BONEYARD CREEK MASTER PLAN

Volume I: The Plan
And
Volume II: Detail Engineering and Cost

The Boneyard Creek Commission:
Conklin & Rossant Planners/
Clark Dietz Engineers, Inc.

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FOREWORD

The Boneyard Creek Commission has been charged with the goal of developing Boneyard Creek as a multi-purpose community asset for watershed management, recreation and urban beautification. This Boneyard Creek Master Plan has been prepared to serve the Commission as a guide in its efforts to achieve this goal.

The gradual, but persistent degradation of Boneyard Creek has long been a community concern. Many projects have been proposed, with some being implemented, in an effort to reverse the trend. During 1976, the improvement of Boneyard Creek and its transformation into an object of community pride was selected by the Champaign County Bicentennial Commission as their Horizon '76 Project. This project sparked the interest and received the overwhelming endorsement of the citizens of the Champaign-Urbana Community.

As a result of this initial citizen impetus, the Boneyard Creek Commission was formed by inter-governmental agreement between the cities of and Champaign, the Urbana and Champaign Park Districts and the Urbana Champaign Sanitary District. Being charged with the responsibility of developing a long-range plan for the Boneyard Creek the Commission, in May of 1977, executed an Agreement with the joint venture of Conklin and Rossant/Clark, Dietz-Engineers, Inc. to prepare the required master plan. The Commission' s endorsement of this document completes the second phase of this Agreement. Conklin and Rossant are Architects and Urban Planners from New York City; Clark, Dietz-Engineers, Inc. have their office in Urbana.

A significant portion of the funds for the project were provided through individual, local contributions. The many community minded citizens whose contributions made this study possible are gratefully acknowledged. The remainder of the funds were provided through a matching appropriation from the Illinois Department of Transportation, Division of Water Resources. These funds were ear-marked for the flood control portion of the project. The continued interest and support of the Department of Transportation and other State and Federal Agencies is greatly appreciated.

In addition to the above mentioned sources, preparation of the Master Plan was made possible by the active interest and cooperation of numerous agencies, civic organizations

and interested individuals concerned about the future of the Boneyard. In particular, we wish to acknowledge our gratitude to:

Boneyard Creek Commission
Champaign County Bicentennial Commission
Champaign County Development Council
Champaign County Regional Planning Commission
Champaign Park District
City of Champaign
City of Urbana
Illinois State Water Survey
University of Illinois at Urbana-Champaign
Urbana-Champaign Sanitary District
Urbana Park District

Many other individuals have contributed their time, talents and personal resources to this effort. To these individuals we would like to extend our appreciation.

As the project now begins the hard journey from plan to real ty, we are confident that, with continued support from these many excellent sources, THE BONEYARD WILL HAPPEN.

VOLUME I
THE PLAN

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CHAPTER 1: INTRODUCTION AND SUMMARY

TOWARD A NEW BONEYARD

Boneyard Creek has long been of concern to many citizens of Champaign and Urbana. Efforts to arrest its continuing deterioration go back many years. Numerous individuals have given selflessly of their time, talents and money in support of this goal. As a result of these efforts and the impetus given the problem through selection as a Bicentennial Year Project the Boneyard Interagency Advisory Commission was established and evolved into the present Boneyard Commission. This Master Plan Report is one important step in that citizen effort to renew, clean and refresh this physical heart of the Twin Cities.

This master plan sets forth the Commission's recommendations on those engineering and design elements that if implemented will make the Community's dreams come true. The Master Plan as presented herein is a conceptual plan to be used as a guide in the future improvement of Boneyard Creek. No attempt has been made to present project level plans but, instead, a general framework is presented within which such project plans can be developed as opportunities arise. The Plan has been formulated so as to encourage the sound development of properties adjacent to the Creek's banks and proposes flood control, water quality and aesthetic improvements which will greatly increase the number and diversity of development opportunities available. Because it is a long-range plan there is significant flexibility in its individual proposals: As much latitude as possible is left to the project decision makers and funding agencies within an overall structure of sound engineering supported by baseline hydraulic criteria which ensure that the Boneyard will "work" efficiently in its role as stormwater drain for the Champaign-Urbana area.

Historically, the central Illinois area of Champaign and Urbana was once a mixture of prairie and marshes. As settlements and farm lands were created ditches, like the Boneyard, were dug to drain low lying areas. Today, Boneyard Creek is a neglected vestige of this past, trapped within a completely urbanized framework and over-burdened in its ability and capacity to continue to function effectively as a storm drainage way. Why did the Boneyard deteriorate? The main reason is that as the villages became cities, and became more and more paved and roofed, more and more water - after storms - ran into the Boneyard than before and more quickly. What was a gentle village mill stream became an urban open drainage way. The water cut a deeper and unfortunately dirtier path through the Cities as they developed.

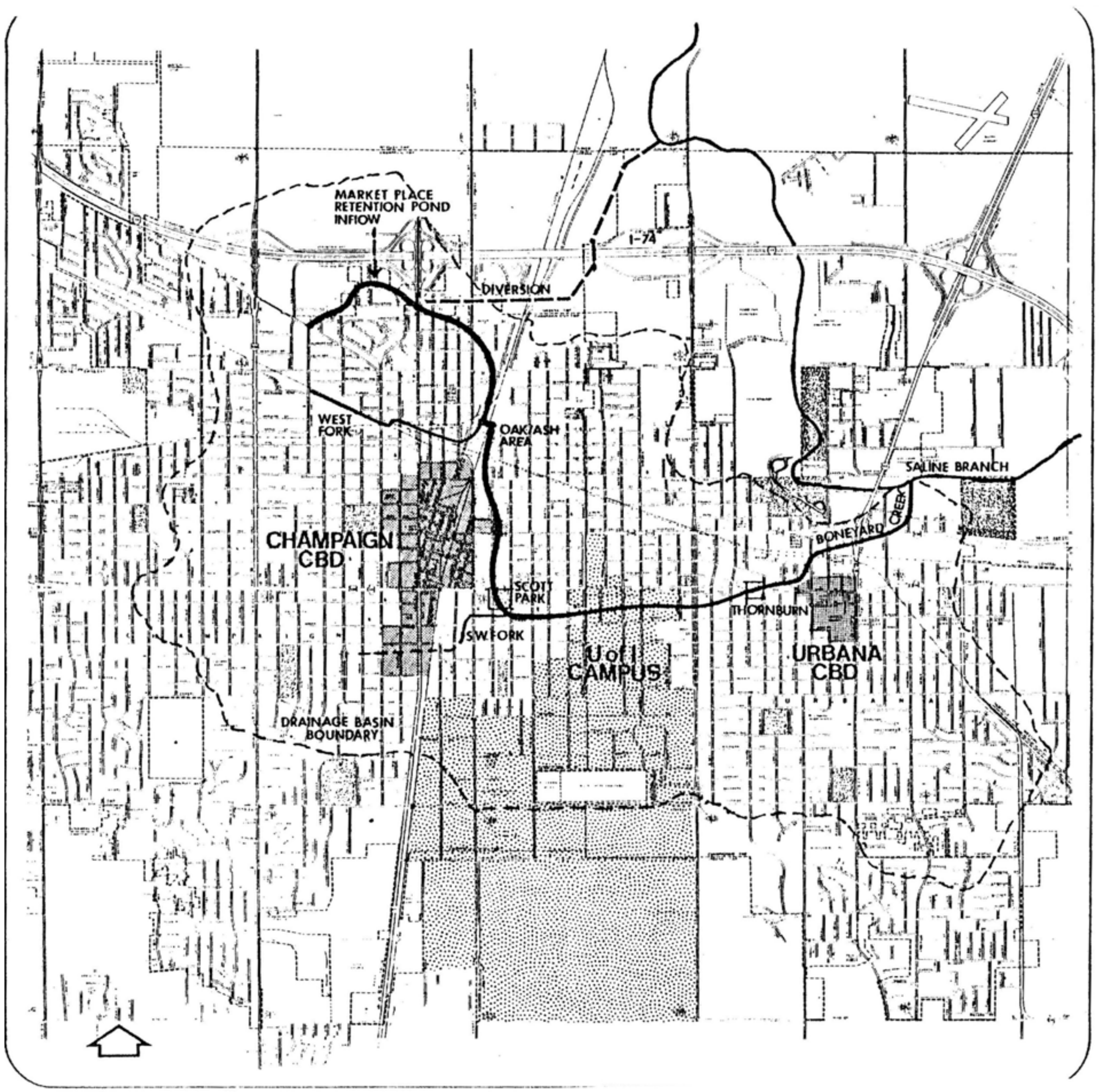
This plan is a long range proposal for the improvement of these Boneyard Creek conditions, both in terms of its ability to handle storms of moderate intensity without flooding, and its environmental quality. It seeks to return the Creek to something like its former visual character and image within a modern engineered framework. It is not merely an isolated project or series of projects, but rather a framework for a gradual, long range restoration and preservation process demanding both public and private participation.

As indicated in Figure 1, Boneyard Creek today drains an area encompassing the heart of the Twin Cities of Champaign and Urbana, and flows along a path which skirts the fringe of both Cities' central business districts and through a portion of the University of Illinois Campus and its Campustown retail area. Thus the Creek touches on many of the important functional elements of the Twin City region and has a community value which goes beyond its essential storm drainage role.

PLANNING FRAMEWORK

Up to now the struggle has been to ward off further deterioration of the Creek channel and the cries of some for the total abandonment of its open, free flowing stream like character. Since the early 1900's various efforts have been made to improve the Boneyard to meet changing conditions, but essentially these have been localized remedial measures directed to one or another individual aspect of the problem. The only comprehensive drainage plan proposed was that prepared by Horner & Shifrin for the Urbana-Champaign Sanitary District in 1949. This plan called for the placement of the Boneyard in a box culvert from a point where the Creek crossed Champaign Street in the City of Champaign, to its intersection with the Saline in Urbana. The bond issue for this Plan was rejected by- the voters and hence the project was never executed. Since this 1949 Plan, various limited improvements along the Boneyard have been made. These include the diversion structure at Neil Street (1961), the sheet piling between Lincoln Avenue and Race Street in Urbana (1962), and attempts to locate and reduce its sources of pollution.

Figure 1: Urbana Setting



The voter's rejection of the Horner & Shifrin Proposal preserved the Boneyard as the open channel it is today, but left the two Cities without an alternative, comprehensive approach for the Creek's future. The purpose of this plan is to provide a new comprehensive framework for the improvement of the Boneyard which is reflective of community desires, and which can be implemented over time. The initial step in this three step master planning process was the Guidelines Report analyzing existing conditions and improvement options. From this, combined urban design and engineering proposals have been developed, reviewed, and evaluated for the formulation of this Plan. The Plan presented herein represents the culmination of Step 2. The final step in the planning process involves an early action project intended to demonstrate the Plan's implementability and provide impetus for further projects.

CITIZEN PARTICIPATION

The interest in the improvement of the Boneyard has become a broad based community effort. The citizens cry for "something to be done about the Boneyard" was focused by the Bicentennial Campaign. From the onset, the Boneyard Creek Commission and the study team have actively sought community involvement in the translation of this cry for improvement into a realistic course of action. One such element were the "Listening Booths" or information Kiosks set up and staffed by members of the planning and engineering design team at key public exposure locations to corner the passer-by. (Figure 2) This method of gathering information from citizens not normally heard from unless specifically sought out, proved to be especially useful. At retail centers shoppers were stopped, given a brief description of the project and then were asked to enumerate the various activities they would like to see along a hydrologically improved Boneyard in the future. From this emerged an array of valuable suggestions and comments which has colored the study objectives and the Plan's proposal. The gist of these comments was:

Figure 2: Listening Booths in Action

Water Flow & Quality:

- Almost all felt that the struggles to improve the flow, eliminate flooding, and improve water quality as an open channel were well worth it. Nobody seemed to take the viewpoint of "just put the Boneyard in a culvert and forget about it." In fact everyone encouraged the development of its scenic stream potentials through the inclusion of ponds, landscaping, planting areas and other elements to make the stream more appealing.

Activities and Use:

- Almost all felt that uses of the improved Creek should be low key involving activities compatible with a linear park. Repeatedly mentioned were walking and jogging paths, bikeways, areas for picnicking, sitting or just basking in the sun. The stress was on the creation of a renewed Boneyard for the visual and active enjoyment of all the community. Additional suggestions were a community band shell, and the use of certain portions of the Creek for School District ecological study tours.

Concerns:

- The concerns expressed were those normal reactions of citizens of an urban community today: such as "don't unduly add to our tax burden"; "don't create security problems"; "in some areas there is not enough parking as it is", and so on. What was special was the high degree of community pride, and the willingness to devote time and physical effort towards the planned improvements. Members of the Garden Clubs, Boy Scouts, Youth Groups, 4-H Clubs, and Trade Associations all indicated a sincere interest in participating in the Boneyard improvements if given direction and assurance that their effort will be meaningful. It is this latent force, added to a framework of Creek hydrologic improvements that will eventually see this plan implemented. It is also to this end that the objectives which follow have been tailored as well as the long range development proposals of the Plan itself.

BALANCED OBJECTIVES

The overriding goal for the improvement of the Boneyard as formulated by the community is that "of developing Boneyard Creek as a multi-purpose community asset for water-shed management, recreation and urban beautification." Essentially this has four aspects: The implementation of flood control measures, the improvement and maintenance of water quality, the development of the Creek corridor activity potentials and finally the improvement of the Creek appearance or aesthetic quality. Summarized below are a set of objectives within each of these categories, which are intended to represent an equitable balance in scope between varying objectives.

Flood Control:

- To limit the 10 year design flood conditions to the confines of a minimum Boneyard corridor.
- To obtain additional capacity wherever it can be achieved at no significant additional cost.
- To tailor the specific control systems to the natural setting and particular needs of the individual reaches.
- To minimize flow peaks where justified through detention basins.
- To limit damage to flow conveyance corridor during severe storms.
- To minimize erosion problem conditions.

Improved flood control is one of the major and more tangible results to be achieved by this Master Plan. In its present state Boneyard Creek serves as the major conveyor of storm water run-off for most of the urbanized Champaign/Urbana area. Today even a storm of only moderate intensity can bring the peak crest to the top of the banks in the Campustown area, and flood low lying street intersections. In order to provide sufficient protection to justify expenditure of funds for flood control, a 10 year design storm has been selected as a minimum design standard for all phases of the Creek's improvement and basements. This figure is higher than the five year criteria often used for storm drainage projects. However, given the almost flat terrain, the proximity of the Creek to surrounding development, anticipated future drainage flow requirements, and the integrated nature of the total planned improvements, this higher design standard is justifiable and desirable.

Water Quality:

- To improve overall water quality in terms of its overall chemical pollution.
- To improve the visual quality of the water for recreational and other uses.
- To minimize quality problems caused by urban run-off.

The need for water quality improvement is obvious. If one is to improve the Boneyard, to the point where it can become a real community recreation and visual asset, the physical improvement of its existing water quality is essential. Often flood control measures can result in improvements in water quality as well. In other cases specific pollution reduction measures are required to improve run-off pollution.

Activities:

To foster the development and promote the use of the Boneyard Creekway corridor as a focus for various activities such as:

- A public pedestrian and bicycle circulation way.
- An urban amenity for community recreation needs.
- An asset to the development potentials and activities associated with the existing and potential future adjoining land uses.

Today, in only a few areas does the Boneyard play a role in the activities of life in the Champaign/Urbana community. Although the potential for a far greater role exists, this has yet to be realized with the exception of an isolated case such as Scott Park. Given that the first two objectives are realized (the reduction of the threat of flooding and the improvement of water quality), the Boneyard of the future can take on new tasks, exploiting its linear corridor and prime location within the heart of the Twin Cities Urban Community. The objective is clear and compelling to develop the activity potentials associated with an improved Boneyard as a linear landscaped Creekway. These potential activities include:

1. Its use as a circulation corridor for Creekside walks, bicycle paths, and jogging trails from Downtown Urbana on the east through the Engineering Campus to Downtown Champaign on the west.
2. Its use as a Creekfront Park for passive recreation needs such as sitting areas, basking in the sun and leisurely strolls.
3. its use in certain areas for more active forms of recreation, where the Boneyard or its associated detention ponds becomes coupled with an urban park where play fields, basketball, tennis courts and other activities exist or are needed.

4. And finally, its use by the adjoining land uses as an integral part of their own activities' overflow. Such examples would include: Campustown, outdoor cafes and retail plazas, University cultural uses and student gathering needs, Thornburn Community Center activities expansion, Urbana Station Theatre outdoor needs, as well as becoming an integral part of any Creekside development.

A Special Place:

- To foster the development of the Boneyard as a special place of unique character, thereby contributing real benefits to community life, and helping to strengthen its economic vitality.

There is no question that the Boneyard today is a liability rather than an asset especially for the adjoining property owners. It is subject to periodic flooding, its banks are difficult to maintain due to extreme fluctuations in the flow, and its channel in some areas has so deteriorated over time through neglect and abuse that its potential visual attractiveness is defeated. The Horner & Shifrin Plan calling for placement of the Boneyard in a box culvert thereby covering the entire creek is one solution to these liability problems. However, the limitation of this solution is that it does not make the Boneyard into a community asset. The realization of the beneficial aspects of the Creek's improvement is a major thrust of this objective. The underlying premise is that the Boneyard of the future can become a special place, a desirable location to live, work and shop and a focus for community events (arts festivals, sports events, or school outings). Coupled with this special place aspect is the catalytic effect on the up-grading of adjoining properties which strengthens property values and encourages new development.

Flowing streams through downtown areas have an innate attraction in themselves. Designed and developed as an urban amenity, the Boneyard Creekway can become a special place in its urban environment. The new Boneyard will attract visitors; it will make going "downtown" a special pleasure.

This Master Plan is comprised of two volumes and a separate package of plan profile drawings for the entire length of the Creek at 100th scale. This first volume describes the overall master plan and the combined engineering and urban design aspects of the project. The second volume is a technical engineering appendix containing supplemental detail information on channel sections and costs for the proposed improvements.

Essentially the plan is conceived as a framework for decisions and an organizing set of concepts to guide present and future Creek related growth and improvements. Given the varied urban environmental setting which now exists along the Boneyard, the proposed improvement program reflects the diversity of the Creek's sub-areas, and the linkages between them. Hence the planning and engineering proposals are individualized and directed to specific sub-area conditions. The local area Planning concepts are diagrammed in Figure 3. A summary of the key aspects of the Plan's proposals follows.

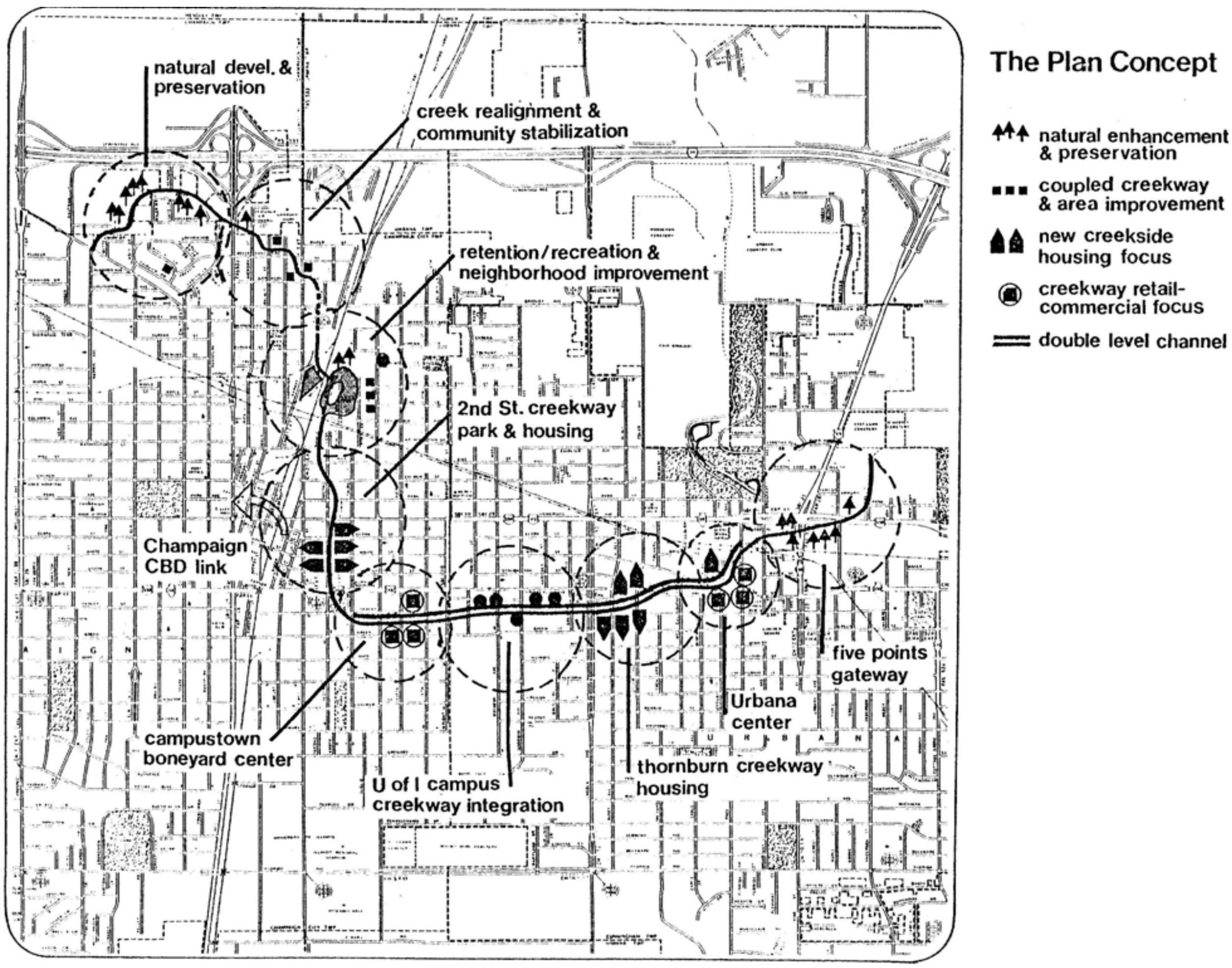
PLAN SUMMARY

Flood Control

The alleviation of much of the current flood prone conditions and the introduction of measures to provide some regulation of peak flow surges is viewed as the generating force for the other improvements. These flood control and flow regulation improvements are designed to reduce the extent of the 100 year flood plain (which the State Water Survey has indicated as covering much of the drainage basin area) and to contain the 10 year peak flows within the channel right-of-way. These proposals include:

- Recommendations for the improvement of the existing channel from the Creek's point of origin at Bloomington Road to south of Scott Park at Third Street.
- Proposals for the realignment of the channel in the Neil to Market Street area and south of University Avenue along Second Street right-of-way.
- Proposals for the improvement of the channel from Third Street in Champaign to Lincoln Avenue in Urbana through Campustown and the University Engineering Campus by recommending the construction of a double level channel comprised of a lower box culvert for storm flows and an upper level open stream for normal flows.

FIGURE 3 – The Plan Concept



- Proposals for the improvement of the existing sheet piled channel sections by the continuation of the double level channel proposed above from Lincoln Avenue to Race Street.
- Proposals to stabilize the existing channel from Race Street to the intersection of the Boneyard with the Saline.
- Proposals to regulate peak flows through the inclusion of a detention basin south of Bradley Avenue adjoining Cap and Gown.

Water Quality:

The plan endorses current enforcement programs of both Cities relating to pollution control, including the location and correction of sanitary sewer infiltration. Unfortunately, it is doubtful that it will ever be possible to improve water quality to the point where it would become acceptable for swimming or water contact activities. However, the plan's recommendations can result in a marked improvement in visual quality and the elimination of health hazards and odors. These planned proposed measures include:

- Attention to the detail design of flood control channel improvements to eliminate erosion prone areas.
- Incorporation of in-stream aeration systems such as fountains and low weirs.
- Low flow augmentation by the skimming of the low flow at the Neil Street diversion structure.
- Recommendations for individual storm line connections to consolidate points of discharge into the creek and to introduce good engineering practices in controlling general surface run-off.

Creekway Development:

These engineering improvements will set the stage for a new role which the Boneyard corridor can play in the development and urban activities of Champaign/Urbana in the future. With the taming of the stream new uses can be incorporated and a fresh planning approach to its adjoining land areas adopted. Specifically-the plan recommends:

- The development and use of the improved Boneyard corridor as a bike and pedestrian circulation route for its entire length linking different sections of the Twin Cities.
- the closing of several select low traffic streets to increase Boneyard related development potentials such as Second Street between University and Springfield Avenues; Burrill, Mathews and Gregory at the University Engineering Campus; and the re-alignment of the West Main Street/Springfield Avenue intersection in Urbana.
- the encouragement of a new Creekside housing development along Second Street in Champaign and between Lincoln Avenue and McCullough Street in Urbana.
- The proposed development of the land surrounding the West Main Street/Springfield intersection in Urbana as a commercial gateway to the downtown, integrated with new housing.
- The proposed development of special creekside parks, playgrounds and plazas to act as focal points and activity centers for different neighborhoods, including a major recreation pond in the Oak-Ash area.
- The strengthening of the commercial mixed use development trends of Campustown, and the improvement of linkages between the Creek and the existing downtowns of Champaign and Urbana.
- Proposed landscape development standards for Creekside walks, sitting area, planting, lighting, etc.

<u>Implementation and Management:</u>
The plan itself represents a long term goal of some 30 to 40 years. With a few exceptions most of the proposed improvements can be staged over time, with no one fixed starting point. They also represent a combination of public and private efforts, where the public funded portions of the flood control system once completed will make available a tamed Creek for adjoining private land development and creekway improvements. In this process the plan looks to the Boneyard Creek Commission or its successor organization to continue inter-municipal coordination. Specifically the plan recommends:

- An early action flood control project and its associated streamway development so that the entire community can comprehend the potential of the Plan. This will act as a catalyst for subsequent improvements.

- The creation of a Special Boneyard Zoning District to foster quality private development of the Boneyard corridor and to establish basic regulations regarding its use and set-back requirements.
- The continuation of an inter-municipal and inter-governmental Commission, to continue to lobby for and coordinate future Boneyard developments.
- The resolution of existing jurisdiction disputes relating to Creek maintenance so that both the improved stream channel and its banks are adequately maintained.

CHAPTER 2: THE BONEYARD TODAY AND TOMORROW

CHARACTERISTICS

The actual source of the Boneyard and its location is not precisely known. The emergence of the Creek, and hence its point of beginning in terms of this study, is in the north-central area of Champaign at the intersection of Bloomington Road and Harris Avenue. Here the Creek emerges from a culvert on the north side of Bloomington Road as a small clear drainage stream some 12 inches wide and a few inches deep. From this point the Boneyard meanders some 3.9 miles through Champaign and across a portion of Urbana until it joins the Saline Ditch at the northern edge of the Illinois National Guard Armory property. Along this course the Creek drains an area of some 8.3 square miles comprising the central portions of both Cities, with a descent of some 54 feet from its point of beginning to its confluence with the Saline. Its primary water source is storm sewer and drainage discharge which maintain a continuous rate of flow although extremely slight (some 2 c. f. s.) for 80 to 90% of the year.

As an urban landscape element, the presence of the Boneyard remains largely unrecognized and tucked away in backyards, for approximately one-third of its course. Only south of University Avenue and along Second Street in Champaign does the Boneyard assert itself on the urban scene. Despite this, the Boneyard and its riparian properties includes some of the major functional elements of the Champaign/Urbana community. These are the new growth area surrounding the I-74/Neil Street intersection as represented by the Market Place Regional Shopping Center, the residential and manufacturing areas of northeast Champaign, the University Campustown retail area and the Engineering Campus of the University itself, the Urbana residential area east of the University, and finally the area defining the northern boundary of downtown Urbana. Within each of these the Creek and its current associated problems demand attention.

PROBLEM CONDITIONS

Old photographs, such as that shown in Figure 4, indicate that the Creek had in the past a far more appealing image and a better functional fit within its urban framework than it does today. Buildings were set-back and the banks were gradual. More important, the Creek was visible and useable. Over time, development has encroached on the Boneyard's

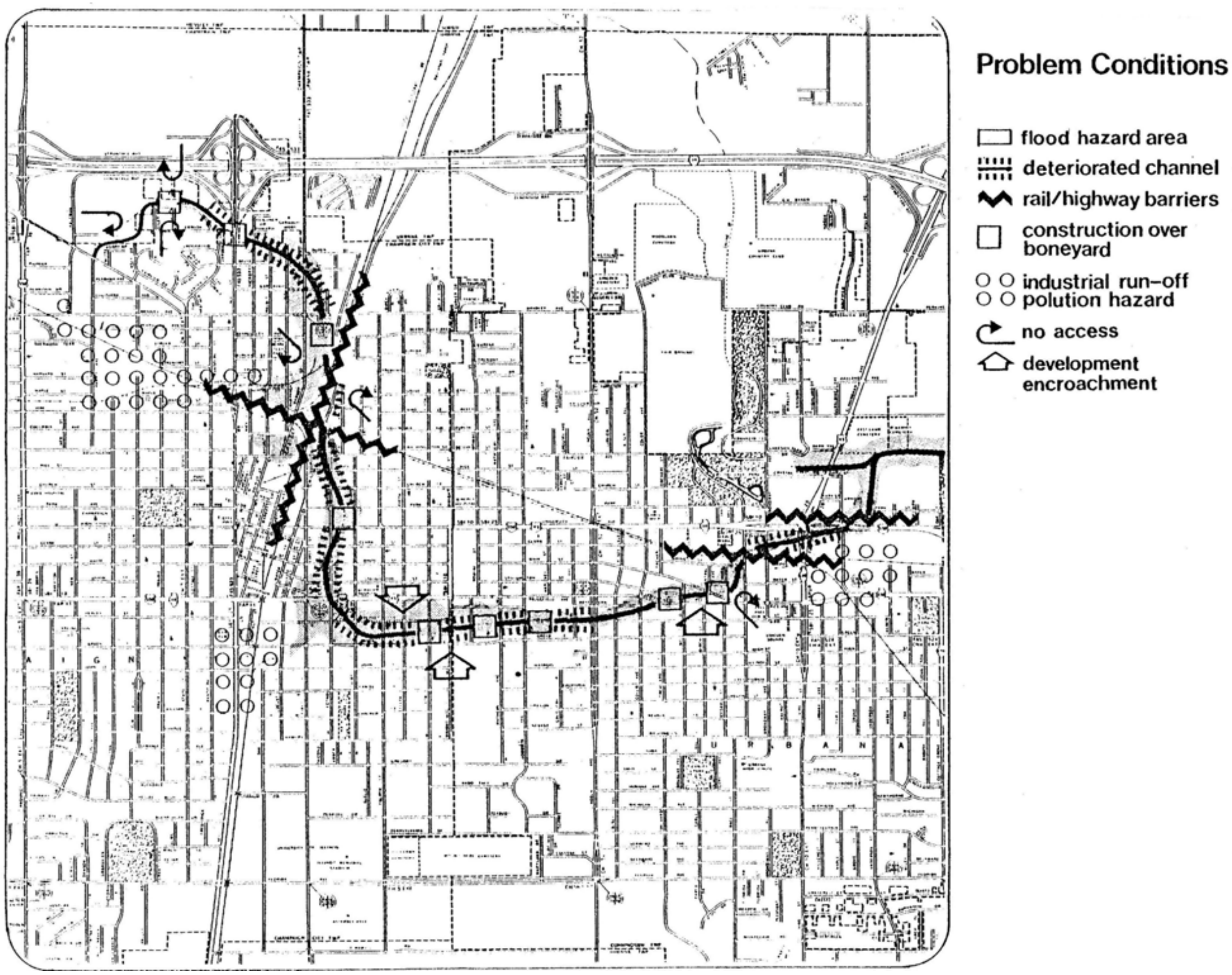
Figure 4: The Old Boneyard Image

drainage way to the point where the Creek is now land locked and frequently invisible. Today major portions of the Creek have become not only neglected but an environmental detriment and eye sore.

This plan seeks to correct these detrimental conditions and to give the Creek a new role and image within the current urban context. The range of these problems to be addressed is depicted in Figure 5. These include:

- Frequent and recurring flooding of low lying areas and basements caused partially by Creek overflow but primarily by the back-up of storm sewer discharges. This is most critical in the Campustown area from First Street to Third Street.
- Continuing problems with stream pollution and water quality. Since the intervention of the Illinois EPA and the directives by the Illinois Pollution Control Board to both Cities in 1971 and 1972 to set a program for the improvement of Boneyard water quality conditions, this problem has become largely stabilized and improved. However, the recent discovery that the Boneyard is the third most critical source of encephalitis mosquitoes, and continuing occasional pollution due to sanitary sewer infiltration indicates that much still remains to be accomplished.
- The deteriorated condition of the Creek channel is also a major problem. The exceptions to this are the upper reaches of the Creek in Champaign and the sheet piled section from Lincoln Street to Race Street in Urbana. Unless corrected, these deteriorated conditions can lead to continued flow blockages, bank erosion, and other maintenance problems.
- Neither of the existing two City Zoning Ordinances addresses directly the problems of development encroachment along the Boneyard and its need for regulation, except indirectly through the administration of flood plain regulations under the National Insurance Program. There are no established guidelines regarding set-backs and incompatible uses. Unless corrected, this can adversely affect the attempts to improve the Boneyard's setting and its water quality.
- There is no one agency or unit of government responsible for the total maintenance of the Creekway. Current jurisdictional questions relative to the roles of the Urbana-Champaign Sanitary District versus that of the cities require definition and coordination as an essential future priority.

Figure 5: Problem Conditions



HIDDEN ASSETS

Despite these problems, the Boneyard, by nature of its location and its latent urban waterway qualities, can become a real community asset and amenity. Figure 6 shows several existing views of the Creek's innate appeal and potential, as yet largely unrealized.

The general description of the master plan which follows indicates a series of proposals for the restoration of the Creek to its former image. Chapter III outlines the elements of the Master Plan's proposals in terms of flood control, water quality, parks and urban open space, circulation and access, land use development and site design components. The application of each of these to different areas or neighborhoods along the Creek is described in the eight reach or sub-area improvement proposals in Chapter IV. These reach divisions are the same as used in the prior Guidelines Report to analyze existing conditions and potentials.

ALTERNATIVE CONCEPTS

In the process of developing the Master Plan a broad range of alternative conceptual approaches to the future improvement of the Boneyard were considered. These as described in the Guidelines Report were:

- The Engineered Boneyard, an approach focused primarily on structural flood control measures.
- "Creekway Park" or the gradual long-term acquisition of the flood plain for park use.
- "Multi-Purpose Boneyard" - the focusing of combined engineering and development improvement on three or four scattered sites.
- "Boneyard Center" - the converse of the above in that it proposed a single focus with modest improvements elsewhere.
- "Living-on-the-Boneyard" - the creation of a Boneyard high density residential district.

From the public and Commission review of these options emerged a consensus for the multi-project approach combining elements of almost all of these options depending on the needs and characteristics of a given area.

Figure 6: Latent Assets

CHAPTER 3: ELEMENTS OF THE PLAN

FLOOD CONTROL

The 100 year flood plain as designated by the Illinois State Water Survey Flood Study weaves its way up the Boneyard, varying in width from one to two hundred feet up to a thousand feet in width. Although it is a standard often used in defining flooding problems, it has proved beyond the economic realities of most communities to attempt to control the flows from this 100 year storm. Although the channel sections proposed in the flood control plan would have an impact in reducing this 100 year flood plain, they have been designed for a more economically feasible goal.

Beyond the reduction of the actual width of the flood plain through specific flood control measures, the development proposals of the Master Plan allow another opportunity at reducing the impact of flooding. As the Master Plan is implemented it will encourage new land uses and types of development adjacent to the Boneyard. The control of future land use development along the Boneyard can provide more open space in areas now within the 100 year flood plain. In addition, new development can be designed with flood proofing in mind to further minimize the impact of potential flooding. In this way the Master Plan can go beyond the flood control achieved by the specific engineering concepts proposed.

The flood control plan outlined here has been conceived as a workable system under present conditions. In the future new developments may allow for additional flood control elements. Due to this some of the flood control specifics might change, but the objectives and amount of control should remain intact or be expanded upon.

The minimum design period is based on the 10 year storm. The reasoning leading to the choice of this design storm is expounded on in Volume II of the Master Plan. Various projects have been based on less frequent return periods where warranted. The thrust of the flood control system has been to fully control the flows designated in the 10 year design storm. This means that the 10 year flood will not overflow the banks of the designated flow corridor or surcharge any closed conduits used in transporting the flow. Even though storms larger than the design storm will produce flows beyond channel capacities, the extent of this overflow and the resultant damage will be greatly reduced when compared to the present condition.

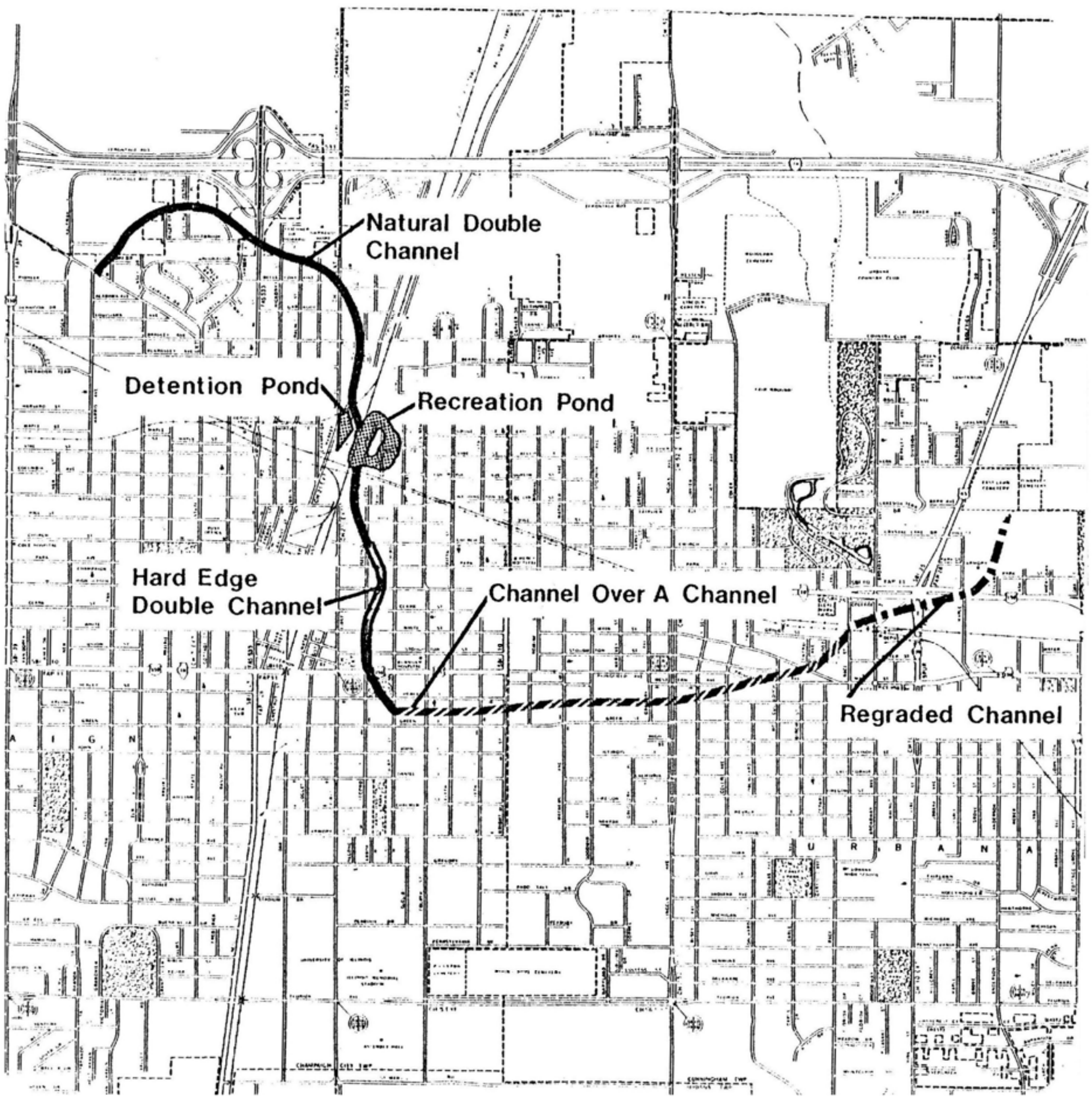
One of the overall concepts involving the flood control plan has been an effort to make it flexible enough that changes can be incorporated as future conditions dictate. In many areas where channelization has been the major thrust of flood control, typical cross sections have been developed to provide the necessary flow capacities for use in future detail engineering. These sections also incorporate other design concepts into the cross section such as erosion control and a bikeway. If changes in the future alter these elements, an alternate section could be designed without effecting the overall operation of the flood control system if flow capacity is maintained and the other design factors are considered.

On the following pages various flood control concepts are described, the location for which is illustrated in Figure 7.

Natural Channel Section

In areas where sufficient right of way is obtainable and flows can be controlled a concept similar to that developed for Scott Park has been used. For these areas a small, natural channel will be maintained with gently sloping banks on each side. During dry weather periods the flow will be contained in the channel with the grassed slopes adding to the area of the adjacent corridor park. When a storm event of significant size takes place, the effect will be a rising water level in the creek that will continue to flow in a contained manner under the influence of the grassed banks. By allowing the flow to spread in this manner, the velocities will remain low. This tends to minimize the scouring effect of the larger storm flow. In addition, when controlling the flow in grassed channels, these reaches will tend to minimize peaks by serving to detain flows rather than channeling them quickly downstream. If a small, hard edged channel were used the flow would be more channelized and move downstream more rapidly. This could lead to increased flooding problems downstream while eliminating flooding upstream, thereby actually compounding the flooding problem. For the most part this concept has been incorporated into the flood control systems of the reaches north of Oak Ash. In these areas it appears that the flows will be small enough to be controlled in this manner, and the natural channel blends well into the existing surroundings.

Figure 7: Flood Control Concept



In addition to flood control some water quality benefits will be derived from this type of approach. The larger grass corridors around the creek will provide for some filtering of direct surface runoff. However, this will not affect the quality of the discharge added by the storm sewers.

A diligent effort will have to be made to track down any point sources contributing to degradation of water quality and eliminate them.

Double Channel Concept

This idea is really a continuation of the natural channel concept. It is proposed to border the Boneyard Creek with a bikeway which will be used to provide access to the creek as well as to tie together special usage areas. Due to a lack of available right of way in some areas, it was found to be advantageous to allow the bikeway to encroach upon the flow corridor. It was out of this need that the concept of the double channel was developed.

The double channel section has been designed in a manner which allows the flow to rise out of the dry weather channel and yet remain below the level of the bikeway during smaller storms. For severe storms the water level will rise to the point where the bikeway and the bank above it become inundated and contribute to the flow carrying capacity of the section. In this way the bikeway will be flooded only during short periods of larger storms. This will cut down on the additional maintenance required after a storm event. When used in this manner, the bikeway is designed as a flood proofed structure.

Channel Over a Channel

The concept of a channel over a channel is the major flood control system proposed for three of the reaches in the project. It consists of two separate flow conveyance systems. The first being a large box culvert located in the bed of the existing channel. All connections that presently drain into the Boneyard channel will be connected to this new box culvert. Consequently, during periods of rainfall the flow collected by the existing storm water collection system will be channeled into the new storm sewer culvert. In this manner the chance of polluted storm water discharges would be eliminated from the visible flow for the University, Campustown and Thornburn reaches both during and directly after a storm. This should affect some improvement in the water quality for these reaches.
The second component of this system is the "natural" channel created on top of the box

culvert. This is a small channel sized to hold the dry weather flow plus any direct runoff from adjacent properties. In order to regulate the level of water in the upper channel, inlets to the storm sewer will be located along the length of the top channel. These inlets will prevent the water surface from rising above a predetermined elevation, thus serving as a safety valve against any possible flooding caused by the upper channel becoming blocked by an obstruction of some type.

For periods of dry weather an inlet system will be constructed at the beginning of the box culvert that will allow dry weather flow to be diverted into the upper channel. During rainfall periods storm flow from the upper Boneyard reaches will be diverted into the box culvert.

Detention Pond

A potential component of the flood control system is a dual site detention basin to be located in the Oak Ash area. The first site is located just south of Cap and Gown and will control the flow from the Boneyard's West Branch. In addition, a recreational pool at Oak Ash reservoir site will provide some control of the flow from the Boneyard itself.

Both sites will be capable of detaining the flow from the tributary basin site area up to the 10 year flood without having to discharge via the emergency spillways. The effect of the basins will be to lower peak flows during a large storm and allow a controlled release of this water over a longer period of time to minimize its detrimental downstream effects. In this manner the flow from the upper portion of the basin is controlled, to a degree, allowing the capacity of the flow conveyance channels downstream to be reduced.

This type of arrangement would also have an effect on water quality of the permanent pool and the downstream reaches. By separating the flow at the West Branch and not allowing it to pass through the permanent pool, the overall quality of the flow to the permanent pool is improved.

Since the majority of the flow passes through the West Branch detention basin at this section of the creek, sediment would settle out in the basin before passing on to the downstream reaches.

Minimizing Flow Rates Indirectly

A concept that has received little attention up to this point has been the effort that could be made to control runoff at its initial source, such as roof tops or parking lots. Although this is not a solution that could be considered an integral part of the actual Boneyard channel improvements, it would have an important effect on the operation of the flood control system of the Creek.

The methods that could be employed are extensive. They include ponding on roofs, cistern storage, porous pavement, grassed strips in parking lots, etc. A subsequent section of the report deals with this concept in more detail.

The advantage in employing this type of control is twofold. First, it will reduce the flow and lower the peaks of the present Boneyard condition. This would allow protection against a less frequent return period with the same amount of structural changes on the Boneyard. Second, it would protect against any future development causing the Boneyard flood control proposals becoming obsolete because of increased flows. If the methods of containing runoff and reducing peaks are employed in conjunction with any new development in the Boneyard drainage basin, such development could take place without a detrimental effect on the Boneyard flood control projects.

Hydraulic Grade Changes

There are numerous sections of the existing Boneyard Creek that have small reaches of adverse and nearly flat slopes followed by a steeper section. Sometimes these have been created by rerouting of the original creek and at other times by blockages from trash or sediment deposits. It would be advantageous to establish a more uniform grade line to avoid the ponding and backwater areas created by the existing inconsistent slope.

There is a tendency for a stream to readjust its bed when realigned but it does not appear that this would present a major obstacle with the type of minimal changes proposed in the Plan profile drawings. In many cases the changes will create a more natural condition than now exists.

Another benefit of this regrading process would be the elimination of stagnant ponds that foster mosquito breeding. In addition, by maintaining a more constant flow, the sedimentation problem created by these ponding areas could be avoided.

Minimizing Increased Connections

The design flows used in the development of the hydrological improvement aspects of the Plan have been based on the flood study work done by the Illinois State Water Survey. This State study is based on present drainage and flow conditions of Boneyard Creek. For this reason, it has been recommended that further future connections discharging to the Boneyard be avoided wherever possible. Most likely it will be impossible to avoid any new connections and this is the reason for the recommended development of an ordinance calling for on site detention of storm water for any new developments discharging into the Boneyard Corridor.

Cleaning Existing Systems Usable Components

Certain portions of the existing Boneyard Creek flow system (i.e. conduits and bridge openings) have been incorporated into the proposed Boneyard flow corridor. Although many of these are capable of greater capacities than presently delivered, they will have to be thoroughly cleaned in order to provide the needed capacity. The amount of cleaning needed is more completely detailed in Volume II of this report.

Future Maintenance

It cannot be overstressed that without an ongoing maintenance program, the capabilities of the proposed system to convey flood waters will be greatly reduced. The culverts and bridge openings will have to be periodically cleaned to maintain their full capacity. The creek itself will have to be kept free of loose debris to prevent blockages from occurring. In addition any plantings as well as the grass and ground covers in the corridors will have to be maintained to a sufficient degree to allow the design capability to be available during storm events.

WATER FLOW IMPROVEMENTS

Existing Flow Conditions

The average discharge for the Boneyard Creek is approximately 4.5 c.f.s. This figure is based on stream data from 1947 to 1976. Since the early 60's a portion of the flow has been diverted directly to the Saline Branch by a diversion structure at Neil Street. This diversion has not had a significant impact on the average flow. Some of the flow diverted has probably been replaced by increased urbanization in the remaining basin area. For the period from 1949 to 1961 the average flow was 4.61 c.f.s. From 1961 to 1976 the average flow was 4.43 c.f.s. It would be erroneous to conclude from this information that if the diversion is reversed, for dry weather flow, the average flow obtained would be .2 c.f.s. In most cases, stream records based on daily averages will provide average flow numbers dominated by the effect of storm events. The average flow of 4.5 c.f.s. is greater than the actual flow in the stream at least eighty percent of the time. It is reflective of the impact of the storm events. For this reason it would be misleading to say that about .2 c.f.s will be diverted during dry weather. In addition the effect of cooling water and industrial water releases to the Boneyard will have an effect on the actual flow available from the diversion. From field inspections during the course of the study it appears that about .5 c.f.s. would be available for diversion during most of the summer months. It is recommended that some type of continuous recording be done at the diversion, upon the adoption of the Master Plan, in order to produce more accurate data on the available flow for final design.

Based on gaging station records, at the U.S.G.S. station on the University of Illinois campus, the Boneyard flow will be one c.f.s or greater ninety-nine percent of the time, and will be above seven c.f.s. only about ten percent of the time. Based on this information, the average condition of dry weather flow to be designed under for existing conditions should be about 2 c.f.s.

Flow Regulation Alternatives

The recommendations of this Master Plan are based on a conclusion that the basic dry weather flow will remain as the criterion for dry weather period designs. The major change would be the addition of the present dry weather flow from the Neil Street Diversion. This amount of flow could be accommodated in most reaches. In situations where a greater depth of water is needed, small check dams will be used to provide additional depth.

Flow Supplementation from Reservoir

One of the alternatives examined in connection with flow supplementation and regulation involved the use of stored water at the Oak Ash reservoir site. It was felt that any prolonged use of this type of flow supplementation was impractical.

The reservoir at Oak Ash would be used in a two fold manner. First a permanent pool would be created to enhance the recreational potential of the site. Secondly, the recreation pond as well as the separate detention pond would be designed in a manner to allow a significant amount of detention storage and therefore serve the purpose of flood control. The possibility of using water stored at this site to supplement low flow periods seems to provide a possible answer to boosting the low flow encountered during dry periods. The major stumbling block to the implementation of this idea is the lack of storage space available at the recreation pond.

The Oak Ash site does not actually provide storage space naturally due to a low spot in the topography, but rather provides an area that can be excavated to provide the needed storage. Consequently, storage space of this type must be considered at a premium due to the expense incurred in providing it. The majority of the excavated space at the two detention sites must be left empty in order to provide the needed detention storage during a storm event, allowing a controlled flow. If this area was used to store water flow supplementation it would not be available at the advent of a large storm.

This means that only about 33 acre-ft. of water available in the permanent pool could possibly be used for flow supplement. If a flow of 5 c.f.s was desired and the existing flow had dropped to only one c.f.s., it would require about four acre-ft. of flow supplementation to maintain the five c.f.s. flow rate for a twelve hour period each day. If the permanent pool was pumped entirely dry it could only supplement the flow in the manner described for about eight days. Since it has been proposed to attempt to stock fish in the permanent pool, it would be impossible to pump it down to any significant degree.

To put this problem into perspective, a mass curve was developed based on the flow data of the University gaging station. Based on a design drought period beginning in the latter part of 1973, the storage requirements to meet a release rate of 80% of the average flow would call for 750 acre-ft. of storage. If we assume that the average flow at Oak Ash is considerably lower than at the University gage station, it is apparent that flow supplementation up to say 4 or 5 c.f.s is impractical from the Oak Ash site.

A second alternative investigated was the supplementing of flow through groundwater pumping. After examination of this alternative, it was concluded that, although it would be physically possible to pump groundwater, the costs make it a prohibitive alternative.

This pumping alternative was investigated from the standpoint that the flow would have to be maintained around 5 c.f.s. to justify flow supplementation. Assuming a 20 year economic life for the pumping facility and spreading the initial capital costs along with maintenance and power costs, the estimated annual pumping cost would be $40,000. Over a twenty year period, excluding the effect of inflation, a minimum of $800,000 will have been spent on pumping. At the end of this 20 year period another capital outlay will be needed to perpetuate the useful life of the pumping facility.

In addition to the expenses mentioned above, another consideration is whether the project is justified in using below grade water resources in this manner. With growing concern for water use conservation, it is a questionable practice to pump groundwater in this manner.

For these reasons the decision was made to develop the Master Plan without the inclusion of additional flow from groundwater pumping.

WATER QUALITY

The overall water quality of the Boneyard and possible methods of improving it has been outlined in a report by CH_2MHILL for the Illinois Environmental Protection Agency. No effort to relate all the findings of this report will be made here as it can serve by itself as the guideline to water quality control.

The overall findings of the report were that the majority of the water quality problems were not the direct result of point source pollution but rather a reflection of the overall water quality degradation found in an urban environment. It appears that the areas where the stream dips below acceptable water quality standards are due to general surface washoff rather than point sources. The problem of water quality is found to be the most extreme in the categories of suspended solids and heavy metals (mercury, lead, iron and copper). Another area where the water could be considered substandard is oil and grease. Oil slicks are often visible in the Boneyard but no good means of measuring this problem exists. Consequently, it should be noted that the problem exists but cannot really be quantified.

The water often exhibits high counts of fecal coliforms but since this has been found to be an unreliable indicator of quality it provides only an indication of a possible problem.

Due to the nature of the source (overall urban runoff) it is hard to devise methods that would greatly improve water quality. A number of approaches are touched upon in the water quality report including air pollution controls, animal controls, auto inspections, fertilizer and irrigation controls, land use controls, litter ordinances, on-site detention ordinances, maintenance programs, and several treatment or structural controls.

Since most of the design work involved structural approaches, the impact on overall water quality was limited. An effort has been made to minimize water quality problems where possible and try to work around them where no solution appears possible in the near future.

One important aspect of water quality that bears special consideration is the mosquito problem. The Boneyard Creek is a major source of the primary local mosquito carrier of the virus of St. Louis Encephalitis (SLE). Much of the discussion that follows was provided by Dr. William R. Horsfall and two of his colleagues, Dr. D.J. Gubler and Daniel M. Brown.

Dr. Horsfall reports that:

- The Boneyard Creek provides necessary conditions to be a potential site for transmission of SLE virus throughout its length. It has suitable water for development of the mosquito carrier; it has attractive shelter for mosquitoes during daylight hours; it provides roosts, perches and nesting sites for bird hosts of SLE, and it passes through residential areas of both cities.
- Birds of many species are known hosts for maintaining the virus. The northern house mosquito acts as the only significant means for transferring the virus from birds to man because it is the only local mosquito that feeds on both birds and man and is abundant enough. This mosquito was responsible for the local outbreak of SLE in 1975.
- The Boneyard is one of three major sources for the northern house mosquito as has been determined during 1976, 1977, and 1978 (see reports on file in the Arborist Division, City Building, City of Urbana, covering 1977 and 1978 particularly). No feasible means exists for abating this mosquito along the stream as the situation is now. Abatement can be successful only by proper engineering when modifying the stream for the planned park system.

Dr. Horsfall further reports in discussing conditions favoring Culex in the Boneyard that:

- Present interrupted cover (bridges, et al.) attracts and shelters female mosquitoes where they may feed on birds and develop their eggs.
- The steep banks, abundant marginal vegetation and numerous partial blockages provide ideal protection to mosquitoes while depositing eggs.

- The water quality provides ideal nourishment for development of larvae.
- The normally slow but sometimes erratic rates of flow provide support and transport for the egg and larval stages so that adults may emerge in Urbana even though the eggs were deposited in the upper reaches.
- Literally hundreds of thousands of adult northern house mosquitoes emerge from the waters of the Boneyard daily during late July and August (see reports noted above and provided to the Planning Commission).

Dr. Horsfall suggests that the following preventive measures be incorporated into the proposals:

- Head waters and stream channel when above ground should have low banks devoid of both marginal plants (high grass and coarse vegetation) and impediments to stream flow.
- Underground portions of the channel should have smooth sides and uninterrupted, regular flow.
- All drains emptying into the channel should be free of waste water high in organic materials (sewage, et al.).
- Lower reaches of the stream should remain underground all of the way to its mouth below 5-Points.

All except the final recommendation have been incorporated into the Plan presented herein. Because of the tremendous cost involved in extending the underground channel to 5-Points, it is being recommended that application of this concept be stopped at Race. However, it is suggested that special attention be given to bank and bottom materials and other site design parameters so as to minimize potential mosquito problems within the framework provided by Dr. Horsfall and his colleagues.

PARKS & URBAN OPEN SPACE

When the Boneyard Master Plan is accomplished a new kind of linear park corridor will join the excellent existing park system of the Twin Cities. This system is now composed of a consistent pattern of moderate sized neighborhood parks plus quite large recreation parks on the periphery of the metropolitan area. The bold diagonal of the Boneyard Creekway Corridor - studded with small specialized parks, plazas and we hope civic events will justly complete, strengthen and compliment this urban open space system. A description of the way Boneyard Creek will relate to the existing park system will follow.

The existing park facilities in Champaign and Urbana and their recreational programs are a great source of community pride, and are highly utilized. For those moving into the community from other regions of the country, the nature of these parks, their programs and their level of maintenance is a delightful surprise.

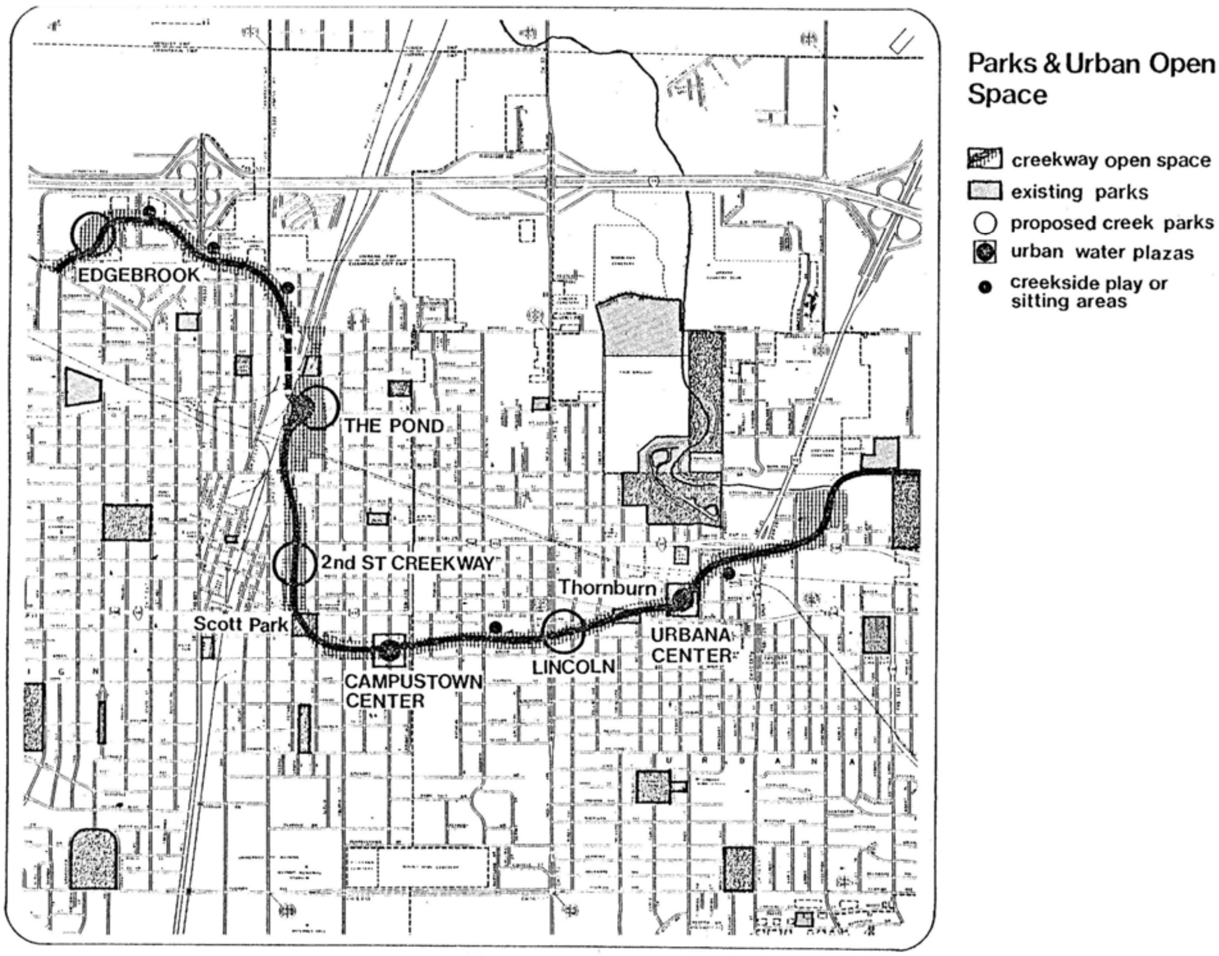
The Champaign Park District currently operates some 29 parks comprising over 400 acres of land. Two of these directly adjoin the Boneyard; Wesley Park (1.5 acres) in the Oak/Ash area and Scott Park (2.6 acres) on the western edge of Campustown. Most recently the Park District has become engaged in the development of the Creek greenways for bike and hiking trails along the Copper Slough in NW Champaign and the Finney Branch in SW Champaign. These greenways, linking park facilities consistently indicate the Park District's active role and commitment to the preservation and development of natural urban waterways. These Creek greenways are related to our Boneyard Creekway plan.

The Urbana Park District operates some 18 parks of approximately 378 acres total. Two of these facilities also directly adjoin the Boneyard; the Thornburn Community Center (2.0 acres) and the Patterson Parklett (0.25 acres). Crystal Lake Park, a prime facility, is developed around the Saline branch a few blocks north of the Boneyard.

Both Park Districts are committed in their respective master plans to the preservation of open space and park development along the Boneyard Corridor. The Champaign Park District is attempting to acquire the property containing a Historic Stone Bridge over the Boneyard North of the intersection of Second Street and Springfield Avenue. The Urbana Park District is currently developing the land adjoining its Thornburn Center for play areas which will eventually result in the uncovering of the now paved over Boneyard in this area. This is an important step, and Thornburn Creekside play area will become a significant part of the new Boneyard of the future.

The relationship between existing parks and proposed Boneyard Creek open space preservation and development program is shown in Figure 8. This program is comprised of five elements: Creekway corridor open space; Community parks; Creekside play and sitting areas; urban water plazas; and special open space uses.

Figure 8: Parks & Urban Open Space



Creekway Corridor Open Space

The Creekway open space is the interstitial tissue which ties all the Boneyard related improvements together and provides the land area for bikeways, creekside walks, and other forms of linkages between different urban areas. At a minimum, it is contained within the eventual 10 year design flow channel area and its maintenance easement. Beyond this line, expansion could occur depending on the availability of land. Essentially the corridor is therefore dependent on public lands, public streets and alleys, dedicated rights-of-way, and private development additions.

It is essential that the Creekway design approach differs from one area to another. In the Edgebrook Reach between Bloomington Road and Neil Street, the plan calls for a natural creek greenway with meandering paths which can serve as a gentle buffer between the residential areas to the south and the commercial and office park areas to the north. In denser urban sections such as in Campustown the creekside walks will take on a more defined and geometric pattern linking plazas and outdoor retail areas. At still other locations this linear walkway open space becomes part of the existing street and sidewalk systems.

Given a defined planting, paving and careful maintenance program for this Creekway corridor, it can become the major urban attraction of the Twin Cities.

Community Parks

Several community parks now exist on or along the Boneyard. The plan proposes that as part of the eventual Boneyard Creekway development these parks be expanded and new ones added to provide park facilities at frequent intervals along the improved Creekway. These have been indicated in Figure 8. Starting from upstream Champaign reaches, they include:

- Edgebrook Park: A proposed new park located on the Boneyard at the end of Edgebrook Drive. The scenic creekside weeping willow grove which now exists in this area would be expanded to create a naturalistic park setting providing recreation facilities to service the needs of the local residential community, especially those of the adjoining new multi-family development furthest away from the existing Hazel Park on Neil Street.
- The Pond: An expansion of Wesley Park providing a recreation pond for the Northeast Champaign area. Today the area immediately south of Wesley Park is a partially vacant urban renewal area with deteriorated housing conditions and an indeterminate future. The

expansion of Wesley Park would serve to consolidate the remaining housing, eliminate those streets no longer needed and create a richly landscaped pond. This exciting proposal will provide a new asset while also screening the railroad tracks from the rest of the community. Developed as a natural area with the possibility of stocking the pond for fishing, this area will handsomely supplement the active recreation facilities provided for the neighborhood at Douglas Park.

- Second Street Creekway: This is conceived as a northern expansion of Scott Park created by the closing of Second Street from Springfield to University Avenue and the relocation of the Boneyard into the former right-of-way. Here landscaped sitting areas could be developed on one side with a bikeway on the other. At Springfield Avenue the Creekway widens to include the Historic Stone Arch Bridge and its adjoining property.
- Lincoln: A proposed small new park in Urbana utilizing the existing triangular open space on the north side of the Creek and east of Lincoln Avenue. Interest has already been expressed in the development of this site for housing. However, it would be better if this site could be preserved as open space to serve the needs of the surrounding residential area. It should be developed as a natural creekside area as distinct from the more active recreational facilities planned in connection with Thornburn.

Creekside Play and Sitting Areas

In addition to the community parks the plan also calls for the development of Creekside play and sitting areas. As shown in the previous Figure 8, these have been indicated as small sites scattered at intervals between the parks. These could take various forms depending on need and land availability. They could range in size from a small paved area containing a few benches as an indention in the creek walkway system to larger areas incorporating a preschool children's playground. By and large it is assumed that these would be developed either by a particular residential or commercial complex or with the use of community development funds. As such they would provide important staccato breaks in the Creek's walkway system and serve as intimate local neighborhood gathering spots.

Urban Water Plazas

In Campustown and near Main Street in Urbana, there is an opportunity to create, alongside the Creek, formal plazas as major public gathering areas in conjunction with future retail/ commercial development. Here elements, such as cafes, fountains, display kiosks, and stepped seating areas leading to the water's edge, can be incorporated into a plaza development for use for public festivals or merely for lunch hour enjoyment. In this manner the Boneyard could play a real role in bringing people back downtown and stimulating retail/commercial activity. The Urbana Boneyard center proposed for the area north of the intersection of West Main Street and Springfield Avenue will be formed around an outdoor pool containing fountains in the summer and a skating rink in the winter. This is illustrated in a subsequent section of this report under the Five Points area development Proposals.

Community Gardens

A great deal of the open space development along the Boneyard should not be programmed in a formal fashion, but left to the initiative of local organizations, such as the Champaign County Development Council Foundation (CCDC), Trade Associations, Garden and 4-H Clubs, or simply a group of concerned citizens. Patterson Parklet in Urbana is an example of such philanthropic enterprises on the part of the citizens of the Champaign/Urbana Community. Another recent example is the scheduled landscaping and planting of a bank by the Creek adjoining University Avenue at the Five Points Area in Urbana. In fact many existing parks have been embellished over the years by the contributions of local citizens acting out of community pride. A clear demonstration of the Boneyard's potentials in the selection of the early action project can capitalize on this sense of pride.

ACCESS, CIRCULATION & PARKING

If the Boneyard of the future is to be truly enjoyed by the people then it must be improved and creekfront circulation routes established. Today with the extensive private land ownership pattern, access is limited, and maintenance is achieved by entering at the cross-streets and walking the length of the channel bed. The exceptions are the maintenance easements owned by the Champaign/Urbana Sanitary District along the sheet piled section in Urbana and the public land areas.

Access

In the future, with the channel improvements a Creek corridor right-of-way will need to be established which can both accommodate the flood control needs and a linear creekside circulation system. As part of this, new points of access need to be established, primarily in the Edgebrook area where there are no street crossings. Those streets which now dead-end at the Creek such as Sunset Drive, Henson Place, and Edgebrook Drive define logical future access points. In addition, this could be supplemented by trying to obtain a right-of-way across an unused building lot on the north side of Briar Lane. Elsewhere along the remaining part of the Creek, as it winds its way through the rest of Champaign and Urbana, it is believed that sufficient access is already provided by the street crossings and public entry points.

Pathways and Walks

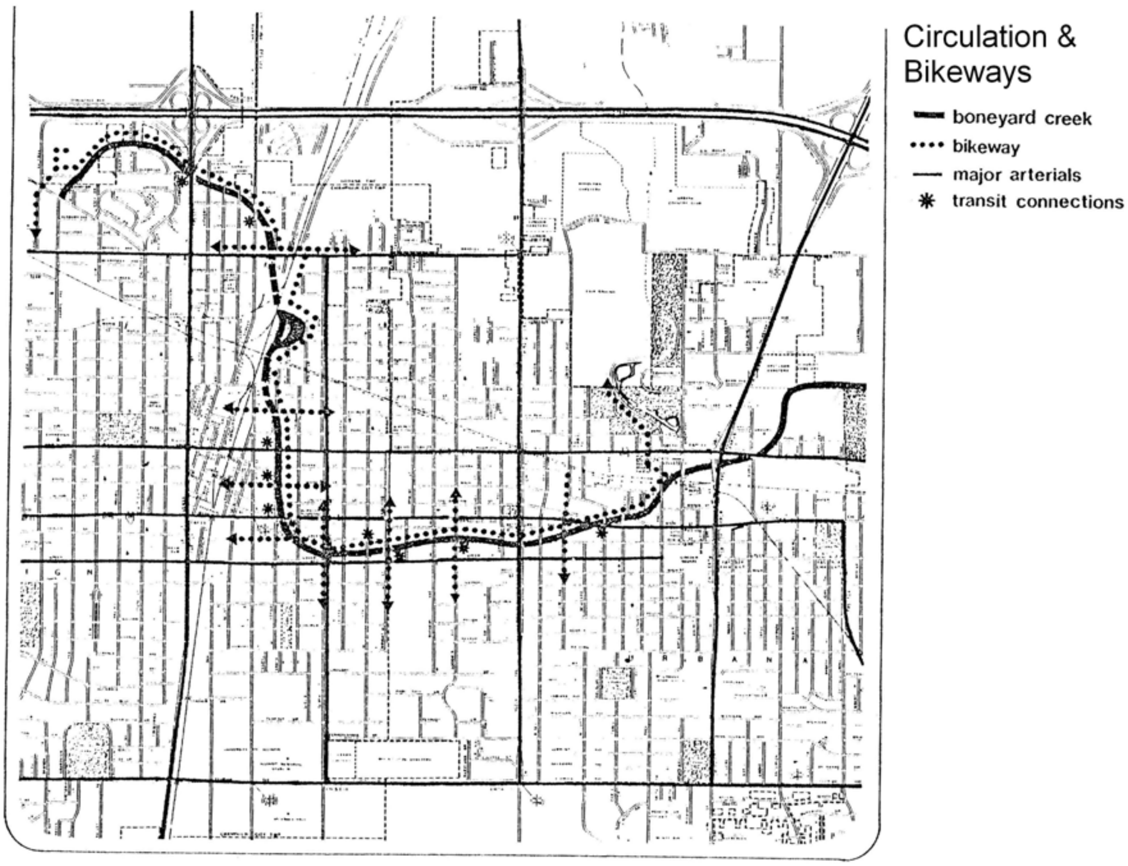
In the Boneyard development there is a unique opportunity to provide a continuous creekfront walk and bikeway system over its entire length with only a few detours onto local streets and sidewalks where passage cannot be obtained due to occasional structures which have been built over the Creek. Some of these creekside circulation routes are already defined and in active use, such as the continuous alley along the Creek from Wright Street to Third Street in Campustown. Others will need to be established along with the channel improvements.

The relationship of a Creek bikeway to existing bike routes is shown in the circulation diagram in Figure 9. Also shown are the major points of transit connections for those using public transportation.

The unique part of a Boneyard Creek bikeway is that it could be developed as a Class I facility (exclusive right-of-way) which could not be provided elsewhere without the narrowing of traffic lanes. Also given the extensive University student population, many of whom live in rental units along the Creek, the active utilization of the bikeway in the central area of the Creek is assured.

For this reason, at least in the University area, a separate walk and bikeway system is thought to be desirable, and which could occur on opposite sides of the Creek. As a minimum, six feet is required for two-way bike traffic with four feet for a separate pedestrian walk. In areas where maintenance use of bikeways is also needed, the bikeway would have to be widened to eight feet.

Figure 9: Circulation & Bikeways

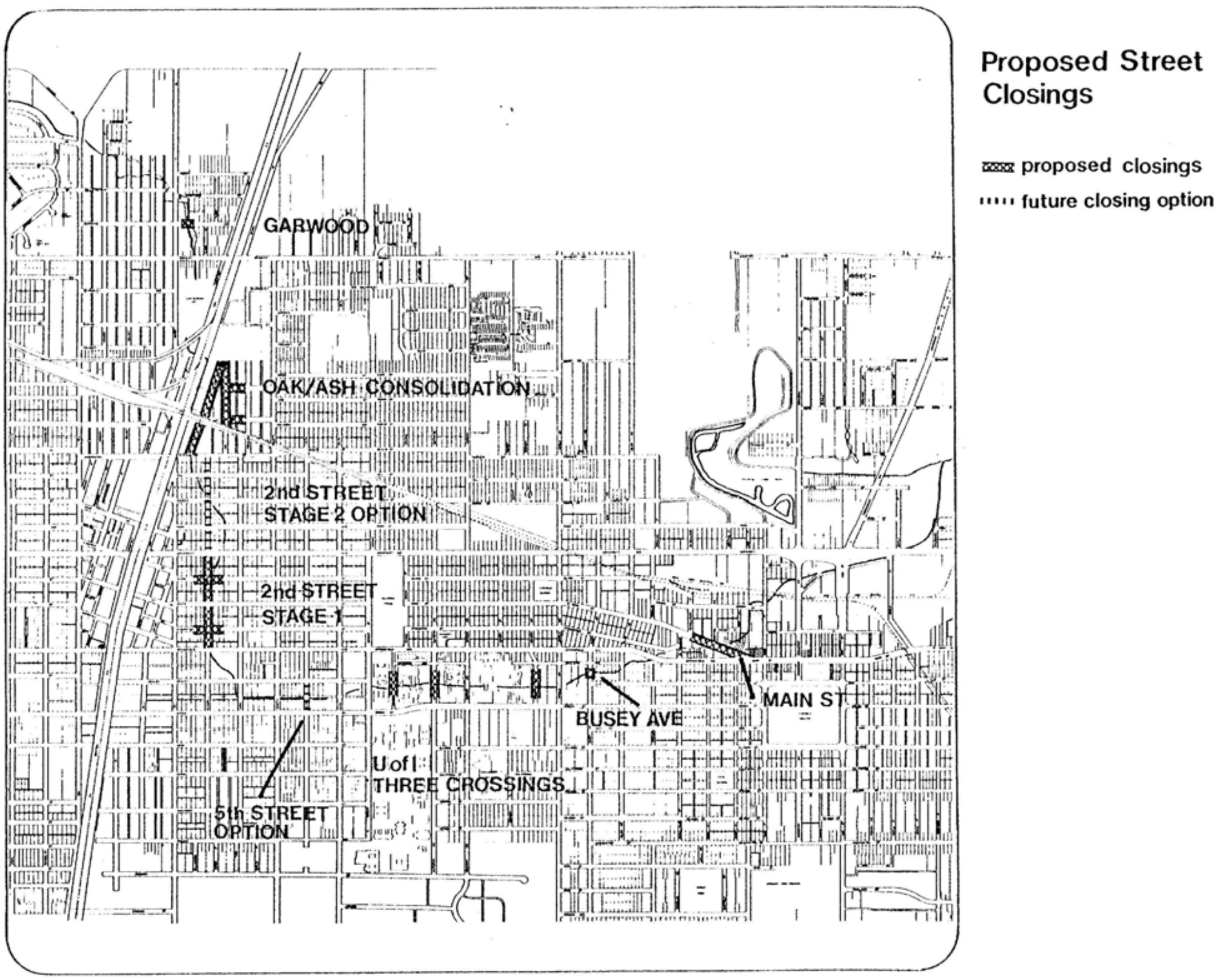


Street Crossings

Another aspect of the master plan are certain proposals for limited street closings which are linked to particular Boneyard development opportunities or Creek related street improvements. Some of these have already been described in the previous section on Parks and Open Space, such as the proposed consolidation of under-utilized streets in the Oak Ash area. Other similar street closings are indicated in Figure 10. These all seek to re-establish streamway circulation continuity by the interruption of low traffic volume streets at the Boneyard and to benefit Creekside development potentials. These proposed street closings include:

- Second Street between University and Springfield Avenues: Second Street currently carries a low traffic volume of approximately 800 vehicles on a daily basis. Between University and Springfield Avenues almost all buildings have their primary access from the side street. Therefore, the closure of this stretch of Second Street appears feasible, and would provide a prime opportunity for the development of a Boneyard creekway park in the right-of-way. In conjunction with this it is proposed to dead-end every other cross-street as indicated in Figure 10. North of University Avenue, Second Street is now needed for access. However, if in the future the existing land uses should change, consideration can also be given to closing this northern portion as well, thereby extending the Creekway Park concept to Washington Street.
- Fifth Street between Green and Healey Streets: The current Fifth Street average daily traffic volume is 1000 vehicles or approximately 20% of the adjoining street volume and considerably less than Fourth Street. The Boneyard plan for this area assumed the closing of Fifth Street, but acknowledges that it may be reconsidered pending future Campustown developments and the outcome of the concurrent "University Area Traffic Study" by Barton-Aschman Associates.
- University Engineering Campus: In order to increase continuity of the Boneyard Creekway which is already interrupted by buildings as it crosses the University, it is proposed to dead-end Burrill Street and Mathews and Gregory Avenues to through-traffic at the Creek, leaving the bridges as a pedestrian overpass. All three of these carry only light traffic volumes, and therefore their closure appears feasible.
- Springfield Avenue and West Main Street Intersection: Over the years various plans and proposals have been made for improving traffic flow and access in this area. This plan proposes to eliminate this awkward triangular intersection entirely by closing Main Street

Figure 10: Proposed Street Closings



- to traffic from Central to Springfield Avenues and routing the Main to Springfield through-traffic along McCullough Street. Vehicular access to stores and residences in the area can be maintained by stub connections as an interim measure. This traffic change would result in continuity being re-established along the Boneyard from Thornburn to Downtown Urbana and land area for special creekside development.

Parking

One of the most prevalent views as one walks along the Boneyard today is that of parked cars. This in itself is reflective of the attitude of a segment of the development community towards the Boneyard. It is the attitude which the future must reverse.

Parking in center city areas is a traditional nagging problem in which Campustown is no exception. The presence of the car cannot be denied, but what are needed are better planning and more extensive screening of its storage areas. In this endeavor a Boneyard Zoning Ordinance proposes greater flexibility in building front and rear setback requirements and better screening provisions for parking along the Creek. It also provides the use of remote parking areas which would assist in the gradual improvement of the situation over time. In other cases, parking structures, integrated in design with the Creekway development, would be less visually disruptive than the extended open lot.

LAND USE DEVELOPMENT

This plan looks to the Boneyard Creekway of the future to play a real and vital role in knitting parts of the Urban Twin Cities Community together, and the strengthening of the development potentials of the neighborhoods which lie along its path. Already Second Street in Champaign and the Creekway area from Lincoln Avenue to Main Street in Urbana have become a focus of new multi-family housing designed primarily for student occupancy. In the future it can be anticipated that growth and change will continue in Campustown and within the northern portion of Downtown Urbana.

The decisions made regarding the future of the Boneyard will affect the types of future development which occur along its banks. The sub-area development plans presented in this Report are illustrative of this potential along the Creekway corridor.

SITE DESIGN ELEMENTS

Coupled with the engineering improvements of the waterway is the improvement of its visual appeal. Although each segment of the Creek may differ in physical conditions and future program, they share in common certain problems and design considerations. The approach adopted to their common elements forms the building blocks of the Boneyard's future development into a real creekway amenity. These major common elements of site design for the Boneyard area are:

- Creekway Land and ROW Requirements
- Channel and Bank Design
- Bridges and Crossings Design
- Walks, Bikeways and Paving Design
- Planting and Landscaping
- Identification and Street Objects

Recommendations concerning each of these, along with appropriate design criteria follows.

<u>Creekway Land at ROW Requirements</u>
Figures 11 and 12 show existing public land holdings bordering the Creek as shaded areas. These include:

- The land owned by the University of Illinois including the Creek frontage between Wright Street and Gregory Avenue; a half block on the north side of the Creek between Sixth and Wright Streets; and the Col. Wolfe School property.
- One parcel of land owned by the City of Urbana on the north side of Main Street.
- Parcels of land owned by the City of Champaign which are now used for municipal parking between Fifth and Sixth Streets, plus an additional parcel in the Oak/Ash area formerly part of an Urban Renewal Project.
- Scott Park owned by the Champaign Park District and the new land acquired from the City as an addition to Wesley Park.
- The Thornburn School owned by the School District and leased to the Urbana Park District and Patterson Parklet.
- The land owned by the Urbana/Champaign Sanitary District at a few locations along the sheet piled section in Urbana.

The balance of the Creek's riparian property is privately owned, which is clearly the predominant condition. All told those private lands immediately bordering the Creek on either side total some 112 lots of varying size and use.

To effect the improvements envisioned by this plan access or easement rights must be obtained and some property acquired.

Thus defined the Creekway may vary in width from one reach to another, or even within one reach itself. However, the goal shall be to establish a continuous drainage way, along the entire

Figure 11: Champaign Public Land & Min. Creek R.O.W.

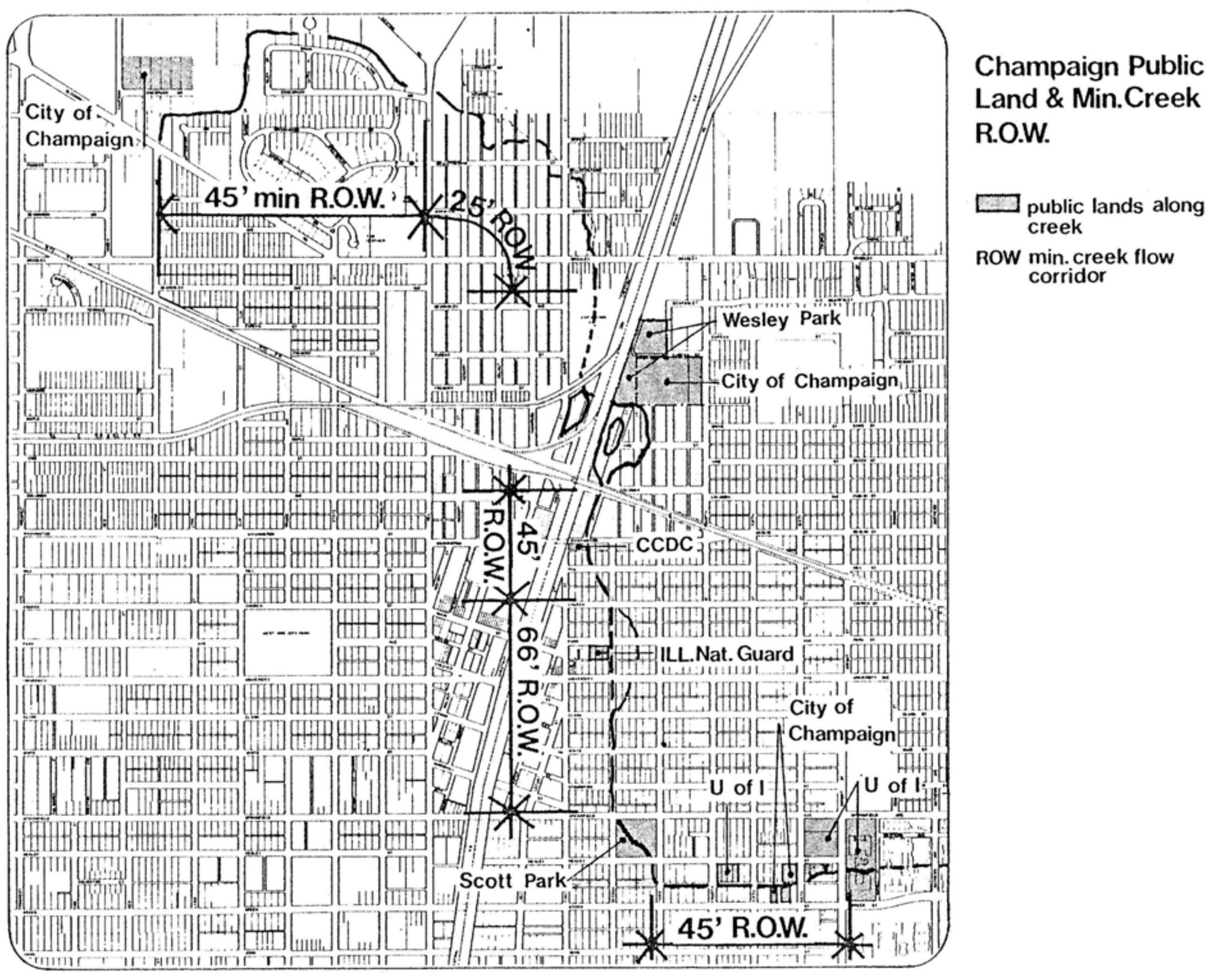
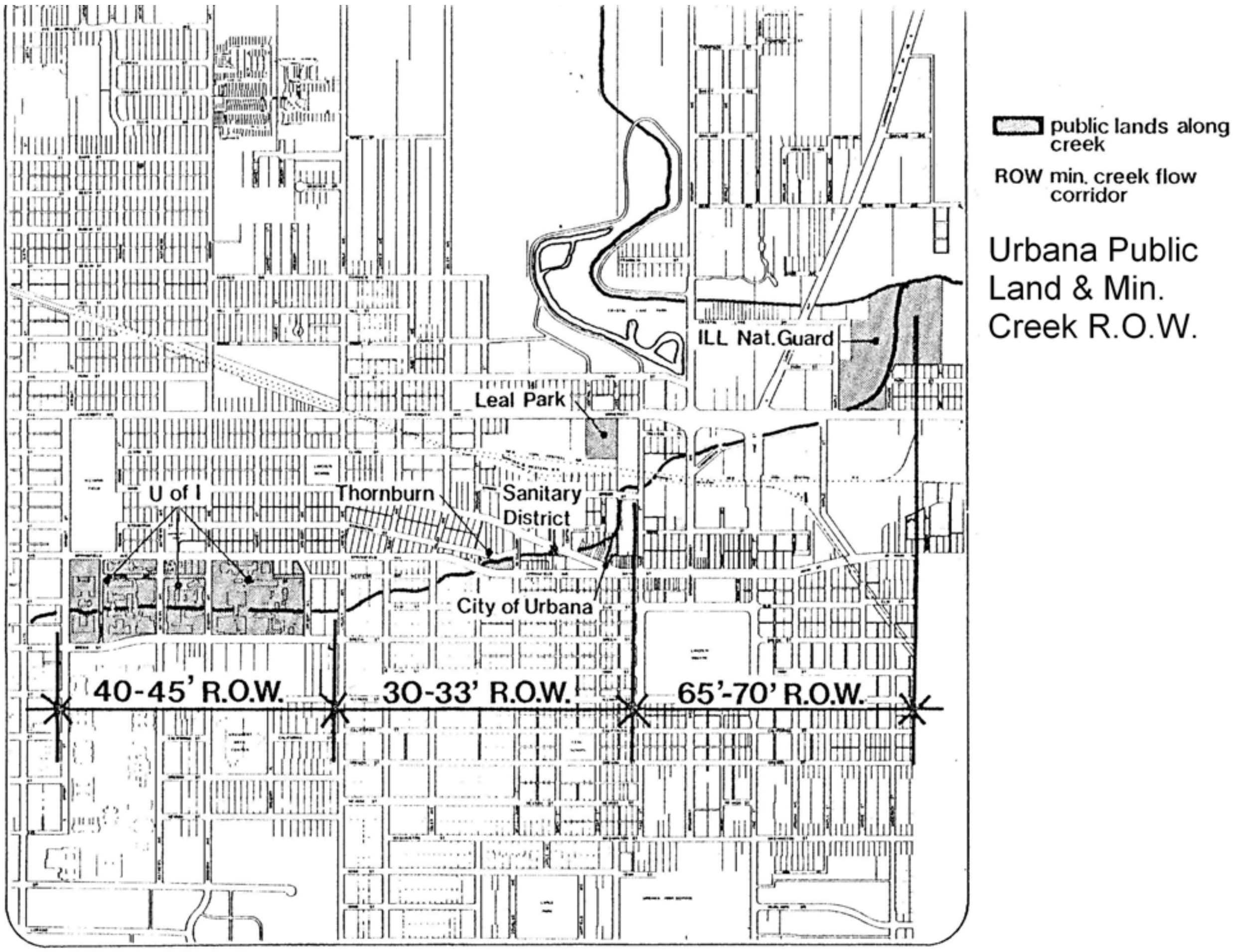


Figure 12: Urbana Public Land and Min. Creek R.O.W.



Boneyard which has the minimum flow R.O.W. width indicated for each reach in Figures 11 and 12, and is capable of accommodating the following functional elements:

- The 10-year design storm channel.
- Passage for maintenance vehicles along one side where the Creek does not border on city streets or alleys.
- A landscaped bikeway.
- A landscaped pedestrian walk on the opposite bank from the bikeway where indicated on the area plans.

Obviously there are stretches of the Creek where these minimum criteria can and should be exceeded and other cases where existing structures have been built over the Creek. However, the purpose is to establish criteria governing new construction, which can accommodate change in the future.

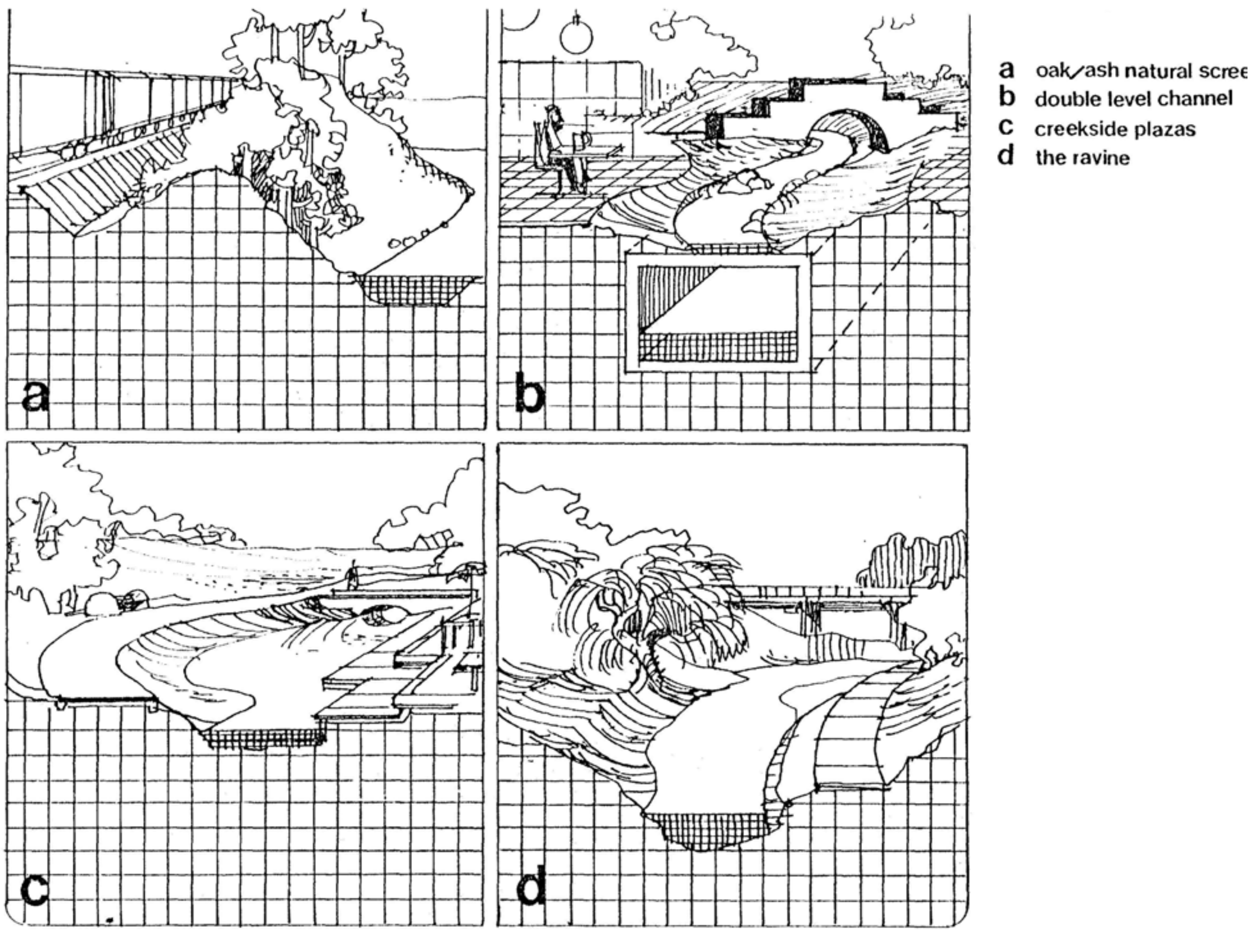
<u>Channel and Banks</u>

Figure 13 illustrates four different types of channel and bank landscape treatment based on the engineering channel sections presented previously. These are:

- Example A: Depicted here is a section of channel in the Oak-Ash area where the banks have been built-up and planted to hide the railroad tracks creating a pleasant back drop for the recreation pond area.
- Example B: The double level channel shown is for the portion of the creek between 3rd Street in Champaign and Race Street in Urbana. Above a buried storm culvert is a tame landscaped surface stream.
- Example C: The hard edged channel shown is for portions of Second Street and Campustown where plazas and sitting areas are brought to the waters edge.
- Example D: The ravine or a section of the channel in the Five Points Area of Urbana where a walkway descends from ground level down to a Creekside walk sheltered by overhanging branches.

These are just four images to convey the range of varied experience and design opportunities which can be achieved along the future Boneyard Creekway. Within these are a whole sub-set of variations and modifications possible. What is important is that quality both in materials and design be achieved.

Figure 13: Channel & Banks



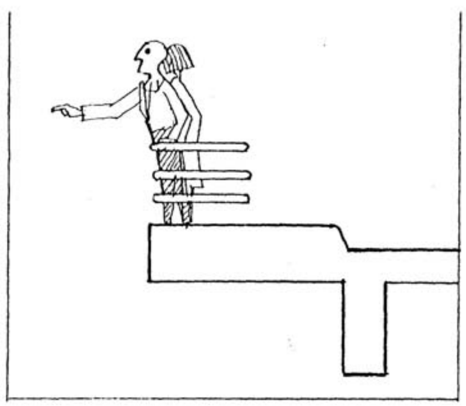
Bridges and Crossings

Over time a great many of the existing Creek bridges and crossings will need to be replaced. This is especially true of the many older deteriorated bridges in Champaign. Here most of the alley bridges are wood and many of the street bridges are showing signs of age. Some of these street crossings are already scheduled for replacement by the City of Champaign under their Long Range Capital Improvements Program.

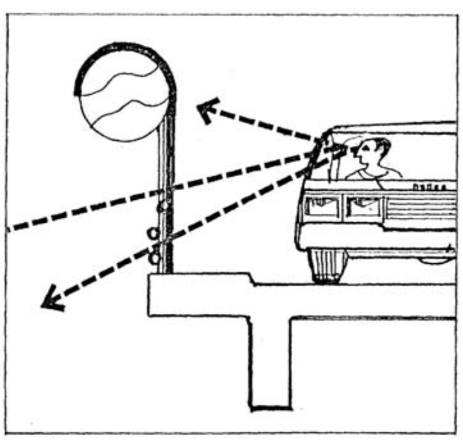
Figure 14 illustrates the manner in which edge design of these bridges can be incorporated into the overall Boneyard program. This includes railings which meet State Highway standards but still permit the passing motorist to savor the Boneyard atmosphere. In other places, the Plan incorporates overlooks where the Creek water level is below the level of the surrounding grade.

Figure 14: Vehicular Bridges

Vehicular Bridges



a pedestrian overlook

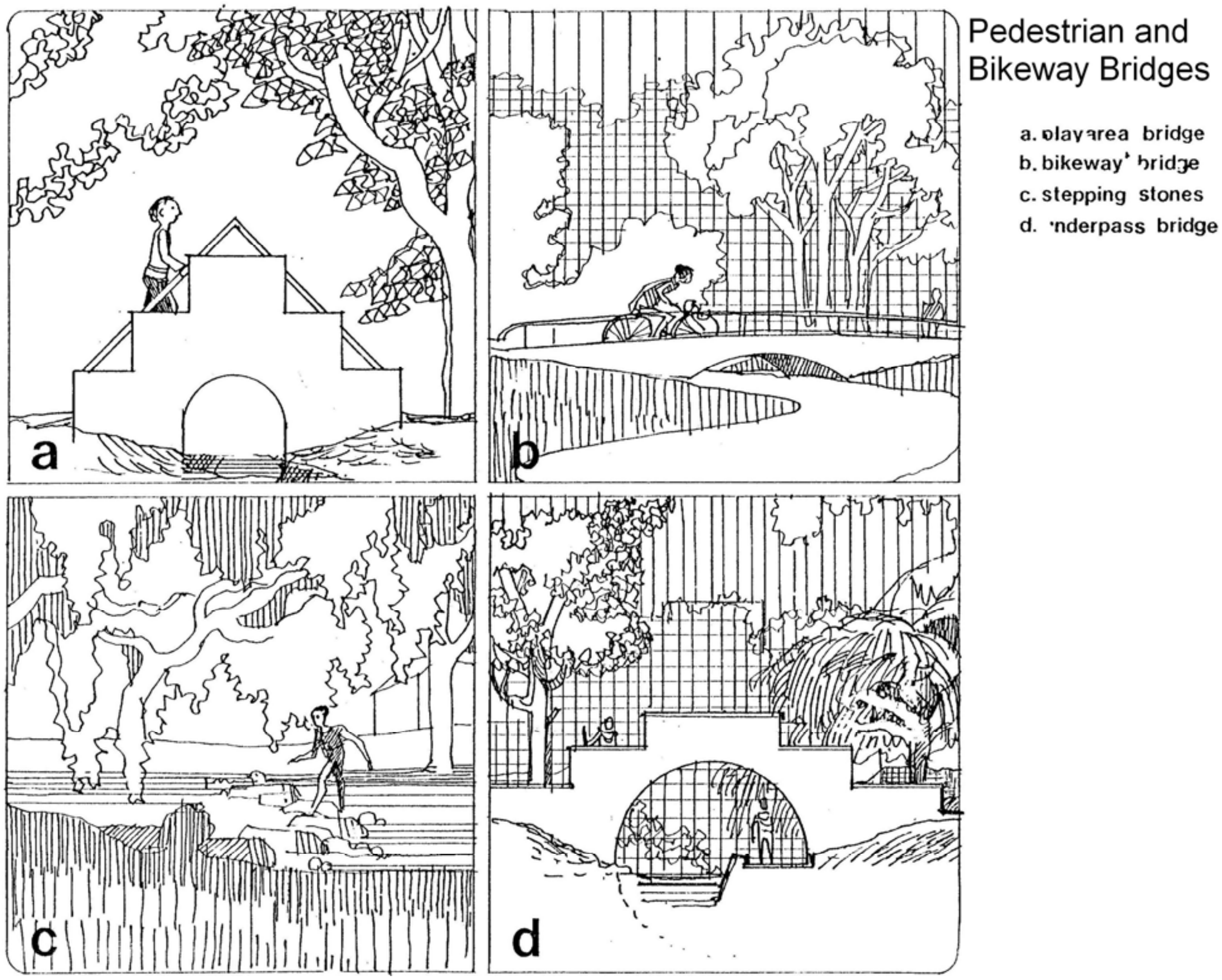


b vehicular overlook

In addition to the vehicular bridges, pedestrian crossings demand design attention. Today except for one or two instances, there are almost no pedestrian bridges over the Boneyard which are separate from vehicular crossings. Figure 15 also shows several types of pedestrian crossings to illustrate the range of opportunities which can enter the design picture once a creekside circulation system becomes established. This includes a Stepped Pedestrian Bridge which this plan proposes as a Boneyard landmark itself. Another is the "Stepping Stones" crossing for the nimble and adventuresome. Here one can stand in the middle of the Creek and watch the water speed up as it flows between the stones. There is also shown a bridge type for bicyclists.

The latter flat bridge can also be used by the handicapped, so that they are afforded equally free movement and full participation in the renewed Boneyard. The Champaign/Urbana community prides itself in its concern for the handicapped and the Boneyard should be no exception.

Figure 15: Pedestrian and Bikeway Bridges



Walks, Bikeways and Paving

The plan looks to the Boneyard corridor of the future to play a major pedestrian and bicycle role. Most importantly it will provide an opportunity to consolidate existing and proposed bikeways in the downtown and University areas, thereby also improving street traffic flow. Three general types of bike and walkway combinations are proposed.

- A combined bikeway and walkway system for natural areas with low volume use.
- A separate bikeway and walkway system located on opposite sides of the Creek in the more urban areas of high traffic volume.
- A combination of bikeway and service vehicle way where maintenance access cannot be provided by other means, which may or may not include a separate pedestrian walkway on the opposite side.

The crossing of these bikeways with city streets will require separate traffic lights at a few of the major arterial streets. At other locations the bikeways and creekside walks will be detoured away from the Boneyard around existing structures built over the Creek.

Paving materials for these circulation routes should reflect the urban design of the area. Bikeways will require a smooth surface paving such as concrete or asphalt. The walks will vary from brick (matching the old City streets) to compacted gravel paths in the more remote areas. The steps and plazas leading to these walks should be integrated in material type and design. This Boneyard Bikeway-Walkway System should be given a special name and distinctive signage and graphics. We suggest the name "BONEWAY" as a short memorable one.

Planting and Landscaping

Unfortunately the existing Boneyard vegetation reflects the Creek's current deteriorated conditions. In most areas the Creek is overgrown with what arborists term "trash species" of trees and plants, with almost no specimen trees worth saving. The existing tree species include: Tree of Heaven, Mulberry, Silver Maple, Sweet Gum, Slippery Elm, Black Walnut, Weeping Willow, Green and Black Ash, Cottonwood, Hawthorne, Sassaphras, Sumac, Box Elder and Red Bud.

In the future, a new planting program needs to be established for the Boneyard, which provide variety in species, in height and density of foliage, and accent flowering species for spring time show. Initially the vegetation in each area must be thinned allowing the better specimens to mature. The new planting program should be staged along with the channel engineering improvements and should anticipate additions in the future by civic groups and gardening clubs.

The following tree species are recommended for the future planting program because of:

- Ability to withstand central Illinois climatic conditions,
- Relative longevity,
- Aesthetic quality and blend,
- Low maintenance requirements,
- Local availability,
- And relative resistance to disease and urban environmental conditions.

Hickory (Carya Sp)
Hop-Hornbeam (Ostrya Virginiana)
Sycamore (Platanus Occidentalis)
Beech (Fagus Sp)
Hackberry (Celtis Occidentalis)
Wild Black Cherry (Prunnus Serotina)
Maples (Acer Sp particularly sugar and red)
Linden (Tilia Sp)
Sweet Gum (Liquidar Styraciflua)
Oaks (Quercus Sp particularly white)
Weeping Willow (Salix Sp used in moderation)
Hawthorne (Crataegus Sp)
Crab Apple (Malus Sp)
Birch (Betula Sp particularly river birch)
Tupelo (Nyssa Sylvatica - withstands wet conditions)
Hemlock (Tsuga Sp)
Pines (Pinus Sp particularly white and red)

This list is not intended to be all inclusive but merely a reference guide. Other trees such as those mentioned in the City of Urbana "Citizens Guide to the Urbana Tree Ordinance" should be considered.

Figure 16: Planting Concepts

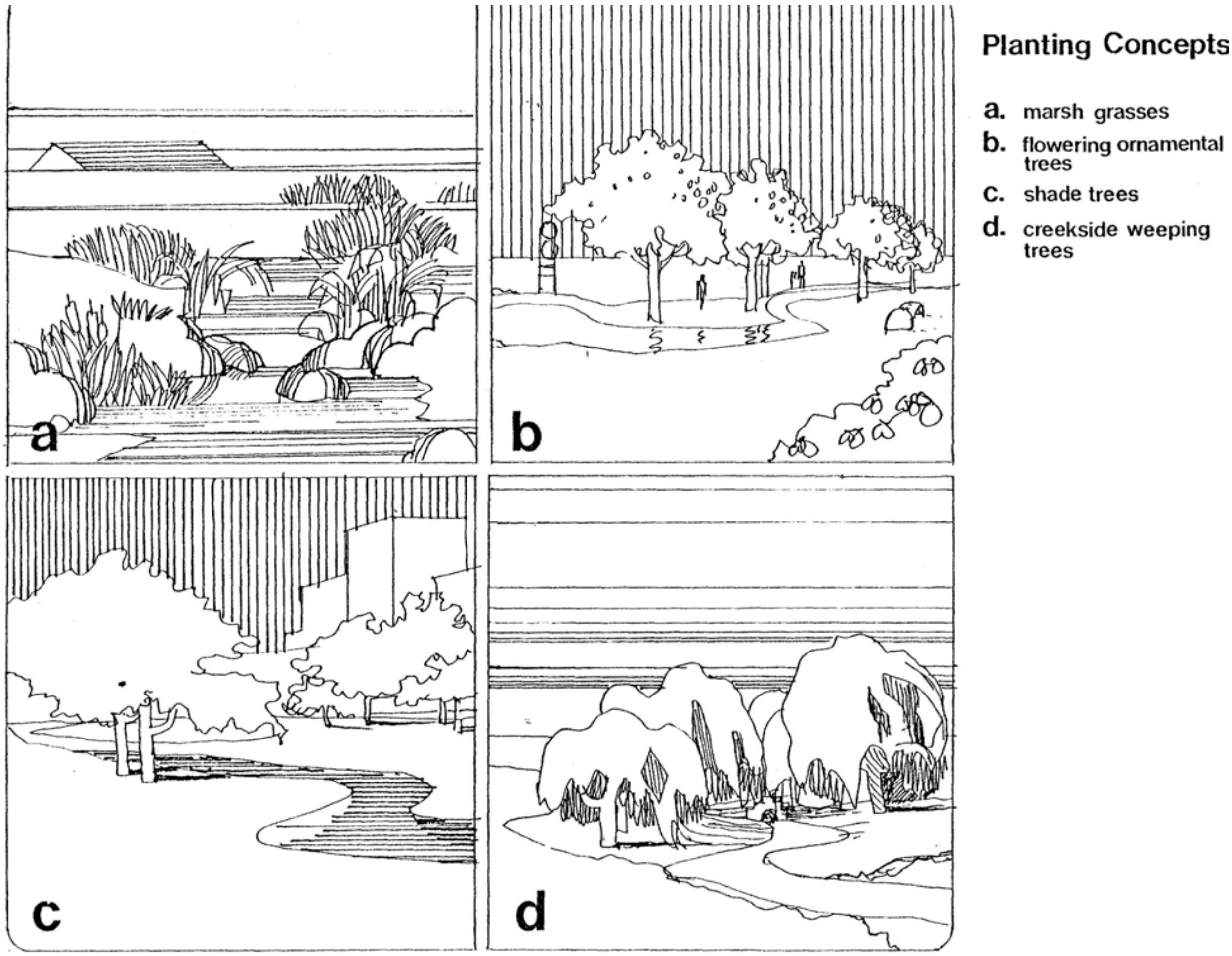


Figure 16 shows examples of four types of creekway corridor plantings. These include the marsh areas, special areas of flowering trees for spring time show, areas of large shade trees, and a weeping willow or beech groves.

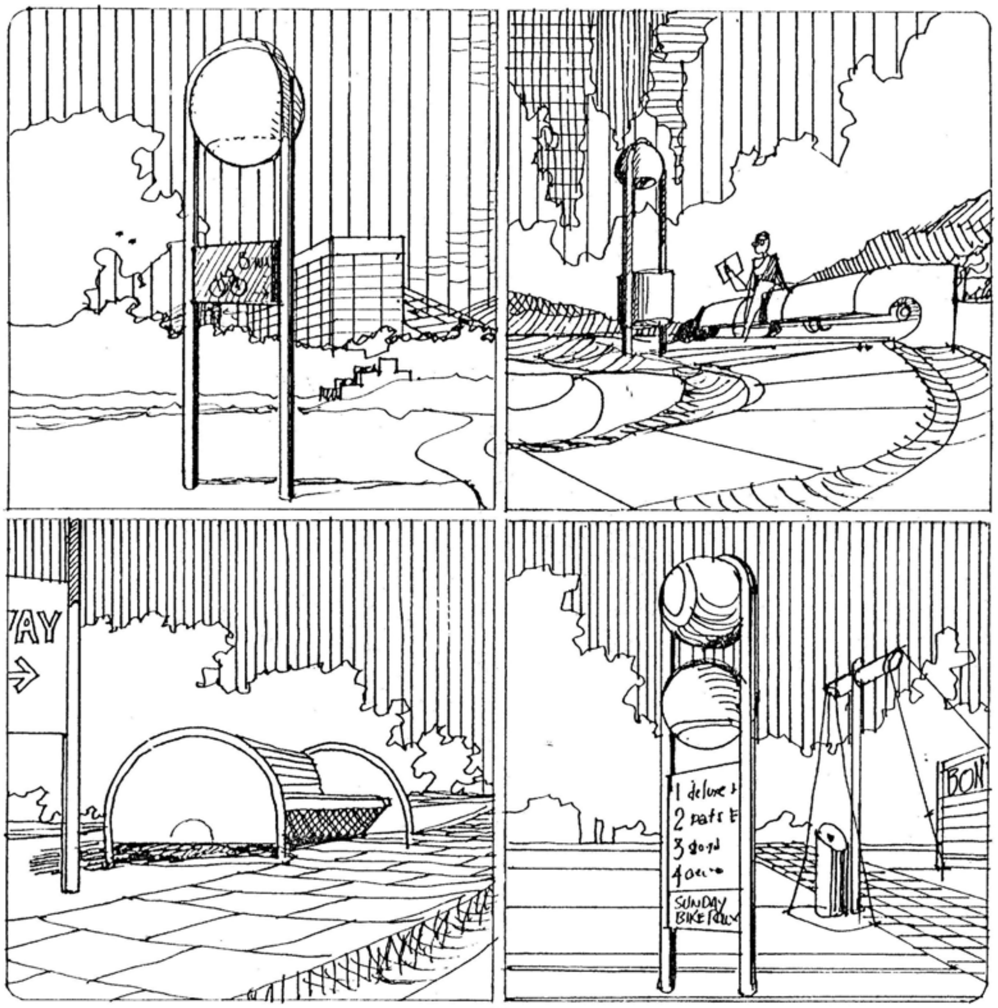
Identification and Street Objects

A great deal can be achieved in the Creekway of the future by the use of lighting, graphics and street objects (benches, kiosks, play sculpture, etc.) to foster the image of quality and create a Boneyard identity. Figure 17 shows the design quality to be achieved. These include:

- A mixture of pole lights and landscape lighting to provide a minimum of a .5 foot candle illumination of walks and bikeways.
- Repetitious use of the Boneyard graphics logo to identify the Creekway Park from bridge crossings and access points.
- The design of special benches, tables and other street furniture which is integrated with the walkway and planting areas, and which has a simple elegance in its design. The designs shown are based on the globe and the semi-circle or arch. These are repeated in various forms and recall the arches used to span the creek.

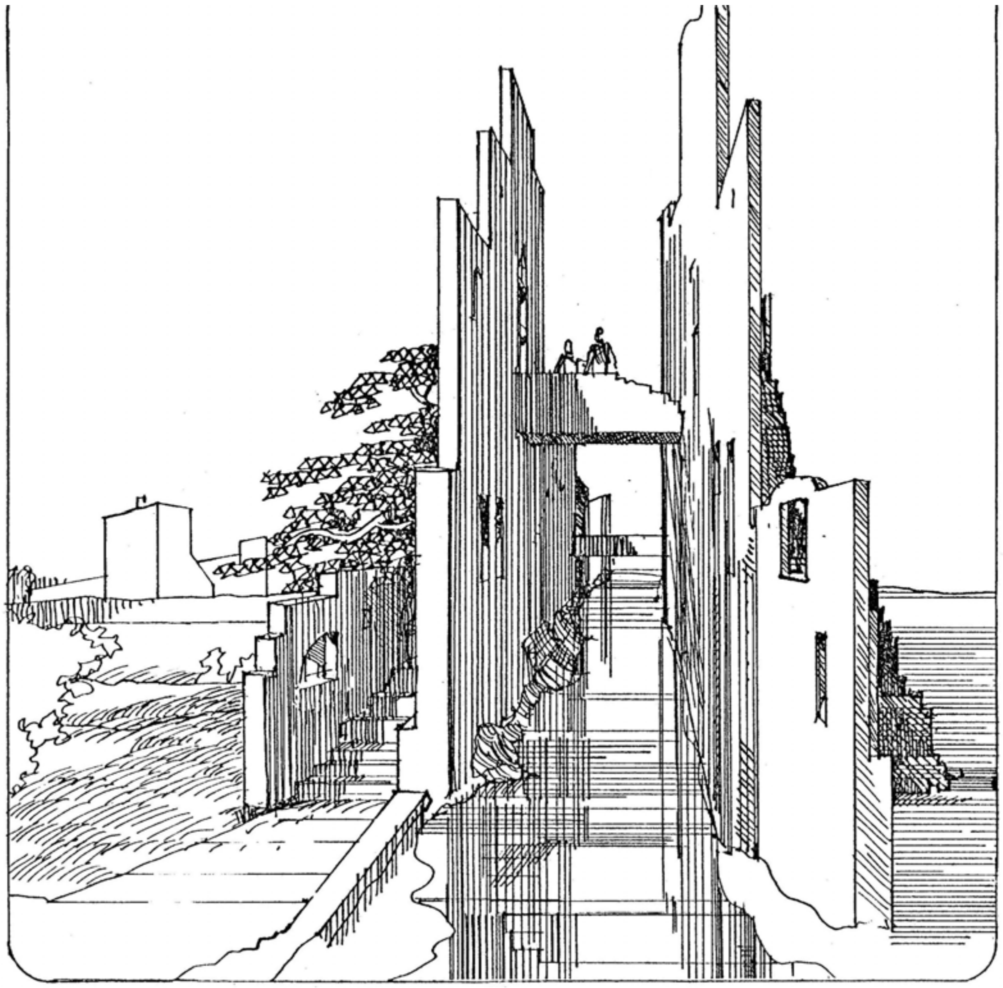
One reason for citizens' perception of the creek or rather the lack of it is that the creek is not felt or experienced as part of the City. One remedy for this is for us to create and encourage this experience forcing a direct confrontation with the old creek. Old-World river cities in fact had this direct feeling by their very nature. To accomplish this in Champaign-Urbana a bold work of art is proposed (Figure 18). Two great parallel vertical walls or facades are placed some 15 feet apart directly on the creek. They tower 45 feet tall. The walls are pierced/with openings or windows, some arched and symbolic, and they are connected by dramatic aerial bridges over the water. The bridges and windows are reached from stairways outside the walls, in a sense, turning architecture inside out. This structure and a small companion one at the University side of Lincoln Avenue will dramatically make all of Urbana and also Champaign aware of the Boneyard Creek experience.

Figure 17: Lighting, Signs & Street Furniture



Lighting, Signs & Street Furniture

Figure 18: Special Objects



Special Objects

view from the Lincoln Street bridge

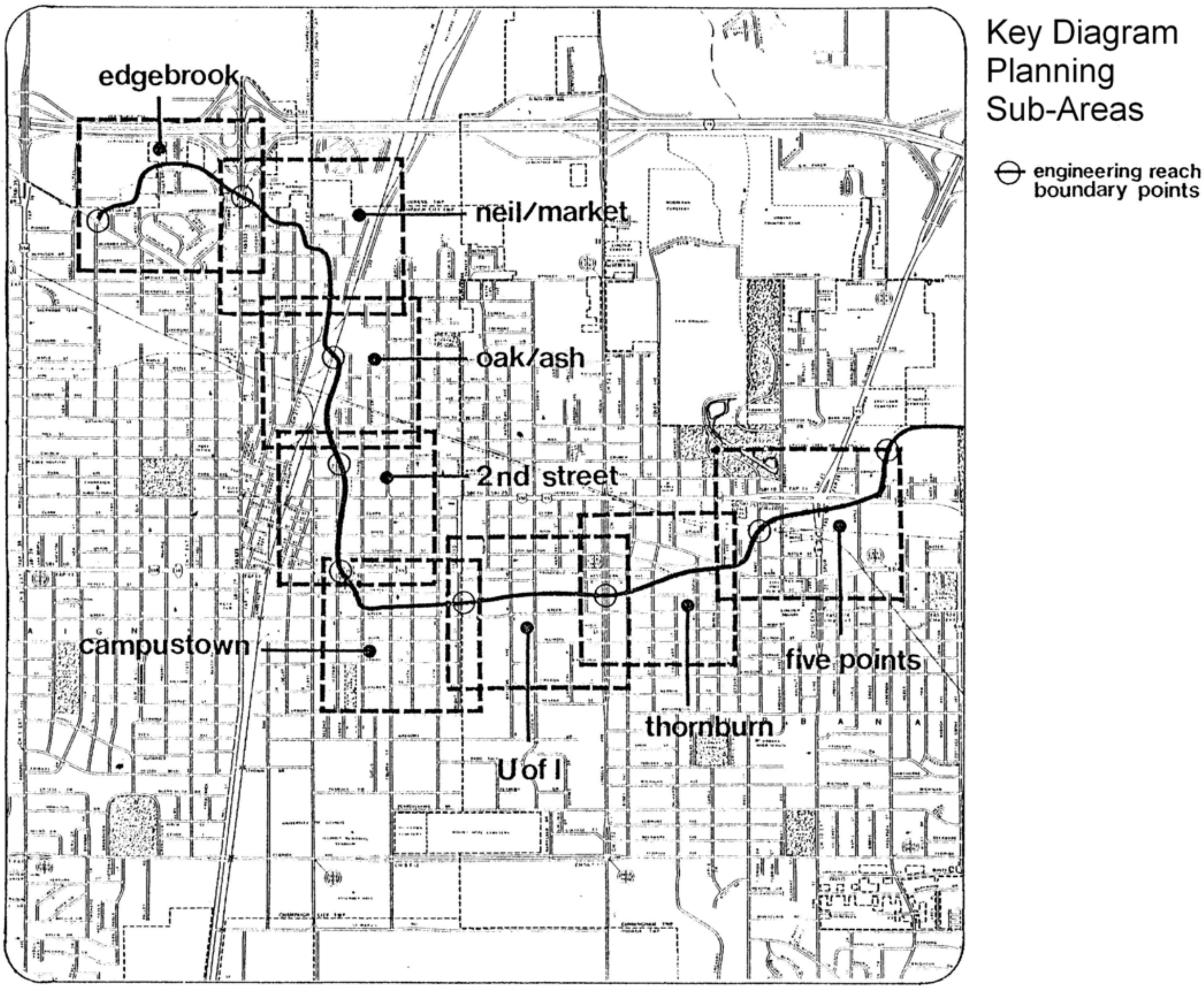
CHAPTER 4: REACH IMPROVEMENT POTENTIALS AND CONCEPTS

For planning purposes, the Boneyard has been divided into eight sub-areas or reaches as described in the Guidelines Report. Starting from the point of beginning at Bloomington Road in Champaign these sub-areas are as follows and are indicated in Figure 19. The first five of these are in Champaign, the last three in Urbana.

- Edgebrook
- Neil/Market
- Oak/Ash
- Second Street
- Campustown
- University of Illinois
- Thornburn
- Five Points

Each of these sub-areas has its own unique characteristics, creek improvement needs and future potentials. In the pages which follow, the key characteristics of each are outlined and proposals for its future potentials described and illustrated.

Figure 19: Key Diagram Planning Sub-Areas



EDGEBROOK

Description

The Creek in this northern most reach is essentially a narrow drainage ditch separating residential development to the south from industrial/ commercial development to the north. Its average water width during normal flows varies from approximately a foot at Bloomington Road to five feet at Neil Street. The major change occurs with the inflow from the Market Place retention pond east of Henson Place. The unique aspect of this reach is that the Creek is entirely free of street crossings and is only covered over at the back of the Henson Place Office Complex and the Holiday Inn parking lot at Neil Street. Another important element is the significant area of undeveloped land north and west of the Creek now zoned for light industrial use. The aerial photograph shown in Figure 20 illustrates these existing conditions. Not included in this photograph is a recent mobile home development at the end of Edgebrook Drive.

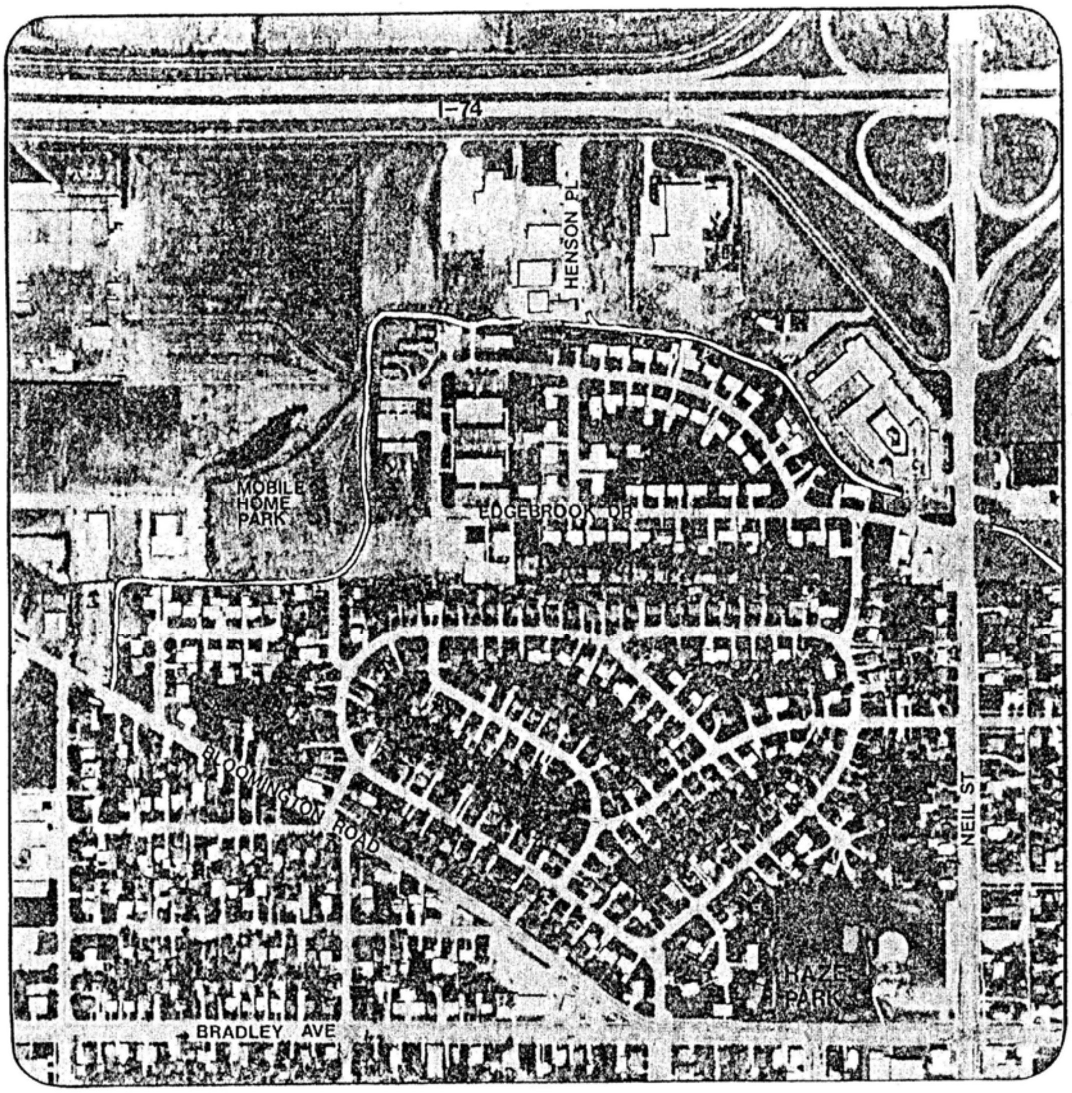
Improvement Proposals

The proposals for the Creek in this area, shown in Figure 21, are focused on the strengthening and highlighting of the Boneyard's natural qualities. This is the sole reach along the entire Creek where paths and walks can flow uninterrupted by the streets. Also here, the channel and fluctuations in flow are readily manageable within gently sloping banks. Only as the Creek approaches the Holiday Inn and Neil Street does the channel deepen and its banks require stabilization.

As a focal point, a new neighborhood park is proposed. As described previously in the Open Space section of this report, this park of some nine acres is intended to develop these natural Creekway qualities, which already exist within a scenic Weeping Willow grove north of Briar Lane (Figure 22). The recreation program for this park assumes the eventual development of a few tennis and basketball courts to serve its residential neighborhood. It is also envisioned that this park would be developed in stages, initially as an extension of the existing Willow Grove with expansion in the future into the area now occupied by the mobile homes.

Also indicated in the area proposal plan are changes in the Neil Street area by the Holiday Inn. Here improvements need to be made in the parking arrangements, stabilizing the channel

Figure 20: Edgebrook – Existing Conditions



Edgebrook: Existing Conditions

Figure 21: Edgebrook Plan

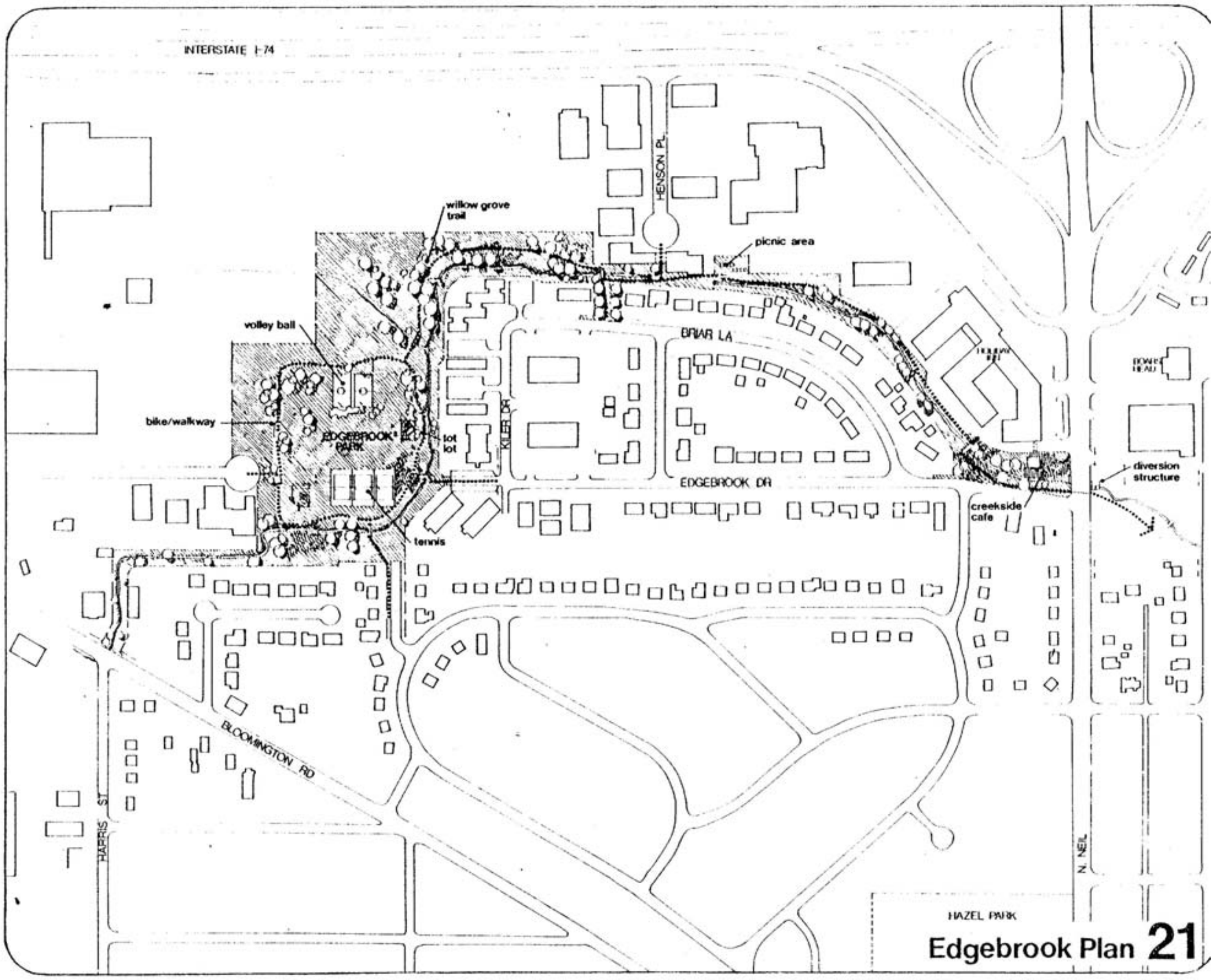


Figure 22: Edgebrook Park

banks, and in the introduction of better Creekside landscaping. With future land changes there is also the potential for the creation of an eating establishment on the Boneyard with picnic tables along its banks.

Various property owners along the Edgebrook reach have expressed interest in the dedication of land for the Boneyard's improvement. By focusing these private efforts a great deal can be achieved right off in moving this plan into action.

Flood Control System

The setting of this reach makes it advantageous to allow the natural aspects of the channel to remain basically intact. For this reason, the flood control aspects of the Edgebrook reach had to fit into this natural scheme of things. Throughout the upper portion of this reach, no major obstacles to flood control are presented. With slight modification in certain areas the natural cross section is capable of conveying the 10 year flood flows without even using the full capacity of the section. It is recommended that plants and other obstructions be kept to a minimum within the 45 foot R.O.W. containing the creek in order to maintain full carrying capacity in storm events. In addition, the bikeway has been placed in the overflow section in a manner allowing it to be inundated during large storm flows serving as a secondary channel to convey storm waters, yet remain dry during the vast majority of the storm events. So for most of this reach the flood control system involves channelization of the flows through a naturalistic channel and flood proofing of any elements (i.e. the bikeway) to allow them to become part of the conveying channel without suffering excessive damage.

Certain areas, due to physical space limitations, are in need of special flood control solutions. It is important to remember that if this portion of the Master Plan is developed far into the future, the space limitations may no longer exist and the general flood control approach described earlier would be applicable. In order to deal with the contingency that these constrictions still exist when this portion of the plan is implemented, the following special treatments have been developed for the plan.

In the area of Henson Place there is some concern that the capacity of the culverts might fall below the 10 year design criteria even when fully operational. Since the plan proposes to leave this section closed, two alternatives exist. First of all, the capacity of the culverts could be enhanced by designing a proper inlet configuration (wing walls, etc.), while also enhancing the appearance of this inlet. The area above the culvert would be graded in a manner to channel any overflow not handled by the culvert overground along the bikeway and spill back into the channel at the outlet of the culvert. The channel would be protected against the scouring effects of this outfall area. A second solution would be to replace the existing corrugated metal culverts within larger concrete culverts, but since this section is remaining closed, the first proposal is recommended.

A second major constriction is the area of the channel near the Holiday Inn. Assuming some additional right-of-way can be obtained, it would be possible to treat the western end of the Holiday Inn section with a reduced natural channel concept. The rest of this section, up to the culverts running under the Holiday Inn parking lot, is severely constricted both by the Holiday Inn and a two family house on Briar Lane. A hard edged channelized section has been proposed to control the high flows in this section.

NEIL STREET/ MARKET

Description

Unlike the previous reach, the Boneyard, in this Neil-Market sub-area, flows through one of the older residential neighborhoods of the City of Champaign, whose areas of deterioration and decline have made it a current focus for Community Development Funds. From Neil Street southeast to Bradley Avenue, the Creek wanders through the backyards of residential blocks in which 30 to 50% of the houses are in sub-standard condition and under streets badly in need of repair. South of Bradley Avenue, the Boneyard passes into a railroad industrial zone and underground. (Figure 23)

The construction of the diversion structure at Neil Street in 1961, which conveys all upstream low flow directly to the Saline, has had a marked affect on this immediate downstream reach. Today the Creek channel south to Bradley Avenue is dry for 90% of the year and in the intervening decade has gradually deteriorated and partially filled in. Currently the City is projecting extensive street, sidewalk and curb improvements in this area as part of their long range Capital Improvements Program (1977-1982). These need to be integrated with the Boneyard improvements.

Improvement Proposals

Essentially the proposed future plan (Figure 24) for this Neil-Market area is geared to combining Boneyard related improvements with those planned by the City, to effect a stabilization of the residential neighborhood and to up-grade its amenities and infrastructure.

The major aspect of this is the proposed change in the existing Boneyard channel alignment to relocate it away from its disruptive diagonal path, and on to the underutilized backyard alleys, and crossing from block to block wherever vacant lots occur. (Figure 24) This ordering of the

Figure 23: Neil- Market Existing Conditions

Neil-Market Exist.
Conditions

Figure 24: Neil-Market Plan

Figure 25: Market Street Play Area

Market Street
Play Area

Boneyard's course and its placement through the middle of blocks, makes available new sites for the construction of in-fill housing, and more area for the effective planning and development of the Creekway. Figure 25 indicates how this mid-block creekway can be enriched as a neighborhood amenity through the addition of sitting areas containing small play objects.

At Neil Street a vacant open field dotted with evergreens and tall sycamore trees forms a scenic and natural upstream entrance to this reach, which should be preserved. The overhead high voltage power lines may aid in this cause. Downstream and south of Bradley Avenue, where the Creek passes under Cap & Gown, the Creekway is interrupted. At this point it is proposed that the bikeway cross the railroad tracks at Bradley Avenue and then turn to the south through the public housing area to Wesley Park.

As part of the engineering for this reach, the skimming of low flow water from the Neil Street diversion structure is proposed. The site development proposals described assume this future modification. The introduction of this added flow would not only extend the continuity of the Creekway system, but would also help to improve the low flow water quality problems downstream.

<u>Flood Control System</u>

The dry weather water flow in this reach is now kept to a minimum by the existence of the diversion structure at Neil Street. If this low flow is reversed, the outlet would be controlled to allow a maximum release rate of 10 c.f.s. by sizing the pipe to release this under the maximum available head. This means that for the 10 year storm the release should be well below this maximum release rate and present no potential flooding for this reach. Due to the lack of any major storm connections through this reach and the effect of the diversion, the storm flow could be handled by a normal channel. This channel has been reshaped for erosion control but is quite similar to the existing section. A number of the existing culverts to be used would have to be cleaned to provide the proper grade and capacity. The bikeway will be located in the same manner as the Edgebrook reach. This allows it to provide extra carrying capacity during severe storms and remain dry during the majority of storm events. All structures within the flow right-of-way must be flood proofed to protect against damage during severe storms. Plantings and other unneeded obstructions should be kept to a minimum and placed on the fringes of the potential flow corridor.

North at the Belle Fontaine Street crossing there is an area which provides a construction problem and the natural flood control channel will not suffice. Here a hard edged, double channel approach has been proposed to convey the flood water. Again the bikeway is recessed below the normal ground level providing extra flow capacity during severe storms. The walls of this double channel would be more structural in nature in order to prevent against excessive erosion during periods of high flow.

The section of the channel from Bradley to the Oak/Ash detention basin inlet would be placed in a large enough culvert to convey the flow encountered during the 10 year storm. Cleaning of the existing pipes and bridge crossings would be needed to ensure the proper hydraulic grade line to convey storm waters without extensive pooling behind constrictions.

OAK/ASH

Description:
The environmental character of this reach, like its neighbor to the north, suffers from the blighting influence of railroad lines, deteriorated housing conditions, and open storage of industrial materials. (Figure 26) The residential sections are generally some of the more "run-down" areas in the City and therefore have become the focus for Community Development Programs. The crossings of the north/south mainline Illinois Central Railroad (ICRR) tracks with the Conrail tracks north of Washington Street, seems to tie a hopeless knot in the Boneyard's continuity. Not only are the tracks themselves one of the major land uses in the area, but from Bradley Street to the south they become elevated further separating development continuity.

After emerging from under the ICRR tracks a block north of Vine Street, the Boneyard enters a former urban renewal area in which the remaining substandard housing is slated for clearance and the balance consolidated. From here the Boneyard flows to the south crossing under the Conrail tracks at Oak Street and loops across Second Street between Church and Clark Streets. Throughout almost all of this reach the Boneyard channel and the street culverts are in a bad state of disrepair. The volume of water in the Boneyard is considerably increased by the inflow from the west fork (a drainage ditch following the Conrail tracks through the western region of Champaign) at the ICRR track crossing.

Improvement Proposals:
The considerable pockets of vacant land, the underutilized industrial properties, and the City owned urban renewal land, provides a prime opportunity for the development of a needed retention pond system. The improvement plan (Figure 27) shows a proposed 15 acre/ft. retention basin South of Cap & Gown to the west of the tracks, and a separate recreation pond on the east side of the tracks. This separation of the retention and recreation functions eliminates the problem of draw-down for recreation use and provides regulation of flow for the Second Street area to the south. The recreation pond can serve as a railroad buffer and a new setting for the consolidation and upgrading of the entire Oak/Ash residential area. Its size is sufficient to be stocked with fish to provide neighborhood residents with fishing from the shore. This pond's development, bordering on Wesley Park to the north, would be of benefit to property values and foster new attempts to affect private residential and local retail facilities development in the area with the pond as an outlook. (Figure 28)

Figure 26: Oak/Ash Existing Conditions

Oak-Ash Existing Conditions

Figure 27: Oak/Ash Plan

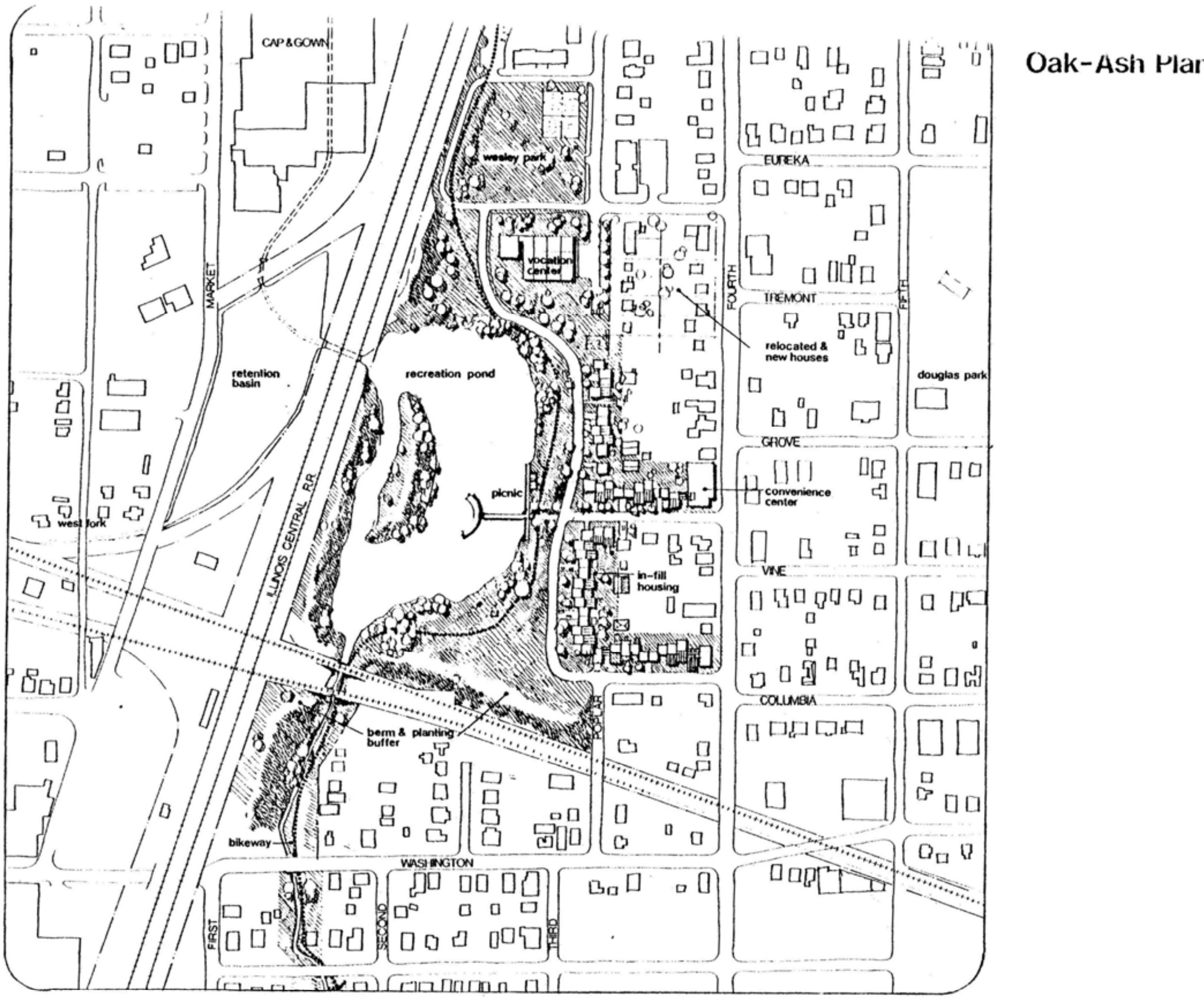
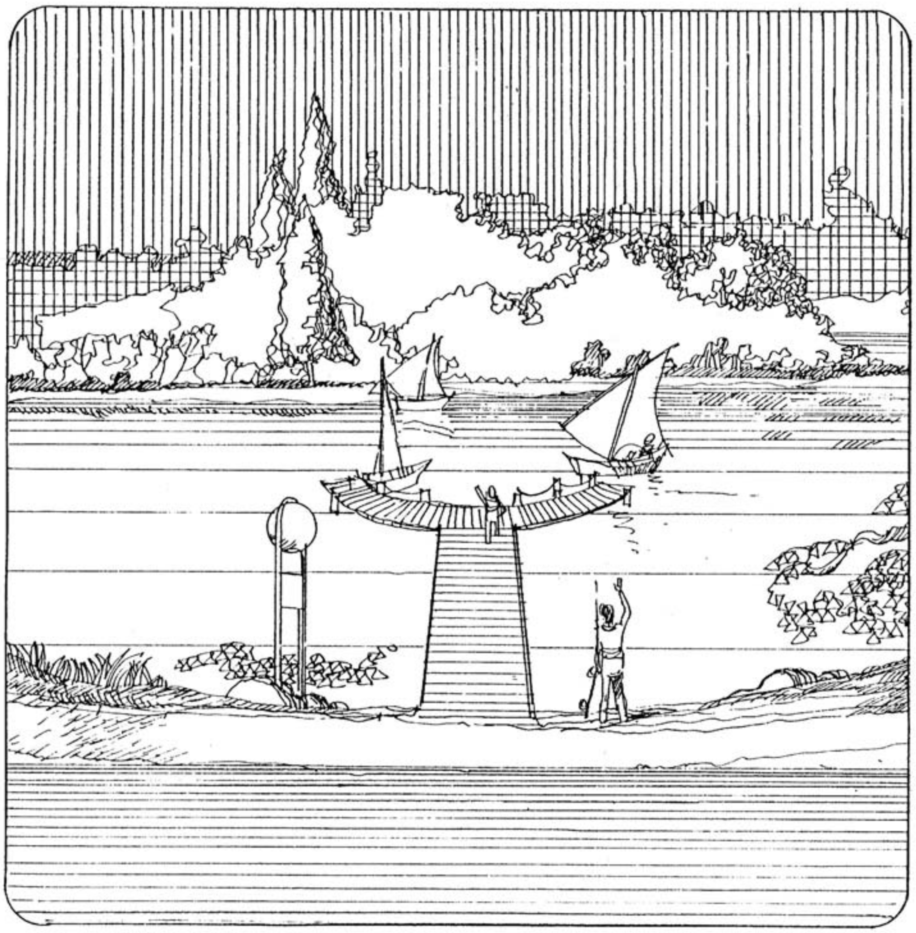


Figure 28: The Pond



The Pond

The course of the Boneyard from the pond south to University Avenue requires extensive channel improvements and the landscaping of its Creekway. Its crossing under the Conrail tracks is sufficiently wide to also accommodate a bikeway on one side. Between the tracks and Washington Street lies another "run-down" residential and manufacturing area in need of redevelopment and upgrading along with the future Boneyard landscaped creekway. Here, the creekway should include those strips of land adjoining the railroad, not suitable for other uses.

Flood Control System

This reach provides one of the major structural flood control systems of the Master Plan. The idea of a detention basin in this area has been in existence for many years. This idea has been incorporated into the Master Plan and many of the downstream projects will be affected by the results of the detention basin on the flow.

The detention of flow would be accomplished using two sites. The first of these, west of the railroad tracks, and south of Cap & Gown would be purely a detention site to control the flow from the west branch. It would be dry except during storm events and would be drained through a gravity orifice, thus requiring no pumping. In the Oak/Ash area a separate recreational pond would be erected. This pond would also provide sufficient detention storage above it to control the flow from the north branch of the Boneyard. For both areas the minimum criteria at a completely controlled 10 year storm have been followed. The fact, that only about 12% of the overall basin is controlled and all storage must be gained through excavation, prevented the choice of a larger design storm.

The detention basin for the west branch would provide about 15 acre-ft. of storage. Using an average release rate of 10 c.f.s., the 10 year design storm could be stored by the detention basin. The release rate will be uncontrolled varying as the pool level rises. The outlet works would be designed to provide the needed average release rate of 10 c.f.s. In addition, additional storage would be available above the permanent pool at Oak/Ash to control the flow from the north branch. The basin at Oak/Ash has been designed to allow the large majority of the storage to be directly above the permanent pool. Consequently, for the vast majority of the storms little or no shore line will be inundated. This will prevent any problems with the shore line of the recreation pond becoming marshy due to the fluctuations of the detention basin.

Due to the expense of providing a new inlet to this area under the railroad tracks, the Oak/Ash project has been formulated on the premise of using the existing double culvert inlet. Although the culvert under the tracks has up until now provided a major flow constriction, the existence of the split detention facilities would solve this problem. The existing outlet would have to be lowered slightly but this should present no difficulties.

The remainder of this reach would be quite deep in relation to the existing channel. Some type of hard edging would be used on one side of the channel and due to the depth of the channel and mitigating effect of the detention basin on the flow, flooding would not be a problem in this down stream section. The existing flooding problem in this section appears to be caused by limiting constrictions at bridges. Lowering the channel bottom will help to open up these bridges and eliminate this problem.

SECOND STREET

Description

Second Street between Washington Street and Scott Park is primarily a low scale residential neighborhood broken in the center by commercial and service facilities along University Avenue. Up to this point in Champaign, the Boneyard has been largely hidden from view, tucked away in private backyards and hardly discernable at street crossings. However, at Second Street, the Creek becomes part of the urban scene for the first time especially south of University Avenue where it flows along the western edge of the Second Street right-of-way. (Figure 29) Just north of Springfield Avenue is the Old Stone Arch Bridge, an object of considerable community sentiment, by which horse drawn trolleys used to cross the Boneyard traveling from downtown Champaign to Urbana.

The Boneyard channel in this reach deepens. Also various attempts have been made over the years to stabilize its sides which were never maintained. As it has become quite overgrown in some areas it has become prey to local blockages causing overflows.

Improvement Proposals

Today the Second Street area south of University Avenue is undergoing change. Old houses are being replaced with new multi-family projects and senior citizen developments, capitalizing on the area's convenient location to both downtown Champaign and Campustown. This trend sets the stage for the Second Street Creekway Park proposal illustrated in Figures 30 and 31.

This Proposal, converting Second Street into a linear park with the Boneyard flowing down the middle, extends Scott Park to University Avenue creates a new and exciting creekside living environment - an outdoor place for the elderly to sit and gather and students to study. As also indicated, this Second Street creekway could be extended in the future, north of University Avenue to Church Street, to complete the realignment of the Creek.

Figure 29: Second Street Existing Conditions

2nd Street Existing Conditions

Figure 30: Second Street Plan

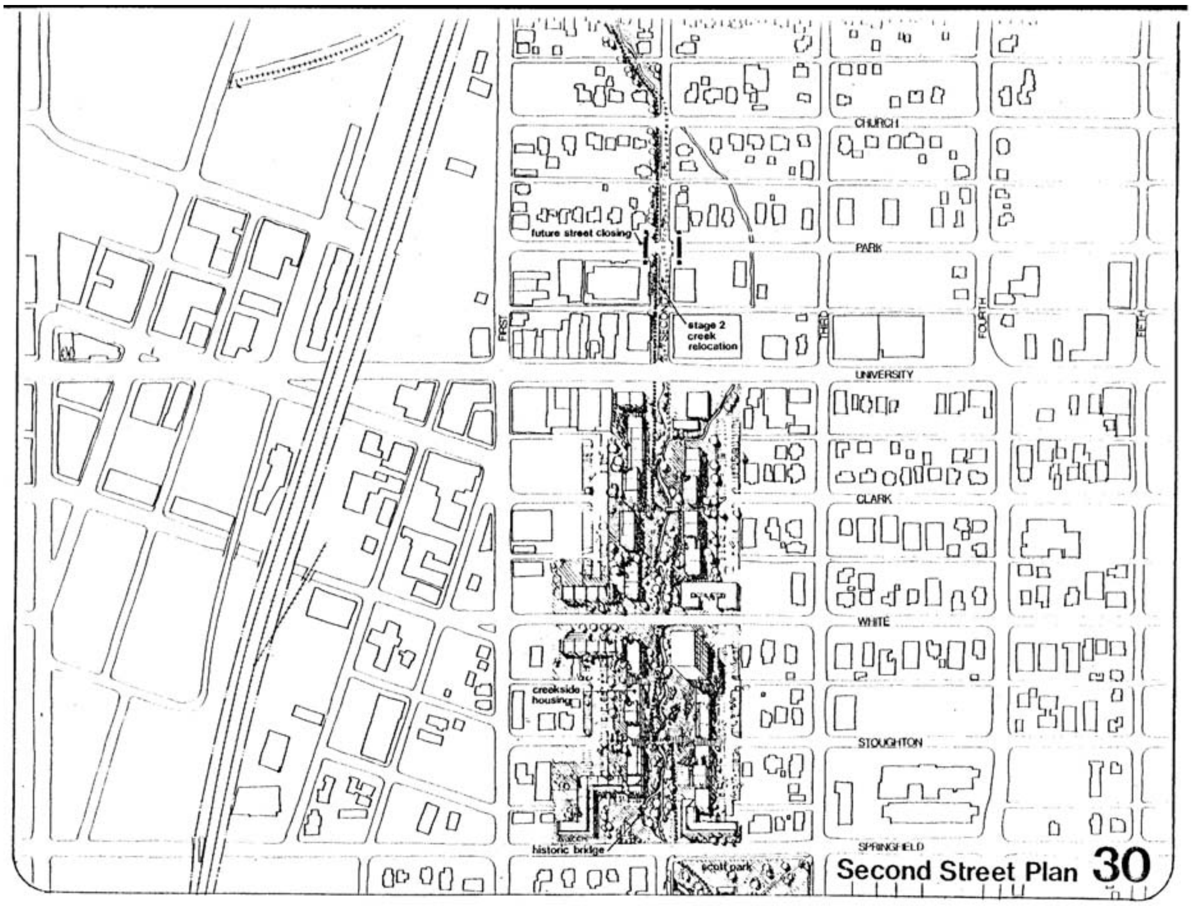


Figure 31: Second Street Creekway Park

Most of the housing now has its front doors on the cross street and its sides to the Creek. Future housing should be reoriented so that what is now a side yard becomes a rear lawn down to the water's edge. Apartment dwellers can sit and see people strolling by and children floating toy boats under the pedestrian bridges. Pieces of this future already are evident. Development parcels are being acquired; the Park District is trying to acquire the Stone Arch Bridge; an upper stream retention pond, necessary to tame the Creek through this area, has been studied before; and the City has already scheduled the improvement of the Springfield Avenue Bridge. What remains is to put all these pieces together into a new and total framework.

Flood Control System

The development of the Second Street reach is closely tied to the Oak/Ash detention basin. If a controlled flow section is to be developed along Second Street some means of controlling flow during storm events is required. A portion of this control would be provided by the Oak/Ash detention basins.

In its final form, the Second Street development would consist of a hard edged channel running in the middle of the 66' Second Street right-of-way.

The new channel bottom will be at the present location of the existing channel bottom. From both sides of the channel the ground will slope up providing a possible overflow channel for high flows. The release from the detention basin, along with any additional flow added from storm sewers after the detention basin, would be handled in the hard edged channel for the 10 year storm.

CAMPUSTOWN

Description

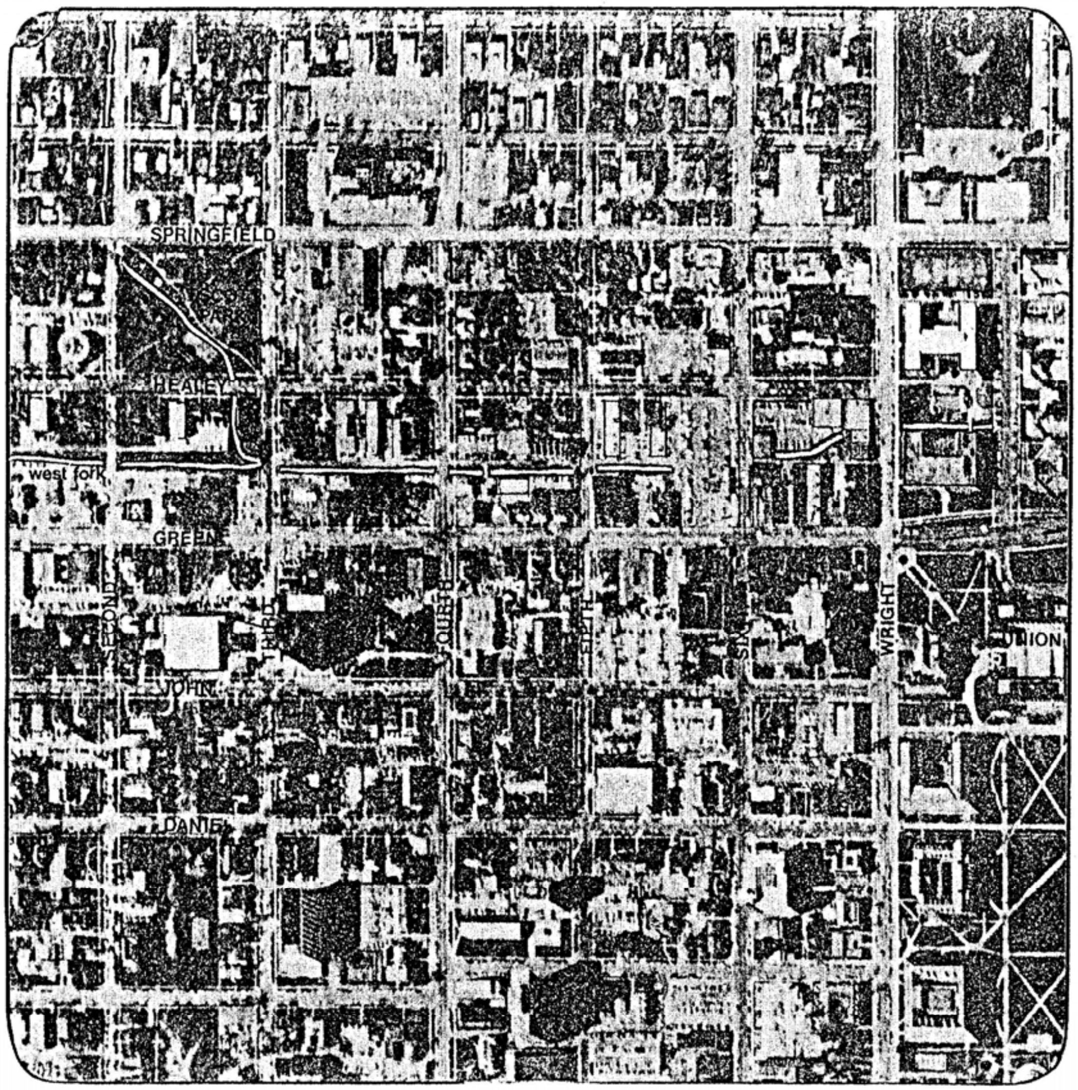
In this area the Creek today is an elusive and bothersome channel deeply cutting through parking areas for the most part, and past University related three and four story walkup housing and retail stores fronting on Green Street. (Figure 32) To the student shopper, the Creek is invisible; to the student apartment dweller, the Creek, especially on summer "dog" days is no amenity. It is also something of a barrier impeding easy flow to Green Street from the north.

Today the Creek is roughly ten feet wide. Its narrow and near vertical banks are edged with dense, wild growth as it runs from First Street to Fifth Street. Between Fifth Street and Wright, the Boneyard is primarily underground in a culvert - cars park above; all too few of them to satisfy storekeepers or students - and the temptation is great to leave the Boneyard buried.

Improvement Proposals

The necessary ingredients in Campustown for intense, lively, street and shopping activity now exist. There is a lot of high density housing next to a fair amount of commercial space, mostly food and drink, plus the great masses of students and faculty.

Figure 32: Campustown Existing Conditions



Campustown Exist.
Conditions

Green Street today is a typical campus strip ~ what is lacking is a pleasant, physical focus for all this activity. A place where the true functions of all this activity ~ to relay, to communicate ~ can take place.

The answer is to exploit the Boneyard as a new circulation spine and activity corridor. To accomplish this, the Master Plan proposes:

- Boneyard stream near the surface, double channel Boneyard Section with a stable flow.
- A bikeway on the northern bank of the Boneyard with bike parking areas, pull-off pads, and landscaping and benches.
- A pedestrian walk on the southern banks of the Boneyard, at the surface, linking plazas, sidewalk cafes, and landscaped park areas.
- Pedestrian bridges linking the northern and southern banks between street bridges.
- Between Fifth Street and Wright Street a new mixed use development project integrating an uncovered Boneyard with multi-level parking, a commercial arcade linking with Green Street, a major Boneyard-Campustown Square, and a new multi-story office and perhaps hotel structure. (See Figures 33 and 34).
- Adjustment of existing zoning to allow higher land coverage but stricter control of alley privileges to eliminate vehicular use.

<u>Flood Control System</u>
The Campustown Reach is potentially the beginning of another major flood control portion of the project. This is the first reach for which the channel over a channel concept has been proposed.

This flood control system consists of two separate conveyance channels. The first of these is a large box culvert with increasing capacity as it moves down the reach. All storm sewer lines along the reach would be connected to this box culvert. In addition, an inlet structure would be constructed that would allow the vast majority of the storm flow in the Boneyard, prior to the inlet, to move down a drop spillway into this box culvert. Consequently, during a storm event all but the direct runoff of the Boneyard corridor right-of-way and about 10 to 20 c.f.s. flowing in dry weather flow diversion of the inlet will be carried by the covered box culvert.

The second channel is a small dry weather conveyance channel to be created on top of the box culvert. Its primary purpose is to carry the dry weather flow and provide the effect of a natural creek in place of the existing large open ditch.

Figure 33: Campustown Plan

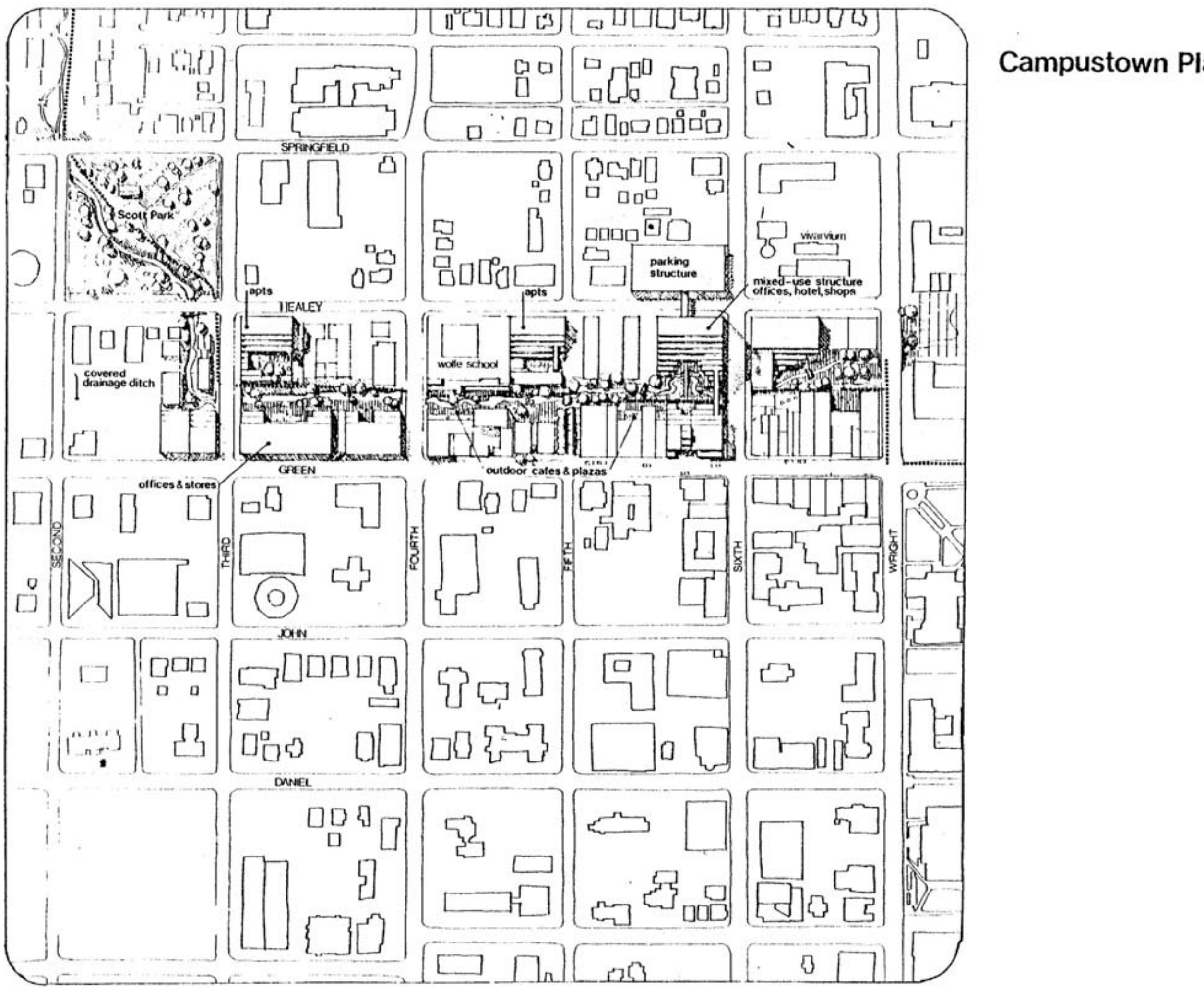
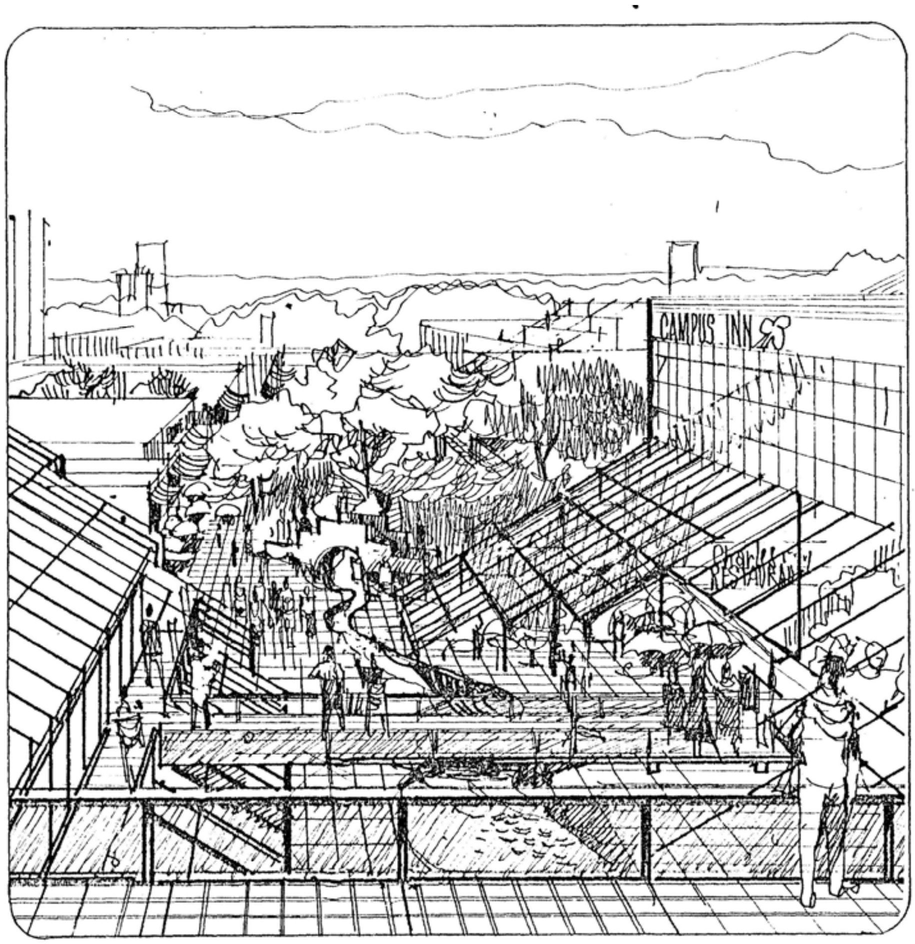


Figure 34: Campustown in the Boneyard



Campustown on the Boneyard

As before, the basic design flow was based on the 10 year storm. The box has been sized so that at the design flow it will be flowing completely full. It must be remembered that if the box culvert flows completely full, the additional frictional effect on the top slab will actually decrease the flow capacity so when some freeboard exists more flow is carried. Consequently, the box actually carries flows greater than those of the 10 year storm, but never less.

In addition to the flow capacity of the box culvert, the upper channel will provide some additional flow capacity. However, due to potential bridge constriction, the upper channel should be counted on only to carry the flow normally associated with it and not any flow from storm sewers. At various intervals along the reach, inlets to the box culvert would be placed above ground. These would serve to regulate flow in the upper channel so it would not go beyond a predetermined level of 1.5 feet.

Along much of this reach the top of the box culvert is near the elevation of the existing channel bottom. This means that during large storms the flow line will be much lower than it has been in the past. This should help alleviate the backwater pressures on the trunk sewers tied into the Boneyard. If the problem is one of lack of capacity in the trunk sewers or the sizing of inlets, then this will do little to alleviate the flooding problem. It does, however, eliminate the portion of this problem caused by the Boneyard.

UNIVERSITY

Description

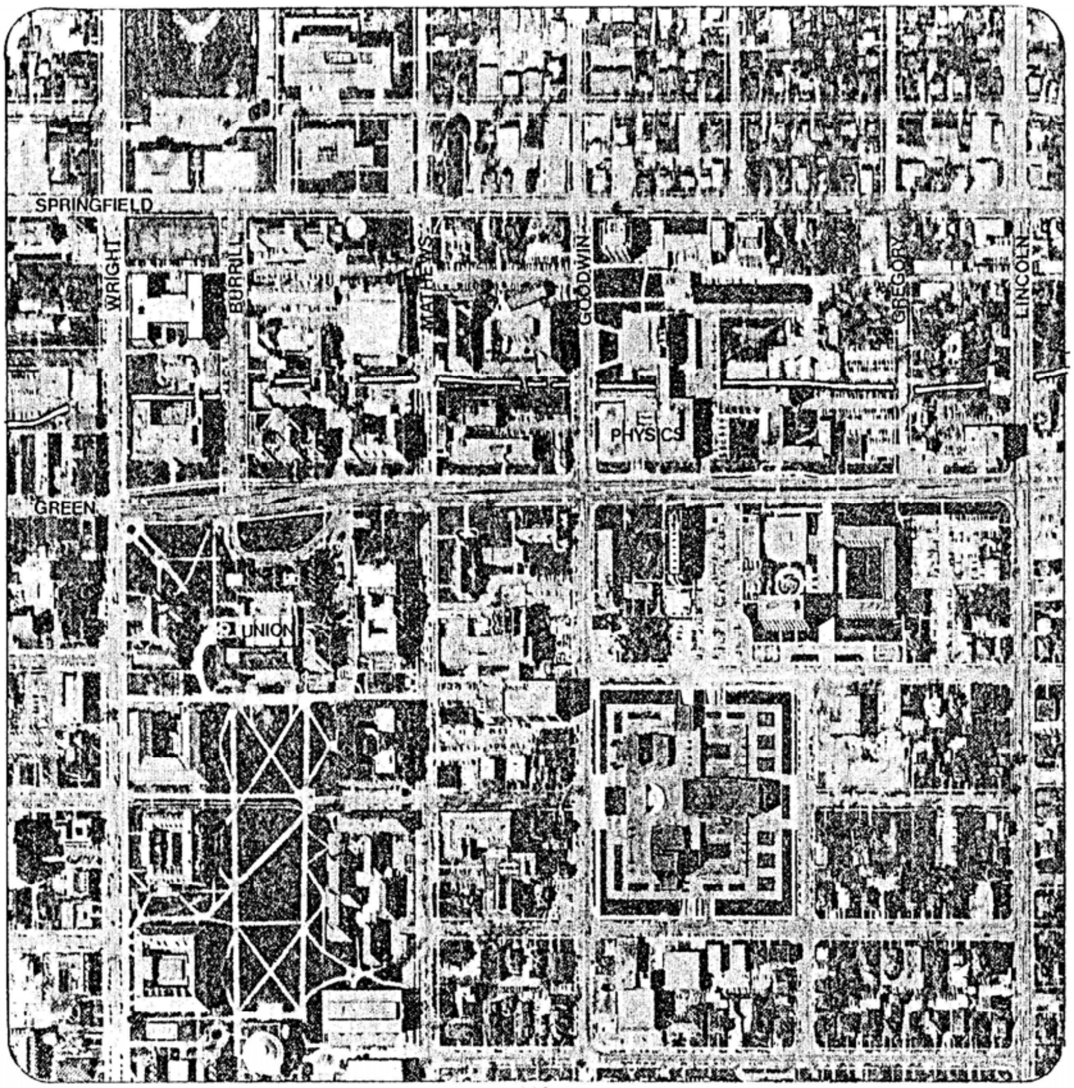
Originally, the Boneyard was a campus landscape element of great importance. Students were initiated with its waters; it was a place to stroll along and enjoy. In those days the Creek was near the surface. Today, portions of the Boneyard as it goes through the University are in a sheet piled section - elsewhere it is equally distant with unapproachable banks. In some cases, University buildings have been built directly over the Boneyard not with any great Panache - but casually as if the act was of no special importance. (Figure 35)

Despite these and other efforts to ignore the Boneyard some of the University community does use and enjoy the Creek. The Boneyard in this area is between 10 and 12 feet below the campus circulation level, and is approximately 15 feet wide at water level. Three streets cross the Boneyard -two of which carry little traffic and serve primarily as parking lot driveways.

Improvement Proposals

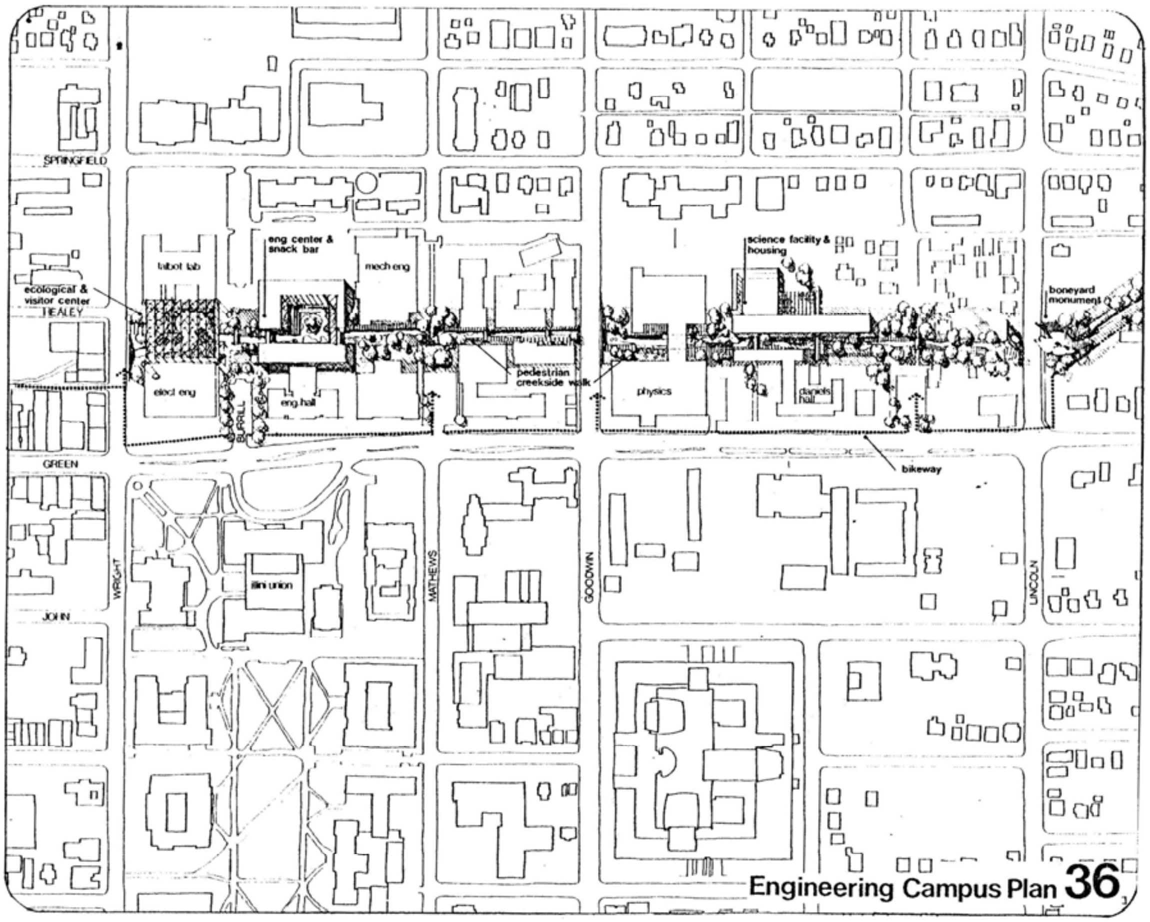
The Boneyard should become, as in year's past, the main east-west circulation spine of the north campus area. To help accomplish this, the Master Plan calls for the Boneyard to be in the new double-channel configuration here as in the Campustown reach. (Figure 36) This will restore the Creek to the Campus. Other measures are:

Figure 35: U of I Existing Conditions



U of I Existing Conditions

Figure 36: Engineering Campus Plan



- Closing of Burrill, Mathews and Gregory Streets and the eventual uncovering of the Boneyard in the street right-of-way except for pedestrian and bike crossings.
- The construction of two Boneyard related facilities - one an Ecological Engineering Study Center between Wright Street and Burrill Avenue, and two, a north campus student gathering place between Goodwin Avenue and Gregory Street.
- Eventual construction of a continuing pedestrian walk along the Boneyard - through and around University buildings from Wright Street to Lincoln Avenue.
- Reconstruction of vehicular bridges to increase visibility of the new Boneyard. Construction of several pedestrian bridges across the Creek for north-south circulation.

Flood Control System

The flood control system associated with the University reach is a continuation of the channel over a channel system.

No major changes occur from the system described in the previous section. As before, the box culvert is enlarged to provide the needed capacity as it extends down the reach. In this section an alternative route exists for the upper channel but this has no significant effect on the flood control capacity of this reach.

It would be possible to use the double channel system for this reach even if it has not been employed in the previous reach. This would call for some type of lift facility to place the dry weather flow in the upper channel. For this reason it has been recommended that the channel over channel system be initiated at Third Street where a gravity inlet is possible.

THORNBURN

Description

This sub-area is similar to Second Street in its land uses and scale of development. It is composed of a residential area, primarily occupied by students, from Lincoln Avenue to Main Street, at which point it intersects with the northern fringe of the Urbana Central Business District. East of Main Street the Boneyard divides a residential area on the north from commercial uses to the south. (Figure 37)

In 1962-63 the entire stretch of the Boneyard channel from Lincoln Avenue to Race Street was lowered and the sides were sheet piled to eliminate flooding problems and improve downstream flow. This project was an engineering success. But it effectively destroyed the Creek as a natural waterway by its placement some 9 to 12 feet below surrounding grade, protected on both sides by a six foot chain link fence.

The main public focus of this area is located midway along the reach. It is the Thornburn Community Activity Center, operated by the Urbana Park District within a building leased from the School District. Currently work is underway to convert the adjoining asphalt playground over the Boneyard, into a landscaped recreation area. Its ultimate development plan calls for a children's play area, (in construction), a basketball facility and the eventual opening to view of

Figure 37: Thornburn Existing Conditions

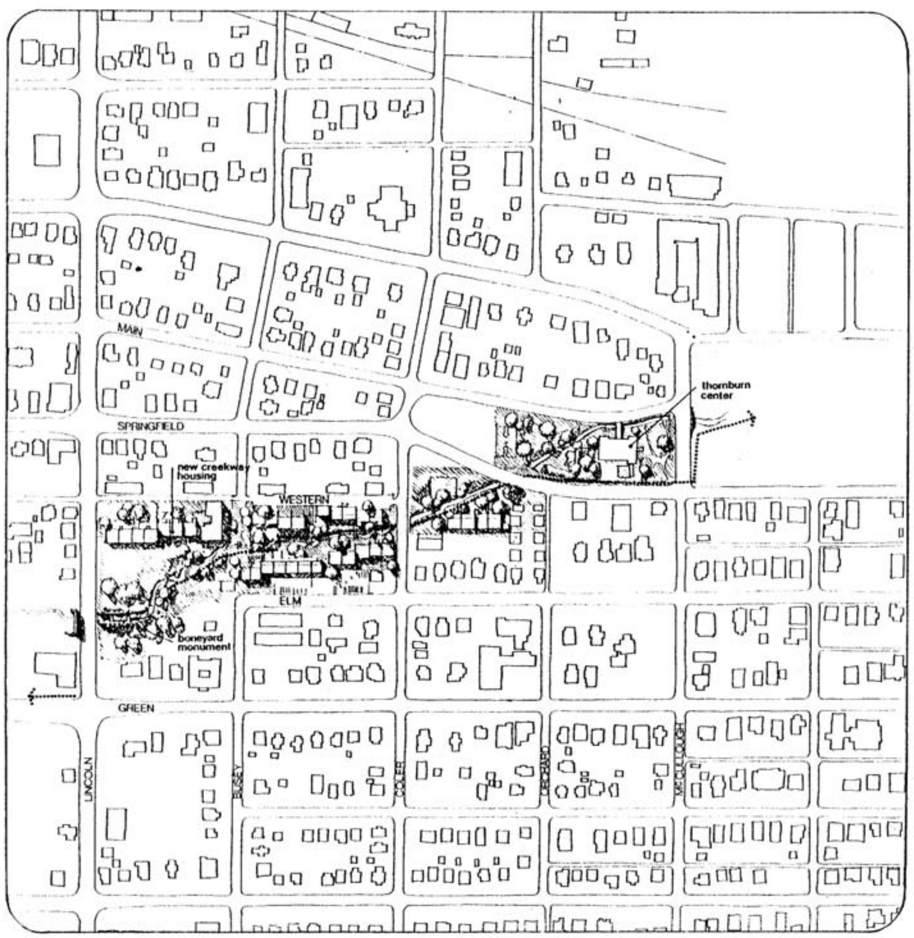
Thornburn Existing Conditions

the covered portion of the Creek. The Park District has also expressed the hope of obtaining the balance of the western portion of the block for future expansion to Coler Avenue.

<u>Improvement Proposals</u>

In this reach, as in the two preceding Creek sub-areas, the double level channel engineering concept is proposed. This will serve to bring the normal water flows to the surface, thereby removing the fence and visual barrier aspects of today. Once brought to the surface, the plan (Figure 38) anticipates continuing residential development along the new Boneyard, producing a Creekway Park similar to Second Street, but here in a mid-block location. Along the way, triangular remnants of housing development land, are shown as being added to the Creekway

Figure 38: Thornburn Plan



Thornburn Plan

open space, to give variety and breathing points. The most important of these is the triangular section of open land north of the Boneyard on the east side of Lincoln Avenue. This is shown as being eventually developed as a mini-park creekway entrance from Lincoln Avenue (a major north-south arterial route) and as a scenic gathering spot for town and gown use.

In addition, the planning concept of developing the Creek as a natural waterway park within residential super-blocks is furthered by the proposed closing of certain minor streets. Specifically portions of Western Avenue to permit a more efficient creekside land utilization for future housing and Busey Avenue to provide streamway continuity.

The eastern portion of this sheet piled reach, bordering on downtown Urbana, is discussed in the next section.

<u>Flood Control System</u>

As with the previous two reaches, the system of flood control recommended for the Thornburn Reach is a continuation of the channel over a channel concept as described in previous sections.

Again it would only be possible to initiate this flood control system at Lincoln if some type of a pump lift station is used to place the dry weather flow in the upper channel.

In addition special treatments would be needed under the bridges at Busey and Coler due to a lack of clearance under these bridges.

FIVE POINTS AND URBANA CENTER

<u>Description</u>

The Boneyard in this reach flows closest to a true downtown area - the Central Business District of Urbana. But here the Creek is as invisible and elusive as ever - it is well below the street and eye level and is sheet piled. It plays no useful role downtown - what is more the downtown area, with the new Lincoln Square Shopping Center at its heart, still lacks definition and a clear edge especially north of the Square. In addition, Springfield Avenue and Main Street form a disastrous intersection right at the western edge of downtown. (Figure 39)

Opportunities along the Boneyard do exist. First there are underutilized areas on this western edge on both sides of the Boneyard and a bright new cultural resource, the Station Theatre, is flourishing to the north of downtown between Race Street and Broadway, also on the Creek.

<u>Improvement Proposals</u>

Given the need to compliment and strengthen Lincoln Square, the plan proposes the following: (Figures 40 and 41)

- Elimination of the fork of Springfield and Main Streets by the orthogonal re-routing of Main Street.

Figure 39: Five Points Existing Conditions

Five Points Exist. Conditions

Figure 40: Urbana Five Points Plan

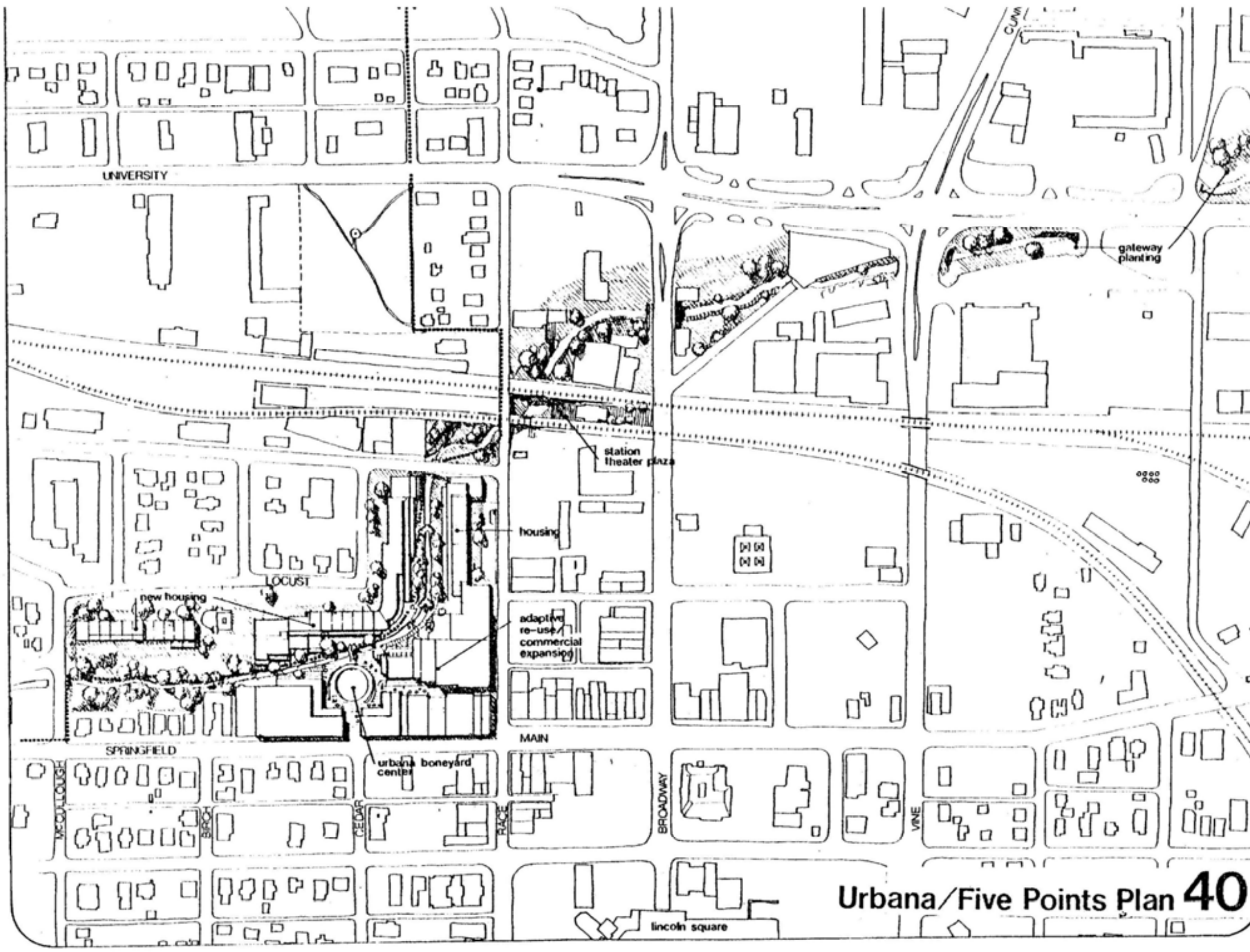
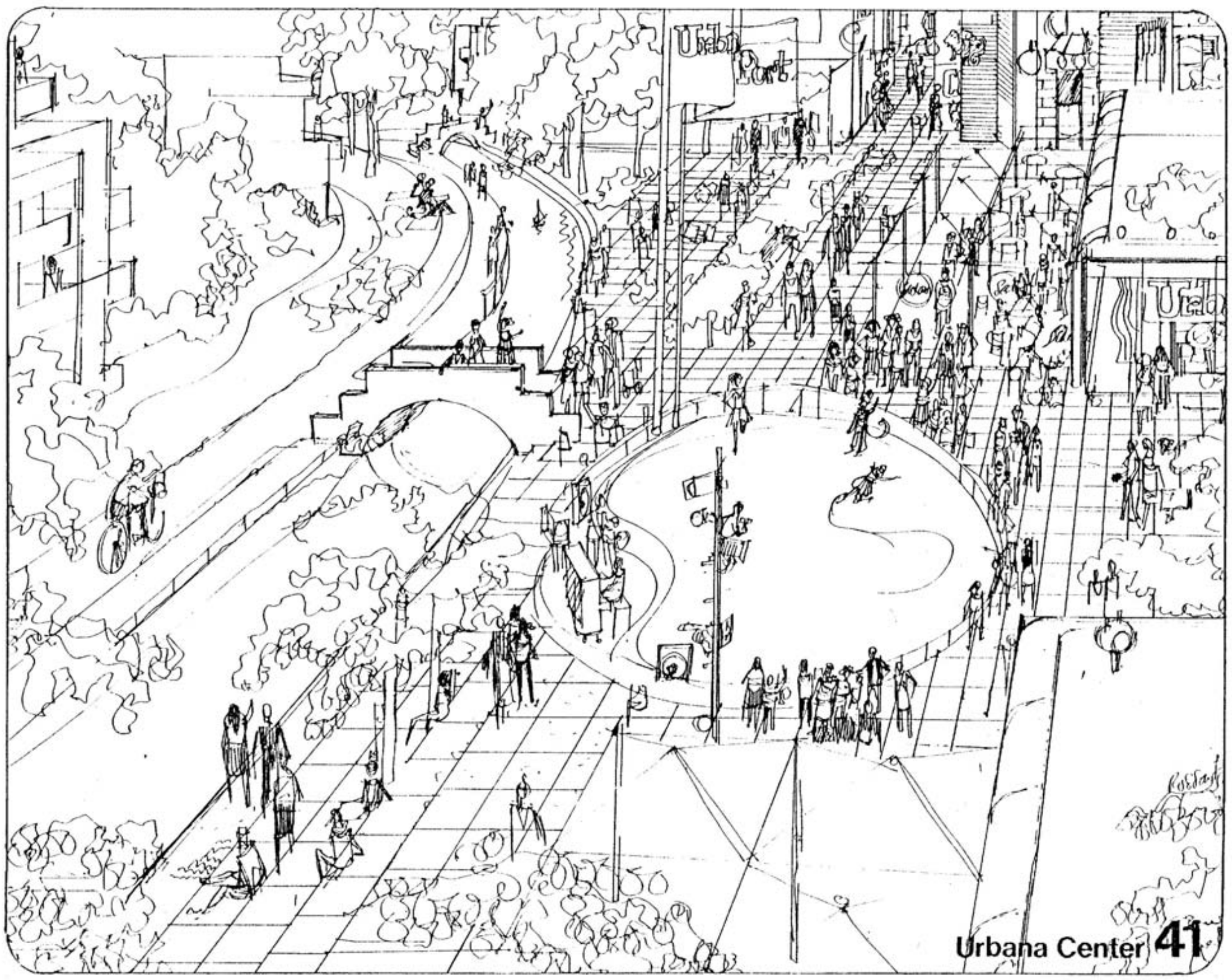


Figure 41: Urbana Center



- Creation of a new plaza on the Boneyard due to this Springfield/Main Street crossing. This new plaza will have opportunities for new Creekside commercial development, a restored and developed Water Street arcade from Race Street and an additional arcade to the south.
- New dense uptown housing to the north of the Creek forming an exciting creekside precinct of mixed use at this western edge of Downtown. Additional housing north of Water on Race Street.
- A highly developed plaza with a skating rink, fountain, a new Boneyard crossing structure, and a bike and walkway toward Thornburn Center to the west and Station Theatre to the northeast.

- Below the Station Theatre a dramatic waterfall ending the double channel Boneyard - a broad pool, landscaped and brightened under the bridges at the theatre.
- A terraced "between-the-acts" area at the Station Theatre incorporating new facilities for the theatre, a cafe, and sitting terraces down to the Boneyard pool.
- A creekside path leading to the Plaza at Main Street. In addition a connection to the south-east linking the theatre with the Civic Center. This last link may include a decorative Boneyard water feature.

In addition, the Five Points intersection along University Avenue is proposed for development as a western landscaped gateway to the Twin Cities. Already businesses in the area have initiated this process with the planting of trees along the banks of the Boneyard mixed with flowering shrubs. To supplement this initiative the plan proposes a richly landscaped lower level creekside walkway from University Avenue to the Station Theater on Race Street. Here, people can stroll during intermissions and circulate between the business enterprises. For the vehicular traveler it will announce the Western starting point of the new Boneyard Creekway development. A key element in this is the long term preservation of the National Guard Armory property as a continuation of the Boneyard to the Saline.

Flood Control System

The last reach in the project will be left as an open channel. The basic revisions for flood control will include some regrading of the channel and reshaping of the cross section in certain areas. As in several upstream reaches a proposed walkway will be inundated during periods of high flow and serve as a secondary channel. For this reason, it would have to be flood proofed against damage during periods of high flow. Any obstructions or plantings should be kept to a minimum within the potential flow corridor.

CHAPTER 5: IMPLEMENTATION AND MANAGEMENT

IMPLEMENTATION STRATEGIES

Implementation is an on-going process which must start with initial conceptual ideas and continue on to actual execution and completion of projects. The range of engineering and planning proposals described previously contain the threads of a related range of implementation strategies. These range from legal and non-structural measures, which rely on the initiative of the private sector, to other options which depend, in varying degrees, on public investment. Current availability of funding will influence selections of initial steps in the process.

Today overlapping responsibilities of different units of government and agencies have slowed action on the Boneyard's obvious needs. The creation of the Boneyard Creek Commission has been the first step in the coordination of mutual concerns for future Creek improvements.

For the implementation of this plan and the effective management of the process, three areas need to be addressed.

- Lobbying for the plan and the funding of its public aspects,
- Coordination and management of the combined public and private development process,
- And finally maintenance of the Creekway and its park facilities in the future.

A clear solution and understanding of the areas of responsibility to each 'of these three items is required for the realization of this plan and the Boneyard's improvement.

As general guidelines the following is recommended:

1. The Boneyard Creek Commission should continue in existence as an intergovernmental agency responsible for the coordination of the Plan's implementation and other metropolitan area developments affecting the Boneyard. It is essential that both City governments, both City Park Districts, and the Urbana/Champaign Sanitary District be represented, and that the University of Illinois and the Regional Planning Commission

should have a key policy and review role over all matters affecting the Boneyard's engineering improvements and its development.

2. It is also essential that the Commission hire a full-time staff to actively seek funding, advise it on technical issues, review zoning applications, update the plan as required, and generally provide day-to-day coordination and management.
3. Improvements once made must be maintained through the establishment of a regular maintenance program. This issue of maintenance is the most puzzling to solve and yet of key importance. Involved are both jurisdictional questions and the matter of funds or special tax assessments for its operations. Also meriting consideration is the assignment of a degree of responsibility to the private adjoining land owners.

It is anticipated that flood control funds can be obtained to initiate work on this project in the immediate future. Before these funds can be obtained, the above items should be resolved.

LAND USE CONTROLS

The ultimate plan's development will depend on a combination of public and private investment. One of the objectives of this study has been to establish general guidelines for a Boneyard Zoning District to be incorporated into the respective city ordinances, thereby removing the current moratorium on Boneyard adjoining property construction.

Figures 42 and 43 show the proposed Boneyard Zoning District in Champaign and Urbana. This District is conceived as an overlay district on top of existing uses and requirements. A proposed amendment to the City Zoning Ordinances governing future construction within this District has been prepared by Professor Clyde Forrest of the University of Illinois acting as Special Consultant to the law offices of Mitchem, Tepper & Gwinn, legal counsel to the Commission. This plan fully endorses the general purposes of this proposed Boneyard Zoning Ordinance stated under Section One as follows:

A. To preserve, protect and where necessary aid in the redevelopment of the character of the Boneyard Creek District as an area of vital significance to the cultural, economic and environmental future of the City of Champaign/Urbana.
B. To promote sound storm drainage management practices, assist in the reduction of flood hazards to persons and property, to improve water quality and to prevent encroachments which adversely affect maintenance access.

Figure 42: Champaign Proposed Boneyard Zoning District

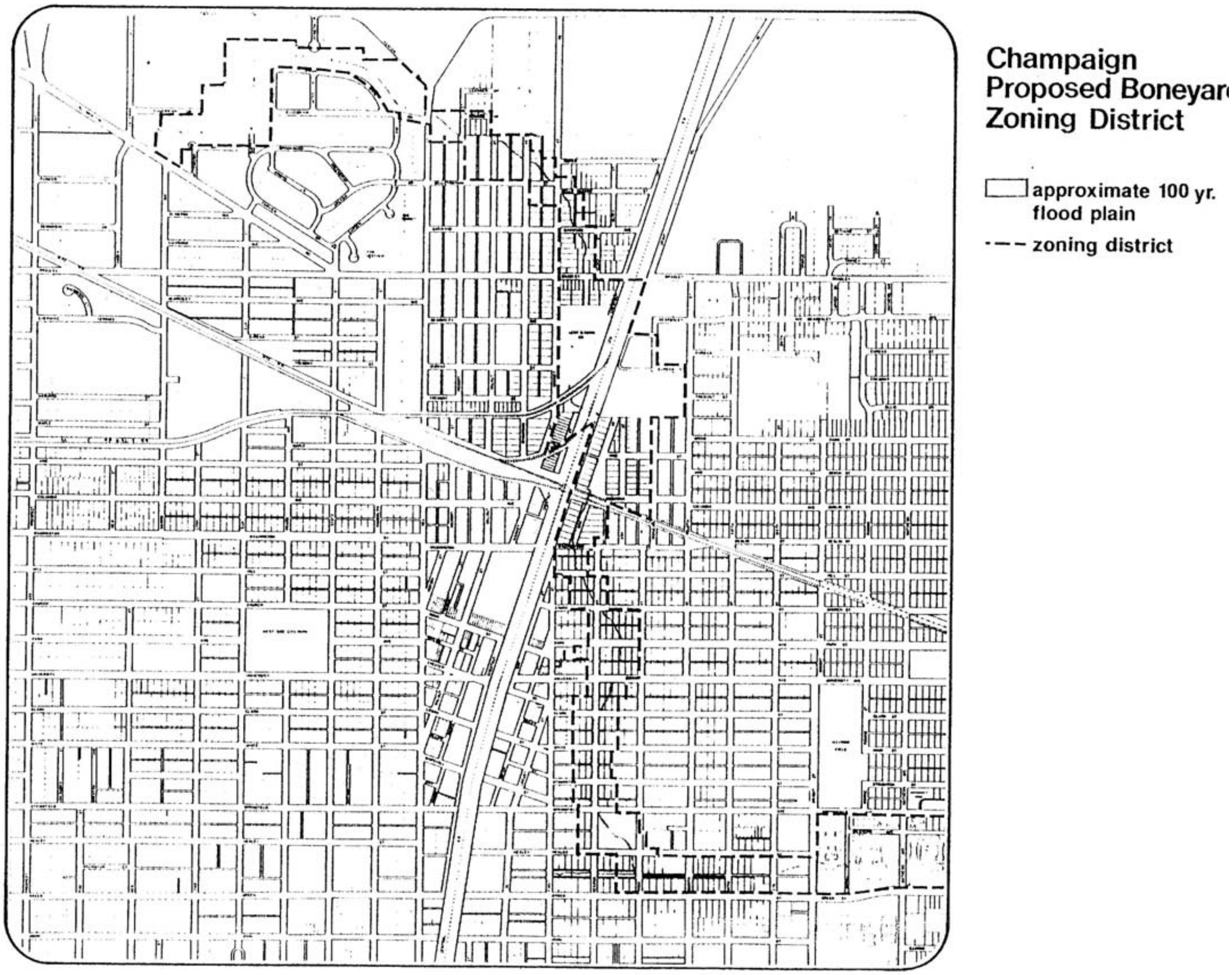
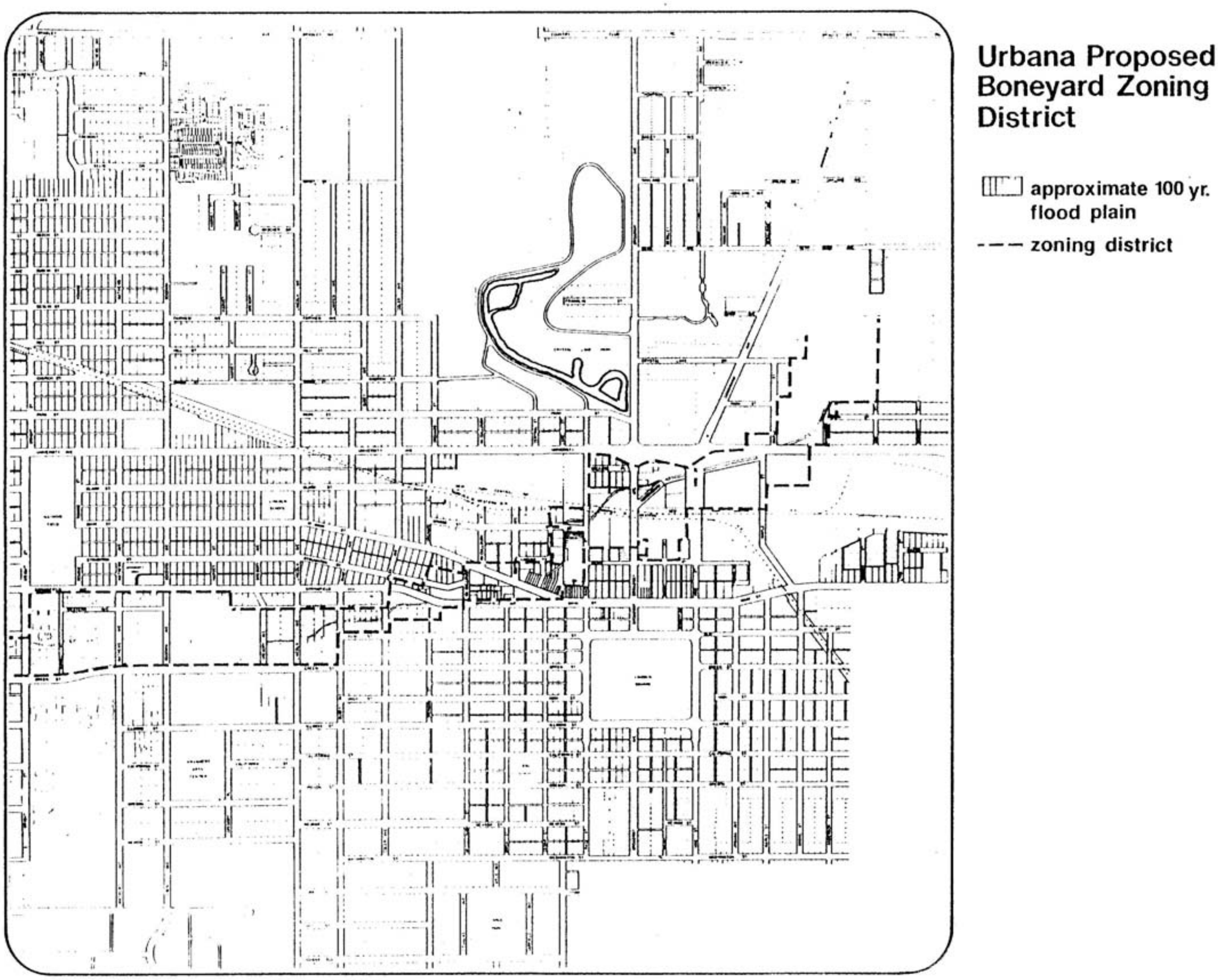


Figure 43: Urbana Proposed Boneyard Zoning District



C. To encourage the development and maintenance of the Boneyard District as a recreational resource, circulation area and to enhance its use for arbor plazas in a manner that will reclaim for that district of the City the benefits of a natural waterway that has been ignored as a design asset and provide a focal point for higher density development.
D. To assist in securing development of a natural area that was an attractive element of the City environment.
E. To retain and improve employment opportunities in the older section of the City.
F. To provide incentives for redevelopment through private initiative in a manner consistent with these purposes and the Comprehensive Plan of the City of Champaign (Urbana).
G. To enhance excellence of architectural design which accommodates the uses purposed by the Boneyard Creek Master Plan including multi-use facilities, structures, and parcels which would promote more attractive, functional and economic development.
H. To promote and conserve the value of land and buildings and thereby protect and improve the City's tax base and revenues.
I. To implement the Comprehensive Plan of the City of Champaign (Urbana).

This plan has established sub-areas or reach improvement objectives which indicate how these general purposes apply to different areas of the Champaign/Urbana segments of the Creek. In summary these are:

<u>Edgebrook:</u> To preserve the quality and scale of the existing residential neighborhood, and to protect and improve the Boneyard waterway as a natural landscape amenity separating the residential uses to the south from the commercial and industrial uses on the north.

<u>Neil/Market:</u> To use the Boneyard realignment and amenities development to foster the upgrading and stabilization of this residential neighborhood by creating new housing sites, creekside sitting and play areas and other community uses.

<u>Oak-Ash:</u> To assist the City of Champaign in its attempts to improve housing and living conditions and in the introduction of new employment opportunities, by the creation of a landscaped recreational pond separating the residential area from the blighted influence of the railroad and the consolidation of its land uses and to provide detention against downstream flooding.

Second Street: To foster residential development trends by the conversion of Second Street from University to Springfield Avenues into a scenic creekway park amenity incorporating a Stone Arch Bridge of Community Historic significance.

Campustown: To promote the mixed use development of the super-block between Healey and Green Streets around a surface level Boneyard waterway as an internal environmental resource and activity focus.

University: Although exempt from local zoning the plan encourages the University to recapture its campus Boneyard image of the past.

Thornburn: To promote and encourage the development of high density quality residential neighborhoods along the Boneyard Creekway Corridor for the City of Urbana.

Five Points: To promote downtown commercial development and develop natural qualities of the Boneyard in the Five Points area as an eastern gateway to the Twin Cities region.

BONEYARD CREEK MASTER PLAN

Volume II:

Detail Engineering and Cost

The Boneyard Creek Commission:

Conklin & Rossant Planners/Clark,

Dietz-Engineers, Inc.

VOLUME II
DETAIL ENGINEERING AND COST

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CHAPTER 1: GENERAL CONSIDERATIONS

INTRODUCTION

Before proceeding into Volume II some comments about the nature of the material, and the manner in which it is used are appropriate. The intent of this Volume is to present in a more detailed manner the proposals outlined in Volume I of the master plan, and set forth the various criteria used in this preliminary design effort.

The material in this Volume is based upon available information concerning present day conditions. Although some of the material presented is detailed, the concepts and general criteria represented by this work that are an integral part of the master plan. Future conditions, changes in thinking or policy, and shifting of priorities will undoubtedly lead to revisions of the master plan. By presenting examples of the suggested approach, along with the criteria this approach is based on, it will be possible to alter the master plan in a manner that leaves it as a cohesive package.

Although much of the material appears detailed, it has been based on general information rather than specifics. The survey information available for the planning process consisted of cross sections at the upstream faces of bridges as well as occasional spot elevations or channel sections provided by the Illinois State Water Survey from their flood plain study. No detailed surveying, baselines, soil tests, borings or any field work other than visual inspection has taken place. All these things would have to be accomplished before an accurate final design could be proposed for any portion of the project.

What is being presented here are examples of specific approaches that can be applied to given areas and a relative look at how these various approaches can be joined together in an overall plan. It is obvious that the typical sections could not be applied across long portions of a reach without being constantly altered to account for variations; but they provide the guidelines for a final design that will account for these variations.

In addition to Volume I and II a series of plan profile sheets have been included with the Master Plan. They were not intended to depict actual surveyed data or stationing but rather provide a means of relating proposed grade lines, flow corridor locations, changes in approach, general locations of various proposed projects, and present an overall view of some of the various elements of the master plan.

GENERAL FLOOD CONTROL DESIGN CRITERIA

<u>Minimum Design Criteria</u>

The selection of a design period for the flood control portions of the project has been mentioned earlier in this text. As a rule of thumb, a five year design period is often selected as a standard in urban storm water design. Flood insurance criteria are often based on the 100 year flood level, and consequently large projects often are designed to withstand the effects of the 100 year flood. Another criterion employed involves the concept of economic life of the project. In this case, a specific portion of a project is designed to a return frequency which closely approximates the number of years of useful service the specific portion of the project will have. A final criterion employed is simply the constraints involved with the physical setting and financial limitations. It may be physically impossible to control a flood of a certain return frequency given a set of physical limitations to work within. Furthermore, the cost of flood control in a difficult situation could exceed the benefits realized by the flood control. In determining design flows, an effort was made to balance these various criteria to come up with applicable design flows for this specific project.

Earlier design projects, such as the Horner Shifrin report based their designs on a five year return period storm. However, two things need to be considered in assessing this decision of the past. First the Horner Shifrin treatment dealt with the Boneyard strictly in terms of a main interceptor for the city's storm water flow. Secondly, the five year storm developed was much larger than a comparable five year storm using State Water Survey criteria would have been. Horner Shifrin appears to have attempted to estimate a storm with complete urbanization. Consequently, their five year storm was representative of some future condition perceived for the city.

In conjunction with this Boneyard Master Plan, a minimum of a 10 year storm was selected. Essentially, this means that in all cases the capacity of a section of the Boneyard was designed to allow the 10 year return frequence storm flow to be carried within the confines of the banks. For specific projects, the design criteria selected could be higher than this basic minimum, but never less. Where additional carrying capacity or storage was available, at no significant increase in cost, it was incorporated into the plan.

Justification of Design Criteria

There are several factors justifying the 10 year return period selection. Many of the proposed projects involved in the Master Plan go beyond the simple need of flood control. Consequently, this called for a greater order of protection than needed for a simple storm drainage project. In order to provide sufficient protection to justify the expenditures of the various projects, a 10 year design storm was selected as a minimal standard of protection. Since the Boneyard Master Plan attempts to promote and encourage certain types of development, a more comprehensive flow control program helps provide the needed climate for development. Furthermore, when dealing with an estimated 50 year time plan, some allotment should be made for changing conditions. Although we recommend against improvements that will lead to heavy increases in the flows to be carried by the Boneyard, some increase may take place in the course of normal events. By allowing some leeway in the design period, a portion of the project completed in the early stages of the total time span of the Master Plan would not be rendered quickly undersized by changing conditions.

Multiple Project Approach

Due to the multiple project approach of the Master Plan an opportunity is afforded to combine a variety of flood control approaches into an optimal solution. In most cases, it is cost effective to use a combination of channelization along with specific detention facilities. An effort has been made in the Master Plan to fit the method of flood control to the other objectives of a given reach.

BIKEWAYS

The general design concepts used in the proposed bikeways for the various reaches were based on some general rules of thumb developed over the years. When actual data are available on soil conditions some of the dimensions called out in this plan could be revised to take the additional information into account. Three types of bikeways have been proposed for the different reaches depending on the specific needs of that reach.

A standard rule of thumb to be followed states that the bikeway should lead from one significant place to another. In general should the entire plan or some adapted form of it be implemented, the need for the bikeway would exist along every reach except possibly the final Five Points reach. In the case of this reach it was felt that any bikeway system might be better tied into Crystal Lake Park than the confluence of the Boneyard and the Saline Branch. For this reason the last reach is shown only as a 5' walkway rather than a full scale bikeway. Even if a given reach is developed it would be essential to check user potential before developing the bikeway along that stretch of channel.

Materials for a bikeway include stabilized earth, crushed stone, soil cement, hot mix asphaltic concrete, cold mix asphalt and concrete. Since in many cases the bikeway is actually located in the flow corridor it would have to be constructed of flood proof materials to avoid damage or excessive maintenance. For the usage outlined above, it was felt that some type of asphaltic mix over a gravel subbase would best serve the purpose. Although this is not the cheapest available material, it appears to be the most feasible way of constructing a bikeway to be used in this manner. A bikeway constructed in this manner would also be most durable to the freeze-thaw situations to which it would be subjected to. In terms of the needed thickness of mix and subbase some information from contractors, who had constructed this type of pathway was considered. It was proposed that 6" of gravel, crushed stone, or slag be used in all cases. Possibly this could be reduced to 4" for a Type B bikeway but in general 4" would be a minimum criteria for the base. The thickness of the mix on top was dependent on the type of loadings to be encountered. In the case of a Type A or Type C bikeway, where it is proposed to use the bikeway as a route for maintenance vehicles and emergency vehicles, the mix should be 3" thick. For a Type B bikeway where no vehicles will use the bikeway a 2" mix thickness appears adequate.

Drainage of the bikeways should be considered in the final design. In the Campustown, University and Thornburn reach the bikeway should slope away from the channel with the flow being collected in small catch basins which would be connected to the box culvert in those reaches. In the other reaches the bikeway could be sloped towards the channel and allowed to drain directly into the channel. As a general rule the slope of the bikeway for drainage should be 1/4" to 3/8" of an inch per foot width of the bikeway.

The overall width of the bikeway is again governed by the type of usage. Design standards call for a minimum 6.5' pavement width for a two lane bikeway. This would allow for two handlebar spreads of 2' plus an additional 2.5 foot maneuvering separation. In general this has been adopted as the minimum design standard. Even though traffic volumes would not always justify a two lane bikeway, no separate pedestrian pathway has been proposed so consequently, no bikeways are shown as less than 6.5 feet. In areas where the bikeway must be capable of providing access by vehicles when needed, the minimum acceptable width would be 8'. In some reaches where vehicle access by the bikeway was needed, but the dry weather channel would be dwarfed by an 8' strip of asphalt, an alternative was needed. For this situation the Type A bikeway was proposed which would consist of two strips of asphalt separated by a grass strip. The separation is desirable because of the greater safety afforded. In the case of this type of bikeway, a 9' width has been proposed.

In connection with bikeways as extensive as those proposed in the plan, it is important to consider the placement of support facilities along the route. Those considered should include rest stops, bike racks, in-formation markers and emergency phones.

It was determined that although either over or under passes would be advantageous at street crossings in terms of safety the cost of such a luxury would be prohibitive. Consequently, at grade crossings at streets have been proposed throughout. Short ramps or curb cuts should be provided where the bikeway intersects the roadway.

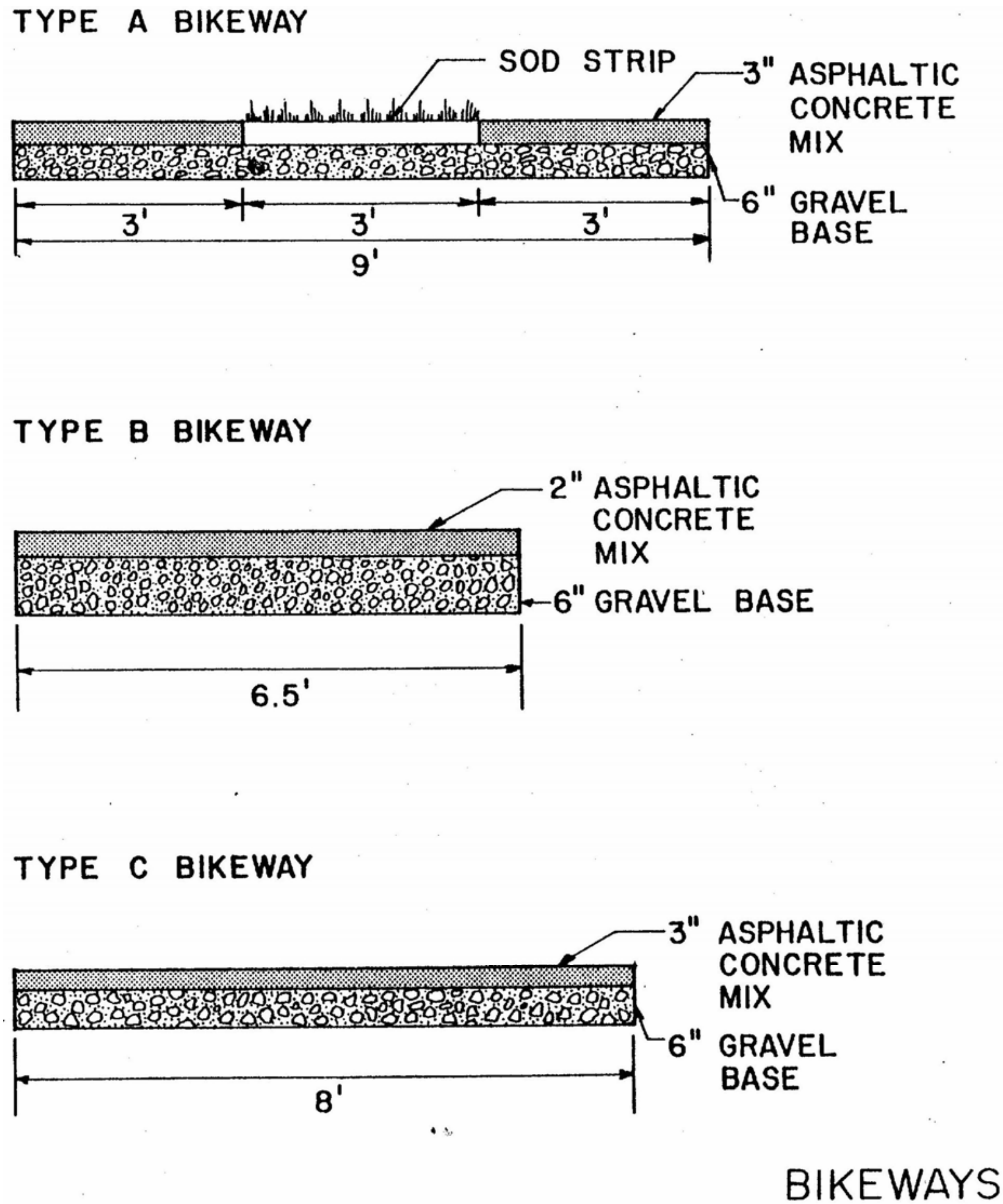
Some other general criteria that should be used in final bikeway design are the following:

- Design speeds of from 10 to 20 mph.
- Radius of curvature based on $R = 1.53\ V + 2.2$ when V is less than 18 mph.
- Grades maintained from 3% to 5% for most runs with a maximum of 10% for very short sections allowed.
- Speed reduction signs for curves with radius under 25'.
- Turns not hidden from view by trees or shrubs.

- Signs marking intersections with other routes of transportation placed 50' from the point of intersection.
- Where possible 3' clearances maintained from the edge of the bikeway and an 8.5' vertical clearance.

The three basic types of bikeways are shown in section view on Figure 1. The Type A bikeway is proposed for reaches where vehicle access for emergency and maintenance vehicles is not provided by existing streets, parking lots or alleys. The idea of separating two 3' asphalt strips by a 3' grass strip was used where it was felt that 8' of asphalt was too imposing. The 6" gravel base would be laid under the full 9' with a 3' wide sod strip placed over 3' to establish the grass strip. A Type C bikeway follows the same criteria but is 8' wide and involves no grass strip. It too, could accommodate vehicle traffic when needed. The Type B bikeway would be 6.5' wide but needs only a 2" mix as a consequence of not being used to provide access for vehicles in areas where it is proposed sufficient access already exists through streets or alleys.

FIGURE 1


TYPE A BIKEWAY
SOD STRIP
3" ASPHALTIC CONCRETE MIX
6" GRAVEL BASE
3'
3'
3'
9'
TYPE B BIKEWAY
2" ASPHALTIC CONCRETE MIX
6" GRAVEL BASE
6.5'
TYPE C BIKEWAY
3" ASPHALTIC CONCRETE MIX
6" GRAVEL BASE
8'
BIKEWAYS

SOIL INFORMATION

The soil information used in the design process was based on general information obtained from a Soil Conservation Soil Survey for Champaign County. It should be noted that the general soil types associated with the soil maps should be field verified before starting the final design process. Should any major discrepancies appear this should be taken into account before final design.

Two predominant soil types were listed on the soil maps. From the beginning of the Edgebrook reach to Main Street (middle of the Thornburn reach) the soil type was listed as 152A Drummer Series. This could be classified as a silty clay loam with moderate permeability and poor drainage. According to the soil survey organic material averages about 6%.

The other type of soil that was encountered from Main Street to the Saline was 76A Otter Series. This is classified as a silt loam with moderate permeability and rather poor drainage. The average organic matter content was estimated at 5.5%.

EROSION CONTROL

The process of erosion control has been a major consideration in designing all the typical sections. However due to the alignment of the channel, there are certain areas that would require additional erosional control methods, especially any sharp bends in the channel. The areas where special erosional control may be needed are listed in a table in the explanation of the design of each reach. This section will list some applicable methods of erosion control that could be applied to these areas.

Before getting into these specialized erosional control treatments some comments need to be made on the process of bank stabilization with grass or ground cover. This is the most predominant erosion control measure suggested in the plan and following are some general suggestions on how this could be accomplished.

One change that has been made from the present day condition is to reshape much of the bank area to slopes of 3 to 1 or flatter. This type of slope allows higher flows to spread out, consequently reducing flow velocities and potential scour problems. Even should toe erosion start at the base of the slope, the flatter ground will be less susceptible to slump type failures allowing procedures to be initiated that would check this type of erosion before it becomes too severe. It should be noted that this grass cover creates resistance to the flow. A balance must be obtained between stabilization of the bank and creating resistance to the flow. This balance could be obtained by proper maintenance of the grass or ground cover through periodic cutting. The slopes of 3 to 1 or flatter should allow for this type of maintenance. In general the allowable velocities for channels in silty loam range from 2.0 to 3.0 feet/sec. An effort has been made to keep velocities in this range. For channel sections lined with Kentucky bluegrass or a similar grass cover the permissible range jumps to from 3 to 5 feet/sec.

Some grasses that would be applicable to the type of bank stabilization suggested include Canadian bluegrass, red fescue, rough bluegrass, and Kentucky bluegrass or possibly some mixture. It may be desirable to have a mixture including annual grass to help establish the grass cover early. Some applicable ground covers for this type of work are Crownvetch, Aaronsbeard, Periwinkle and Ajuga.

The general procedure for establishing the grass cover should include the following steps:

- Clear and clean site.
- Stockpile topsoil and save, performing initial grading with subgrade.
- Install any drainage system.
- Place topsoil.
- Apply any soil modifying materials indicated by soil test (i.e. lime, fertilizer, etc.)
- Perform deep tillage (6") and smoothing.
- Apply starter fertilizer.
- Do final grading and smoothing.
- Firm up seedbed.
- Apply seed or ground cover.

The pH of the soil should be checked before seeding. It should be around 6.5. If it is over 7.5 sulfur or an equivalent substance should be added. Under 6.2, lime or an equivalent substance should be added. The starter fertilizer used in the preparation process should be high in nitrogen. The seed mixture should include at least 60% of the permanent species desired. Annual ryegrass could be added to help create a temporary cover. The seeded area should then be covered by a mulch of wheat straw, wood chips, hay or shredded bark with twine or string used to hold the mulch in place if straw or hay is used. An alternative to the mulch is the erosion fabric that could be placed over the bank and degrades over time. This however is more expensive than conventional mulch.

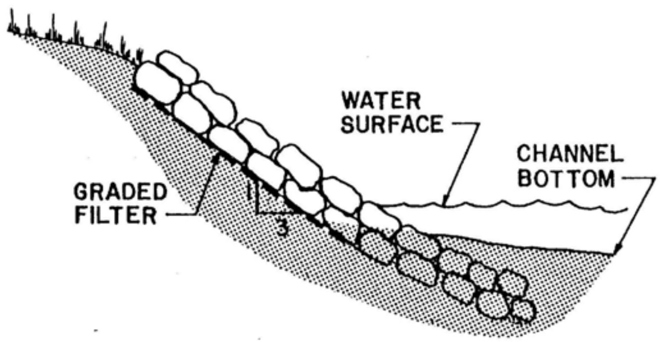
Although this type of approach should stabilize much of the bank area, around sharp turns additional measures should be taken. Three methods of controlling the erosion at the turns will be suggested here although others exist that could be considered at the time of final design. Section views of the various approaches are shown on Figure 2.

The first method would be rock slope protection or rip rap. The advantages of this type of protection are numerous.

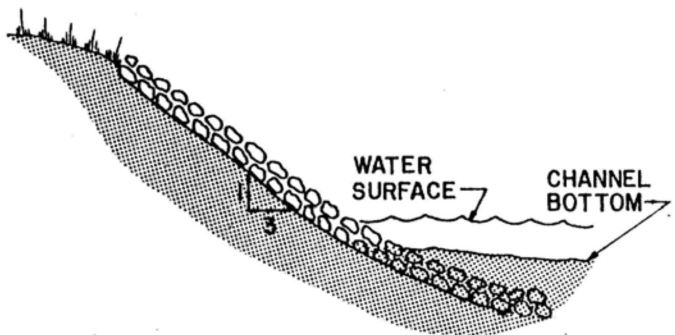
- Flexibility, not weakened by slight shifting resulting from embankment settlement.

- Local damage or loss easily repaired.
- Construction uncomplicated, no special equipment or practices needed.
- Fairly natural appearance in recreational areas.
- Possible growth of vegetation often will grow through further stabilizing the slope.
- Placement of additional thickness can be placed at the toe as needed to offset scour.

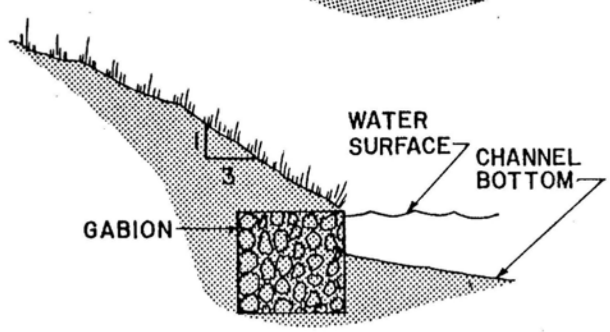
FIGURE 2



GENERAL ROCK SLOPE PROTECTION



GROUT ROCK SLOPE PROTECTION



STONE FILLED GABION

SLOPE PROTECTION

The major disadvantage of this type of treatment in this area is the lack of available stone. Rip rap made with under sized stone is of little use. In addition proper drainage must be provided for under the stone, making use of a graded filter of material in various sizes. The protection should begin below the horizon of possible scour and extend to expected high water marks. Generally the rock should be placed in two layers. Rock that is fractured, porous or otherwise physically weak should be avoided for rock slope protection.

A second method which could be used for erosion control is grouted rock slope protection. In this approach the voids in the rock armour are filled with grout. This has proven a useful technique where ordinary rock slope protection is not economically possible. Although the grouting will usually more than double the cost per unit volume of stone, the use of smaller sized stones in grouted rock slope protection allows a thinner armour layer which offsets the increase in volume unit cost. In addition the need for backing material on fine grained slopes is greatly reduced eliminating this cost. Extra care must be taken to see the grouted rock armour is not undermined. For this reason the armour must extend below the potential scour line. The ends of the armour area should be protected by smooth transitions to and from the embankment. The same type of rock quality should be sought in this type of protection although standards on specific gravity and hardness can be lowered somewhat if necessary. A good strength grout should be applied with aggregate no greater than 3/4" and a slump of 3 to 4 inches.

The final method would involve the placing of gabions at bends where severe erosion would be possible. It was felt that by burying a portion of the gabion and then covering them with grass they could protect against toe erosion without infringing on the natural aspects of the reach. Of all the methods gabions which are wire baskets filled with rock or brick would probably be the most cost effective.

MAINTENANCE

The importance of this aspect cannot be overstressed in this Master Plan. No matter how good the final design is it will never be a total success unless a periodic maintenance program is initiated and kept up. Projects of the same nature have often failed due to a lack of attention once the initial construction phase was completed. If the project is not maintained it can never function as it was designed and there would be little reason to complete it in the first place. For a project like this maintenance activities will be required in a variety of areas.

- Care of grass or ground cover used to stabilize banks.
- Care of plantings and landscape elements built into the final designs of various reaches.
- Cleaning and servicing of hydraulic elements such as culverts, flow diversions,

throttle pipes, bridge openings, etc.

- Maintenance of bikeway and its support facility.
- Weed control and maintenance of banks at permanent pool.
- Cleaning of detention basin of accumulated sediment.

This is only a partial list of the type of maintenance activities that would have to be performed on a regular basis. At the time of final design in a given section a full commitment to maintenance of the final product should be made.

METHOD OF FLOW REDUCTION

Increased urbanization in the drainage area served by the Boneyard will continue to place a greater strain on the flow conveyance capacity of the sections designed for this master plan. For this reason the two cities must attempt an even more concerted effort at initiating on site measures to reduce and delay urban storm runoff. The following is a listing of some methods proposed in the Soil Conservation Services technical release No. 55.

- Cisterns and covered ponds
- Rooftop gardens
- Surface pond storage in residential areas
- Ponding on roofs by constricted downspouts
- Increasing roof roughness (rippled roof or gravel)
- Porous pavement (parking lots, alleys)
- Vegetated strips (parking lots, street medians)
- Ground water recharge (perforated pipe, french drains)
- Routing flows over lawns

Studies have shown that in a 200 acre urban watershed, peak flow was reduced by 8% through the use of gravel minidikes on slightly slanted roofs. In another case, grass protected infiltration trenches controlling parking lot runoff reduced flood peaks by 5%. A major contribution could be made by the initiation of measures to cut down on the amount of runoff rather than simply attempting to convey it out of the area.

CHAPTER 2: REACH DESIGN CRITERIA

EDGEBROOK

Flooding Problem

The area encompassing the reach designated as Edgebrook has generally been treated in terms of a minor priority for flood control improvements. This approach can be justified for a number of reasons.

- A relatively small number of drainage connections are made throughout the reach. (The major exception would be the culvert extending from Market Place Mall but the flow from this area is controlled by an existing detention pond).
- High water marks in the area tend to indicate flow levels within reasonable proximity to the creek.
- Much of the surrounding area is underdeveloped in comparison to other reaches, minimizing the potential damage of overbank flows.
- The existence of the North Boneyard Diversion structure serves to control any downstream impact this reach would have on the flow and peaking characteristics of subsequent reaches.

It has been assumed that the flood plain through this area would be fairly narrow and problems in controlling the 10 year design storm would result more from inadequate culvert conveyance than insufficient channel capacity.

The flood plain work undertaken by the Illinois State Water Survey did not extend into the Boneyard Creek reach designated as Edgebrook. Based on the assumption that the diversion would for all practical purposes control the 100 year flow from this drainage area, it was felt that no flood study work was required in the Edgebrook reach. Consequently some design flows were calculated for this reach based on the regression equations developed in U.S. Geological Survey Water Resources Investigations 77-117.

It should be noted that in general the equations apply to rural drainage basins and while they might provide an approximate flood flow value, consideration should be made to adjusting the values for the urbanization. After further investigation it was concluded that for the purposes of this study the computed values would provide adequate design criteria. Some of the reasons justifying this assumption are the following:

- At the present time the degree of urbanization along much of the reach is less than for the overall project area, and in fact is more representative of rural characteristics.
- Comparison of values of the Carns publication regression equations and those of a

frequency distribution based on the historic record of flow at the U.S.G.S. gaging station at the Firehouse showed the quick peaking characteristics of the Boneyard to cause more frequent return period storms (1, 2, 5 year) to be under estimated by the regression equations, while the 10 year and above was actually over estimated by the regression equations. Assuming this effect to be fairly constant, it appears no adjustment was needed for the degree of accuracy needed in this study.

- Fairly low potential exists for extensive flood damage.
- Entire reach design is based on value calculated for overall basin rather than trying to reduce it upstream. This will lead to increased storage through most of the reach.
- The proposed sections, often quite close to the existing ground surface, will be capable of passing higher flows in many areas, again leading to increased storage and a minimization of flood damage potential.
- In the 16 years of operation, the diversion structure at Neil Street has never been seen to come close to its 360 c.f.s. capacity under normal conditions. (Note the only time any overflow has been mentioned occurred when the level of the Saline caused a back-up, cutting down the structure capacity.)
- The value of the basin area was selected conservatively, possibly causing slightly conservative design values.

Design Flows

Based on an average reach slope of .003 and a drainage area of 560 acres, the following table lists the 10, 50 and 100 year peak discharge as calculated by the regression equations.

Recurrence Interval	Peak Discharge
10 year	214 c.f.s.
50 year	330 c.f.s.
100 year	380 c.f.s.

The selected design flow for this entire reach was the basic criteria of channel control (i.e. no out of bank flooding) for the 10 year storm or 214 c.f.s.

Corridor Width

The basic flow corridor width for this reach is 45 feet. This is the recommended width used to transport the flow through the reach. It has been designed to limit development or plantings in this area to void reductions in needed capacity. Included in this 45' width are the 4' to 5' dry weather channel, bikeways varying from 6.5' to 9' and adequate open space to maintain 3 to 1 slopes or flatter. In addition, this corridor could be expanded where available space allows for screening, plantings, and further development. Anywhere a section differs from this width it is noted in the text on that section.

Reach Sections

The applicability of the information to follow may be slightly altered when actual survey data is available for the Edgebrook reach. The design concepts presented in the Master Plan were based on a visual survey of the area accompanied by spot measurements made at various stages of the planning process. For the purpose of this study, it has been assumed that the channel bottom maintains a fairly uniform grade of .0029 up to the Henson Place Culverts, .0078 through the culverts, then .0025 to the entrance of the Holiday Inn parking lot culvert. At present, this culvert appears to have a slightly adverse slope to it. In many areas through this reach, no alterations are being proposed to the present dry weather channel. Consequently the final grade proposed in this section will vary slightly from the present assumptions once the survey information for the final design process is obtained.

From the beginning of this reach to the entrance of the willow grove around station 13+70, the present condition of the channel fits well into the concept of a natural section with gentle slopes to control the rise of flow during storm events. It appears that this section of the reach has been previously relocated to obtain its present alignment. The section runs in a series of straight sections with rather abrupt turns. The majority of the sections have been designed to provide slopes stabilized with grass or ground cover, mild enough to avoid erosion problems, and allow machinery maintenance. For these reasons the slopes are 3 to 1 or flatter in all sections. Slopes steeper than this might be acceptable in terms of erosion but present a maintenance problem, and consequently have been avoided wherever possible. It is suggested that cross section reshaping be done only where extensive erosion is present or the natural ground contours differ markedly from the suggested sections. An effort should be made to integrate the existing vegetation especially the trees in the willow grove into the shaping process. This will call for some flexibility in the bikeway location throughout the reach. Those locations suggested in the section represent an average position to be used as a guideline. Care should be taken not to raise ground elevations around the existing trees to a degree endangering them.

The bikeway design through this reach will generally be type A in order to allow access of the area by both emergency and maintenance vehicles. The exceptions to this would be at the Henson Place culvert and in the vicinity of the Holiday Inn.

The following text will refer to the typical sections for the reach. An explanation of the design criteria for each and the sections of the reach they would apply to will be included. Table 1 provides a listing of design flows and capacities for the typical sections designed for the reach. Table 2 lists the stationing of portions of the reach where various sections would apply.

Typical Section I

The section defines a good approximation of the existing ground surface in the early portion of the reach. It is based on a 45' corridor section which is explained in an earlier portion of the text. The section consists of three sub-sections. The first of these is the dry weather flow channel. In general, the shape of this section would be trapezoidal with the bottom being parabolic. Under conditions of low or intermittent runoff, this section tends to hold its shape better than the triangular or trapezoidal section. It also tends to concentrate flow during low flows to decrease siltation. Most natural sections tend to approximate a combined section involving trapezoids and parabolic bottoms. In many areas of this reach, the condition of the natural channel is quite good and could be used with some added erosion control. This is encouraged wherever possible. Eventually the side slopes of the dry weather channel will erode back to the stabilized edge closely approximating the natural dry weather channel that presently exists. It should be realized that with this small section it would be impossible to conform exactly to the trapezoid or parabolic shape, but this serves only as a general guideline. (The dry weather section would carry about 1 c.f.s. in the parabolic portion and approximately 5.5 c.f.s. to the top of the dry weather channel. This will handle all small storm events for the reach.

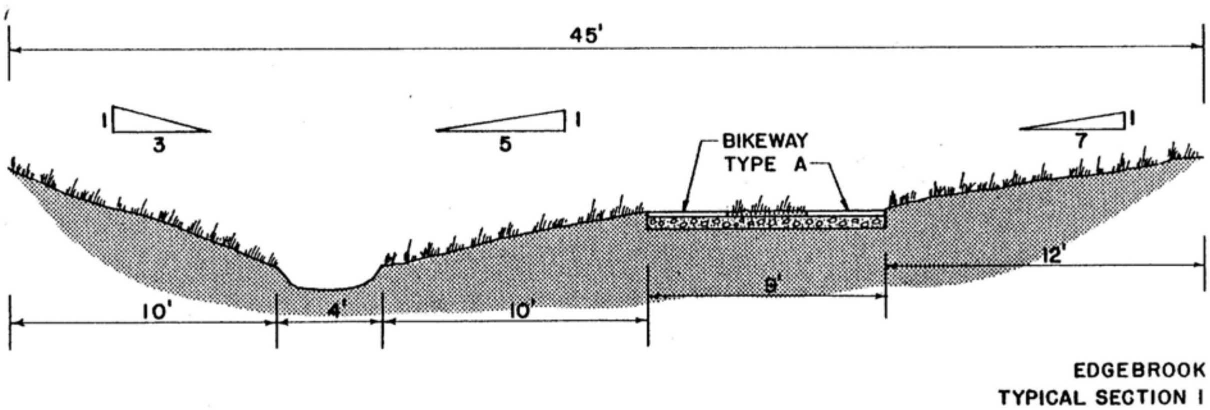
The rest of the section could be divided into the area of the section below the bikeway elevation and the rest of the section up to the elevation reached at the top of the 45' corridor. The characteristics of the rest of the section attempt to account for the existing ground shape to minimize the need for extensive excavation or reshaping. The slopes have been maintained at 3 to 1 or flatter which will allow for mowing of slopes which is very important in reducing the roughness factor and controlling the mosquito population. An attempt has been made to allow high flows to spread out through the section in order to keep velocities at acceptable levels for scour control. Only during very large storm events will the added capacity above the bikeway elevation be needed to handle the flow.

Consequently, the bikeway will only be infrequently inundated during the course of a normal year. Even when the flow does rise to the bikeway elevation, it will remain there only for a short duration before receding. All slopes should be stabilized with grass or ground cover depending on the physical surroundings. Although some plantings of trees or shrubs could be placed in this flow corridor, they would have to be tolerant to occasional wet conditions and should be kept to a minimum in order to preserve the flow carrying capacity.

It appears that in many areas additional width could be added to the corridor. In terms of the plan it is important to remember that the 45' corridor is a minimum criteria being used to control flow and could be expanded on in areas where the opportunity presents itself.

The various sections through the reach have been designated in Table II, with the stationing applying to the accompanying plan/profile sheets.

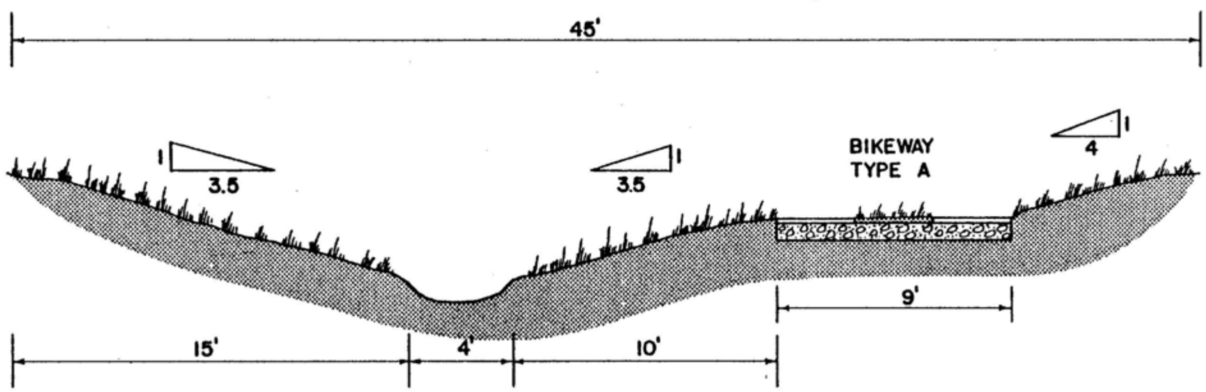
FIGURE 3



Typical Section II

This section is basically a duplication of Section I, except for a redistribution of the available 45' corridor width. At the present time there are some areas, where due to minor constrictions, the distribution shown in Section I would not be possible. To eliminate this problem some of the area, specifically five feet, has been shifted to the narrow side to allow construction under present conditions. All other criteria and reasoning for the design of this section are basically the same as Section I. Should future conditions remove the constrictions, this section could be replaced by Section I.

FIGURE 4

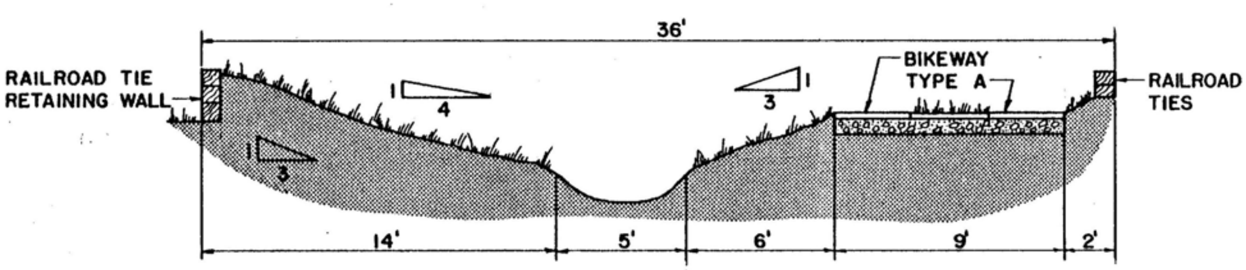


EDGEBROOK
TYPICAL SECTION II

Typical Section III

This section has been designed for one specific area. For the first 345' along the Holiday Inn a construction exists that does not allow a full 45' section without some type of land acquisition. An alternate 35' section has been designed that would allow construction without the additional land acquisition. Again should future conditions eliminate the obstruction or make land readily available, one of the 45' sections could be applied. Along much of the 345' the ground elevation on the left bank (looking upstream) appears to be too low. This low bank could be raised using the cut material taken out of the right bank to install the bikeway. Along this built up section either a small railroad tie retaining wall or additional R.O.W. for grading would be needed. The dry weather channel would be basically the same as described for Typical Section I except for an increase of 1 foot in the width of channel. On the right bank, the bikeway has been lowered below the existing ground elevation to provide sufficient flow capacity. Again a small railroad tie retaining wall may be needed to raise the elevation to the existing ground outside of the corridor. All slopes were maintained at 3 to 1 or flatter.

FIGURE 5



EDGEBROOK
TYPICAL SECTION III

Typical Section IV

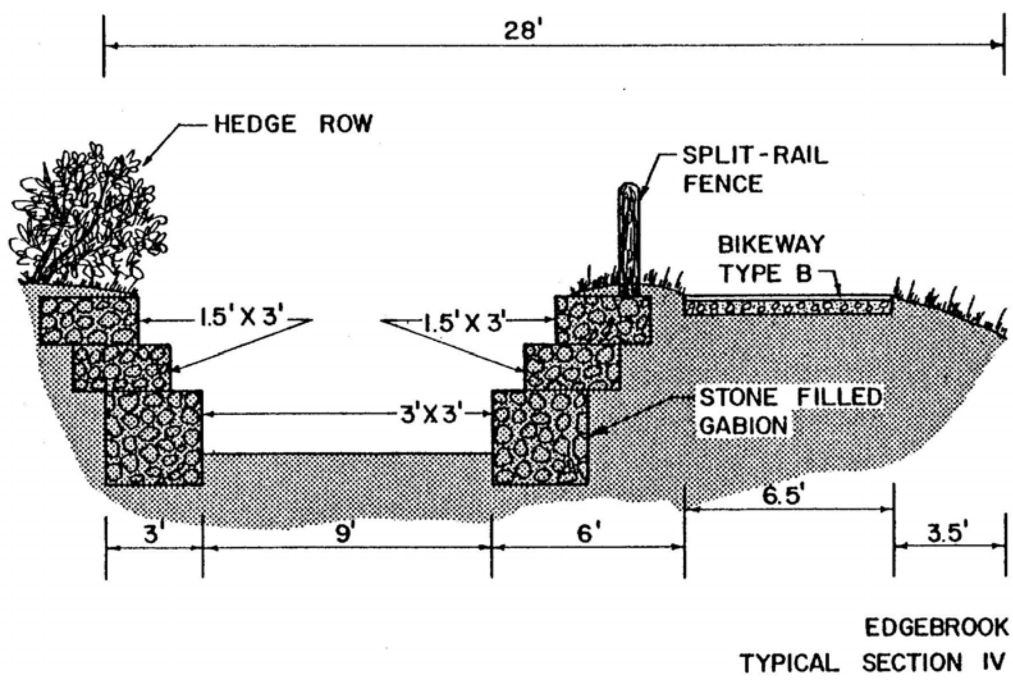
This section is needed as the construction provided by the Holiday Inn and a duplex on Briar Lane, causes, even a further reduction of available channel area. In this case, the Problem is severe enough for some type of a hard edged section. In the section shown, gabions have been proposed as the material for this hard edge based on economic considerations, lack of maintenance time, and ease of installation. The section could also be constructed of stone or concrete if this was deemed a better solution at the time final design is completed. The bikeway along this 165' length of this treatment would be Type B. Access for maintenance or emergency vehicles is already available just to the right of the section corridor.

Sod would be placed over the gabions to establish a grass cover and a small grass slope would be established on the far right side of the Section.

On the left side of the section some type of hedge would be established to protect against someone falling into the channel. On the right channel it appears that there is insufficient room for plantings and consequently some type of split rail fence could be used. This type of fence would provide sufficient protection while allowing clear sight lines to the channel.

Some excavation would be needed to establish channel sections, but the section attempts to balance the cut and fill areas to avoid any hauling away of removed earth.

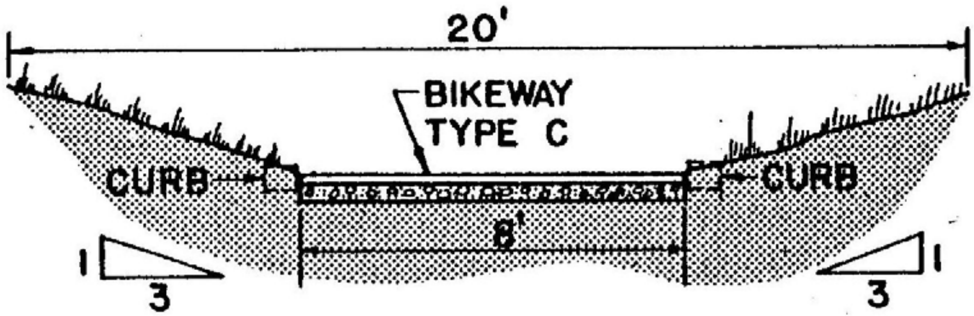
FIGURE 6



Typical Section V

This section applies specifically to the 265' length of the reach be-hind Henson Place where the Boneyard will be left covered. It will be located directly over the culvert and provide an overflow channel for large storm events that would exceed the capacity of the culvert. This excess flow would be channeled above the culvert along the bikeway and drop back into the larger channel available at the culvert outlet. In this manner, the bikeway section can serve as a secondary conveyance channel. The slopes on either side of the bikeway would be 3 to 1 for maintenance purposes and covered with grass or ground cover. These slopes have to be built up using excavated material from somewhere else in the reach.

FIGURE 7



EDGEBROOK
TYPICAL SECTION V

TABLE 1

HYDRAULIC CAPACITIES EDGEBROOK

Section (Slope)		Design Flow	Flow to Bikeway Edge	Maximum Channel Flow	Average Velocity
I.	(.0025)	214.0 c.f.s.	62.7 c.f.s.	244.8 c.f.s.	3.0 feet/sec.
II.	(.0025)	214.0 c.f.s.	79.4 c.f.s.	334.9 c.f.s.	3.6 feet/sec.
III.	(.0025)	214.0 c.f.s.	91.2 c.f.s.	314.1 c.f.s.	3.6 feet/sec.
IV.	(.0020)	214.0 c.f.s.	~~~	235.0 c.f.s.	4.4 feet/sec.
V.	(.0075)	114.0 c.f.s.	~~~	133.0 c.f.s.	5.1 feet/sec.

TABLE 2

SECTION DELINEATIONS FOR REACH I

Station	Section Type
0+00 to 1+84	II
1+84 to 5+80	I, II
5+80 to 6+30	Crossover Area
6+30 to 13+70	I
13+70 to 16+80	II
16+80 to 19+00	II
19+00 to 20+00	Crossover Area
20+00 to 21+80	I
21+80 to 24+45	V
24+45 to 29+15	I, II
29+15 to 32+60	III
32+60 to 34+25	IV

TABLE 3

SPECIAL EROSION CONTROL

Station

1 + 84
5 + 80 to 6 + 30
9 + 60
11 + 30
16 + 80
19 + 00
20 + 00
29 + 15

NEIL/MARKET

Flooding Problem

The Neil/Market reach has exhibited minimal flooding problems since the installation of the diversion structure at North Neil Street. This structure has effectively channeled the flow from the basin above Neil Street directly to the Saline Branch, significantly decreasing the flow in the Neil/Market reach. The diversion should remain operative, although a slight modification has been suggested that would allow the structure to divert only during storm events when the flow removal actually serves some purpose. During dry weather the flow would continue in the natural channel by having a 12" throttle pipe remove the water from behind a 1' weir installed at the beginning of the diversion structure. This pipe has been sized so that the maximum release rate would be limited to 10 c.f.s. under the worst condition. This would not be enough of a flow increase to cause any flooding problems downstream. It appears that the culverts and bridge openings were sized for a past condition that involved flow from the upstream basin but probably not the degree of urbanization that exists today. Since the large majority of the upstream flow would still be eliminated during storm events, with some cleaning of the existing culverts and bridge openings, sufficient flow capacity will be available. In some cases this does not even mean removal of all the sediment from the culverts. With the reshaped, cleaned out channel proposed the flow capacity of this reach will be well above the design flow levels. In the process of providing gently sloped banks of 3 to 1 or flatter, the channel capacities are well above the 10 year design flows. It is safe to assume that the flooding problems in this reach will be well controlled.

Design Flow:

The design flows for this reach were based on the flood study work done by the Illinois State Water Survey on the Boneyard. These flows were calculated using the Illudus and TR-20 computer programs. In this case the 10 year storm was again used as the minimal flow control criteria throughout the reach. Two basic design flows were used for the reach. Up to the Market Street location one value was applied and then slightly increased for the portion of the reach between Market Street and Collegiate Cap & Gown. The S.W.S. values were increased by 10 c.f.s. throughout the reach to account for the worst 10 year condition possible due to the added flow from the diversion structure. In reality the 10 year storm would not produce enough head in the diversion structure to cause a 10 c.f.s. flow in the throttle pipe under normal operation. On the assumption that some type of blockage could occur in the diversion simultaneously with the 10 year storm, the full 10 c.f.s. addition was used. It has been assumed that extensive pressure flow would not be possible through the diversion structure. The following is a listing of the design flows used:

Location	Recurrence Interval	Peak* Discharge
Neil to Market	10 yr.	24.3 c.f.s.
Neil to Market	50 yr.	32.7 c.f.s.
Neil to Market	100 yr.	38.3 c.f.s.
Market to Bradley	10 yr.	27.0 c.f.s.
Market to Bradley	50 yr.	37.0 c.f.s.
Market to Bradley	100 yr.	43.7 c.f.s.

*10 c.f.s. added to all S.W.S. flows

The selected minimal design flows were 24.3 c.f.s. from Neil to Market and 27.0 c.f.s. from Market to Bradley.

Corridor Width

The flow control corridor for the Neil/Market reach is considerably narrower than the Edgebrook reach although many of the general design concepts remain. Two factors dictated this change in corridor width. The flows for this reach are considerably smaller than for other reaches. Even with the proposed 25' width, the channel capacity will be well above the 10 year storm minimum. Secondly, there has been some relocation proposed to make the creekway more accessible yet keep mandatory land acquisition to a minimum. With this criteria it would be possible to construct the proposed alignment with some land acquisition and some minimal right of way agreements. This type of approach was felt to be justified for a number of reasons.

- The overall reach character is residential and consequently, the usage of any linear park should be limited.
- This approach would allow immediate construction while allowing for an increase in the corridor if the land becomes available.
- The corridor could still be constructed for intermittent flows if the diversion is not altered. It was felt the need for a 45' corridor if no flow was present became minimal.

In this reach, due to the existence of numerous street and alleyway connections, the bikeway would not have to provide a route for maintenance or emergency vehicles. Consequently, a Type B bikeway is sufficient. The corridor of 25' is based on a 6.5' bikeway width, 4' channel width, and sufficient open space to maintain slopes 3 to 1 or flatter.

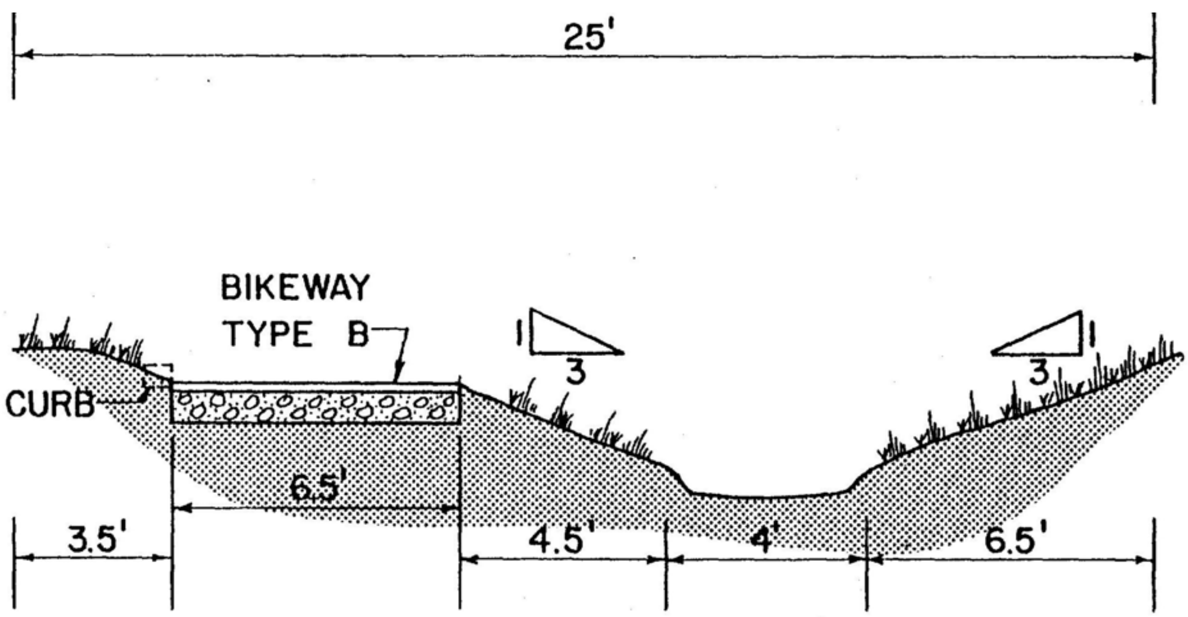
Reach Sections

As previously stated this reach has been proposed with a 25' flow corridor. The corridor would start just east of Neil Street as a dry swale, except during storm events, up to Champaign Street. The typical sections show a dry weather channel but for this portion of the reach, the entire section could be grassed over as no dry weather flow would exist. A 12" throttle pipe would run from the diversion structure but due to the lack of fall in the beginning of the reach could not discharge into the channel until reaching the area of the Champaign Street culvert. Due to the new alignment that would make use of some mid-block alleys, new culvert crossings would be needed at Walnut Street and Bellefontaine Street. It appears that 36" reinforced concrete culverts would be sufficient. The general concept would be the same as that used in the Edgebrook reach. This calls for a natural channel with gentle sloping banks to allow the high storm flows to spread out. In certain areas where realignment has taken place or the original channel would be cleaned of silt deposits, the ground elevations become too high to allow for gentle slopes in a 25' width. To handle these small hard edges, channel walls have been proposed rather than the natural channel. The proposed section shows stone walls but other materials could be substituted. This discussion is handled in more detail in the text dealing with Typical Section IV. This general approach is taken up to the Bradley Avenue crossing at which point a 42" culvert has been proposed for water quality purposes. The bikeway treatment would leave the flow corridor at this point due to the Cap & Gown culvert. There does not appear to be a good practical solution to the removal of the Cap & Gown culvert so it has been assumed that from Bradley to the Illinois Central Railroad tracks, no user corridor is justified. It was felt that water quality would be better if the Boneyard ran in a closed culvert through this area to the outlet of the culverts under the railroad tracks.

Typical Section I

Section I is based on a corridor width of 25'. It consists of three basic flow sections. The first is the dry weather channel composed of a combination trapezoidal and parabolic section. Basically the comments made about the dry weather channel for the Edgebrook reach are applicable in this case. The width of the channel is slightly less, being 4' wide. The rest of section is divided into one flow area up to the bikeway and a second area including the rest of the section to the top of the 25' width. All slopes for this section would be 3 to 1 and stabilized by either grass or ground cover. Even during full flow conditions velocities will be low enough to prevent excessive erosion. The bikeway would be Type B in this section or 6.5' wide. It would not be designed to allow use by emergency or maintenance vehicles. The basic difference in this section from Typical Sections II and III is the way the open area is distributed to obtain the depth from the top of the section to the bottom of the channel. In this case the overall depth of the section would be about 3.0 feet.

FIGURE 8

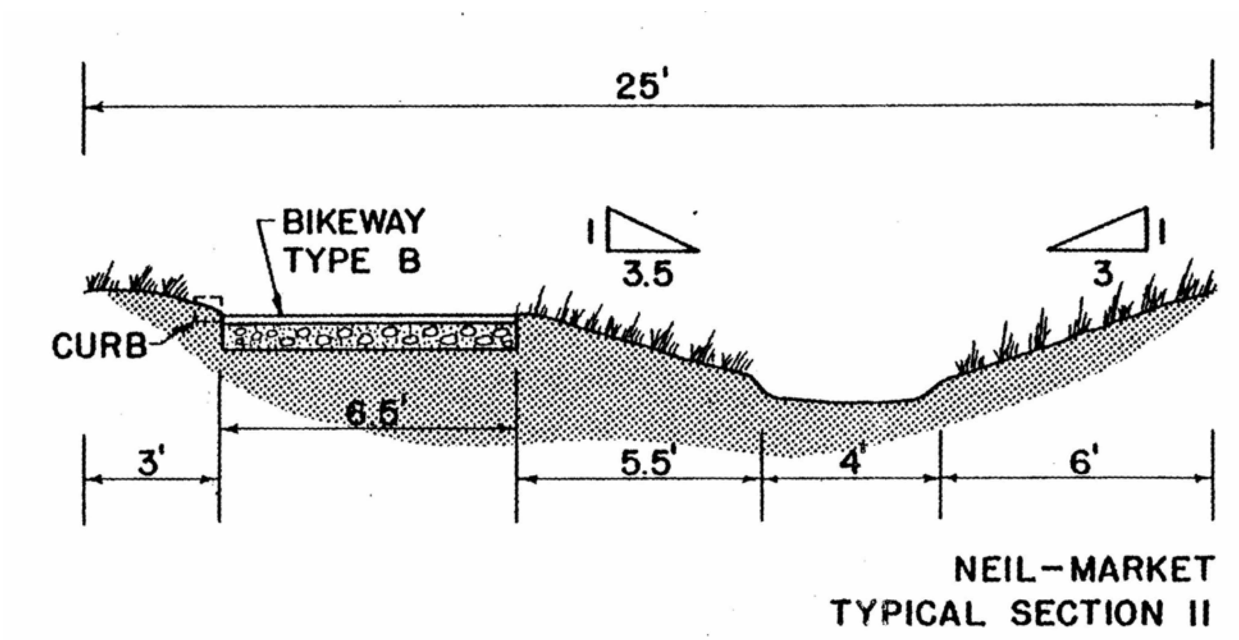


NEIL-MARKET
TYPICAL SECTION I

Typical Section II

Section II is basically the same as Typical Section I with the exception of one aspect. Due to a 3.5 to 1 slope and a slight variation of the bank open space distribution, the depth from the top of the section to the bottom of the channel is less. For the given section, the depth is approximately 2.5 feet but could go to 3 feet by changing the left channel closer to the bikeway. In general, this section would be applied in the upper end of the reach where a very narrow dry swale now exists. However it would not be applicable in the relocated portions of the upper reach.

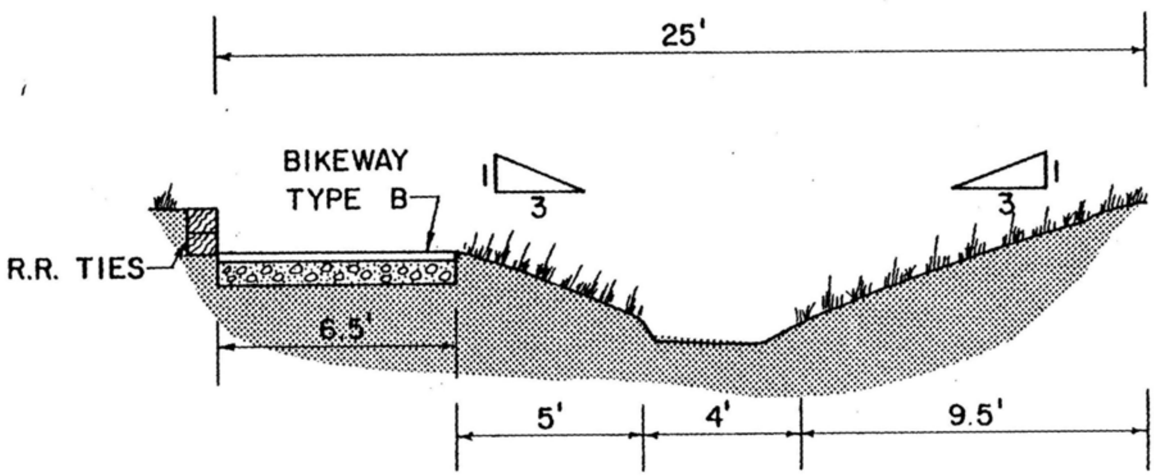
FIGURE 9



Typical Section III

The design concepts employed in this section are similar to those used in Section I and II. There are two major features that differ from the previous sections. The depth in this section from top of section to channel bottom is between 3.5 and 3.75 feet. Within a 25' corridor it was not possible to obtain the needed depth while maintaining the 3 to 1 slope with the arrangement exhibited in Sections I and II. To over-come this small, hard edged section was placed on the left side of the cross section and both the bikeway and channel shifted to the left. The hard edge would take up 1 foot in elevation and could be constructed of two railroad ties. It was felt that this would be the most cost effective approach although the small wall could be constructed of other materials if a more cost effective material is available.

FIGURE 10



NEIL-MARKET
TYPICAL SECTION III

Typical Section IV

In various portions of the reach, the depth from the top of the section to the bottom of the channel must be greater than provided for any of the previous sections. It would not be possible to accomplish this and maintain 3 to 1 slopes. The alternative was to go to a wide section or a hard edged flow channel. In order to maintain the possibility of construction under present conditions, the hard edged approach was selected over the wider section option. The rest of the section follows the design standards set forth in the discussion of earlier sections.

Some flexibility would be available in the materials used to construct the short channel walls. Those shown in the section would be of block with a stone veneer or large stones. Other possible approaches could involve concrete, grouted gabions, railroad ties or some combination of materials.

FIGURE 11

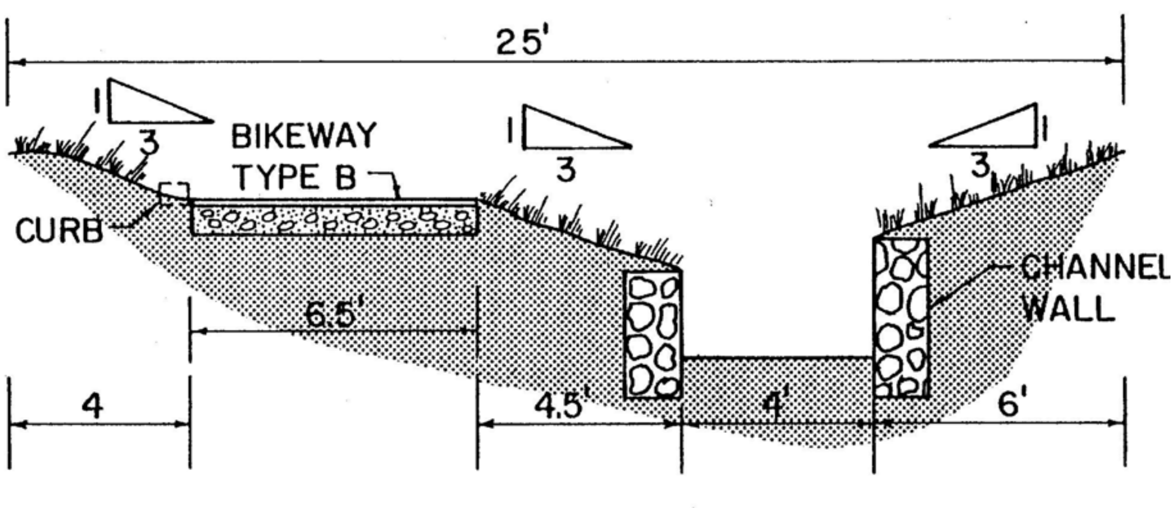


TABLE 4

HYDRAULIC CAPACITIES NEIL/MARKET

Section (Slope)	Design Flow	Flow to Bikeway Edge	Maximum Channel Flow	Average Velocity
I. (.0025)	27.0	48.9 c.f.s.	71.8 c.f.s.	2.0 feet/sec.
I. (.0012)	27.0	33.9 c.f.s.	49.8 c.f.s.	1.4 feet/sec.
II. (.0012)	24.3	16.3 c.f.s.	40.4 c.f.s.	1.5 feet/sec.
II. (.0010)	24.3	14.5 c.f.s.	36.9 c.f.s.	1.9 feet/sec.
III. (.0012)	27.0	29.6 c.f.s.	86.3 c.f.s.	2.0 feet/sec.
III. (.0025)	27.0	42.7 c.f.s.	124.5 c.f.s.	2.8 feet/sec.
IV. (.0012)	27.0	32.5 c.f.s.	75.6 c.f.s.	1.8 feet/sec.
IV. (.0025)	27.0	46.9 c.f.s.	109.1 c.f.s.	7.6 feet/sec.

TABLE 5

SECTION DELINEATIONS REACH II

Station	Section Type
0+00 to 3+30	IV
3+95 to 5+50	I, II
5+50 to 8+15	I, III, IV
8+15 to 9+45	I, III, IV
10+25 to 11+65	I, III
11+65 to 12+93	I, III
13+24 to 16+11	I, III, IV
16+81 to 18+71	IV
19+61 to 23+11	IV
23+91 to 28+16	I, III, IV

TABLE 6

SPECIAL EROSION AREAS

Special
5 + 50
8 + 15
11 + 65
11 + 85
14 + 49
17 + 51
24 + 31
26 + 41
27 + 16

OAK/ASH

Flooding Problem

The flooding problem in the Oak Ash reach stems from the large amount of flow added by the west branch of the Boneyard at the beginning of this reach. This, in addition to the flow coming from the normal Boneyard channel, must be passed through a double culvert under the Illinois Central Railroad tracks. Under present conditions the capacity is limited by a blockage of the culverts due to sediment deposits. Due to the inability of the culverts to pass the flows encountered, the tendency is to create a large pond of water behind the entrance to this culvert system. It is possible that by cleaning and maintaining these culverts sufficient capacity would exist to pass the 10 year design storm. However, this would cause even larger peaks downstream possibly compounding an already existing flooding problem. For this reason a more extensive flood control approach was taken than just passing the flow through this culvert. After crossing the Norfolk & Western Railroad line, the reach again has a change in character where the creek meanders as an open channel through a residential area. In this portion of the reach some flooding due to bridge opening capacities and channel capacities could take place.

The design flows through this reach are based on the assumption that a detention basin to control the flow in the west branch would be built. Consequently, for the 10 year design storm a controlled release would take place from the detention basin that would average 10 c.f.s. and would not go above a peak release rate of 15 c.f.s. The outlet structure should be designed to perform under this criteria. In reality the release would vary with the head created on the orifice opening by the level at the water surface in the detention pond.

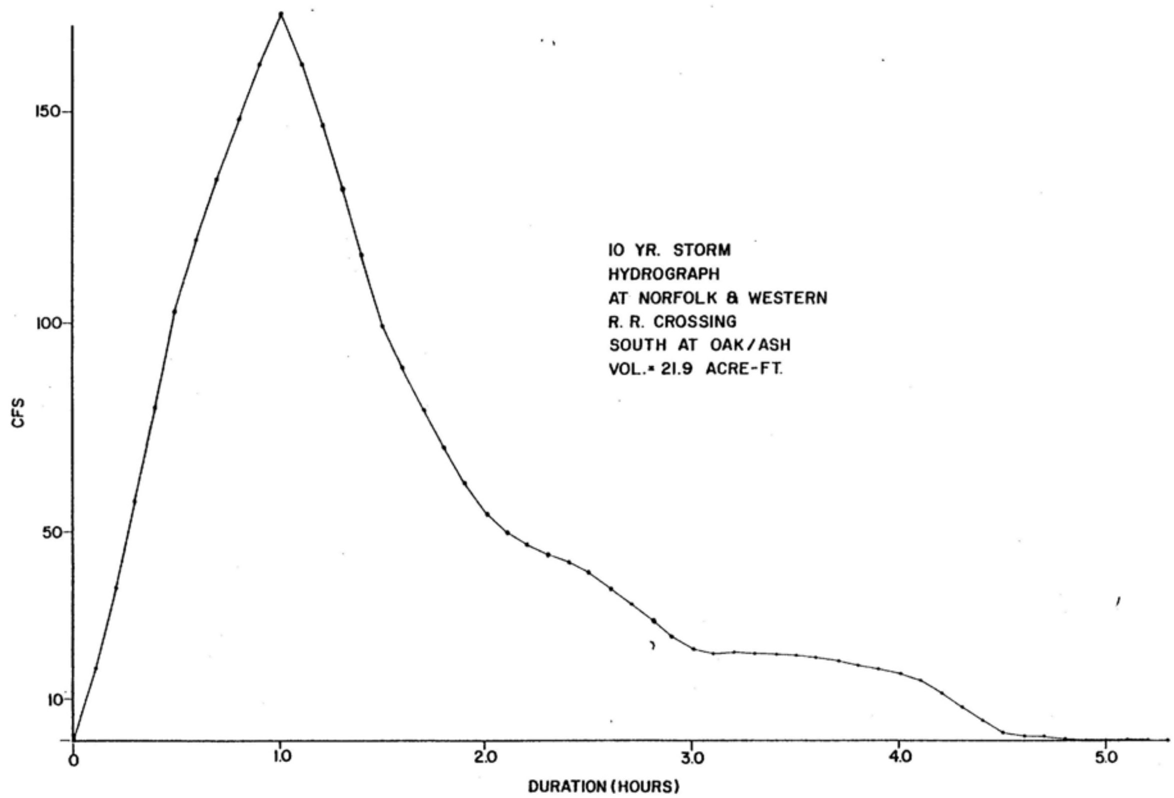
The effect of this detention basin was put back into the 10 year TR-20 model assuming a worst condition of almost constant release at 15 c.f.s. from the west branch detention basin. This provided a design flow at 98.9 c.f.s. for the remainder of the Oak Ash reach after the outlet under the Norfolk & Western Railroad line.

In addition, a permanent pool has been proposed for the 0ak Ash area. This pool, if constructed, would provide the needed storage to control the flow from the North Branch of the Boneyard. The release rate here could be controlled with a 5 c.f.s. peak release rate. This would further reduce the downstream flows to the remainder of the Oak Ash reach and the Second Street reach. However, although the reduction was computed by altering the TR-20 10 year storm model, the subsequent reaches were designed with flows only affected by the west branch detention basin. In this way these designs could be constructed without the construction of the permanent pool at Oak Ash coming first. Hydrographs have been included that show the proposed Boneyard flow coming into the Oak Ash pool and west side detention basin.

Corridor Width

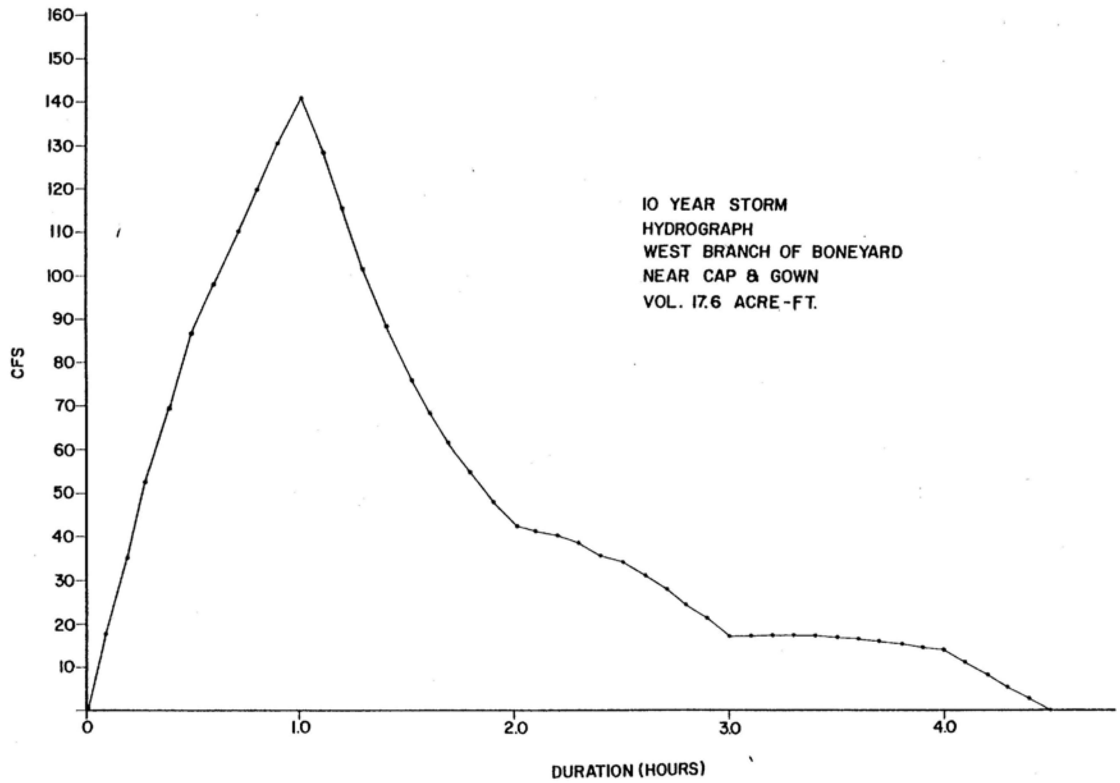
This design criteria applies only to the portion of the reach between the outlet under the Norfolk & Western Railroad line and Church Street. It was felt that it would be possible to continue the 45' corridor through this section of the Oak Ash reach. This would, however, require the acquisition of land in some areas where the constriction presented by a house would not allow a corridor of this width. Again, in areas where additional open space is available the corridor could be extended to allow greater development. Included within the corridor would be a 5' wide dry weather channel, a 6.5' type B bikeway (sufficient vehicle access provided by streets and alleys) or 8' Type A bikeway, and open space to allow channel slopes of 3 to 1 or flatter.

FIGURE 12



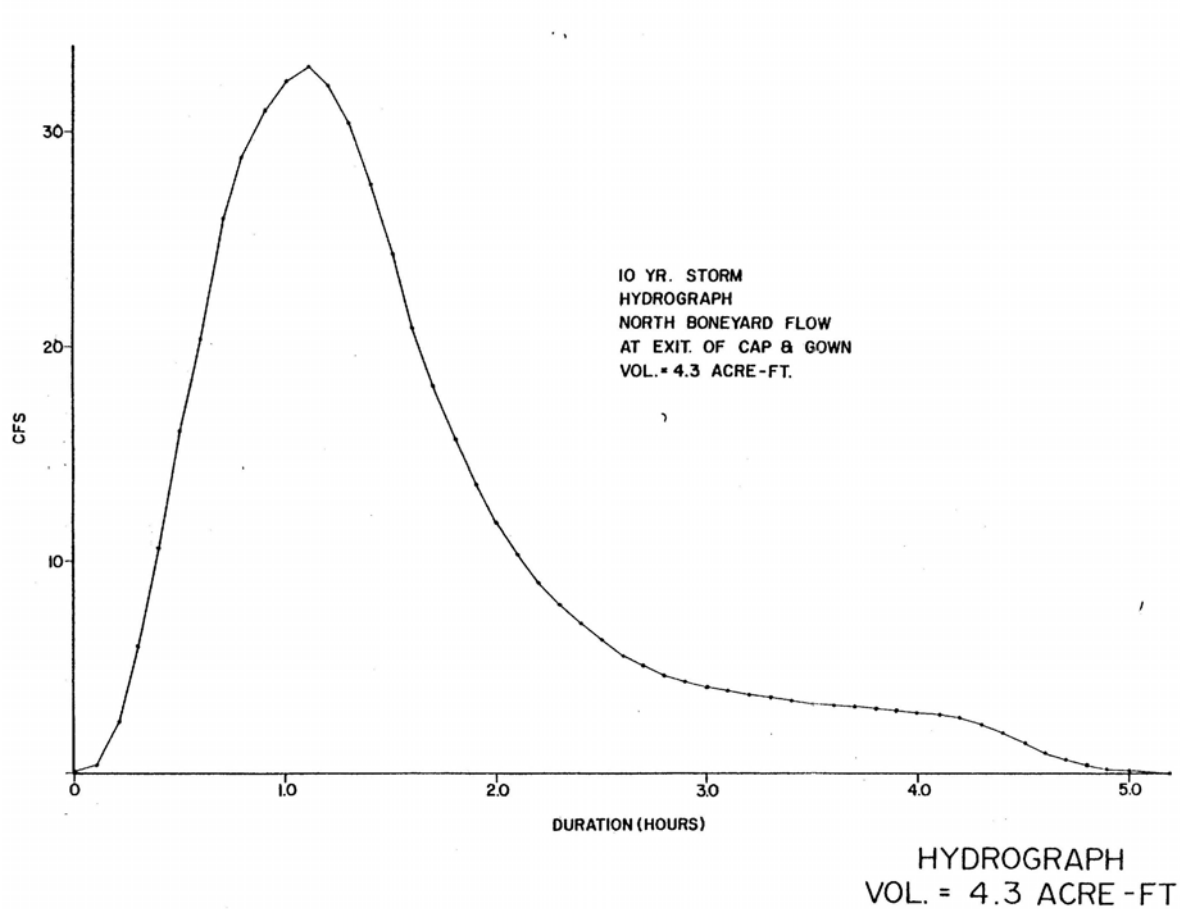
HYDROGRAPH
VOL. = 21.9 ACRE-FT.

FIGURE 13



HYDROGRAPH
VOL. = 17.6 ACRE - FT.

FIGURE 14


30
20
10
CFS
0
1.0
2.0
3.0
4.0
5.0
DURATION (HOURS)
10 YR. STORM
HYDROGRAPH
NORTH BONEYARD FLOW
AT EXIT. OF CAP & GOWN
VOL. = 4.3 ACRE-FT.
HYDROGRAPH
VOL. = 4.3 ACRE-FT

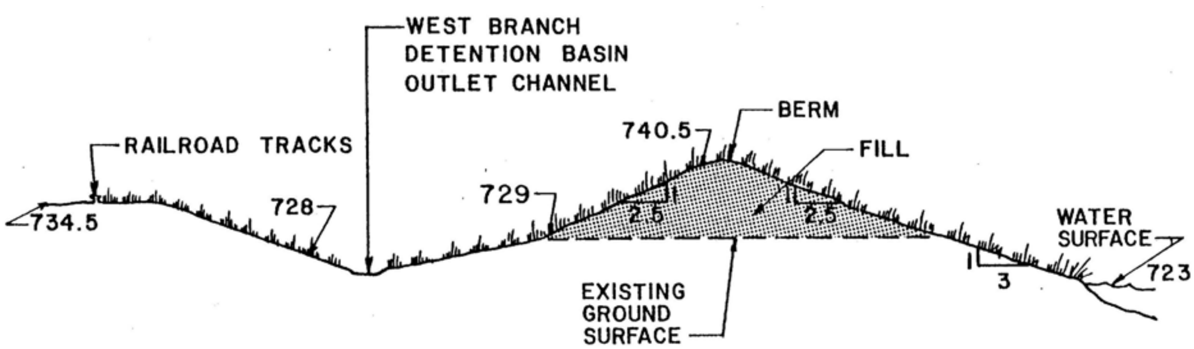
Reach Sections

The first major elements proposed for this reach were the detention basins to be placed at the top of the reach. Due to the constriction at the railroad tracks, this area was already serving as a detention basin. It was felt that a properly operating detention basin could be created for the west branch that would allow the downstream flood control benefits while avoiding inundation at large areas upstream. The decision to have a detention basin separate from the permanent pool at Oak Ash was based on two factors. By separating out the effect of the west branch, the development of downstream proposals such as Second Street became possible; regardless of when the permanent pool was developed in the area east of the railroad tracks. Secondly, the quality of the water from the west branch would greatly decrease during storm events due to washoff from the railroad right-of-ways and the numerous storm sewers feeding into it. Although this is true of the north branch also, by placing the flow in a culvert at Bradley Avenue some of the quality problems would be reduced. By allowing only the flow from the north branch to reach the permanent pool, it was felt that the quality of water in this pool would be improved. Also by keeping the majority of the flow from passing through the permanent pool the problem of sedimentation would be decreased. The majority of the sediment coming out of suspension would take place in the west side detention basin where it could be more easily removed. The size of the detention basin would be approximately 3.4 acres just to the south of Collegiate Cap & Gown. In general the elevation of the ground in this area is about 730.0' although it varies somewhat. This area would be excavated down so that 3 acres were at elevation 725.0'. This would then provide a minimum of 15 acre-feet at storage area for storm events. The existing double culvert outlet under the railroad tracks would be modified so that a double box would allow flow to be split between the two culverts. The flow from the north branch at the Boneyard would flow through a closed 36" conduit to the northern most box at the modified crossing of the railroad tracks. The other box would have an orifice opening that would allow a maximum of 15 c.f.s. to pass through it under a head at 5'. In this way the release from the detention basin would be controlled by gravity and yet the flow from the west branch would be separated. The detention basin would be a grassed area and some type of fencing would be provided so that during storm conditions when water was present in the basin it did not become a safety hazard. The top of the double box inlet structure would be covered with some type of grate at an elevation of 730.0 feet. In this manner if the storage available in the detention basin is used up by a storm larger than the 10 year storm a greater release will pass through the double culvert to minimize potential flooding in this area.

Under normal conditions the flow from the west side detention basin will discharge into a reshaped channel along the location of the present Boneyard, just to the east of the Illinois Central Railroad tracks. This channel would be located between the tracks and a bermed up area around the permanent pool. The flow in this channel would follow the course of the present Boneyard and discharge under the Norfolk & Western Railroad tracks. The flow from the north branch of the Boneyard could discharge into this same channel until the permanent pool is constructed at which point it would be diverted into this permanent pool.

The size of the permanent pool shown is 6.5 acres but a great deal of flexibility is available in terms of altering this size in the final design process. It has been assumed that the pool would have an average depth of about 6' with the deepest sections being 10 to 12' in depth although again a great deal of flexibility is available in final design. A portion of the material excavated to create the pool would be used to build a berm between the pool and the railroad tracks on the west and south. A sluiceway outlet would be created that would release a maximum at 5 c.f.s. under the head created by the rise in water surface when the 10 year design flow from the north branch of the Boneyard is stored above the surface at the permanent pool. In this way the pool serves as a detention basin for the flow from the north branch at the Boneyard. The fluctuation at the water surface would be less than a foot due to the relatively small flows coming from the north branch.

FIGURE 15



SECTIONAL VIEW OF
OAK/ASH BERM

There are some problems of water quality that should be mentioned in regard to a permanent pool at Oak Ash. For one, the pool may contain fairly high levels of phosphorus and the potential for algae bloom in the pool exists. Secondly, the problem of heavy metals in the flow could create a concentration of these substances in the sediment of the permanent pool. This could limit the pools potential for fishing.

Further investigation of the effect groundwater would have on establishing the pool would have to be considered. Borings of the area should be taken before final design to determine the level of the groundwater table as well as the material present for excavation.

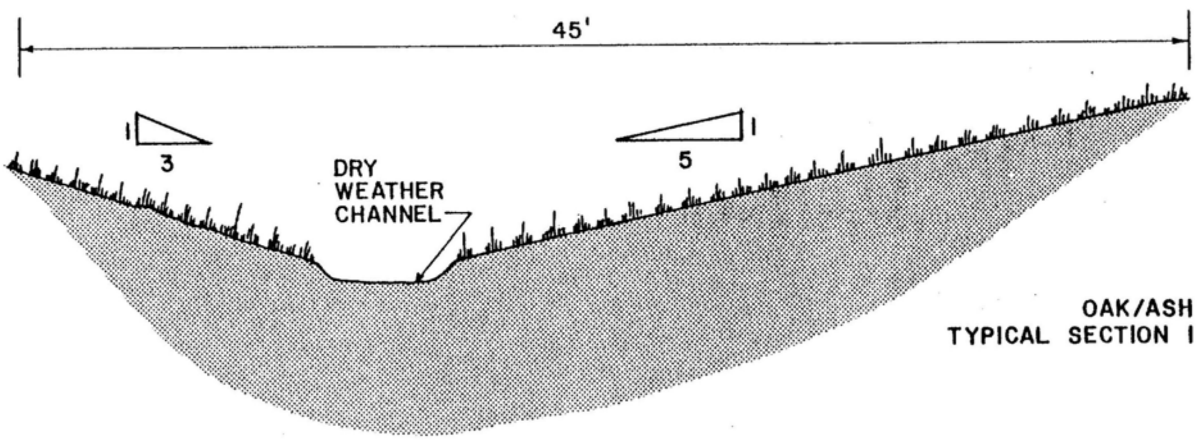
A final consideration for this area is that the detention pond for the west branch is based on the 10 year storm. Often due to potential problems downstream when the capacity of a detention basin is exceeded a more conservative design figure such as the 50 year storm is chosen. By controlling the shape and development of the area around the permanent pool up to elevation 730.0 feet it would be possible to allow for emergency storage in the event of a storm larger than the design storm. By providing an additional 25 acre-ft. of emergency storage it would be possible to detain the 50 year storm in this area. Final design should minimize the development of any structures within the 730.0 elevation to allow for this type of an approach.

The remainder of the reach is again developed on the concept of allowing the flow to spread out across the section during storm events. The channel would be lowered somewhat to allow the release from the permanent pool to be at elevation 723.0 feet. Due to the mitigating effect on the flow of the detention basins, the sections for this reach will hold flows well above the design flow. This accepted capacity and storage has been allowed since it is gained without great additional cost to the project. Modification of the culvert at Church Street would have to be undertaken to allow the Second Street proposed development.

Typical Section I

This section would be the flow channel for the release from the west branch detention basin and also the flow from the north branch until the permanent pool is constructed. It would not include a bikeway. On the left side of the section would be located the railroad tracks and a berm screening the permanent pool would eventually be located on the right. The section consists of a dry weather channel (5') along with grass stabilized slopes at 3 to 1 or flatter.

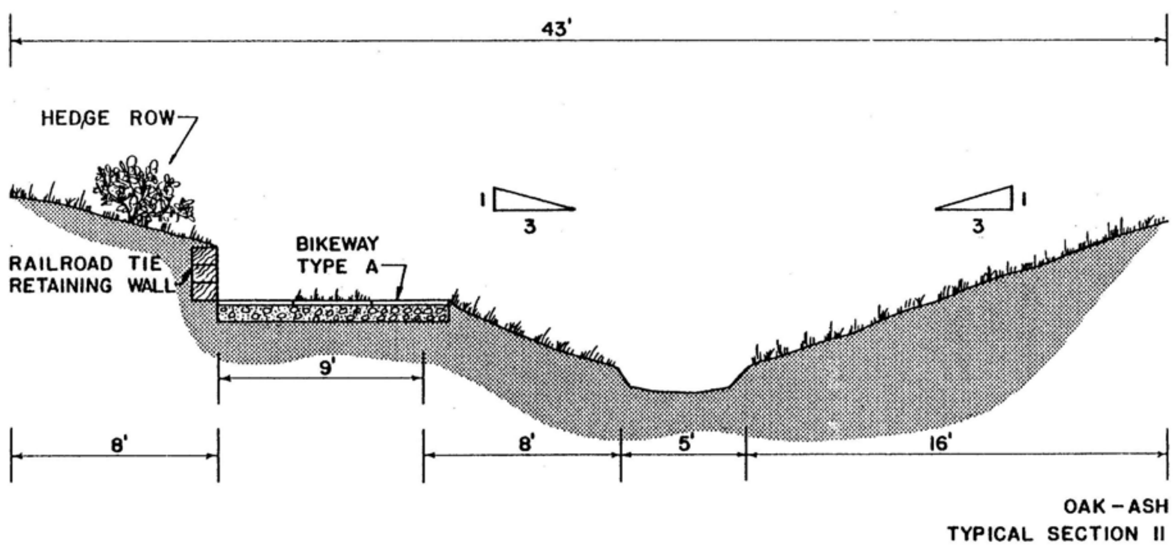
FIGURE 16



Typical Section II

Typical Section II returns to the concept of spreading out the flow over the 45' section. It includes a type A bikeway because no other means of access would be available in this portion of the reach. The elements in the section are a dry weather channel similar in design to the one proposed for the Edgebrook and Neil Market reaches, a type A bikeway, a two foot railroad tie retaining wall on the left side of the section and 3 to 1 slopes stabilized with grass or ground cover. Due to the height of the surrounding ground surface around the channel, the 2' retaining wall was needed to work within the 45' wide corridor. Some type of hedge row is proposed to serve as a screen on the left side of the section to eliminate any safety problems created by the 2 foot drop at the retaining wall.

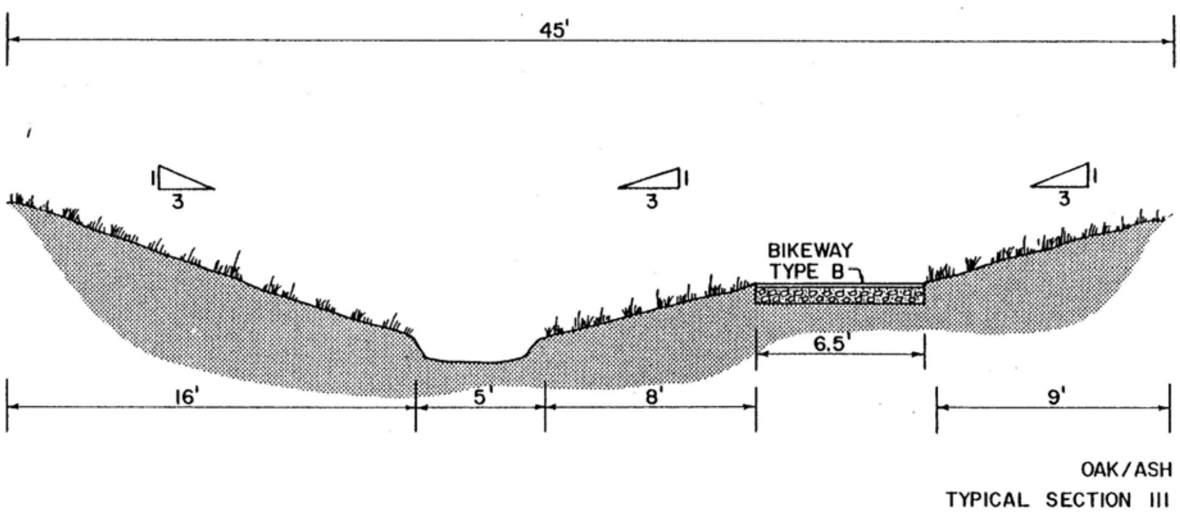
FIGURE 17



Typical Section III

Section III is basically the same as Typical Section II with a few slight modifications. Because access is available via streets or alleys for the portion of the reach involving this section, the bikeway has been changed to a type B bikeway. Also the location of the bikeway is now on the right side of the channel necessitating a crossover between the area of application of Typical Section II and Typical Section III. Finally due to a lower ground surface around the section, the need for the retaining wall present in the previous section is eliminated. All other criteria are the same.

FIGURE 18



Typical Section IV

This section is basically a repeat of Typical Section III. The only difference is that due to less of a difference between the bottom of the channel and the surrounding ground surface, the slopes of the secondary channel vary from 3 to 1 down to 4 to 1.

FIGURE 19

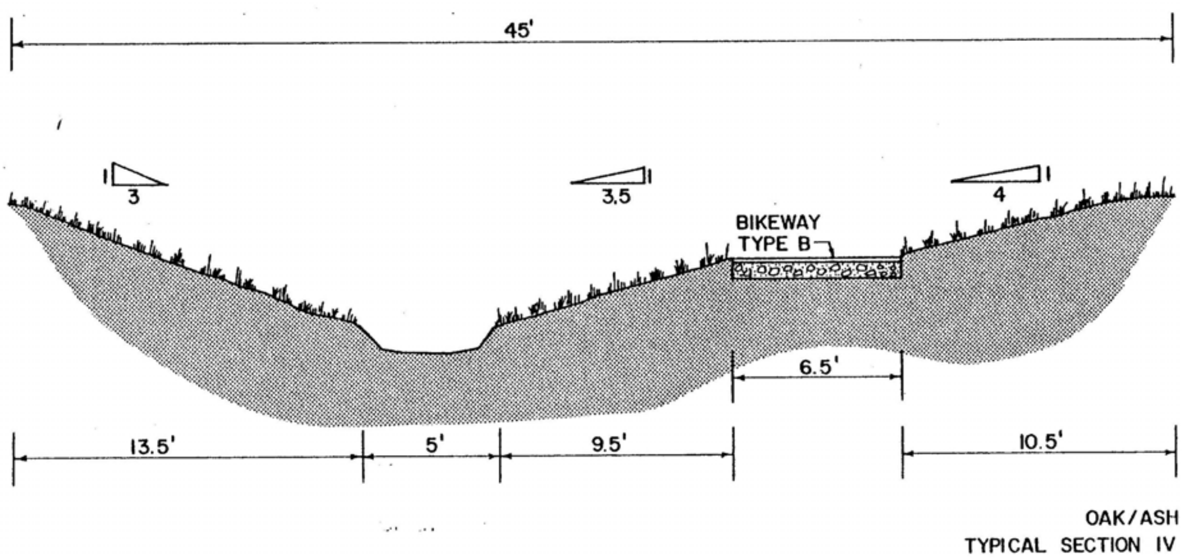


TABLE 7

HYDRAULIC CAPACITIES REACH III

Section (Slope)		Design Flow	Flow to Bikeway Edge	Maximum Channel Flow	Average Velocity
I.	(.00123)	79.0	---	375.0 c.f.s.	3.3 feet/sec.
II.	(.00173)	98.9	93.8 c.f.s.	470.2 c.f.s.	3.4 feet/sec.
III.	(.00173)	98.9	58.6 c.f.s.	314.7 c.f.s.	3.0 feet/sec.
IV.	(.00173)	98.9	90.9 c.f.s.	369.7 c.f.s.	3.2 feet/sec.

TABLE 8

SECTION DELINEATIONS FOR REACH III

Station	Section Type
0+00 to 9+40	I
10+55 to 14+96	II
15+25 to 17+65	III
18+22 to 120+20	IV

SECOND STREET

Flooding Problem

The area of the Boneyard designated as the Second Street Reach exhibits two major flooding potentials. The first of these is the limitation on flow that can be conveyed by the channel as it exists. The problem here is one of maintenance as much as actual cross section area. Sediment deposits, sections of adverse slope, blockages created by material in the channel, along with some undersized sections of channel, combine to create a flood hazard even during the 10 year storm. A second problem is a function of lack of capacity at various bridge openings or culverts. The problem here stems from a combination of factors. It appears that some of the older bridges were sized for smaller flows that no longer exist due to the increase in flows from added connections and increased urbanization. In addition to this, many of the openings have lost capacity due to siltation in the channel. Simply cleaning these openings would not correct the problem since this would create low spots with respect to the surrounding channel. Flow would pool up and slow in these areas causing increased siltation and the final result would be a return to the silted in condition.

Several areas through the reach exhibit banks with excessive scour and undercutting. Areas where the channel was shored up with stone are being undercut and are collapsing into the channel. This is due to the steepness of the banks and the excessive velocities generated in the confined channel.

A special problem area in this reach is the historic stone arch bridge. Excessive flows under the bridge are undermining the structure. In order to allow for its preservation a means of limiting the flow under it must be developed.

To put all this in perspective, it should be noted that although some potential for flooding exists in this reach, much of it appears controllable to a large degree. Historically it has not remained an area of extensive flooding.

Design Flows

The design flows for this reach were again based on the hydrologic work done by the State Water Survey in the course of their flood study. The original flows were based on the Boneyard under present conditions and the assumption that no flow is added at the Neil Street diversion. In order to represent the magnitude of the flows under the various conditions, a list of expected flows will follow for various potential future conditions, in terms of the detention ponds upstream.

Flow Based on S.W.S. Present Day Conditions

Location	Recurrence Interval	Peak Discharge
Church to Park	10 yr.	202 c.f.s.
Park to University	10 yr.	207 c.f.s.
University to Springfield	10 yr.	231 c.f.s.
Church to Park	50 yr.	344 c.f.s.
Park to University	50 yr.	344 c.f.s.
University to Springfield	50 yr.	351 c.f.s.
Church to Park	100 yr.	449 c.f.s.
Park to University	100 yr.	449 c.f.s.
University to Springfield	100 yr.	449 c.f.s.

Flow Based on the Existence of West Branch Detention Basin

Location	Recurrence Interval	Peak Discharge
Church to Park	10 yr.	99 c.f.s.
Park to University	10 yr.	131 c.f.s.
University to Springfield	10 yr.	175 c.f.s.

Flow Based on the Existence of West Branch Detention Basin and Oak Ash Pool with Controlled Release

Location	Recurrence Interval	Peak Discharge
Church to Park	10 yr.	81 c.f.s.
Park to University	10 yr.	120 c.f.s.
University to Springfield	10 yr.	166 c.f.s.

For design purposes the flows have been selected with the existence of the west branch detention basin assumed. This would allow for the construction of the Second Street reach after the west branch detention basin is built but before the permanent pool at Oak Ash is created. The flows are again based on the 10 year storm. Since, due to some routing questions it is unclear if the lower value between Church and Park is totally valid, it has not been used as a design flow. The area north of University Avenue is based on a design flow of 130.6 c.f.s., and between University and Springfield a value of 174.6 c.f.s. was applied.

Corridor Width

In order to accomplish the development of the Second Street reach, the assumption has been made that the present street would be closed to traffic making the 66' right of way available for development of the Creek. The channel would be relocated approximately in the middle of the street and the present channel filled with the exception of the area in close proximity to the stone arch bridge. Based on this, the typical sections have been designed using a 66' wide corridor. Included in this corridor is a 10' channel width, a 6.5 foot bikeway, an 8' pedestrian walkway, and open space areas of various widths.

Reach Sections

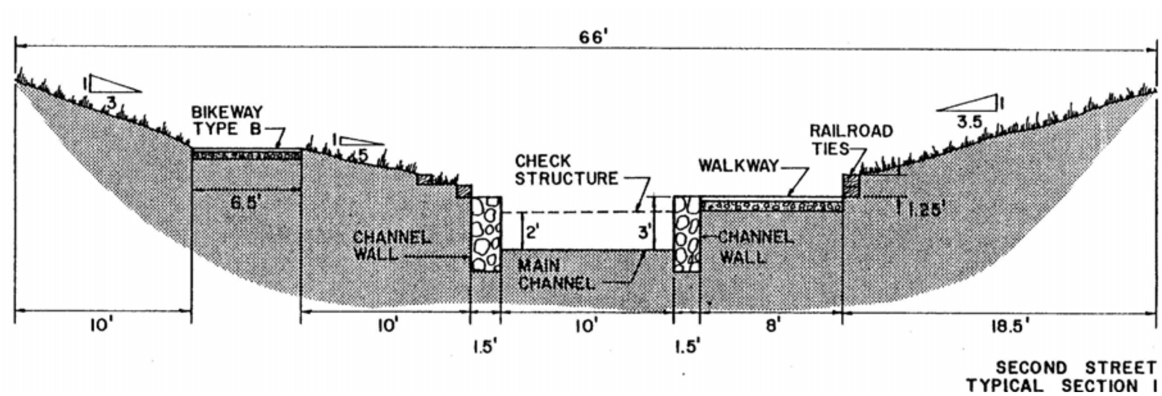
As mentioned before, the basic assumption for this reach is that Second Street would be closed and the channel relocated in the middle of the available right of way. Church Street, University Avenue and White Street would remain open to traffic. This would require new culverts or bridges at all three of these streets. Park, Stoughton, and Clark would all be closed through the Second Street corridor and could be made into cul-de-sacs. It was felt that the stretch of the reach from Clark to Springfield lent itself more readily to this type of treatment then from Church to University. Due to access problems in the reach north of University, it is being proposed that the portion from Clark to Spring-field could be developed in the primary phase of construction. Then as future conditions allow alternate access or reduce the need for it, the remainder of the reach could be developed in a second phase.

The detention basin for the west branch would be needed to lower design flows to a level that could be handled in the typical sections. The basic idea would be to create a 10' wide hard edged channel approximately 3' deep. Fittings for stop planks would be included in the design of the channel wall and they would allow 2' high stop planks to be placed across the channel to help maintain an acceptable depth. These could then be removed to allow maintenance and the removal of any accumulated sediments. A flow of approximately 30 c.f.s. would pass over the stop planks within the confines of the channel walls. Flows above this up to the design flows would pass out of the original channel but be confined in a secondary channel created by the walkway on the right side of the section and some steps on the left. A throttle pipe would be placed into the channel wall that would allow a small amount of water to be siphoned off to outlet into a portion of the old channel that will remain under the stone arch bridge. This small flow could pass under the bridge and return to the primary channel at the Springfield Avenue bridge crossing. In this way some flow could be maintained under the stone arch bridge while separating it from the main flow channel and protecting it against excessive storm flows. By placing the entrance to the throttle pipe directly before a stop plank and with the top of this pipe even with the top of the stop plank, the maximum head above the top of the pipe would only be about 2.75' during the design storm. By sizing the pipe small enough the flow reaching the Stone Arch Bridge during the 10 year design storm will still be very low.

Typical Section I

Section I is the type of development that could be applied to the portion of the reach north of University Avenue. The first major feature of the section is the channel walls. They would extend about three feet above the bottom of the channel with a width of 1.5 feet. It has been suggested that the walls be constructed of concrete block with a stone veneer placed over the portion of the walls that would be visible. When the final design for this section is completed, it should include a proper footing for each wall. This is needed to keep the wall in place and avoid the situation where the channel wall slumps into the flow channel. Although the materials described were felt to present the best solution, other possible materials include concrete, stone block, gunite, or gabions. Part of the secondary channel would be formed by the 8' walkway directly to the right of the channel wall. At the end of the walkway a small wall would be created of railroad ties or an alternate material to provide confinement for flow above the walkway up to 1.25'. Again the needed depth is provided by a series of two railroad tie steps. One would be placed next to the top of the channel wall and a second further to the left. The area between the two steps could be planted with a water tolerant ground cover. The other major element in the section is the 6.5 foot Type B bikeway. For the purpose of this plan, it has been assumed that the 8' walkway would be designed to support the loadings created by maintenance or emergency vehicles. All banks are sloped at 3 to 1 or flatter.

FIGURE 20



Typical Section II

Typical Section II is basically the same as Section I. There are two changes from the previous section. The slopes for this section are flatter than in Section I due to the surrounding ground surface being closer to the elevation of the channel bottom. Secondly the depth of the secondary channel above the primary channel walls would be increased slightly to 1.75'. All other criteria are the same.

FIGURE 21

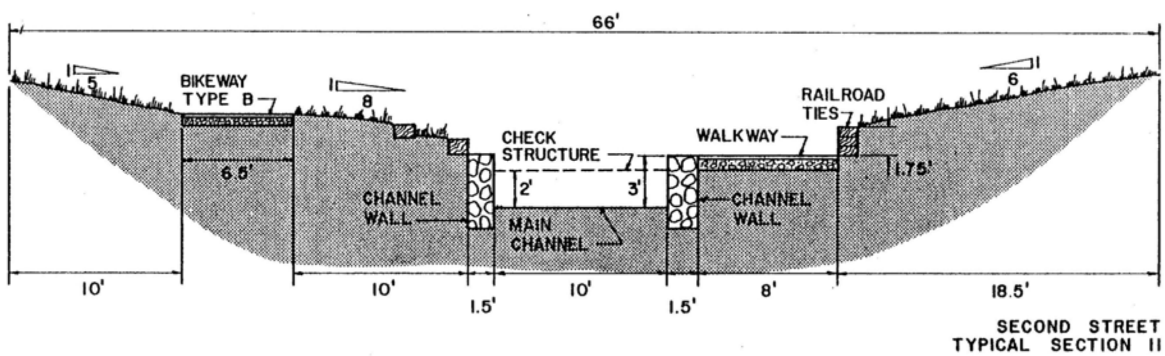


TABLE 9

HYDRAULIC CAPACITY ~ SECTION I & II SECOND STREET

Section (Slope)	Design Flow	Flow in Channel	Velocity
I. (.0027)	130.73 (Det. basin only) 120.03 (with pool)	129.20 c.f.s.	3.2 ft/sec
II. (.0027)	174.63 (Det. basin only) 165.70 (with pool)	179.0 c.f.s.	3.6 ft/sec

TABLE 10

SECTION DELINEATIONS FOR REACH IV

Station	Section Type
0+00 to 6+23	I
7+04 to 19+29	II

CAMPUSTOWN

Flooding Problem

The flooding problem in the Campustown reach appears to be the most serious under present conditions. It is not entirely clear what portion of this flooding is directly attributable to the Boneyard and in what portion the Boneyard is only one factor. Based on the 10 year design storm the flows under present conditions would exceed the banks in some areas with many of the bridge openings lacking the capacity to pass flows this large. An equally severe problem is created in that when the level of the Boneyard rises to near the top of the banks it impedes the flow from the storm sewer laterals hooked into the channel. This causes these storm sewers to back up further complicating the overbank flooding situation. This type of flood problem has been observed for several storms including flows below the design flows. The development planned for this section would eliminate the Boneyard contribution to these flooding problems.

Design Flows

The design flows in this reach were based on the State Water Survey Flood study information on the 10 year storm. These flows are basically unadjusted for any upstream flood control so the design capacities on the box culvert would be applicable even if nothing had been initiated upstream.

Flow Based on S.W.S. Present Day Conditions

Location	Recurrence Interval	Peak Discharge
Third to Sixth	10 yr.	575.0
Sixth to Wright	10 yr.	596.0
Third to Sixth	50 yr.	980.4
Sixth to Wright	50 yr.	1005.6
Third to Sixth	100 yr.	1263.7
Sixth to Wright	100 yr.	1263.7

The design flow used for the box culvert in this reach was 575 c.f.s between Third and Sixth, and 596.0 c.f.s. between Sixth and Wright.

Corridor Width

The corridor width through this section would be 45'. By using the area of the present channel as well as the alley that runs along the north bank it would be possible to run this 45' corridor through the reach under present conditions. The alignment would remain basically the same using the existing bridges. Any corridor width less than 45' would not be effective without some type of steps or retaining walls. In order to maintain the 3 to 1 slope criteria, with a 6' wide channel and the 9' needed for a Type A bikeway, 45' serves as the minimum. In areas where additional space is available this corridor width could be extended to allow for even flatter slopes but this area does not appear to be available under present conditions.

Reach Sections

The general design in this reach centers around the channel over a channel concept outlined in Volume I. The area from the entrance at Scott Park to Third Street will remain as is. It would be advisable to go to a hard edged channel from Healy to third to prevent erosion. From Third Street to the end of the reach the concept of channel over a channel has been proposed. This would involve a box culvert with interior dimensions of 13' x 7', with the dry weather flow diverted to a small channel established above the box. Just before the box culvert begins a small weir structure will be placed in the bottom of the channel (on the order of 1 foot high). This will be used to pool up water during dry weather to be diverted to the upper channel. A small conduit located below the water surface level created by the weir will siphon the dry weather flow from this small pool to the channel above the box. Under normal dry weather flow conditions all the flow will be siphoned to the upper channel. Downstream at the weir a chute spillway will channel any flow over the weir, down into the box culvert. At this point in the reach the top of the box culvert is at the elevation of the existing channel with the bottom of the box culvert well below the present channel elevation. In the work done for the Horner Shifron report, it was stated that almost no bridge replacement would be needed for a box culvert suggested in that study. It has been assumed that by keeping at or above the bottom level of that box the new box would not require any mandatory bridge replacement.

Due to the increased head on the dry weather diversion pipe the flow going to the upper channel will also be increased but could be limited to about would come directly from the creek corridor and would not increase flows enough to create problems. As a safe guard against the upper channel flooding, if debris would block a bridge opening, drop openings running down to the box culvert could be placed under a number of bridges.

These could be covered with a type of bar screen for safety purposes and be positioned to control the elevation in the upper channel from 1.5 to 2 feet. The area above the chute leading from the normal channel bottom at Third Street down into the box culvert would also have to be open but again could have some type of a slotted or raised top for safety purposes. This type of an arrangement would allow the majority of dry weather flow to be carried in the upper channel and the box culvert to be used to carry the increased storm flows. The arrangement described would be only one way of handling this flow split and could be altered at the time of final design. It was based on using only gravity means to split the flows at this juncture. A more elaborate gated arrangement could be created that would divert all flow to the box culvert during storm events except the drainage of the upper corridor. Two factors would have to be considered before going to this more elaborate approach. First the gated arrangement would have to include some means of actuating the gates in the diversion during storm events. Secondly this type of mechanical solution would be more costly to build and to operate. For these reasons this type of approach has been avoided in the proposed plan, but should be considered further at the time of the final design for this section.

The reasons for taking this approach involving the channel will be touched upon in this section. However, it should be remembered that the same approach is being suggested for the University and Thornburn reaches so everything related here also would apply to those two reaches. The present condition of the Boneyard involves a wide and deep open channel carrying very little flow except during storm events when the channel would often flow near the top. It was felt that a more advantageous situation would be one where the Boneyard could be raised back up nearer the surrounding ground level where it would again become visible and could be integrated into the surrounding community. In a sense this meant returning the present Boneyard back to what it had been in the past, a small meandering creek. Because this system still had to serve as the major conveyor of storm flows for the area the channel over a channel concept seemed to fit the rather specialized needs of this problem. It allowed the return to the "old" Boneyard while providing better flow conveyance for storm flows than presently exists. Besides this the box culvert provides significant advantages to this, as well as subsequent reaches. These are listed in the following comments:

- An improvement in water quality through these three reaches due to the separation of the majority of the storm water from the upper channel. The quality of the water is much worse during and directly after storm events. This overall impact in these three reaches will be diminished due to the majority of this low quality water being carried in the box culvert.
- Water quality would also be improved by the fact that all connections would be made to the box culvert throughout the three reaches involving the channel over a channel concept. This would provide a perfect opportunity to locate any unwanted or illegal connections and see that they are eliminated or connected to the proper source. Some of the problems involving water quality can be tied to incidents where a break in a sanitary line has caused flow into a storm sewer. Under the proposed plan this poor quality water would never reach the upper channel. However, since the box eventually outlets at the beginning of the Five Points reach all problems of this type should be corrected as soon as possible.
- In terms of flood control due to less resistance to the flow the box culvert carries more water than the present open channel condition.

- The flood problems in the Campustown Reach associated with the level of the Boneyard backing up storm sewers and causing severe flooding could now be eliminated since the top of the box is near the bed of the old channel and the bottom of the box well below the present bed. The water surface elevation during storm flows will be much lower than it has been in the past. Consequently this backwater pressure placed on the storm sewers by the Boneyard will be eliminated. In this manner the Boneyard's component to the problem is removed. The cities would have to check storm sewer capacities and sizing of inlets to see that this is not also contributing to the problem if total elimination of the problem is to be achieved.
- By taking the large majority of the storm flows and placing them in the box culvert the erosional problems in the Campustown, University and Thornburn reaches would be controlled. The excessive flows and velocities associated with the present day open channel situation would not occur with the channel over a channel, due to the small flows to be conveyed in the upper channel. Bank scour would no longer be severe as a consequence of the majority of the flow being carried in the closed conduit.

The general design shown for the box culvert was based on certain criteria that should be considered during the final design process. The 10 year storm was selected for the basic design criteria but it was applied in a specialized way to the box culvert. Because of the additional functional resistance of the top slab a box culvert will actually carry more water before it is flowing full. For this reason the box has been designed so that even when flowing full and the effect of the top slab is present it will convey the 10 year design flow.

This means that before it is flowing full the box will actually carry significantly higher flows than the 10 year storm but still would carry the 10 year storm under worst conditions. All calculations were based on a Manning equation, using a roughness coefficient of .013, and assuming subcritical flow conditions. Table 11 shows the design flow criteria and expected capacities.

Typical Section I

This typical section most directly applies to the upper portion of the Campustown Reach with Typical Section I of the University Reach more applicable in the lower end of the reach. It is based on a 45' corridor width. The top of the box culvert shown would be approximately equal with the existing channel bed dimensions shown in the box are the proposed interior dimensions. The bikeway would be a Type A due to the need for maintenance vehicles and expected heavy user interest through this reach. All slopes have been kept at 3 to 1 more for maintenance purposes since no flow would reach most of the slopes to create erosional problems. The section does show asphalt berms on either side of the 6 foot dry weather channel created on top of the box. Further study would have to be made of actual soil conditions to determine if these are really needed. If put in they would be buried and not visible from above. After a period of operation the channel bottom would accumulate enough sediment to cover the box and the concrete would no longer be visible. The location of the dry weather channel on the top of the box would not be fixed and a mild meander could be created. Excessive sharp meanders could lead to some erosional problems and should be avoided. In constructing the upper channel all water could be temporarily diverted to the box culvert until the bank cover is properly established. Then the system could be put in operation as originally designed.

FIGURE 22

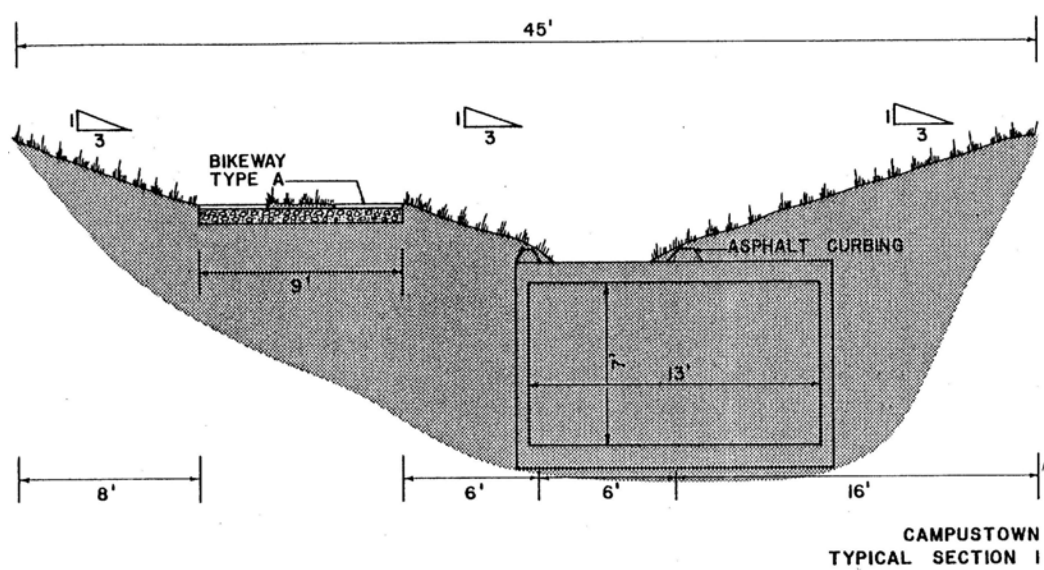


TABLE 11

HYDRAULIC CAPACITIES FOR REACH III

Box Size (Interior)	Slope	Design Flow (10 year)	Flowing Full	Velocity (Flowing Full) feet/sec.	.5' Freeboard	Velocity feet/sec.
13 x 7	.00101	575	575	6.3	678	8.0
13 x 7	.00109	596	598	6.6	704	8.3
14.5 x 7	.00103	734	733	6.7	874	8.6
15 x 7.5	.00119	823	822	7.3	983	9.4
15.5 x 8.0	.00120	944	943	7.6	1131	9.7
16 x 8.5	.00112	1032	1034	7.6	1243	9.7
17 x 8.5	.00118	1143	1143	7.9	1383	10.2
17.5 x 8.5	.00118	1187	1184	8.0	1437	10.3

UNIVERSITY

Flooding Problem

The problem in the University reach is not overly extensive. Some of the backwater pressure exerted on sewers may also be found in this reach but not to the degree found in the Campustown reach. The major problem here is bank erosion and scour as well as some undersized bridge openings.

Design Flows

The design flows are based on the State Water Survey flood studies. These flows are based on present conditions and no adjustment of the values are involved. The following is a listing of flows based on the S.W.S. work.

FLOWS BASED ON THE S.W.S. Work

Location	Recurrence Interval	Flow
Wright to Mathews	10 yr.	596 c.f.s.
Wright to Mathews	50 yr.	1006 c.f.s.
Wright to Mathews	100 yr.	1235 c.f.s.
Mathews to Goodwin	10 yr.	734 c.f.s.
Mathews to Goodwin	50 yr.	1198 c.f.s.
Mathews to Goodwin	100 yr.	1392 c.f.s.
Goodwin to Lincoln	10 yr.	823 c.f.s.
Goodwin to Lincoln	50 yr.	1363 c.f.s.
Goodwin to Lincoln	100 yr.	1560 c.f.s.

The selected design flows were based on control of the 10 year storm. This means 596.0 c.f.s. from Wright to Mathews, 734.4 c.f.s. from Mathews to Goodwin, and 822.8 c.f.s. from Goodwin to the end of the reach. This increases flow where major sources of additional flow are added, generally designated by a major storm sewer or a number of smaller sewers creating a large additive effect.

Corridor Width

The corridor width being proposed for the University reach is 40'. This is a decrease of 5' from the previous reach. The major reason for the decrease is the increased restriction provided by the buildings in the area. Although this 40' corridor would provide sufficient space to pass flows a wider open space corridor is encouraged where space is available. In addition to this there is also a potential alternate that is being proposed as an option in terms of corridor location. For the alternate proposal the box culvert would remain located in the present flow channel, but due to some buildings across the channel like the Physics Building, the upper channel would follow a separate route. The area around the original channel would be filled and could be available for development. The upper channel and bikeway could then follow a new route basically making use of an alley north of the present Boneyard location. It should be remembered that great flexibility is available in this route for the upper channel and variations from the route shown would be possible.

Reach Sections

The general treatment in this reach is simply an extension of the one described for the Campustown reach. It would be possible to have this treatment in the University reach without having it in the previous reach.

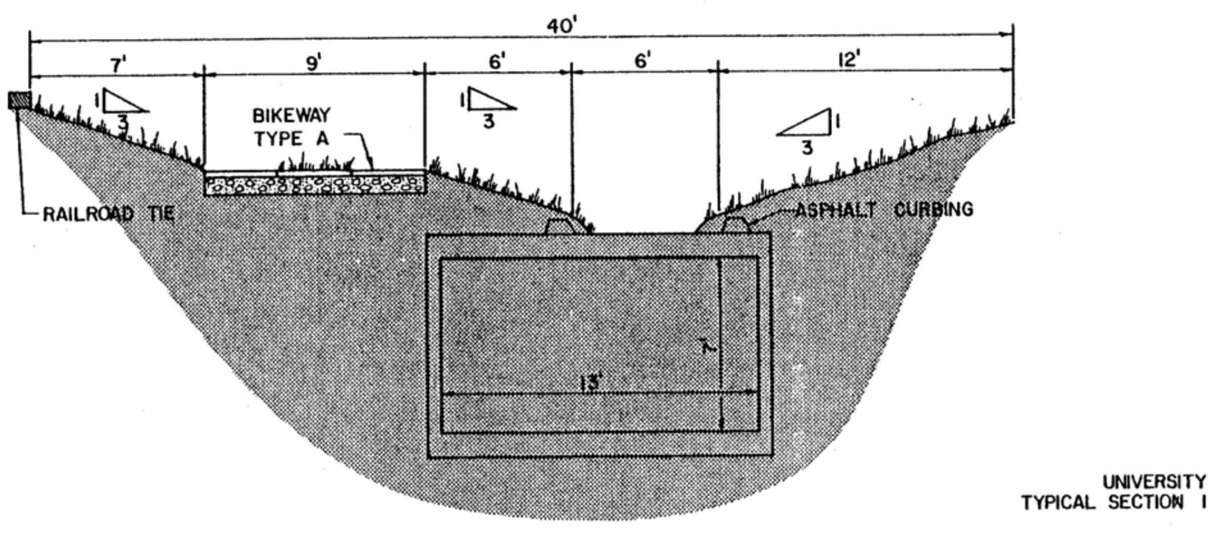
This would however call for some type of a lift facility since a gravity separation wouldn't be applicable at the beginning of this reach. By the same token if this reach was developed in a way other than the proposed approach an outfall protective structure would be needed at the beginning of the reach to protect against scour and a pumping lift facility at the end of the reach. Due to the complications added by these additional facilities it was felt that a continuous approach starting at Campustown, through University, and ending after the Thornburn reach is the best approach.

The one aspect of the treatment in this reach that differs from the Campustown reach is the possibility of the separation of the upper channel route from the route of the box culvert. The final decision on the alternate route would depend on the conditions in the reach at the actual time of final design. For this reason the plans for this report have shown this possible route although others potentially exist.

Typical Section I

This section is most applicable to the upper end of the University reach. By the time the box culvert has reached the area where this section would be applicable the top of the box has come up, due to a hydraulic slope slightly flatter than that of the present day channel. The upper slab of the box is from 2 to 3 feet above the present channel. The bottom of the box has also come up in relationship to the bottom of the channel. For this reason not as much elevation must be taken up by the upper channel side slopes and a 40' corridor is possible. In the section shown a railroad tie is located on the left side of the section to take up a small excess portion of the space from the channel to the banks at the edge of the section. The need for this type of small railroad tie wall will vary along the reach and would have to be accessed on a foot by foot basis at the time of final design. Except for the aforementioned element of design the other criteria remain the same as the previous sections. During the construction period an effort would have to be made to save any trees or other plantings along the banks of the corridor. It should be noted that due to the control of the level in the upper channel at 1.5 feet, extensive plantings could take place above this needed flow level.

FIGURE 23



Typical Section II

This section is basically the same approach taken on the previous two sections. It again includes a 6' channel width, 3 to 1 slopes and a Type A bikeway. Due to higher banks a slightly larger retaining wall is needed on the left side of the section. A second option is shown that would eliminate the need for the retaining wall if space were available to expand the flow corridor back to 45' wide. A portion of the reach to which this type of approach would be used is at present sheet piled. In order to establish the section shown, the existing sheet pile would have to be cut off below the new ground level. The interior dimensions of the box in this view are 7.5' x 15.0'.

FIGURE 24

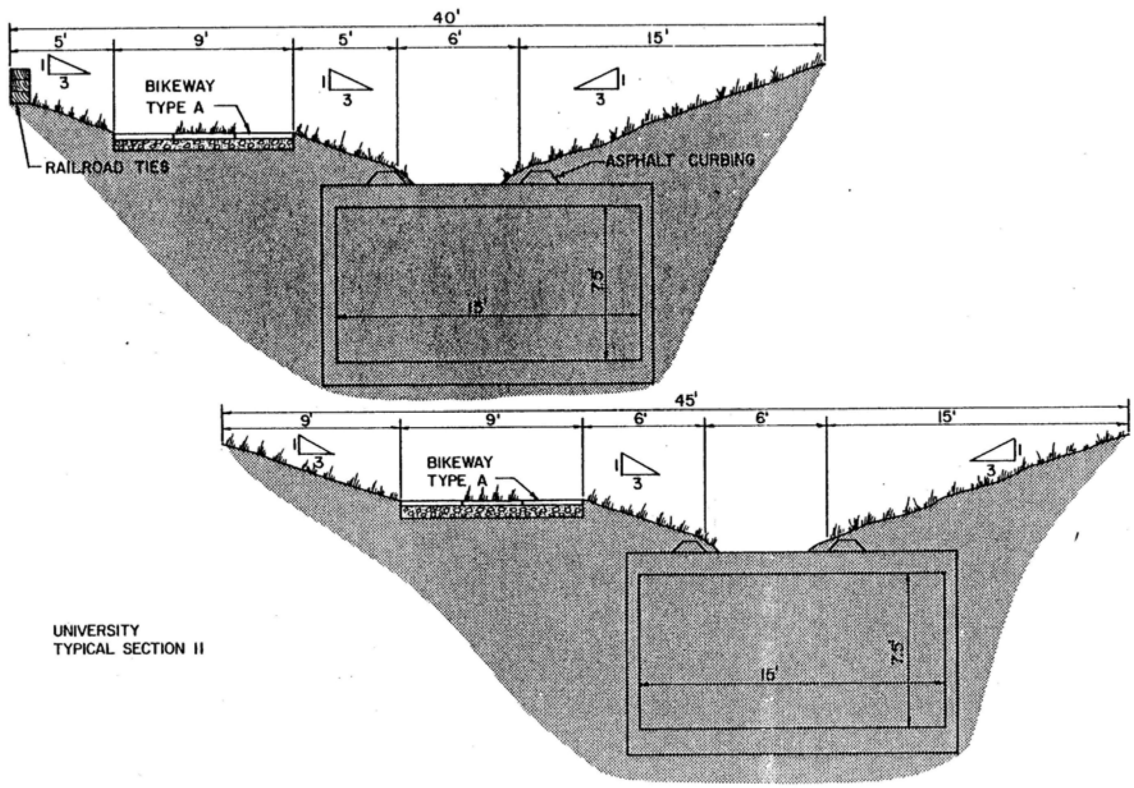


TABLE 12

SECTION DELINEATIONS FOR REACH VI

Station	Section Type
1+00 to 36+73	I (University)
36+73 to 50+89	II (University)
50+89 to 59+50	I (Thornburn)

THORNBURN

Flooding Problem

The flooding problem through the Thornburn reach is less severe than the previous two reaches although it still exhibits some of the same characteristics. Some of the potential for severe flooding problems has been tempered by the installation of the steel sheet piling. It does pass a significant amount of flow and protect against bank scour. However, it eliminates any of the characteristics of a natural stream, as well as creating a potential safety hazard and "eye sore" problem. A constant problem has been debris thrown into the open channel and how to maintain it. Some of the bridge openings also provide some constrictions where the channel has to narrow. Another factor to consider is the limited life of the sheet piles. At some point in the future they would have to be replaced and consideration should be given to a new approach. The sheet piles have been constructed in a manner that assists in going to the box culvert concept.

Design Flows

The design flows are again taken from the flood study work of the State Water Survey. These flows are based on the present day conditions determined for the reach. The following is a listing of the flows used in the design for the Thornburn Reach:

Location	Recurrence Interval	Flow
Lincoln to after Busey	10 yr.	944 c.f.s.
After Busey to McCullough	10 yr.	1032 c.f.s.
McCullough to Griggs	10 yr.	1143 c.f.s.
Griggs to Race	10 yr.	1187 c.f.s.
Lincoln to after Busey	50 yr.	1573 c.f.s.
After Busey to McCullough	50 yr.	1731 c.f.s.
McCullough to Griggs	50 yr.	1998 c.f.s.
Griggs to Race	50 yr.	2012 c.f.s.
Lincoln to after Busey	100 yr.	1764 c.f.s.
After Busey to McCullough	100 yr.	1944 c.f.s.
McCullough to Griggs	100 yr.	2206 c.f.s.
Griggs to Race	100 yr.	2244 c.f.s.

Again the design flows were selected based on the criteria of fully controlling the 10 year storm. Due to the nature of the box culvert, additional capacity is actually available. The design flows for the reach ranged from 943.8 c.f.s. at Lincoln Avenue to 1186.8 c.f.s. at Race Street.

Corridor Width

The nature of the Thornburn reach is significantly different from the other two reaches involving the channel over a channel concept. Here the existing channel is the sheet piling which weaves through essentially a residential area. Due to the ability of the sheet pile to confine most flows encountered to date, development has been allowed to take place close to the stream. This cuts down on available space for a flow corridor under present conditions. For this reason the design corridor was made smaller to allow construction under present day conditions. From Lincoln to Coler the corridor would be 35' wide and then further reduced to 30' between Coler and Race Street. Although this corridor represents the needed design minimum to include the channel, a Type A bikeway, and maintain slopes at 3 to 1 or flatter, consideration should be given to expanding this corridor as future conditions allow.

Reach Sections

This reach basically continues the same approach as the previous two reaches. Most of the design criteria that went into the box culvert has been set forth in the material on the previous two reaches and will not be repeated here. There are a few situations unique to this reach that need to be commented on. The area around the Thornburn Community Center is presently covered. An interest has been expressed in opening this area up. The development of the channel over a channel concept would allow this to be accomplished in an acceptable manner. This type of a design would allow an open channel visible on the surface but not deep enough to present a serious safety problem. Also it requires a limited amount of area and allows more space for other types of development.

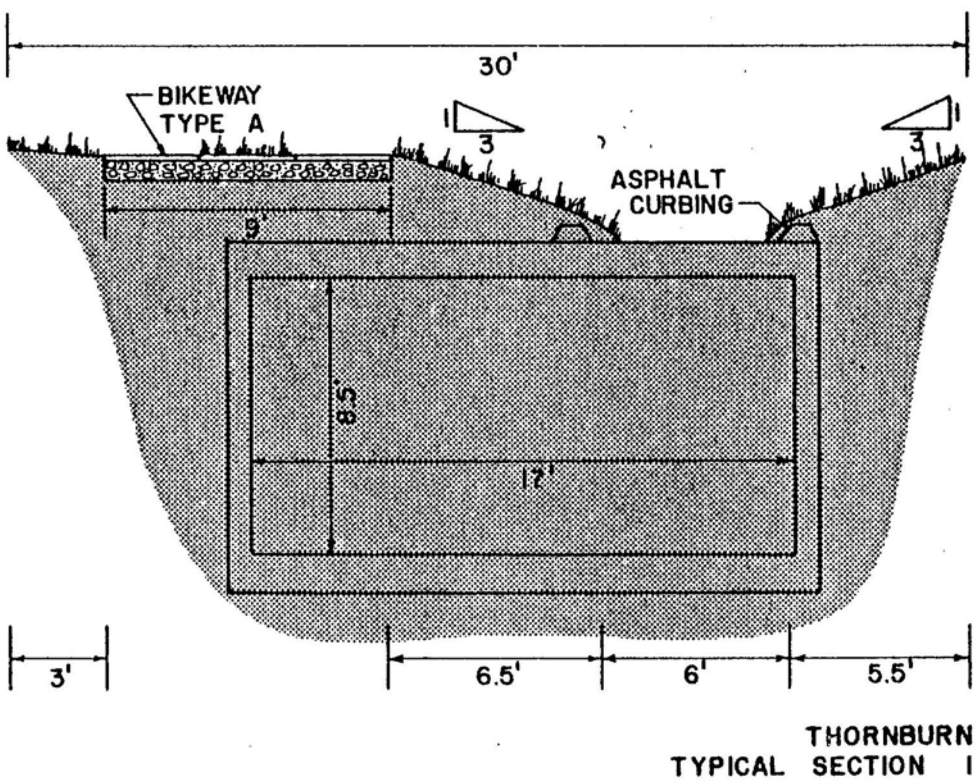
Another major difference between this and the other reaches is that by the time the outlet, just after the railroad tressel east of Race Street, is reached the top of the box is near the surface and the bottom outlets at the level of the original channel. In this way there is no need to attempt to lower the elevation of the channel in the final reach.

A major consideration of final design should be the potential scour problems at the outlet of the box culvert. During dry weather conditions the flow from the upper channel could fall off the top at the outlet and down to the level of the channel in the final reach. With some type of riprap protection this operation would create no problems. However, the large flows with high velocities discharging from the box culvert would create an erosional problem. An energy dissipation structure would have to be constructed along with some riprap protection for the slopes extending down from the energy dissipation structure.

Typical Section I

This section is basically the same as the others involving the channel concept. It applies to the portion of the reach from Lincoln to the Thornburn Center since the corridor varies from 35 to 30 feet the section shown represents an average condition needing 33' of corridor width. It includes the same elements as previous sections, namely the box culvert, type A bikeway, upper channel with asphalt berms and slopes maintained at 3 to 1. Again, the sheet piling would have to be cut below the new ground line.

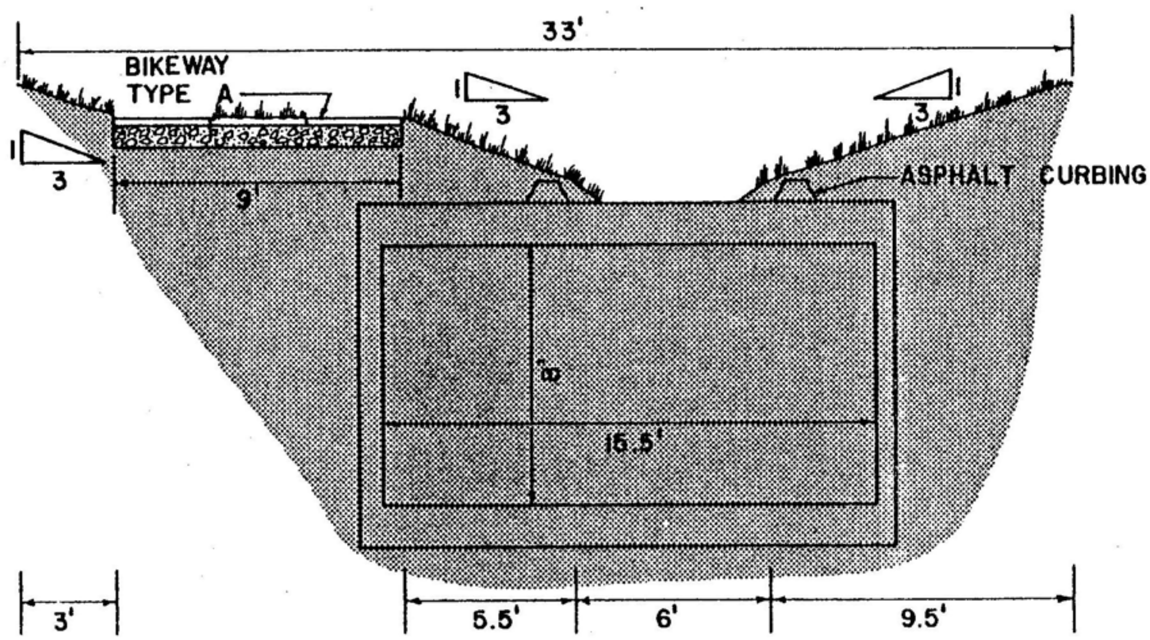
FIGURE 25



Typical Section II

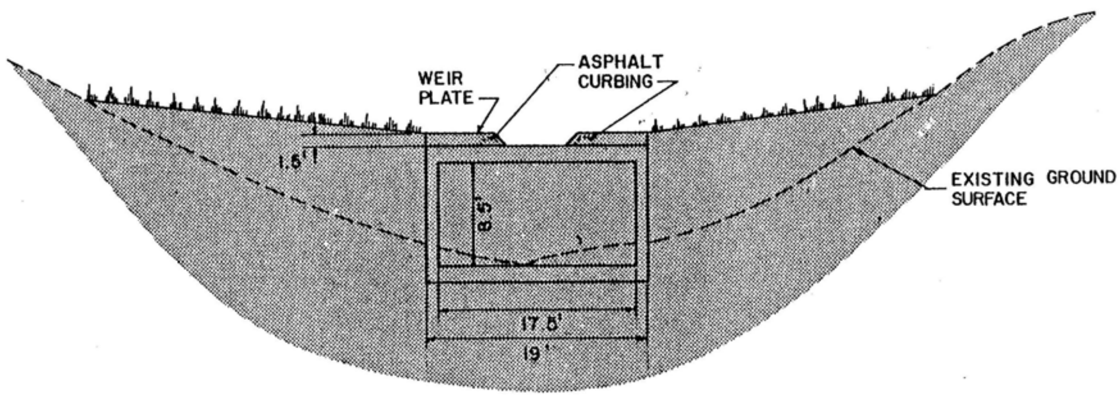
This section basically follows the same format. The one major difference is that as the upper channel approaches Race Street there may be a need to build up the area around the upper channel slightly to keep the flow in the upper channel properly confined.

FIGURE 26



Typical Section III
This section is a simplified view of the outlet of the channel over a channel approach. The dotted line represents the open channel cross section of the existing channel of the outlet. The box would outlet at the level of this existing channel.

FIGURE 27



THORNBURN
TYPICAL SECTION III
(OUTLET CHANNEL OVER
A CHANNEL)

TABLE 13

SECTION DELINEATIONS FOR REACH VII

Station	Section Type
0+00 to 13+47	I (Thornburn)
13+47 to 35+11	II (Thornburn)
36+78 only	III (Thornburn)

TABLE 14 – BOX CULVERT, EXISTING CONDITIONS

	Run Length of Box	Existing Channel Bottom (El.)	Slope	El. Top of Box	El. Bottom of Box	Design Flow (c.f.s.)	Flow When Box Full (c.f.s.)	Flow with 5' Fireboard (c.f.s.)	Size of Box
	~~	712.09	.00101	713.0	704.08	575.0	575.0	678.0	13 x 7
4th	493	712.48	.00101	712.5	703.58	575.0	575.0	678.0	13 x 7
Parking Lot	654	713.04	.00101	712.34	703.42	575.0	575.0	678.0	13 x 7
5th	941	711.32	.00101	712.05	703.13	575.0	575.0	678.0	13 x 7
6th	1220	710.97	.00109	711.77	702.85	596.0	598.0	704.0	13 x 7
Wright	1720	710.25	.00109	711.23	702.31	596.0	598.0	704.0	13 x 7
EE Dr.	2125	708.88	.00109	710.79	701.87	596.0	598.0	704.0	13 x 7
Burrill	2190	707.89	.00109	710.72	701.80	596.0	598.0	704.0	13 x 7
EE Lab.	2341	707.72	.00109	710.56	701.64	596.0	598.0	704.0	13 x 7
Upstream Firestation	2471	707.91	.00109	710.42	701.50	596.0	598.0	704.0	13 x 7
Firestation	2498	708.21	.00109	710.39	701.47	596.0	598.0	704.0	13 x 7
Alley	2568	707.63	.00109	710.31	701.39	596.0	598.0	704.0	13 x 7
Mathews	2775	706.86	.00103	710.08	701.16	734.4	733.0	874.0	13 x 7
Goodwin	3233	706.57	.00119	709.61	699.78	822.9	822.0	983.0	15 x 7.5
Physics Building	3471	706.23	.00119	709.33	699.50	822.9	822.0	983.0	15 x 7.5
Gregory	4191	704.48	.00119	708.47	698.64	822.9	822.0	983.0	15 x 7.5
Lincoln	4552	703.35	.00120	708.04	697.46	943.8	943.0	1131.0	15.5 x 8
Busey	5064	700.92	.00120	707.43	696.85	943.8	943.0	1131.0	15.5 x 8
	5314		.00112	707.13	695.96	1032.0	1034.0	1243.0	16.0 x 8.5

TABLE 14 – CONTINUED

Coler	5571	699.62	.00112	706.89	695.67	1032.0	1034.0	1243.0	16.0 x 8.5
Springfield	5899	699.39	.00112	706.52	695.35	1032.0	1034.0	1243.0	16.0 x 8.5
McCullough	6478	699.09	0.00118	705.87	694.7	1142.6	1143	1383	17.0 x 8.5
Main	6943	698.11	0.00118	705.32	694.15	1142.6	1143	1383	17.0 x 8.5
Griggs	7826	696.34	0.00118	704.28	693.11	1186.8	1184.0	1437.0	17.5 x 8.5
Race	8063	695.97	.00118	704.00	692.83	1186.8	1184.0	1437.0	17.5 x 8.5
Outlet after	8230	D.S.		703.80	962.64				

FIVE POINTS

Flood Problem

The basic flood problem in this reach has not been one of overbank flow, but rather excessive scour and to a lesser degree, some loss of capacity due to heavy overgrowth in the conveyance area. It was felt that these could best be controlled by some reshaping of the banks and a regular channel maintenance program.

Corridor Width

The basic corridor width has been proposed as from 65' to 70', depending on the available space. The major concern was to propose a plan that was workable under present conditions and still maintain 3 to 1 slopes, both for erosion control and to allow maintenance.

Design Flows

Using the data from the State Water Flood Study work, the design storm was the 10 year storm as with previous reaches.

Location	Recurrence Interval	Flow
Race to Saline	10 yr.	1427 c.f.s.
Race to Saline	50 yr.	2468 c.f.s.
Race to Saline	100 yr.	2865 c.f.s.

For all sections of this reach, the design flows was 1427.0

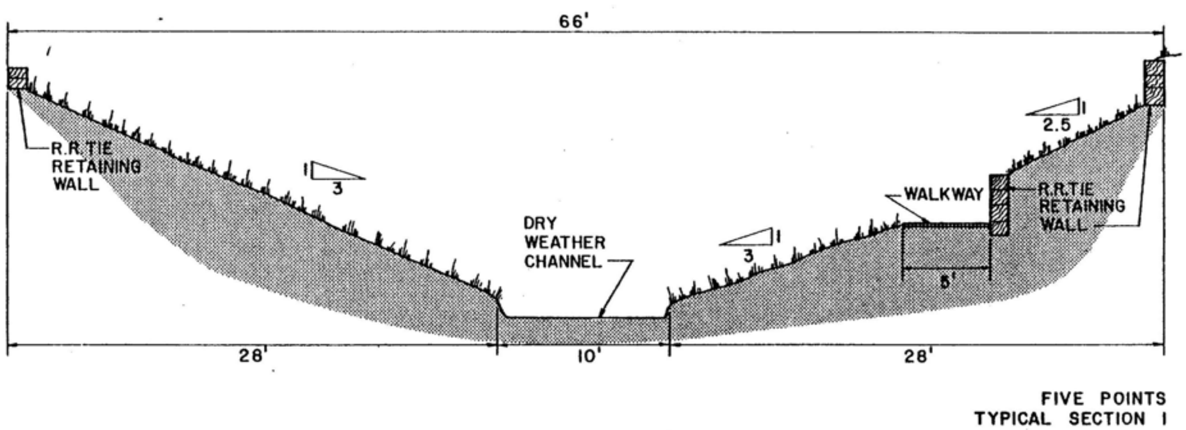
Reach Sections

For the most part, no major changes are being proposed for Reach VIII in terms of the flow corridor. It was felt that this should be left as a natural open channel treatment. A walkway has been added to the sections to allow access to the reach. There would be some minor reshaping of the reach along with a slight grading of the channel bottom to create a more uniform grade.

Typical Section I

This section is very close to the general shape of the banks for much of the early part of the reach. It would fit in a 66' wide corridor. Included in this width would be a 10' dry weather flow channel, 5' walkway, and grass or ground cover stabilized 3 to 1 slopes. In addition, several railroad tie walls have been added to the section to allow 3 to 1 slopes to be maintained.

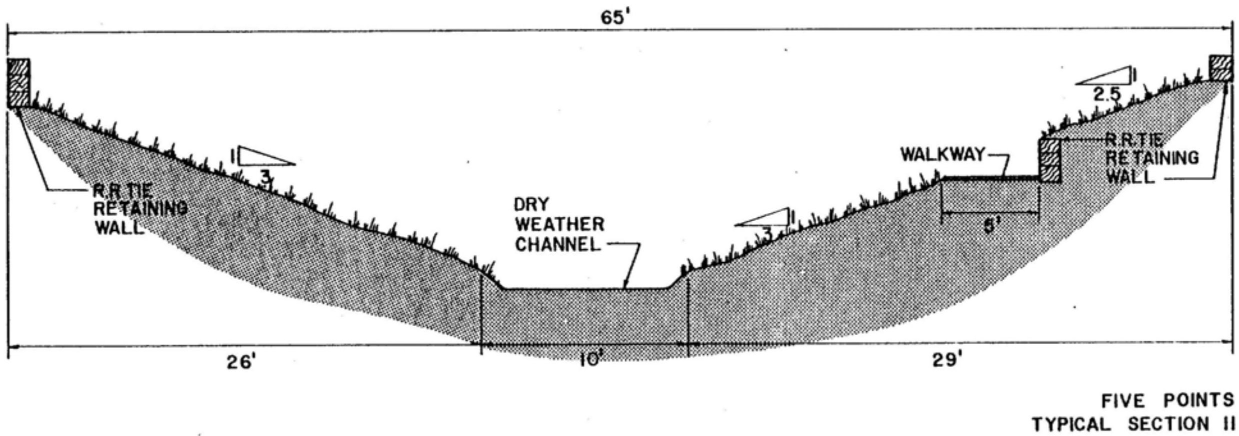
FIGURE 28



Typical Section II

This section is basically the same as the first typical section. It would include the same elements as the first section in a 65' corridor width. One difference in this section is the need for substantial excavation to flatten out the bank on the right side of the section.

FIGURE 29



Typical Section III

This section would apply to the reach as it approaches the Saline Branch. Here, due to additional available space, the corridor width is greater and the need for the railroad tie retaining walls is eliminated. Only minor reshaping of the existing ground contours would be called for.

FIGURE 30

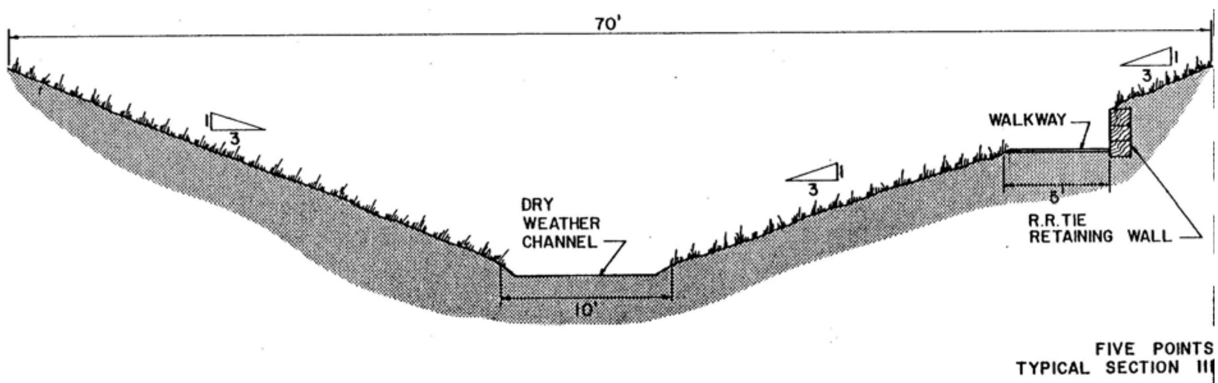


TABLE 15

HYDRAULIC CAPACITY REACH VIII

Section (Slope)	Design Flow	Flow to Walkway	Maximum Flow	Velocity
I. (.0015)	1427 c.f.s.	404 c.f.s.	2890 c.f.s.	5.8 feet/sec.
II. (.0015)	1427 c.f.s.	718 c.f.s.	2673 c.f.s.	5.8 feet/sec.
III. (.0015)	1427 c.f.s.	862 c.f.s.	2716 c.f.s.	5.7 feet/sec.

TABLE 16

SECTION DELINEATION FOR REACH VIII

Station	Section Type
0+00 to 11+00	I
12+40 to 15+90	II
20+05 to Confluence	III

TABLE 17

SPECIAL EROSION AREAS

Station
0+00 to 0+31
8+60

CHAPTER 3: STAGING AND COSTS

Staging

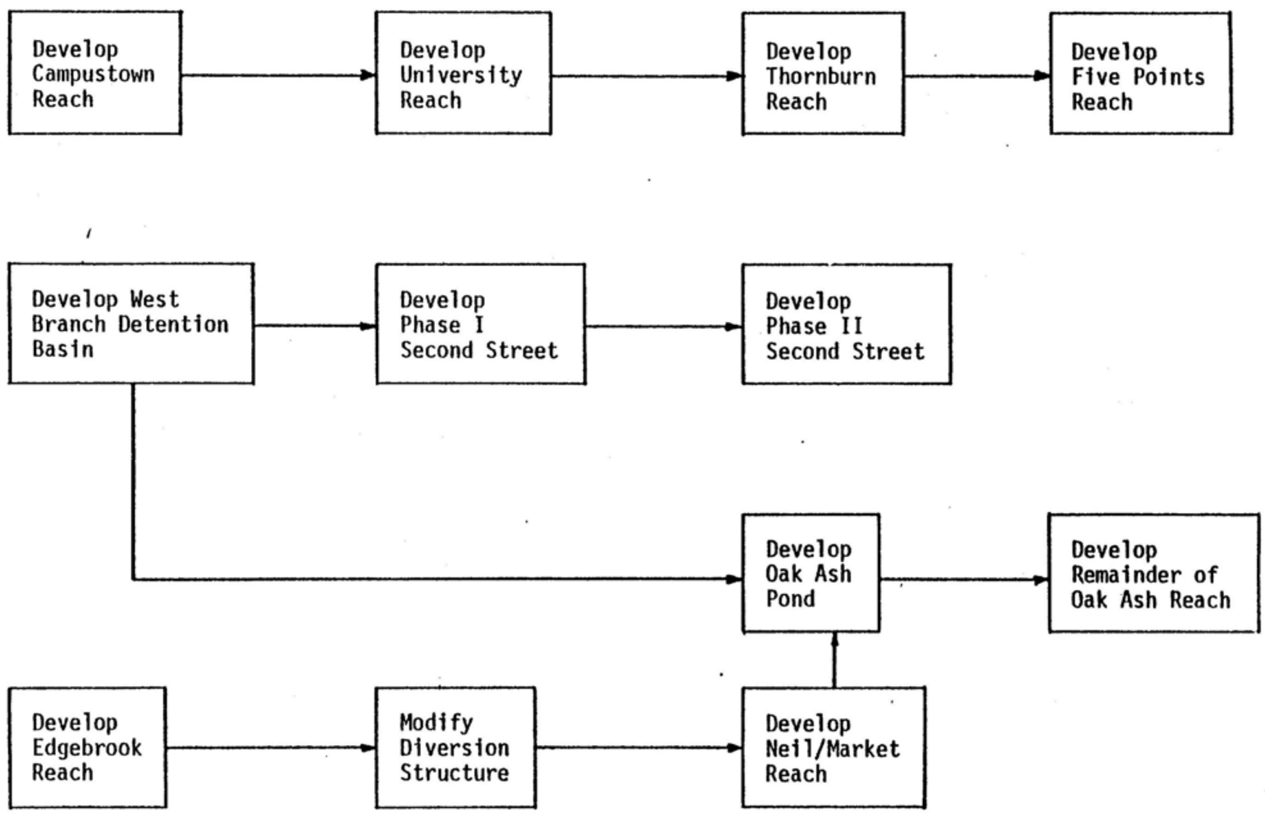
The course of implementation of a master plan is often complicated due to the manner in which various projects are interconnected. An important concept of the master plan has been to present an overall plan for the entire Boneyard corridor in order to allow the impact of a specific project to be considered for its overall effect. At the same time some rather detailed suggestions as to reach by reach approaches have also been presented in this master plan.

An effort has been made to design the various reach approaches in a manner allowing great flexibility as to the order of development. Factors such as local priorities, available funding, and immediate needs will most certainly play a role in the direction development takes.

Still in the overall development of the plan, the development of a given reach can be keyed into a certain project within the plan or one reach's development might depend on the prior completion of another reach.

The following chart provides a listing of a suggested staging. It should be noted that only the connection of Second Street to the west branch detention basin is deemed essential. Other staging options are based on a method of staging to take advantage of certain aspects of design but are flexible and could be subject to change.

FIGURE 31


Develop Campustown Reach
Develop University Reach
Develop Thornburn Reach
Develop Five Points Reach
Develop West Branch Detention Basin
Develop Phase I Second Street
Develop Phase II Second Street
Develop Oak Ash Pond
Develop Remainder of Oak Ash Reach
Develop Edgebrook Reach
Modify Diversion Structure
Develop Neil/Market Reach

Costs

Providing costing information for the various projects at this time in the planning process provides certain unique problems. Although certain types of treatments are being proposed in various reaches often, when it involves a process such as bank stabilization or channel reshaping, the full extent of the needed treatment cannot be understood until the detailed field work required for final design is completed. At the point of final design all the financial aspects of the design can be fully accessed leading to detailed costing of the project. Obviously this type of information is not presently available at this stage of the planning process. However, some value can be gained by putting various projects in perspective based on generalized cost data. Although this type of cost data is only a rough estimate, it allows comparison of various projects in a relative sense.

The preliminary cost data for this draft report were obtained by making estimates of the amount of various approaches to be used to obtain general costs for portions of the different reach developments. The elements making up the overall cost are listed reach by reach. Areas where an associated cost will be involved that cannot be presently estimated will also be noted in these estimates. Due to the extensive nature of projects and coverage areas, only costs covering major concepts or proposals are included in these initial cost estimates.

The estimates here are based on present day dollars. Consequently, the cost of a given project would increase when built at some time in the future.

Edgebrook Costs

Bikeway	$43,650
Bank Stabilization and Shaping	$21,000
Hard Edge Sections (Gabions)	$10,000

Costs not included: R.O.W.'s, land acquisition, culvert upgrading, special erosion treatments

Neil/Market Costs

Bikeway	$21,300
Bank Stabilization and Shaping	$26,000
Hard Edge Sections and Walls (stone walls & R.R. ties)	$30,750
New Street Crossings	$12,000
Modification of Diversion	$31,000
Piping South of Bradley	$43,500

Costs not included: R.O.W.'s, land acquisition, special erosion treatments

Oak Ash Costs

Detention Basin Excavation	$157,300
Hydraulic Structures (Inlet, Outlet, etc:)	$ 10,000
Landscape	$ 6,000
Oak Ash Pool & Berm (Excavation and handling)	$840,443
Inlet and Outlet for Pond	$ 10,000
Bikeway (Washington to Church)	$ 10,200
Bank Stabilization and Shaping	$ 24,500
Retaining Walls (R.R. ties)	$ 5,300

Costs not included: fencing for detention basin, R.O.W. and land acquisition, special erosion treatments

Second Street Costs

Hard Edge Channel Walls (Stone)	$110,350
Bikeway	$ 16,500
Walkway	$ 54,000
Channel Steps & Retaining Walls (R.R. ties)	$ 30,900
Bank Stabilization	$ 5,000
Excavation	$ 55,000
Near Street Crossings	$ 50,000

Costs not included: check dams, treatment at stone arch bridge, R.O.W. and land acquisition, utility relocation

Campustown Costs

Box Culvert	$ 670,000
Bikeway	$ 21,900
Asphalt Berms	$ 3,750
Landscaping	$ 1,000
Excavation	$ 87,000

Costs not included: R.O.W.'s and land acquisition, inlet structure, opening covered sections

University Costs

Box Culvert	$2,160,000
Bikeway	$ 36,200
Landscaping	$ 2,000
Excavation	$ 112,000
Railroad Tie Retaining Walls	$ 11,600
Asphalt Berms	$ 6,200

Costs not included: R.O.W.'s and land acquisition

Thornburn Costs

Box Culvert	$2,500,000
Bikeway	$ 44,000
Landscaping	$ 1,500
Excavation	$ 81,000
Asphalt Berms	$ 8,000

Costs not included: R.O.W.'s and land acquisition, stilling structure at outlet, opening covered sections

Five Points Costs

Bank Stabilization and Shaping	$ 37,000
Railroad Tie Retaining Walls	$ 70,000
5' Walkway	$ 20,000

Costs not included: R.O.W. and land acquisition

One additional cost area not addressed up until now is the land acquisition cost. In some areas it is hoped that additional land can be incorporated into the project other than the amount used in the flow corridor. The following is a listing by reach of land for the flow corridor and an estimate as to the amount presently in the private and public sector. In some cases the project will require only an easement on this land rather than out right ownership.

Reach	Acres	% Private	% Public
Reach 1	3.70	100%	~~~
Reach 2	1.80	95%	5%
Reach 3	16.62	13%	87%
Reach 4	2.92	0%	100%
Reach 5	2.70	67%	33%
Reach 6	2.93	95%	5%
Reach 7	2.65	90%	10%
Reach 8	5.31	85%	15%

As stated before it is possible that only an easement will be needed on the private land. If it is assumed that this land would have to be acquired and using an average value of $15,000/acre across the project, the cost of the private land is $286,800.

Design Storm Flood Damage

In order to make a judgment as to the merits of the project, some type of assessment of potential damage is needed. Before applying for funding, a cost/benefit study would have to be accomplished assessing the flood control portion of the project. Since it is doubtful that flood control alone would justify this type of project, the cost/benefit study should also assess the overall approach including potential commercial and recreational benefits. Comments as to a possible approach to the cost/benefit study follow this damage assessment.

Using the information available, an estimate was made of the potential damage from a 10 year storm (the design storm). It was felt that since the sections in this report were designed to handle the flows from this storm with no flooding it would provide useful information in assessing the proposals of this plan. It should be pointed out that storms of greater magnitude may well occur during the economic life of the project. The damage of these would greatly exceed those estimated for the 10 year storm. Although the proposed project would not eliminate the flooding of all these storms, it would have an impact reducing the flood damage they cause. For example, due to the freeboard in the box culvert and the capacity of the upper channel to carry flow, these would reduce the damage of the floods with magnitudes greater than those of the design storm. Only a true cost/benefit study would provide the sufficient detail for a more exact analysis accounting for the damages of a wider range of flow magnitudes.

The following table provides a breakdown of the estimated damage from the 10 year design storm. The direct damages were obtained in the following manner. For residential areas, the water level provided by the Illinois State Water Survey flood study was coupled with estimated first floor elevations obtained from contour maps and a field check. Using the FIA stage/damage curves, estimates of the structural damage and damage to the contents were arrived on as a percentage of the market value of the structure. The value of the contents was taken to be 30% of the value of the structure as suggested by Griggs[2].

10 Year Flood Damage

Land Use	Direct	Indirect
Residential	$353,880	$53,082
Commercial, & Apartments	$100,000	$25,000
Industrial	$150,000	$67,500
University	$105,000	$35,700

Total Damage = $890,162

1. Flood Damage Factors - Depth Damage Curves, Federal Ins. Admin. Sept., 1970.
2. Griggs and Helweg, State-of-the-Art of Estimating Flood Damage, Water Resources Bulletin, April, 1975.

Again for commercial, industrial and University buildings an estimate was made based on the water level of the Illinois State Water Survey work. Some input from local businessmen was obtained but these figures represent only an estimate. In addition a value was added for indirect damages for each land use type. The values used were 15% of direct damages for residential, 35% for commercial, 45% for industrial, and 34% for university buildings. Indirect damages include dollar loss for lost business and services, rerouting traffic, safeguarding health, the cost of alleviating hardship, delays and related phenomena.

The "need" for a project such as the Boneyard renovation cannot be assumed in our society, especially in this day of private and public financial caution. A project must be justifiable in terms of benefits relative to the costs of project implementation. A preliminary flood damage analysis of the Boneyard design storm was performed to provide a basis for determining whether to do a detailed and more costly economic analysis.

There are several additional approaches that would be incorporated into a more detailed study, if the results of this study indicate that a more sophisticated economic analysis is necessary. The first step would be a thorough field survey to establish first floor elevations for buildings within the flood plain of 5, 10, 25, 50 and 100 year storms. Mail surveys for owner's estimates of potential property damage would have to be done once flood levels were established for each structure. This is especially critical for commercial and industrial properties since little data on flood damages of these properties exists in the literature. With this information an "annual flood damage" estimate can be determined.

It is possible to consider various alternatives to channel improvement in a flood damage economic analysis. These include the creation of detention storage reservoirs, floodproofing of structures, relocation of people and structures outside the floodplain or combinations of the alternatives.

Several benefits other than property loss are estimated in more costly analyses. These include the reduction of indirect flood damages such as the travel costs around flood areas and losses caused by interruption of utility services; and intangible losses such as health hazards, death and psychic damages to residents either fearing floods or experiencing them. A multiple-use project such as the Boneyard would also entail multiple benefits and costs such as those associated with aesthetics and recreation.