear through evaporation or percolation into the soil. Typically these natural basins are wetlands, swamps, bogs, or fens with either shallow standing water or ground water levels very near or at the surface (93 C.J.S. sec. 112). Therefore, once surface waters of this definition empty into or become a part of a natural stream or lake they are no longer "diffused" and their status to land is defined by riparian (rivers) or littoral (lakes) right doctrines.

Land abutting surface waters that are collected or concentrated in an artificial watercourse have been held in *Thompson v. Enz*, 379 Mich. 667 (1967), not to have riparian rights. According to the Michigan Farm Bureau Water Rights Task Force, the limitation of this definition of riparian waters also extends to county and intercounty drains (1980, p. 55). The subjects of this chapter then, are waters that are defined as "diffused surface waters" and waters in "artificial watercourses or drains."

1:1.2 Rights, Duties and Liabilities for Surface Water Drainage

The legal rights regarding diffuse surface waters are appurtenant to the land on which they occur. The rights that govern them are among the "bundle of rights" that are acquired and held by title to the land. The owner of land then, has the right to collect and appropriate it for his own use any water that falls on their land without a liability incurring to others. Further, riparian rights do not accrue to waters of this classification and limited duties are imposed on a lower landowner to receive surface water from an upper landowner (93 C.J.S. sec. 113).

The basic situation for drainage interdependence in Michigan is defined by the doctrine known as the natural flow rule or "civil law" rule. This rule states that between owners of higher and lower land, the higher landowner has a right or easement over the land of the lower landowner upon which a duty or servitude to receive the water is visited. The servitude on the lower landowner extends only to those waters flowing onto them in their natural, diffused state. They have a right to repel or obstruct water that is concentrated and/or diverted by the upper landowner onto them. This duty on the lower landowner estate extends even if there is no natural outlet to relieve them from the waters of the dominant, upper landholder (93 C.J.S. sec. 114).

1:2 STATUTORY METHODS FOR SURFACE WATER DRAINAGE

Statutory rules for modification of natural surface water drainage patterns were first developed when Michigan was still a territory more than fifty years before the courts articulated the common law structure. This fact evidences the State's recognition of the necessity of artificial land drainage and desire to promote its development. Given the limitations under common law for extensive artificial drainage and conflict resolution between two or more parties, much of the surface drainage of water that has been accomplished has been by rights and procedures established by statute.

The primary objective of this section is to concentrate on the nature of the structure of rights found in the statute that currently prevails, P.A. No. 40 of 1956 (MCL 280.1-280.630), known as the Drain Code. A brief chronological history of previous drainage statutes will be discussed sufficient only to indicate the development of major features. Where appropriate in the analysis of the Drain Code, more in-depth background relating to these previous statutes will be pursued.

1:2.1 Territorial Laws

The first statutory provision for drainage appears in Sec. 9 of "An Act to Regulate Highways," passed in 1819 (Vol. 1 Laws of the Territory of Michigan, p. 449). This Act authorized the county commissioners to appoint township highway supervisors and gave them powers to:

Cut timber, and to dig in the highways, and to enter on the lands adjacent to the highways, and to cut, make, cleanse and keep open such gutters, drains and ditches therein as shall be sufficient to convey and draw off the water from said highways, with the least disadvantage to the owner of the land; and the owner and every other person, except the supervisor, is hereby prohibited from filling up, stopping or obstructing such gutter drain or ditch under the penalty of eight dollars, to be recovered by action of debt with costs, by the supervisor before a justice of the peace of the proper county.

These provisions were obviously limited to drainage necessary for roads and it wasn't until 1827 that provisions for the resolution of land drainage conflicts between two property

owners were established in sec. 19 of "An Act Relative to the Duties and Privileges of Townships" (Vol. 2 Laws of the Territory of Michigan, p. 317). In part, sec. 19 provided:

That whenever there are low grounds or swails, rendered unproductive by marshy or stagnant waters, which can be conveniently drained by ditching through one or more farms of adjoining improved lands, similarly situated, so as to render the whole more valuable and productive or wherever it shall be necessary and useful to have a drain or ditch on the line between two improved farms, to render them more productive, each person interested shall make and maintain a just proportion of the cross ditches or drains.

This language implies that drainage was a mandatory duty as between property owners indicating the value placed on promoting land development.

If conflicts did arise between property owners as to respective duties, the size of the drain, location, or necessity, an application could be made by any one of the parties, with notice to the other for settlement by "fenceviewers." Fenceviewers were residents of the township selected to resolve various disputes between landowners, including drainage, and their decision was conclusive. Further, if any person did not maintain their proportion of drainage and after four weeks notice neglect or refuse to do their part, they became liable for their neighbors' damages, which were determined by the fenceviewers and recovered in court. These same provisions appeared in an 1833 Act of the same title, sec. 27 (Vol. 3 Laws of the Territory of Michigan, p. 1038).

These three early statutes clearly demonstrate the pro-development attitude of the territory and were designed to achieve utilization of the land based resources necessary to sustain the inhabitants. Individual rights to the land were clearly subservient to the interests of others "so as to render the whole more valuable and productive." Recall that the time period is prior to statehood and the objective was to encourage settlement. Given the agrarian economic base of society at the time, settlers were looking for good farmland and their numbers were sought to increase the population to attain statehood.

This "mandate" for drainage by the territorial laws provides an interesting contrast to the natural flow doctrine that was articulated in the 1884 case of *Boyd v. Conklin*. In fact, it probably goes a long way to explain why over fifty years elapsed before a legal case developed arguing that the property rights structure should limit the servitude duty. This is the

essence of the political process, that the higher elevated lands under territorial laws could receive payment of damages by the lower landowners for not maintaining artificial modification of the drain pattern to one of being liable for increasing the flowage. From a position of privilege to one of responsibility is as radical a shift in property rights as can be accomplished.

The absence of litigation could also mean that the incidence and value of the conflicts were not sufficient to warrant the time and expense of court. In addition, the property rights were still in the process of being developed and refined in the new state. This is how situations of conflicts develop, by assigning or permitting the exercise of rights, in this case in real property and by the structure of those rights permit one interest to dominate when they conflict. Whose interest is allowed to dominate is the public choice question, which is resolved by the legislature in creating the structure of the rights in statutes. If the outcomes that exist are not what are desired for a given situation then the laws governing the structure of the property rights must be changed.

The development of the statutory drainage rights after statehood was attained in 1837 will now be outlined, emphasizing only the major changes in rights structure.

1:2.2 State Statutes 1839-1955

Since the first State drainage statute was passed in 1839 not less than 45 separate acts were passed prior to the Drain Code of 1956, most amending or adding to several basic rule structures. Since 1956, the present Code has been amended over 200 times, indicating that the rules for drainage in the statutes have long been dynamic in shifting or expanding the rights and duties for artificial drainage development.

The first statute was entitled "An Act to provide for the draining of swamps, marshes and other low lands", Chap. 80 Laws of Michigan (1839). This law provided: "that any person owning any swamp, bog meadow, or other low land, who shall be desirous to drain such land and who shall deem it necessary, in order thereto, that a ditch or ditches shall be opened through lands belong to other persons . . ." make an application to the township justice of the peace if the land owners refuse to cooperate. The justice then issued a summons directing the county sheriff to assemble twelve "reputable freeholders" of the county and to give at least six days notice to the property owners in question. The twelve "jurors" then met and viewed the property in question, and studied a map that the applicant had to provide giving location and dimensions of the drain. They considered arguments against the drain and then approved or disapproved of it as planned or made changes. If they determined it necessary, then they stated it in writing and

also made a determination of whether the benefit to the opposing landowners was greater than the damages. If the damages were greater, then the applicant paid the amount determined and the costs of the proceedings.

After making the payments for procedure and damages, the applicant then entered onto the lands through which the drain was to run to excavate it with his "servants, teams, carriages and other necessary implements." The applicant and his heirs and assigns also gain a perpetual right to enter on those lands to maintain the drain to its original dimensions only. If the downstream owner obstructs this drain, then they are liable to pay the applicant double the damages assessed to their property by the jury. A map of the drain was filed with the township clerk with the only restriction on the applicant being that he could only enter on the lands of others between May 1st and September 1st to remove an obstruction, apparently to avoid crop damage.

Essentially, there was little difference between Chap. 80 and the previous territorial act in terms of procedure and rights. Probably the most significant change was the number of jurors involved in the decision, which was increased from two to twelve, increasing the costs of the action to the applicant. This involved not only direct payment of their fees but also increased time to assemble and arrive at a majority decision which is inherent as the group grows.

A fundamental change occurred in 1846 when Chapter 80 appeared as Chapter 131 of the Revised Statutes and a step was added before applying to the justice of the peace. It provided that an application be first submitted to the township board who were "to inquire and determine and certify . . . whether the marsh, swamp or lowlands are a source of disease to the inhabitants, and whether the public health will be promoted by draining the same." If the board certified it as such, then the applicants filed their certification with the justice of the peace, who implemented essentially the same procedure as Chapter 80, involving nine commissioners instead of twelve.

The situational aspects regarding public health during this period in Michigan's history placed great emphasis on reducing the high incidence of malaria and other disease. Dr. Dunbar documents well the misery that the settlers of the State encountered from these diseases, the transmission of which were linked to water bred mosquitoes (1965). These conditions gave Michigan a bad reputation, discouraging settlement and growth.

Apparently the public health conditions were particularly severe in Lenawee County for which the Legislature in P.A. 1847, No. 104 appointed by name three commissioners to supervise the drainage of lowlands in four townships that in their judgement "affect injuriously

the health of the inhabitants.” This act also became the first county level drain law because it provided that any other county board of supervisors of the state may appoint three commissioners for the same purpose. Thus, a dual level of responsibility was created. The township laws were permissive, providing for involvement upon application and utilizing nine jurors to determine necessity, compensation of damages and apportionment of benefits. The county law was directive, virtually mandating that drainage be undertaken when it was necessary for the public health.

This dual system of drainage was promoted by the eminent domain provisions of the Constitution of 1850, which provided in Article 18 section 2:

When private property is taken for the use of benefit of the public the necessity for using such property and the just compensation to be made therefore, except when to be made by the State, shall be ascertained by a jury of twelve freeholders, residing in the vicinity of such property, or by not less than three commissioners appointed by a court or record, as shall be prescribed by law.

Apparently, because the courts were at the county level, only the board of supervisors could direct the use of the optional three commissioners while the township level justice of the peace could appoint a jury of freeholders.

Act No. 104, P.A. 1847 was amended three times before being replaced by P.A. 1857 No. 169 and although maintained separately from the township Act 131 of the Revised Statutes were combined to form Chapter 38 of the Compiled Laws of 1857 entitled "Of the Drainage of Swamps, Marshes and other Low Lands That Affect Injuriously the Public Health". This act provided considerable latitude to three commissioners who were appointed and served at the pleasure of the board of supervisors. The commissioners were directed to personally examine the marshes and lowlands of the county, making observations and surveys as they deemed necessary to determine the costs, route and dimensions of drains to serve those lands. They also determined the benefits and damages that each affected parcel of land was to pay and after receiving bids for construction made a report to the circuit court of their findings. The court, after public notice, held a hearing to consider objections and confirmed the report as is or with changes. The county board then ordered the taxes spread by the townships and construction began.

Act 169 was the first drainage law to allow for the reconstruction or improvement of existing drains by "deepening, widening or cleaning out." It also provided for fines for obstructing drains and for annual reports by commissioners to the board of supervisors of their activities and expenditure of funds.

When the next major compilation of laws was undertaken in 1871, the dichotomy between township and county level drainage responsibilities continued appearing as Chapter 47, "County Drain Law" and Chapter 48, "Township Drain Law". The County drain law was rewritten in P.A. 1869, No. 42 after six amendments to the previous P.A. 1857, No. 169 law. It required only one commissioner to be appointed by the board of supervisors for two-year periods. The commissioner no longer initiated drainage proceedings but acted only upon application signed by at least one half of the properties traversed or any ten if it were necessary for sanitary reasons only. Applicants had to post a bond for the costs incurred in case the drain was not constructed. However, once an application was received, the Drain Commissioner made a unilateral decision as to proceeding with surveying and obtaining right of way.

Several other major changes or additions of Chapter 47 involved:

- the option of a 12 man jury or three court appointed commissioners for condemnation;
- the abandonment of the proceedings by petition of two-thirds of the property owners assessed at the time apportionment is reviewed, if they pay all costs incurred;
- appeal of the Drain Commissioner's decisions to the courts or a jury;
- for drainage between two counties the commissioners acted as one with report to both county boards and to the commissioner of the State Land Office;
- for the drainage of lakes;
- to mandate a duty on the landowners whose land the drain crosses to maintain the drain
- to allow five landowners near the obstruction to apply to the commissioner to have it removed and assess the costs up to \$10.00. If the costs exceed this then a majority of landowners were required with all benefited land paying.

One interesting innovation that was contained in section 27 of the Act (C.L. 1871, sec. 1771), provided the right to anyone taxed for a drain to have the right to cross another landowner for access to the main drain if it did not cross their land and to maintain a private drain. This would seem to contravene the common law rights of the natural flow doctrine previously

discussed that was later established in *Boyd v. Conklin* (1884). The interdependence affects of extending such rights are significant and the existence of this provision in later laws is absent.

The Township Drain Law, Chapter 48 of the Compiled Laws of 1871, was enacted by P.A. 1871, No. 98 and required for the first time, the election of a township Drain Commissioner. The previous law, Chapter 131, Revised Statutes of 1846, had been amended four times in the interim, the most significant change being the transferring of duties from the township board to the township highway commissioners (P.A. 1865, No. 348). Under Act 98 the township Drain Commissioner was elected annually and responded to applications with bond for expenses from any one person to establish existing watercourses, or to "locate a ditch, for the purpose of draining any swamp, lake, marsh, or other lowlands".'

Unlike the county Drain Commissioner, the township commissioner had to notify in writing all interested parties and publish in a newspaper a notice of a meeting to examine the drain requested and to hear all persons interested. The Commissioner then decided whether it was necessary to establish an existing watercourse or locate a ditch to drain land and/or to improve the health of the inhabitants. If he deemed it not necessary, then another application could not be entertained for at least one year.

Procedures identical or similar to the county drain law applied to the township for surveying, condemnation, letting of contracts, taxes, appeals, records and disbursement of funds. One ironic part of the township law was that for drains between two or more townships, the township commissioners acted jointly and kept separate records instead of requiring a proceeding under county law.

Taken together or singularly, these two laws represented a significant increase in the complexity of drainage rules, generally by providing more due process and procedural review. Both chapters together totaled twenty-eight pages in which considerable detail is specified as to the mechanics of taxation and delinquency, disbursement of funds, highway and railroad crossings, and contracts.

Separate statutory provisions for townships and county drainage procedures continued until 1897 when the township Drain Commissioners position was abolished and all drainage law was consolidated under P.A. 1897, No. 254. The previous 26 years were apparently very turbulent, judging by the body of case law and the fact that there were 12 amendatory acts or additions, eight to the county law and the balance to township law. In addition, the township law was rewritten under P.A. 1885, No. 227 and resulted in the township and County Drain

Commissioners having concurrent jurisdiction over township drains. Further, successful legal challenges against the joint action of township Drain Commissioners for drains involving more than one township (*Alger v. Slaght*, 64 Mich. 589) and for the levy, collection and accounting of drain taxes (*Emerson v. Township of Walker*, 63 Mich. 483) all but eliminated the necessity of maintaining a distinction from county proceedings.

Several other major legal challenges regarding fundamental issues also occurred in this time period, both in 1888. One was a constitutional attack on the grounds that the drainage laws were contrary to Art. 14, sec. 9 of the 1850 Constitution providing that the state should not engage in works of internal improvement except in the expenditure of grants to it. The Supreme Court held in *Gillett v. McLaughlin*, 69 Mich. 547, that providing for local improvements for the benefit of the public health and paid for by persons and townships benefiting and constructed by county or township officers was not in conflict with this provision. It should be noted that the State was liable for assessments to state lands at this time, which was the basis of this suit.

The other case was *Kinne v. Bare*, 68 Mich. 628, wherein the Court stated:

Drain laws, which take from the citizen his private property against his will, can be upheld solely upon the ground that such drains are necessary for the public health. They proceed upon the basis that low, wet and marshy lands generate malaria, causing sickness and danger to the health and life of the people; that, when they are of such a character as to injure the health of the community, they become and are public nuisances, which ought to be abated, and the legislature has the right, under the police power inherent in every government, to protect the people from plague and pestilence and to preserve the public health. But drainage for private advantage, to improve the quality of the land or render it more productive or fit for culture cannot be justified under the police power.

With this case the finding of necessity for public health was clearly established and in fact was the only reason allowing condemnation to be exercised.

Act No. 254 (C.L. 1897, sec. 4308) was entitled “Construction and Maintenance of Drains.” It provided for the appointment of a County Drain Commissioner for a two-year term in every county of the state. The Commissioner had jurisdiction over all legally established drains in the county including township drains except those totally within a city. Drainage procedures were initiated by an application of ten or more property owners; at least three of which were liable for an assessment. If there were three or less property owners liable for

Assessment, only one needed to sign, the balance of signers could be from within the township. The applicants were liable to pay all preliminary costs.

Upon receipt of an application, the Drain Commissioner would examine the route of the proposed drain and if in his opinion it was "necessary and conducive to the public health, convenience or welfare" he employed a surveyor to determine if it was practical. If it was, the Commissioner issued a First Order of Determination describing the route and course, dimensions, and right of way required. Provisions were made for the owners of the lands traversed to contract with the Commissioner if they all agreed with the plan to perform the work as surveyed and if they paid all of the expenses to that point in addition to construction. The drain so constructed and approved was then legally established.

If all owners didn't voluntarily release rights-of-way, condemnation proceedings were initiated by application to the probate court for appointment of three special commissioners who determined the necessity and compensation for the taking. This procedure was spelled out in considerable detail as to due process and length of time, and for the option of a property owner to demand a jury. Damages that were awarded were deducted from assessments for benefit.

For the first time provision was made to construct "blind" drains of tile or pipe. The fact that the surface could be restored for use with tile drains could also be taken into account in the award for damages for right of way. A requirement was also made that when a drain is constructed along a highway each property shall be provided a bridge or culvert, the initial cost of which is part of the project with maintenance the property owner's responsibility. Recognition that the lands benefited constituted a special assessment district was also made and certified in a Final Order of Determination.

After rights-of-way were obtained, a contract was let for construction and notice for a day of review of apportionment of benefits was personally served on all landowners assessed along with posting and publishing requirements. Assessments were based on benefits. Landowners could appeal their apportionment of benefit to the township. The township was also assessed for public health benefits and road drainage. If the township wished to appeal their assessment, they filed for a board of review to the probate court. The State was also liable for an assessment the same as other lands as long as the total of all drain taxes ever assessed didn't exceed 50% of the price of the land.

More extensive procedures were also provided for intercounty drains. Commissioners were required to jointly perform the same functions as they did for county drains. If they could not agree on the percentage that each would pay for a project they selected one other county Drain Commissioner whose decision was final. An existing intercounty drain could be improved by cleaning out, widening, deepening or extending upon application by five landowners of either county, one of which must be liable for assessment. The same requirement for applicants applied to improvements for existing county drains.

Again, the Commissioner determines if the application should be granted and follows the same proceedings as for new drains. The provisions of the Act also clearly state that it may apply to the channels of natural creeks and streams, levees, dykes and barriers or to relocate an existing drain for better outlet. Drains could also be abandoned upon application.

The Commissioner, for the first time, was allowed to appoint one or more deputies who received two dollars a day, compared to the Commissioners three dollars per day. Provision was also made for the Attorney General to develop a set of blank forms for the administrative provisions of the Act and for the Secretary of State to publish the Act.

The next major compilation of laws occurred in 1915 and P.A. 1897, No. 254 (C.L. 1915, sec. 4870) had been amended four times. The Drain Commissioner in P.A. 1909, No. 118 was initially required to be elected to a four-year term. However, in P.A. 1911, No. 185 this was reduced to every two years. The number of applicants was changed to require a number equal to one third of the landowners traversed by the drain. Also new was the requirement that the Commissioner publish a notice of a meeting for all persons owning land liable to an assessment who were against the drain project to appear. The Commissioner was still responsible for the decision to determine whether it is necessary for the public health, convenience and welfare. The use of dams and pumping equipment, and the use of a drain for sewage disposal from cities, villages and townships was also added.

Limitations were placed on the amount of taxes assessed to townships at-large being one half of one percent of the total assessed valuation. All appeals of assessments were referred to the probate court for appointment of-three special commissioners. Decisions regarding intercounty drains were still determined by the commissioners, but if they could not agree as to necessity or benefits they appealed to the state highway commissioner and his decision was final.

The final major statute prior to the present Drain Code was P.A. 1923; No. 316 entitled "General Drain Law" (C.L. 1929, sec. 4838). Act 254 and amendments served as the foundation

of Act 316, which for the first time was identified as “An Act to codify . . .” The complexity and comprehensiveness of drainage legislation increased significantly with these two statutes which now involved eighteen chapters. All of the features previously discussed under Act 254 apply to Act 316 except those noted below.

Perhaps one of the most significant, fundamental changes was the recognition of a "drainage district" and the requirement that it be established by separate application as a prerequisite to constructing a drain. The application to layout and designate a drainage district required signatures of ten land owners of the township in which the drain is located, half of which must be liable for assessment unless there were twenty land owners or less affected in which case only one was required. Upon receipt of the application, the commissioner served it on the judge of probate who appointed a board of determination comprised of three, five or seven members of the board of supervisors. At a public meeting with notice by mail to the municipalities and by publication, they made a determination of whether the district was practical and conducive to the public health, convenience and welfare. If it was, they issued their order to the Drain Commissioner, who employed a surveyor or engineer to layout a drainage district of all the benefited lands and to design a drain to serve those lands, giving the size, location and estimate of cost. With this information the Commissioner published a notice establishing the drainage district.

The method of paying for the preliminary costs was changed from the applicants making deposit to payment from a revolving fund established by the board of supervisors. This fund was established from ad valorem countywide tax collections, which was repaid if the drain was constructed out of the assessments to the landowners in the district.

To construct the drain designed by the engineer under the application for the district, it was necessary for a petition from a number of landowners within the drainage district equal to one half the landowners traversed be submitted. The Commissioner then made application to the probate court for an identical procedure of appointing a board of determination as for a drainage district to decide the necessity of "locating, establishing and constructing" the drain.

The procedure for cleaning out or improving an existing drain required a petition signed by five property owners, only two of which were liable for an assessment. The petition was addressed by the same probate court procedures for appointing a board of determination. P.A. 1929 also specifically permitted maintenance of existing drains for the first time and an amendment, No. 318 mandated annual inspection of all drains with authorization to expend up to

twenty percent of the original cost of the drain in any one year without a petition. Maintenance was allowed when inspection showed that work was necessary to ". . . keep the drain in working order or where an emergency condition exists endangering the public health, crops or property" (C.L. 1929, sec. 4908).

Procedures for intercounty drains were also modified, establishing for the first time a formal "drainage board" of the Drain Commissioners of all counties in a drainage district and chaired by the Commissioner of Agriculture. The drainage board determined the questions of practicability and necessity instead of a board of determination with the commissioner of agriculture only voting in case of a tie. The same general requirements for signers and procedures applied to establishing new intercounty drains as intracounty. For reconstructing an existing drain, twice as many signers were required, or ten, all of which must be liable for assessment and only one meeting to determine necessity was required.

Act 316 maintained the same procedures for condemnation, assessments and appeals as provided in Act 254. Also retained was the provision to assess state owned lands for benefits. In 1925, an amendment was added to provide for the issuance of bonds by the drainage district, providing for up to twenty annual installments. The Drain Commissioner signed on behalf of the drainage district and the county clerk for the county. Thus, the Drain Commissioner could obligate the landowners, and municipalities in a drainage district without statutory limit to long term indebtedness. The county, without option, was obligated to make payment out of the general fund if the drain fund was unable to pay the principal and interest and be reimbursed when the delinquent drain taxes were collected.

The ability to bond in order to finance drainage projects was a significant milestone because it provided for the funding of the more costly projects in an affordable manner. Typically, these involved either large mainstream channelization or urban storm drains where the areal extent was great or the economic value of providing for the public health, convenience or welfare high. The drain law by 1929 had grown to eighteen chapters comprised of sixty pages of ever increasing detail; however, it was still fairly ambiguous.

Another little heard of drainage law was passed in 1929, entitled "Agricultural Land Drains" (C.L. 1929, 4980). This act immediately succeeded Chapter 77 containing P.A. 1923, No. 316 in the compiled laws and many sections were cross-referenced to it. The intent was to provide an expedient procedure to collectively organize agricultural landowners and to use the Drain Commissioner as an administrator to distribute costs, let contracts and finance projects.

The Act only applied to tile drains and provided that an owner or owners may make application to the Drain Commissioner to establish a drainage district. Apparently, the district could only be comprised of the applicants' lands for which even a single owner was eligible. The applicants were required to submit an application fee of \$.75 per acre of land owned by them for the preliminary costs.

After the Drain Commissioner verified land ownership of the persons who applied, he/she commenced with a survey of the proposed drain. The Commissioner then made the determination of practicality of the drain with a denial requiring notification in writing. If approved, the lands described in the application were established as the district and the Commissioner notified the applicants. The Commissioner then decided if the taxes would be spread over a minimum of three years or maximum of twenty and let bids for the construction. Procedures for construction contracts, levying taxes and bonding were the same as other drainage projects under Act 316.

The most interesting aspects of Act 158 are what is not provided, giving clear indication of its intended application. First of all, there was no provision to involve lands of owners who do not sign the application for benefited assessments. There are no public meetings to hear those for or against and no notice requirements except to receive construction bids. There were no condemnation proceedings and no requirement that rights-of-way be obtained. Further, there was no intercounty drain provision. Once a drain project was completed and assessments paid, the drainage district was abandoned and dissolved.

Act 158 was obviously enacted to provide an expedient way for one or more landowners to accomplish tiled agricultural drainage in a situation of voluntary cooperation. Because the benefits to agricultural tile drainage, where there is no surface water inlet, generally accrue to only the lands through which they are laid, limiting these proceedings to only those had some merit. In addition, because a tile drain requires an adequate outlet they generally involved lands already within a more expansive, open channel watershed/drainage district. By allowing for the short-term establishment of a drainage district, property owners could utilize the financial option of long-term bonding. The Drain Commissioner also provided a third party to decide the distribution of costs and to let contracts. Even though there was no maintenance provision this is less of a problem with tile drains because of generally longer service life. If it was necessary to cross the lands of another who did not cooperate then the provisions of Act 316 could be used.

Also in 1929, Act 318 was passed amending most chapters of Act 316, including a requirement that the county provide office supplies and blue prints to the Drain Commissioner and allow the Commissioner to hire an engineer. Several other amendments were added in the time leading up to the new code in 1956. A chapter allowing drainage districts to contract with the federal government was added by P.A. 1947, No. 197. At this time joint projects with the Corps of Engineers were an option for drainage and flood control projects on major rivers in urban areas and the USDA Soil Conservation Service in agricultural situations. Today, the Environmental Protection Agency is also a likely party. Drainage districts offer the only institutional structure capable of overlapping a multitude of municipal jurisdictions on a watershed basis with the powers of condemnation and taxation necessary to meet the cost sharing provisions of most federal programs.

A provision was added in P.A. 1954, No. 189 to allow the consolidation of drainage districts providing the ability to utilize a broader watershed approach to solving drainage and flooding problems. The final amendment was added by P.A. 1955, No. 44 which had brought fundamental changes. One was the change to a three-person board of determination appointed by the Drain Commissioner. Recall that previously the board was appointed by the judge of probate of members of the board of supervisors. Secondly, it provided for applications and petitions solely by a municipality if it was liable for at least 66% of the cost at-large on the basis of benefits to public health. Also changed was the requirement for landowner applications or petitions from a number equal to one-half to one requiring two-thirds.

By 1955, the General Drain Law had grown to a total of nineteen chapters, not counting the Agricultural Drain Law. These statutes provided the basic rule structure for application of artificial drainage modification at the local, county and multi-county levels. As an existing framework it provided a structure to work from as different situations of drainage interdependence developed with the growing, urbanizing society that Michigan evolved into during its thirty-three year life. At the same time, the law continued to serve the rural and agricultural land drainage situations, resulting in a continuing need for a comprehensive set of rules. Because of the nature of this broad-spectrum application the rules are necessarily complex. This increasing complexity and demand for response to changing needs resulted in a re-codification in 1956, which is the subject of the following section.

1:2.3 The Drain Code of 1956

The present statutory institutional structure that provides for the undertaking of artificial intensified land drainage in Michigan is P.A. 1956, No. 40, the short title of which is "Drain Code of 1956" (M.C.L. 280.1-280.630). The "Drain Code," as it is referred to herein, represents the current product of an evolutionary process of enacting and re-codifying laws that built directly upon most of the provisions of the previously cited 1923 "General Drain Law." Prior to that Act, P.A. 1897, No. 254 laid the foundation for many of the basic rules, most of which are recognizable in some form in the present Drain Code. Since 1956, over 200 amendments have been passed evidencing the continued evolution of the rules to respond to increasingly complex and changing situations of application.

As a codified statute, the Drain Code is a systematic compilation of the laws promulgated by the legislature to regulate drainage between two or more parties. In the words of the Court of Appeals in *Toth v. Charter Tp. of Waterford* (1978), 91 Mich App 173: the "Drain Code represents the legislature's attempt to codify all laws regarding drains and to provide for detailed, specific and exclusive procedures to be followed in proceedings to construct and maintain drains."

1:2.4 The Basic Structure of the Drain Code

The basic legal foundation that provides the legislature the power to enact laws for the undertaking of drainage in Michigan is contained in Article 4, sec. 51 of the Michigan Constitution of 1963, wherein it states:

The public health and general welfare of the people of the state are hereby declared to be matters of primary public concern. The legislature shall pass suitable laws for the protection and promotion of the public health. (MCLA 280.2)

In addition, Article 4, sec. 52 provides:

The conservation and development of the natural resources of the state are hereby declared to be of paramount public concern in the interest of the health, safety and general welfare of the people. The legislature shall provide for the protection of the air, water and other natural resources from pollution, impairment and destruction. (MCLA 280.462)

Michigan has historically utilized the legal entity of a "drainage district" to allow land drainage for protection of the public health and development of the natural resources. Michigan

is among thirty-nine states in the U.S. utilizing the drainage district concept, many of which are established by procedures of a codified law (Clark, p. 599). The Attorney General of Michigan has defined a drainage district as comprised of:

An area of land which shall be drained and benefited by the construction of a drain. Initially the area to be included in the drainage district is fixed by the survey made at the time that the route and type of construction of the proposed drain are determined. A drain does not exist independent from a drainage district. (Op. Atty. Gen. 1963-64, No. 4037, p. 9)

The area of land defined by survey generally correlates closely with the natural topographic watershed or contributory drainage area. Artificial drainage modifications to the natural patterns, particularly at the periphery of the watershed, can cause a distortion between it and the drainage district, however.

The distinction between a "drain" and a "drainage district" is fundamental. The drainage district is the legal entity; the drain is only a physical facility that serves the district. Power to implement a constitutional provision can only be conferred by the State to a legal entity designated directly by the constitution or by statute in compliance with constitutional provisions. Drainage districts are provided by the latter as outlined in the Drain Code, which provides that a drainage district when established, "shall be a body corporate with power to contract, to sue and to be sued, and to hold, manage and dispose of real and personal property, in addition to any other powers conferred upon it by law" (MCLA 280.5).

The other basic powers that are conferred to a drainage district under the Drain Code are the levy of special assessment taxes on the benefited lands of the district to pay for drainage facilities and eminent domain to condemn private property for the location, establishment and maintenance of the facilities of a drainage district. The "body corporate" designation of a drainage district is also important to engage another provision of the Constitution, Article 9, sec. 13 which provides: "Public bodies corporate shall have power to borrow money and to issue their securities evidencing debt, subject to this constitution and law" (MCLA 280.275).

The specific, detailed procedures of the Drain Code are to be followed "so that controversies may be heard and settled swiftly and with finality" (*Matter of Round Marsh Drain* 1977, 76 Mich. App. 714). Further, that the "Proceedings under the drain code, other than condemnation proceedings, are administrative proceedings" (*Battjes Builders v. Bouma* 1969, 15 Mich. App. 618). The administration of the procedures of the Drain Code is by a public officer

entitled a "Drain Commissioner" or by the board of county road commissioners in counties with less than 12,000 population. Currently, there are Drain Commissioners in 68 counties who are elected to four-year terms.

The Drain Commissioner, however, does not represent any political entity other than a drainage district and his representations are not binding upon counties, townships or municipalities (MLP Drains sec. 2). The power and authority of the Drain Commissioner are exclusively derived from the Drain Code. According to the Attorney General in the previously cited opinion:

The County Drain Commissioner must look to the statutes as the source of his powers and since his functions are not governmental in a political sense his implied or inherent powers are decidedly limited if he has any such powers at all.

Reinforcing the Drain Code as the exclusive source of power and authority for the Drain Commissioner, the Court of Appeals in *Toth v. Charter Tp. of Waterford*, previously cited, stated: "Absent fraud, all matters pertaining to the locating, constructing, cleaning, or extending, etc. of drains are to be determined according to the procedures set forth in the drain code." This authority extends to all legally established drains of the county and provides broad powers for the implementation of drainage projects. It is important to note, however, that the Drain Commissioner cannot initiate proceedings to construct new drains or improve existing ones except by application or petition as specified in the Code.

1:3 BRIEF HISTORY OF THE DEVELOPMENT OF HYDROLOGY

Engineering, (the successful application of force to our environment) almost always precedes science in human endeavors. Science describes how or why the engineering operates according to natural laws. Only after enough trial and error, often over centuries, are enough successes extracted from many attempts that the scientific principles underlying both the successes and failures are understood.

These newly understood principles then lead to new engineering applications and after more successes and failures additional principles are understood. It can be generalized that the more complex a phenomenon is the longer it takes for useful rules of thumb to be devised and the longer, in historical terms, it takes for science to evolve from practice.

It should not be surprising then that in such a complex area as hydrology, it did not begin to develop as a science until the seventeenth century. By this time the precursor to hydrology, hydrologic engineering, had already been practiced for at least 5000 years (Kazmann).

Early philosophers observed the nature of surface flows and rainfall as part of the hydrologic cycle but often their speculation was faulty. Homer believed that there were large open subterranean reservoirs that supplied rivers, seas, springs and deep wells. He did however observe and note the dependence of flow in aqueducts on BOTH the conveyance cross section and velocity. This was something that was lost to the Romans and in fact awaited Leonardo Da Vinci for its rediscovery.

During the first century BC, Marcus Vitruvius set forth a theory in his 8th Volume of *De Architectura Libri Decem*. His theory is generally considered to be the predecessor to modern notions about the hydrologic cycle. Vitruvius postulated that rain and snow falling in the mountains, soaked into the ground and later appeared in the lowlands as springs and streams.

In spite of the lack of accurate theories, however, practical application of various hydrologic principles was often employed. In many ways, hydrological engineering projects built by our early ancestors have only been equaled in the past 100 years. The earliest civilizations in the Nile and Tigris-Euphrates Rivers were dependent upon irrigation. A large dam across the Nile was built about 4000 BC allowing previously barren lands to be irrigated and reclaimed for agriculture. Several thousand years later a canal to carry water from Cairo to Suez was built.

The Egyptians were confronted by the problem of determining the probable flood height and therefor the number of acres that would be flooded in any given reach of river. Either too much or too little flooding could mean famine. If not enough acreage was flooded to produce crops or if dikes were overtopped and washed out, thus destroying the crops and/or removing the storage for later crop needs. The Egyptians were thus forced to devise a system for measuring and recording the height of the Nile at many points. Comparing the data with data from previous years then let them forecast the high water mark downstream with reasonable accuracy. By 2000 BC data were being recorded as far upstream as the Second Cataract, near the present Egyptian-Sudanese border. These inscriptions have been discovered chiseled in rock.

There is evidence that long before 3000 BC the lowlands of the Persian Gulf along the lower Euphrates River had been reclaimed for agriculture. The irrigation and drainage projects in this part of the world are even more amazing than the Egyptians'. The hydrology of the Tigris-Euphrates is much more complex and far less predictable than the Nile. The twin rivers

also carried five times as much silt as the Nile and the water was highly mineralized. This meant much more extensive maintenance and dredging and the need for over-irrigation and subsurface drainage to counteract the excessive salt concentrations in the soil. Maintenance was critical in those times too! Mesopotamian towns were protected from floods by construction of large earthen dikes at an early date.

The conquest of Mesopotamia by Hammurabi around 1760 BC led to strong centralized control of water. Several of the Laws in the Hammurabi Code dealt with irrigation: each man had to keep his portion of the dike and ditch system in repair, and if he did not, was forced to compensate his neighbors who were damaged by flooding. Each district governor was responsible for keeping shipping canals open. Nearly 4000 years later, Hammurabi's influence on the development of water resources in these arid lands is still evident.

The sophistication of the early Mesopotamians in the field of irrigation is demonstrated by the photo and interpretation in Appendix 1 and 2. Appendix 1 is a photo of an original property record in baked clay of an area near Nippur and Appendix 2 is the line drawing of the translation. This tablet is probably a part of the official Nippur equivalent of the modern day county tax assessment record.

The level of engineering prowess is demonstrated by a well authenticated story of the Persian Cyrus the Great who diverted the flow of the Euphrates River from the channel it took through the city and then used the abandoned channel as a road for his troops to enter Babylon unopposed and capture it with only minor resistance. Certainly only sophisticated engineering and understanding of the river's hydrology along with efficient earth moving organization could have diverted the flow quickly enough to take Babylon by surprise.

There were also similar developments in the Yellow River system in China about this time but details of these works are only recently coming to light as China opens her libraries to the world.

There was Greek and Roman aqueducts but the humid climate of Europe did not necessitate irrigation. The aqueducts did not include regional storage nor did they exhibit any significant understanding of the role that velocity as well as cross sectional area plays in establishing the volume of water flowing through a given cross sectional area in a given period of time.

Near the end of the 15th century Da Vinci and Bernard Palissy independently reached accurate understanding of the water cycle through direct observation. Little quantitative

measurement of hydrologic variables occurred before the real advent of “modern” hydrology with the work of pioneers such as, Perrault, Mariotte, and Halley in the seventeenth century.

Perrault measured rainfall in the Seine River watershed over a three year period and using this and measurements of runoff, together with knowledge of the area of the river basin, showed that rainfall was adequate in volume to account for river flows. He also measured capillarity and evaporation.

Mariotte gauged the velocity of the seine and used measurements of cross sections to translate the velocity measurements into terms of discharge.

The English astronomer, Halley, measured the rate of evaporation of the Mediterranean Sea and concluded that the amount of water evaporated was roughly equivalent to what discharged from rivers into the Mediterranean.

The eighteenth century brought numerous advances in hydraulic theory and instrumentation, the spring board of which was the publishing by father and son John and Daniel Bernoulli of two mathematical demonstrations of $V=\sqrt{2gh}$. These men built on the discovery of Castelli (1577-1644) that the volume of fluid in a given time was a function of the depth of water in a bowl, or a function of the head; the discovery by his pupil Toricelli (1608-1747) that the velocities of fluid are as the square roots of the head; the discovery by Huygens.

During the nineteenth century experimental hydrology flourished. The most significant advances were made in groundwater hydrology and in the measurement of surface water. Significant contributions were:

- Hagen-Poiseuille’s capillary flow equation
- Darcy’s law of flow in porous media
- Dupuit-Thiem well formula
- The beginning of systematic stream gauging

The basis for modern hydrology was firmly established in the nineteenth century but most of the efforts were empirical in nature and it was not until the twentieth century that the fundamentals of physical hydrology were firmly established. (Viessmann, Knapp, Lewis, and Harbaugh 1977)

In the first part of the twentieth century the inadequacy of many of the earlier empirical “rules of thumb” became obvious. Governmental agencies began their own programs of hydrologic research in response to this realization. From about 1930 through 1950, rational analyses began to replace empiricism. (Chow, Ven Te (ed.) *Handbook of Applied Hydrology*. New York: McGraw-Hill Book Company, 1964)

Examples of this are evident in the development of:

- Sherman's unit hydrograph
- Horton's infiltration theory
- Thies's non-equilibrium approach to well hydraulics.

Post 1950, a theoretical approach to hydrologic problems has largely replaced the less sophisticated approaches of the past. An advance in scientific understanding of the physical basis of hydrologic relationships together with the development and rapid improvement of high speed digital computers have made both practical and economical extensive mathematical modeling and data manipulation that would have been impossible even a few years earlier.

The next major hurdles to be scaled in the coming century may well be both social and scientific. The major roadblock to accurate modeling of watershed hydrology may be the lack of data available on an historical, spatial, and real time basis for precipitation and stream flow. The major impediments in developing useful data may be both economical and social. It is expensive data to gather and we are modifying the absorptive ability of our rural and urban landscapes faster than we can accrue the data to predict the watershed's response to this alteration.

If we are to successfully manage the watersheds of the twenty first century, it will be because we make a major shift and begin to incorporate biology and ecology into our engineering and hydrology.

We will need to develop rules of thumb to use in managing our watersheds, rivers and streams that incorporate the biology and ecology of natural streams. We will need to do this even before we fully understand the underlying principles fully. We will learn from our successes and failures and incorporate what we have learned into the next project. When we do merge the biological and ecological with engineering and hydrology, we will begin to see water and its environment as a resource to be used and integrated with our developments. We will utilize, enjoy and infiltrate it on site, to maintain the functions of the natural hydrology of each site to as great an extent as possible. Achieving this will be the biggest challenge for all of us in the twenty first century.

1:4 A BRIEF HISTORY OF DRAINAGE IN MICHIGAN AND THE STATUS AND IMPORTANCE OF THAT DRAINAGE TO MICHIGAN

Drainage in the United States occurred in two primary developmental bursts, during 1870 to 1920, and then in the post World War II years of 1945 through 1960. Early settlers used

primarily small surface ditches to drain wet spots in fields and then dredging or cleaning out small streams as the outlet for this surface drainage. American farmers increasingly found it necessary to have large outlets beyond individual farm boundaries to accommodate drainage necessary to produce crops.

Around 1830, increased public pressure was brought to bear on Congress to release federal swamp and wetlands for private development. The Swamp Land Acts of 1849 and 1850 resulted after 20 years of deliberation. These were the first important pieces of federal legislation related to drainage. These acts transferred federal swamp lands to the states on the condition that they be sold to private interests and that the proceeds from the sales be used to construct facilities to reclaim them. However, until territorial and state legislation authorized the formation of drainage districts and county or township level drainage projects which crossed property borders, there was very little sale and drainage of these federal swamp lands.

In 1902, The Reclamation Act was passed and was another milestone in that it signaled the Federal Government's intention to become directly involved in land reclamation. Up until this time land reclamation was clearly limited to state and local efforts.

The Depression saw the collapse of many drainage districts and projects and the neglect of most of those which survived. In 1935, Congress authorized the Reconstruction Finance Corporation to refinance drainage and irrigation districts which were in financial distress. Districts in 26 states were able to continue their existence due to this program. The Civilian Conservation Corps (CCC) and other federal relief agencies also played a role in the survival of these drainage enterprises.

Also in 1935, the United States Department of Agriculture's (USDA) Bureau of Engineering took over responsibility for 46 CCC camps involved in the rehabilitation and reconstruction of drainage projects organized under state laws. This responsibility was transferred to the Soil Conservation Service in 1938.

These programs played a major part in preparing the land for the great agricultural expansion during and following World War II.

The Flood Control Act of 1944 authorized the Army Corps of Engineers to construct major drainage outlets and flood control projects and the Federal Watershed Protection and Flood Prevention Act (P.L. 83-566) of 1954 authorized USDA to plan and construct many watershed improvement works and drainage outlet channels in cooperation with state and local governments.

In order to understand the importance and extent of agricultural drainage we need to look at some historical statistics:

- In the United States by 1920, 53 million acres of a total of 956 million acres of farmland was drained.
- By 1960, 86.6 million acres of non-federal rural land was drained.
- By 1985, this figure increased to 109.7 million acres and 75.5 million acres of this total was used for cropland.
- A 1982 Survey by USDA-NRCS shows 233 million acres of non-federal rural land that have wet soils (not necessarily wetlands). Of this total 45% was cropped and 30% forested.
- 107 million acres of wet soils were identified as prime or adequately drained of which 72% were cropland.

About two thirds of all *drained farmland* in Michigan depends on public outlets by county or intercounty drainage systems. Statistics from USDA surveys in the early 1980s show that Michigan had 5,515,000 acres of artificially drained land. 70 percent of the drained land was cropland in 1982. The survey also showed that 30 percent of all cropland in Michigan was drained. USDA estimated in 1998 that the percentage of agricultural cropland drained was still about 30 percent.

Agricultural drainage is installed in Michigan for two main reasons:

1. To allow for timely field operations such as seedbed preparation, planting, and harvesting.
2. To protect field crops from extended periods of flooded soil conditions.

We are sometimes asked:

1. What is the average cost of draining and maintaining drainage for agricultural land?
2. What is the percentage of the total capital investment in agriculture that is in drainage infrastructure?
3. What have been the returns of this investment?

These are difficult questions to answer completely reliably but using data from the census of agriculture and census of drainage since 1920 does allow us to develop the following picture:

In 1985 there were 233 million acres of “non federal rural land” and 110 million acres of agricultural land benefited from artificial drainage. Artificially drained cropland was 30 percent

of total cropland of 12,868,333 acres. As stated earlier there are 5,515,000 acres of artificially drained land in Michigan and 70 percent of this is in cropland (3,860,500). 60 percent of area drained still depends on public outlets (county and intercounty drain systems)

The average real cost of providing group or multiple owner drainage outlets was \$225 per acre in 1985 in the U.S. and had been essentially constant since 1915.

The cost of providing surface drainage to these public outlet drains has risen between 1965 and 1985 to \$140 per acre. The cost of subsurface drains at the same time decreased substantially to \$415 per acre in 1985. (This reflects the trends toward new plastic subsurface drain tile and more efficient trenching methods.)

In 1985 it was estimated that the value of all U.S. farm drainage systems was over \$40 billion, based on replacement costs. This included \$15 billion for public agricultural drains and \$25 billion for on farm systems.

Allowing for depreciation, it was estimated that the net capital value of all U.S. farm drainage work was estimated to be \$25 billion, \$15 billion for public drains and \$10 billion for on farm systems. This is estimated to be up to 4-6 percent of the value of all farm real estate nationally and up to 30 percent of the value of all farm real estate in Michigan.

The aggregate nature of available data makes it impossible to estimate the actual increase in value attributable to drainage. But when counties with high incidence of drainage are compared to counties with low incidence of drainage there are some interesting relationships. An analysis of the 1982 Census of Agriculture data shows that real estate values in 256 predominantly agricultural counties in the eastern U.S. were 27 percent higher than values in 1422 predominantly agricultural counties which had a low incidence of drainage.

Since 1985 there has been continued increased intensification of on farm drainage at the same time as there has been an intensification of concern for the environmental impacts of both historical and present day drainage projects on the hydrological system and the ecosystem.

It is hard to imagine that much of the Midwest farm belt and its world class agricultural production was originally swamp or land too wet to farm. Much of the land was shunned or considered a hell-hole unfit for settlement, due to the swarms of mosquitoes and common outbreaks of malaria and other insect borne diseases. Drainage greatly improved the habitability of the land, saved many lives and greatly enhanced the agricultural productivity and economic vitality of the state.

And yet we have lost more than half of the original wetlands in this country. In the process we have impaired the hydrologic functions of our watersheds and greatly reduced the habitat for wetland dependent wildlife, affecting the diversity and balance of nature and threatening or endangering the survival of many species of birds and other wildlife. In many cases the water quality of our streams and lakes have been negatively impacted by the drainage of these wetlands.

It is easy to see why controversy and drainage are old bedfellows. The engineering projects that have bettered our lot in many ways, by their nature are demanded and occur before we have full understanding of their impacts on the world around them. Any altering of our environment, whether to reduce the scourge of disease, make travel and commerce more possible or to open new land for food and fiber will and has had a major impact on our environment. In the middle ages there was bitter opposition to the draining of the fens in England from the fowlers and fishermen who saw their livelihood threatened.

There are always impacts from land use decisions and always those who might consider themselves winners or losers, but as we become more and more able to influence the natural systems around us it becomes imperative that we start looking at the land and its products as more than discrete resources.

As long as our numbers were few and technology simple we could get by in this fashion. We may impose our own arrangements on natural systems, but neither engineers, drain commissioners or lawyers can amend or repeal the laws of nature.

The coming century will need to be one of where we learn, as Dr. Lynton Caldwell of Indiana University says so well, “To identify, to protect, and in the interest of human welfare, to manage the natural ecosystems upon whose continuing viability human welfare depends.” This approach, to the extent possible, will allow natural processes to carry on the work of maintenance and self-renewal of our necessary artificial systems. Our vast system of drainage and irrigation infrastructure is a prime example of a system which requires constant attention to keep it functioning in a safe and productive fashion.

Dr. Caldwell says: “To describe these systems as artificial is not to condemn them or to suggest that they are intrinsically inferior to natural systems. Civilization requires the construction of artificial ecosystems. The ecosystem approach to their management is not to return them to nature, but rather to benefit from the fullest extent from the operation of natural

processes...to substitute where ever possible the economy of nature for human effort is the essence of economic as well as ecological good sense.”

The degree that we realize the importance of working with the natural ecological processes in helping us build a better system to manage our watersheds, stormwater, and drainage infrastructure for Michigan, the farther we will go in the next century to assuring that these watersheds survive as vital, vibrant, and sustainable communities.

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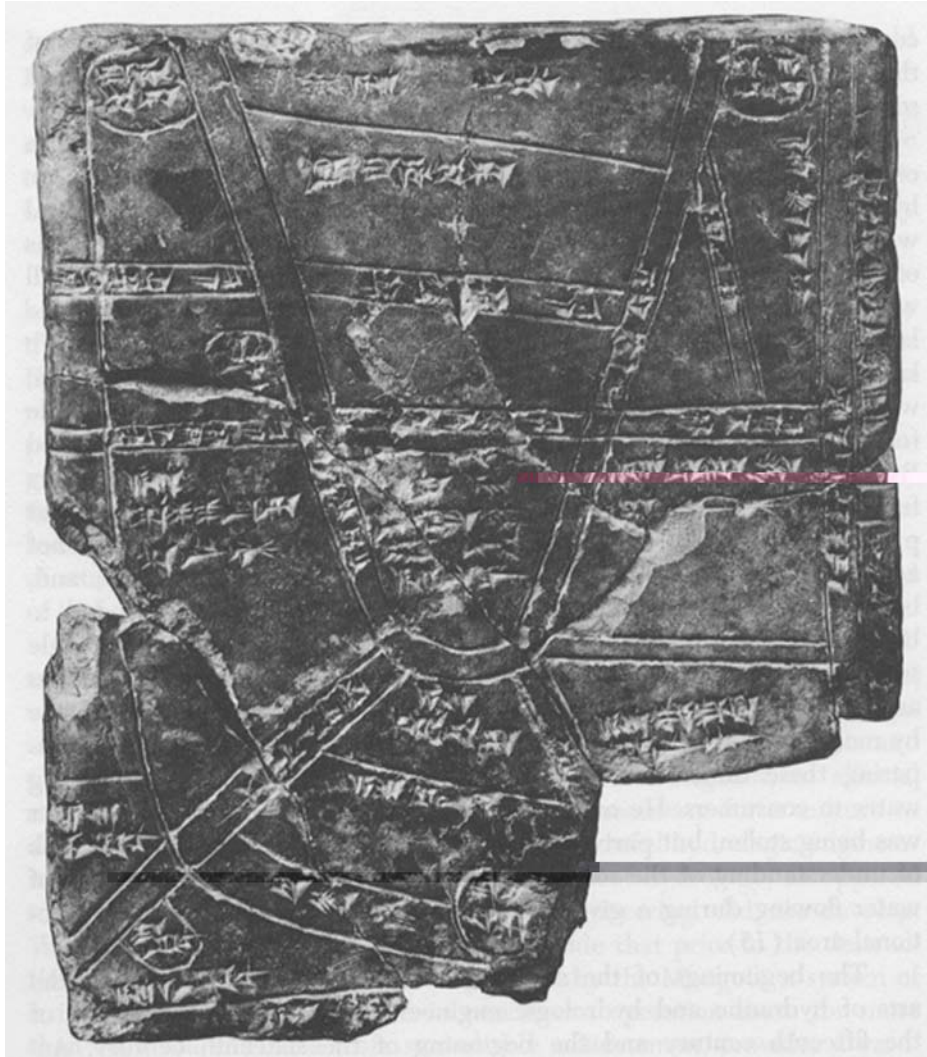


Fig.1 Map of the fields and irrigation canals near Nippur, Mesopotamia circa 1300 B.C. (Photo of tablet at University of Pennsylvania Museum)

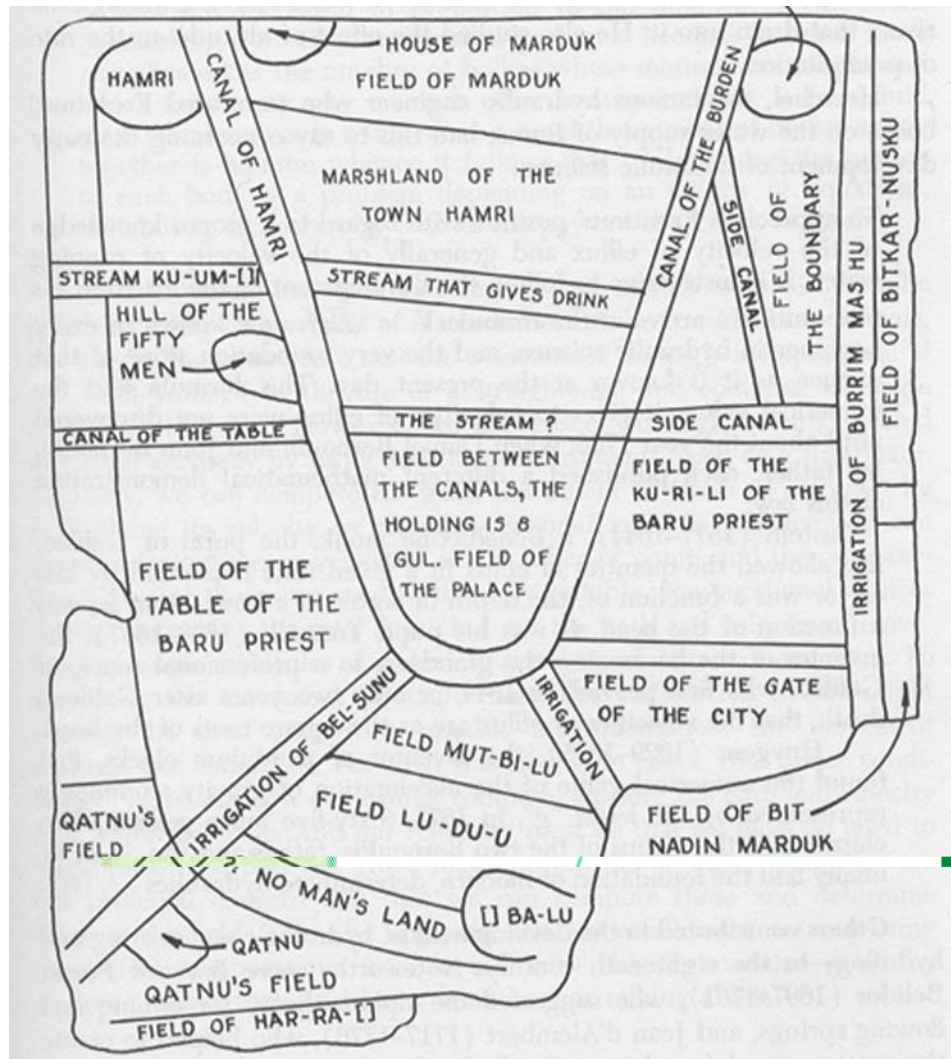


Fig 2 Translation of cuneiform tablet from M.S. Drower, 1954. Main irrigation canal encloses the central field in a parabola. The elongated rectangular fields on the right may have been included to “key in” this tablet with other tablets that depict an adjacent area.