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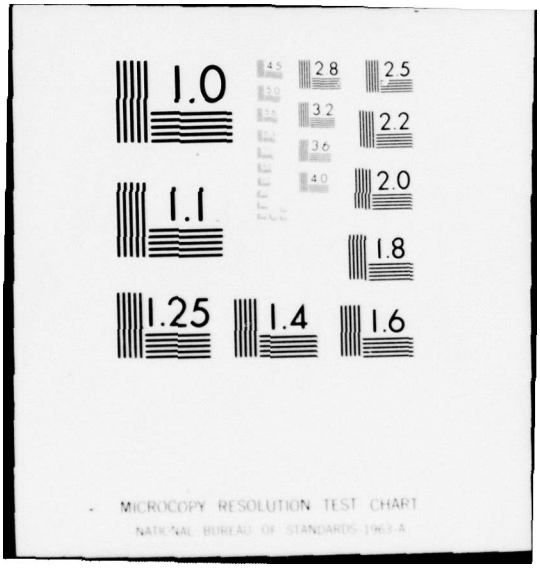
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VOLUME III

PLAN FORMULATION APPENDIX

REVIEW REPORT ON THE MISSOURI RIVER AND TRIBUTARIES

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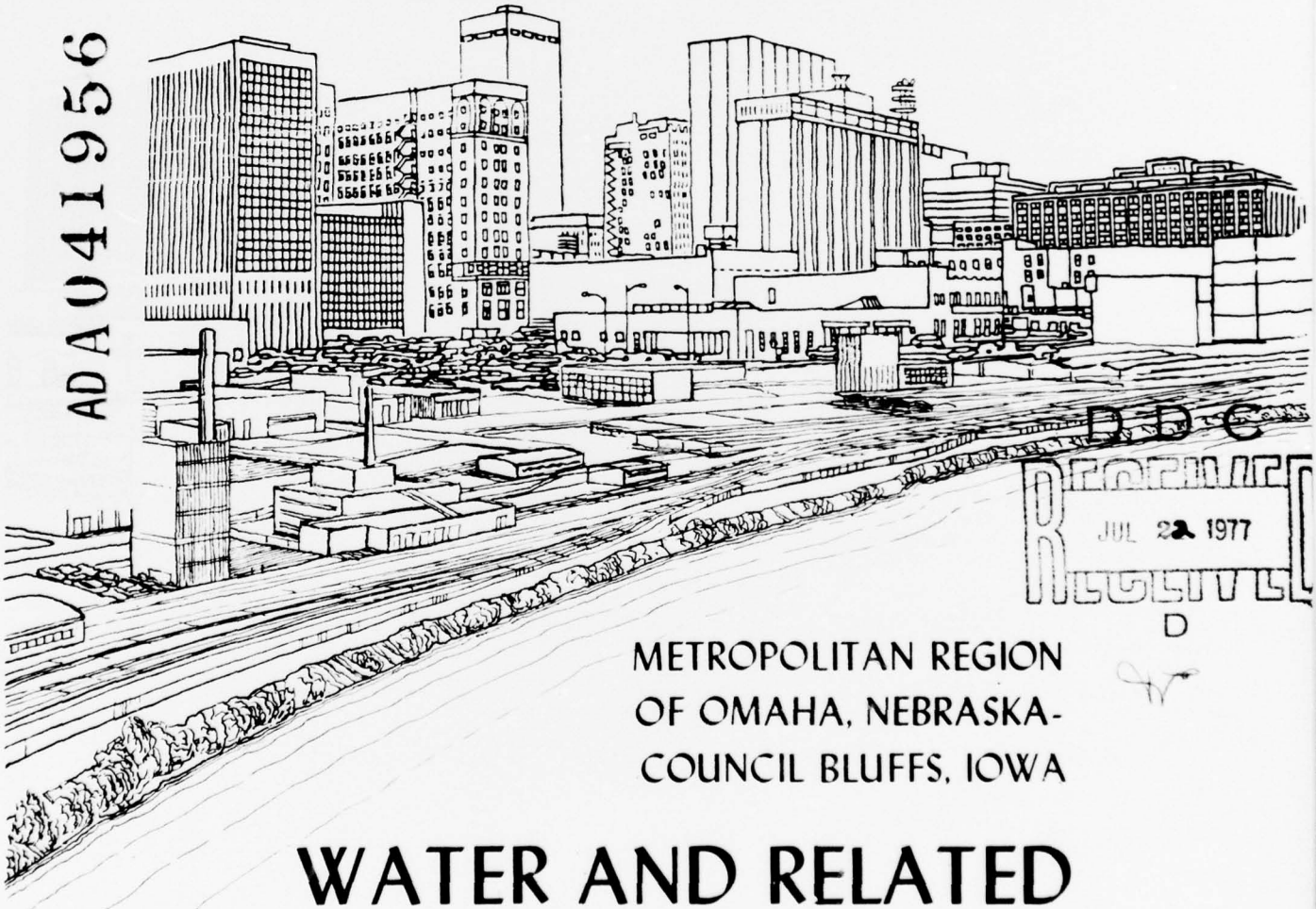

METROPOLITAN REGION
OF OMAHA, NEBRASKA-
COUNCIL BLUFFS, IOWA

WATER AND RELATED LAND RESOURCES MANAGEMENT STUDY

JUNE 1975

REVIEW REPORT FOR

Metropolitan

Omaha, Nebraska-

Council Bluffs, Iowa

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WATER AND RELATED LAND RESOURCES MANAGEMENT STUDY

Volume III. Plan Formulation Appendix.

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REVIEW REPORT FOR
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
WATER AND RELATED LAND
RESOURCES MANAGEMENT STUDY

Volume III Plan Formulation Appendix

ANNEX A	ALTERNATIVE FUTURES
ANNEX B	WASTEWATER
ANNEX C	WATER SUPPLY
ANNEX D	FLOOD CONTROL
ANNEX E	RECREATION

PREPARED BY THE

OMAHA DISTRICT CORPS OF ENGINEERS

DEPARTMENT OF THE ARMY

REVIEW REPORT FOR
METROPOLITAN OMAHA, NEBRASKA
COUNCIL BLUFFS, IOWA
WATER AND RELATED LAND
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Volume III Plan Formulation Appendix

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DEPARTMENT OF THE ARMY

SECTION A

INTRODUCTION

SECTION A

INTRODUCTION

1. The purpose of the Plan Formulation Appendix is to provide in one document the results of the planning process. The appendix documents significant regional problems, concerns, issues and planning objectives (Need Identification); illustrates the iterative formulation of alternative urban water resource plans (Plan Formulation); shows the results of the impact assessment and evaluations (Effect Assessment); and indicates alternative ways to implement the plans (Institutional Analysis).

2. The Plan Formulation Appendix for the Omaha-Council Bluffs Urban Study is subdivided into six components. The six components are:

Plan Formulation Appendix - Main Volume

Plan Formulation Annex A - Alternative Futures

Plan Formulation Annex B - Wastewater Management

Plan Formulation Annex C - Water Supply

Plan Formulation Annex D - Flood Control

Plan Formulation Annex E - Recreation

3. The main volume contains a summary of the problems and needs, planning objectives, the final alternative urban water resource plans, the evaluation of the final plan components, and a summary of the alternative institutional arrangements necessary to implement the plans.

4. The main volume is supported by five annexes, each on a specific water resource functional area. These annexes are to be considered an integral part of the Plan Formulation Appendix. Each annex presents the iterative planning process used for each functional area. The annexes are prepared as individual documents to allow independent use where desired.

SECTION B

PROBLEMS AND NEEDS

PROBLEMS AND NEEDS

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SECTION B

PROBLEMS AND NEEDS

Land Use and Urban Growth

1. Annex A - Alternatives Futures presents a detailed consideration of the land use issues and concerns in the study area. The annex also presents the rationale behind each Alternative Future, the water resource system effects, and a listing of other effects of public interest.

2. Each of the alternative urban growth patterns used in the study respond to one or more of the following public concerns:

- Preservation of Agricultural Land - Most growth that will occur in Douglas and Sarpy Counties will occur in Class I through IV agricultural land. Conservation of food-producing capabilities is high on the list of community concerns.

- Costs of Public Services - Suburban spread development results in increased community costs with a rise in tax levies and service charges.

- Urban Core Decay - Suburban expansion of Omaha has caused population and economic activity decline of the central city resulting in general deterioration.

- Conservation of Energy - Mass transit systems are rarely economically viable under spread development; more compact development requires less use of all energy sources.

- Rural Community Economic Growth - Fringe communities are concerned about becoming "bedroom communities" where they are required to provide all community services but do not have an industrial tax base.

3. To respond to the above public concerns, four alternative urban growth futures were used in the Urban Study. These are:

- Growth Concept A - A continuation of present trends in land use. That is, the continued suburbanization of the area, with low density residential urban sprawl directed away from the core city.

- Growth Concept B - Controlled expansion of urban Omaha with emphasis placed on encouraging higher density residential development, revitalizing the urban core, and developing satellite cities based on existing communities located around the fringes of the metropolitan area.

- Growth Concept C - Similar to Growth Concept B, except it does not include the satellite cities. It is primarily characterized by redevelopment of the older areas of Omaha and Council Bluffs, coupled with higher density growth on the urban fringes.

Growth Concept D is similar to Concept A, except that it assumes substantial development will occur along major transportation corridors producing a star-shaped metropolitan area.

Wastewater Management

4. Annex B - Wastewater Management, presents a detailed analysis of current wastewater management problems in the study region. Sources of pollution include inadequately treated domestic sewage, combined sewer overflows, urban storm runoff, agricultural runoff, and industrial wastes.

5. There are over 100 municipal wastewater treatment plants in the study area. Only 13 of these plants are known to be capable of meeting the 1977 Federal standards for secondary treatment. Sewage plants for the city of Omaha discharge 62.5 million gallons per day of which 61 million gallons do not receive secondary treatment. Three major combined sewer areas exist in the study area: (1) Over 17,000 acres in the Omaha-Missouri River drainage area; (2) Over 5,000 acres in the Little Papillion Creek drainage area; and (3) over 1,000 acres in the Indian Creek drainage area. Discharges of these overflows cause a serious violation of State water quality standards even in the Missouri River where dissolved oxygen content approaches zero during an overflow event.

6. Urban storm runoff contributes large quantities of organic material, solids, nutrients, oils, metals, and dissolved salts to

the area's streams. Particularly susceptible is the Papillion Creek System. Urban storm discharges cause a serious water quality violation in the lower Papillion Creek basin.

7. By far, the largest source of pollutants entering the area's streams is from agricultural runoff. Sediment, nutrients, bacteria, and farm chemicals enter the streams in large quantities during storm events.

8. Industrial waste discharges are not as significant as the other waste sources. The major problem area is waste from the meat-packing industry. Problems at Omaha's meat-packing pretreatment facility are the major industrial concerns.

9. The Omaha-Missouri River sewer system is not capable of consistently delivering sewage flows to the treatment plant. The city of Omaha estimates that 4.5 billion gallons of raw sewage entered the river in 1973 because of problems with existing grit removal facilities.

10. Proper operation and maintenance of several small treatment plants in the study area are lacking. Nebraska does not have a mandatory requirement for certified treatment plant operators.

11. Table B-1 lists the wastewater management needs in the study area.

Table B-1
Current Wastewater Management Needs

Item	
Increased sewage treatment	90 plants
Treatment of overflows or sewer separation	23,380 acres
Treatment of urban runoff	41,040 acres
Agricultural land conservation	1,272,000 acres
Industrial wastes	1 plant rehabilitation
Sewer system improvements	8 grit chambers

12. In addition to these needs, substantial additions to current wastewater management facilities will be required in order to achieve the goals and objectives of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). These goals will be discussed in the next section. If the goals are to be met, all communities will have additional wastewater management needs.

Water Supply

13. Annex C - Water Supply presents a detailed discussion of current and future water supply problems in the study area.

14. There are 55 municipal water systems in the study area. Table B-2 indicates current water supply needs.

Table B-2
Current Water Supply Needs

Need	Number of Systems
Better water quality	42
Increased supply capacity	15
Increased storage	26
Disinfection capability	26
Water supply plan	37

15. Future water supply problems are the increasing rate of water use and the source of water supply. Per person water use is currently expected to increase by 37 percent by 2020. This increase coupled with population growth will result in a 2020 water usage that is 2.5 times the 1973 usage. Resource conservation dictates that attempts be made to reduce the increasing rate of comsumption.

16. The major issue concerning source of supply is use of the limited Platte River water resources. Priorities and legal constraints will have to be established at the State level for use of this resource.

Flood Control

17. Annex D - Flood Control defines the existing flood problems in the study area. Flooding problems exist along the Platte, Elkhorn,

Missouri, Nishnabotna, and Boyer Rivers and along Papillion, Indian, Mosquito, Willow, and Allen Creeks. Smaller streams such as Betz Ditch, Mud Creek, Cole Creek, and Hell Creek are also flood-prone areas.

18. Flood problems at Missouri Valley, Iowa are attributable to the Boyer River, and to Willow and Allen Creeks. Ice jam conditions are the main cause of flooding. Locally constructed levees aggravate the flood problem. Average annual damages are estimated to be $200,000.

19. Flooding in Council Bluffs from Indian Creek is caused by high intensity rainfall of short duration. The flood problems are aggravated by an inadequate channel and by an urban renewal project situated across the flood plain. Average annual damages are estimated at almost $1,000,000.

20. Flooding in Council Bluffs by Mosquito Creek is caused by short duration, high intensity thunderstorms. Flooding is very infrequent, with estimated average annual damages of $100,000.

21. The major flood problems along the Missouri River occur both north and south of the urban area. Two levee units, L-611-614 and R-616, are in the planning stages and when constructed, will protect areas south of Omaha. The Omaha District has a Missouri River floodway study underway which will define flood problems in other areas within the study region.

22. Floods along the Platte-Elkhorn Rivers have a potential of inundating about 65,000 acres of primarily agricultural land. Transportation and urban lands are also subject to flooding. Average annual damages are about $190,000.

23. Floods in the Papillion Creek basin are caused by high intensity thunderstorms; urban and agricultural lands are affected. Average annual damages are estimated to be $2,145,000, which makes the Papillion Creek flood problem the most serious in the study area.

24. Table B-3 summarizes the flood control needs in the study area.

Table B-3
Flood Control Needs

Area	Average Annual Damages
Boyer River and Missouri Valley	$ 200,000
Indian Creek and Council Bluffs	900,000
Mosquito Creek and Council Bluffs	100,000
Missouri River	1,182,000
Platte-Elkhorn Rivers	190,000
Papillion Creek Basin	2,145,000

Recreation

25. Annex E - Recreation defines specific needs for recreation in the study area. Outdoor recreation needs were determined using adopted State and local standards. These standards are available for local parks, regional parks, and natural areas.

26. Table B-4 lists the outdoor recreation needs for 1975, 1995, and 2020.

Table B-4
Outdoor Recreation Needs (Acres)

	1975	1995	2020
Local parks	1,262*	5,046	9,377
Regional parks	16,045	36,851	48,104
Natural areas	16,762	33,900	41,428

* Surplus

27. The Nebraska State Comprehensive Outdoor Recreation Plan, (SCORP) also identified acreage needs in terms of specific activities using projections of activity preferences and acreage-carrying capacities. Table B-5 represents the acreage needs extracted from the Nebraska SCORP for 1972 and 1990 for the Omaha area.

Table B-5
Specific Recreation Activity Needs (Acres)

	1972	1990*
Lake swimming	15	22
Lake fishing	1,303	6,403
Camping	599	989
Powerboating	8,082	11,862
Water skiing	4,380	7,430

* Recreation provided at Papillion Creek sites 10, 11, 16, and 3A is accounted for in the needs figures.

SECTION C

GOALS AND PLANNING OBJECTIVES

GOALS AND PLANNING OBJECTIVES

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SECTION C

GOALS AND PLANNING OBJECTIVES

1. The goal of the Omaha-Council Bluffs Urban Study is to provide a range of urban water and related land management plans that are compatible with the comprehensive urban development and environmental goals of the region. The goal is defined by accomplishing the regional planning objectives set forth below and is described further in the annexes to this volume.

2. Table C-1 lists the regional planning objectives used for each functional area in the study.

Land Use and Urban Growth

3. The land use objectives are reflective of public concerns over land use. Some of the objectives conflict, therefore, the use of alternative urban growth futures in the planning process was dictated.

Table C-1
Regional Planning Objectives

Functional Area	Objectives
1. Land Use and Urban Growth	Promote a more compact urban development pattern. Promote large scale redevelopment of blighted areas. Promote higher density fringe development. Encourage mass transportation. Encourage energy conservation. Preserve existing agricultural area. Promote industrial decentralization to ensure the economic stability of selected satellite cities. Provide for the protection of the freedom of the individual landowner. Provide complete individual freedom on where and how to live. Provide low density development to afford maximum individual privacy.
2. Wastewater Management	Meet State water quality standards in all streams in the study area. Reduce or eliminate pollution from all waste sources. Meet 1977 effluent requirements and 1983-1985 goals of PL 92-500 for all publicly-owned sewage treatment plants. Provide an additional 115 M.G.D. by 1995 and 185 M.G.D. by 2020 of sewage treatment capacity in the study area. Provide for recycling of wastewater effluents. Provide for non-structural approaches to wastewater management.
3. Water Supply	Provide a reliable water supply to all residents of the seven-county study area that meets the 1962 United States Public Health Service and 1974 Safe Drinking Water Act Standards. Provide all communities with a minimum of 1-day's storage for emergency and fire protection purposes. Provide enough water treatment plant capacity for additional maximum day demands of 200 M.G.D. by 1995 and 356 M.G.D. by 2020. Minimize potential conflicts over water resource development and environmental concerns in the Platte River. Reduce projected demands by approximately 40 M.G.D. by 2020.

Table C-1
(Cont'd)
Regional Planning Objectives

Functional Area	Objectives
4. Flood Control	Provide the highest degree of flood protection economically feasible for Missouri Valley, Council Bluffs, and the greater Omaha Area. Provide flood plain management measures to avert future flood damages. Provide for multi-purpose use of flood management measures wherever possible.
5. Recreation	Provide enough outdoor recreation area to accomodate an additional demand of 25,350,000 activity days by 1995 and 43,704,000 activity days by 2020. To meet 1995 activity day demands, provide an additional 5,046 acres of local parks, 36,851 acres of regional parks, and 33,900 acres of natural areas by 1995. To meet 2020 activity day demands, provide an additional 9,377 acres of local parks, 48,104 acres of regional parks, and 41,478 acres of natural areas by 2020. Within the above acreages, provide 26 acres for lake swimming, 8,300 acres for lake fishing, 11,952 acres for powerboating, and 6,627 acres for water skiing by 1990. Provide 400 miles of protected streams in the Lower Platte Basin by 2020 as indicated in the Platte Level "B" Plan. Provide the above, using multipurpose objectives wherever possible. Provide for the above with the least disturbance of existing land uses.

Wastewater Management

4. The wastewater management planning objectives generally follow national objectives called for in PL 92-500, State objectives defined by Iowa and Nebraska Water Quality Standards, and local problems and needs.

Water Supply

5. The water supply planning objectives are related to local water supply needs, the 1962 United States Public Health Service Recommended Drinking Water Standards, the Safe Drinking Water Act (PL 93-573), and the probability of the need for general resource conservation.

Flood Control

6. The objectives for flood control planning are well defined through national flood control planning procedures.

Recreation

7. The recreation objectives were taken from the Nebraska and Iowa State Comprehensive Outdoor Recreation Plans, the MAPA Open Space Plan and Program, and the Platte Level "B" Study. The objectives contained in the above reports were modified, combined, and extrapolated where necessary to provide a near common base for recreation objectives. The final definition of recreation objectives was provided by the Bureau of Outdoor Recreation. It is to be understood that recreation objectives vary widely and those stated in this study represent guidelines rather than strict requirements.

SECTION D

PLAN FORMULATION

PLAN FORMULATION

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SECTION D

PLAN FORMULATION

Single Purpose Plan Formulation

1. The formulation of the alternative urban water resource plans is detailed in each of the plan formulation annexes. The interrelated aspects between each of the water resource areas and between water resources and land use are also defined in the annexes. The results of the iterative plan formulation processes will be discussed in this section.

2. Tables D-1 through D-5 display the iterative plan formulation process. The initial and final plans are indicated, along with the primary reason for eliminating some of the initial plans or concepts. Essentially three iterations of the planning process were made proceeding from initial plans and concepts to the final more detailed alternatives. For the purpose of later reference, a final plan component number has been assigned to each alternative.

LAND USE AND URBAN GROWTH

3. Table D-1 displays the plan formulation iteration for land use and urban growth. From an initial 9 urban growth possibilities,

Table D-1
Land Use and Urban Growth Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
1. Land Use and Urban Growth				
No growth	Eliminate ZPG-not possible for 30-50 years. Omaha growth rate currently above State and national rates			
Peripheral sprawl with unplanned development	Retain as a trends forecast	Concept A-Low density sprawl growth	1.A	Growth Concept A unacceptable among informed public, majority of public desires according to land developers. Least cost-effective
Redevelopment of older neighborhoods	Retain for further consideration; Riverfront New-towns-in-town	Incorporate as part of controlled Growth Concepts B & C		
Satellite new cities	Retain as limited alternatives-Riverfront New Town	Incorporate as part of controlled Growth Concept B		
Satellites built upon existing communities	Retain as partial alternative; regional planning objective of MAPA Council of Officials	Concept B-Interior redevelopment, planned fringe expansion, satellite cities	1.B	Growth Concept B preferred as a second choice among the informed public
Planned peripheral growth	Retain for consideration at increased fringe density	Concept C-Higher density planned fringe expansion Interior redevelopment Incorporate also as part of Concept B	1.C	Growth Concept C preferred as first choice among the informed public. Most cost-effective
Stellar growth with urban land uses along transportation corridors	Retain as a possible growth future	Concept D-Transportation corridor sprawl	1.D	Growth Concept D preferred as third choice among the informed public
Non-metropolitan new cities	Eliminate-lack of economic development potential			
Expanded non-metropolitan communities	Retain-use State or local growth projections	All four Growth Concepts except for satellite cities		

four growth patterns were selected for use in the urban study. These four represent the broadest range of realistic urban growth alternatives suggested at the local level. Concept A represents a trend forecast in land use and assumes no dramatic policy changes. Concepts B and C are controlled growth alternatives aimed at resource conservation. In addition, Concept B provides for population and economic activity decentralization to satellite cities. Concept D is similar to A, with transportation corridors influencing urban growth.

WASTEWATER MANAGEMENT

4. Table D-2 displays the plan formulation iterations for wastewater management. The wastewater management plans are divided into areawide plans and plans for the specific problem areas of combined sewer overflow, storm runoff, and miscellaneous waste management problems.

5. Eight initial areawide wastewater management plans were considered. Sewer system regionalization, methods of stormwater handling, and conventional versus land treatment systems were the plan-distinguishing variables. Public involvement and economics narrowed the eight plans to three basic plans and a major land treatment option. All areawide plans use the MAPA Comprehensive Water Pollution Control Plan as a base to expand upon in relation to PL 92-500's requirements. Treatment plants in the areawide plans are staged to provide treatment to one of three levels: secondary treatment (Level 1), tertiary treatment (Level 2), and zero discharge (Level 3). Areawide Plans 1 and 2 use conventional treatment methods at all plants; Plan 3 uses land irrigation at minor urban and non-urban plants; and the land treatment options consider land

Table D-2
Wastewater Management Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
2. Wastewater Management				
2A. Areawide Management Plans				
Plan I-Basic Plan - Maximum Sewer extension; 3 major urban, 7 minor urban, 34 rural treatment plants. Treatment and discharge. Upstream treatment and discharge for stormwater	Retain for further consideration	Same as Initial Plan I Treatment of municipal water to three levels; stormwater treatment to Level 1	2.A.1 Plan 1	Most cost-effective plan for Level 1 treatment and Growth Concept A & D
Plan II-Same as basic plan with limited sewer extension and 11 minor urban plants	Retain for further consideration	Same as Initial Plan II	2.A.2 Plan 2	Most cost-effective plan for Level 1 treatment and Growth Concept B or C
Plan III-Basic Plan with stormwater conveyed to central treatment plants	Eliminate-stormwater conveyance not cost-effective			
Plan IV-Basic Plan with elimination of the Omaha-Missouri River treatment plant	Eliminate-plant elimination not cost-effective			
Plan V-Same as Plan IV except central treatment of stormwater	Eliminate-stormwater conveyance not cost-effective			
Plan VI-Same as Plan III except all domestic wastes and stormwater provided with land treatment	Eliminate-land treatment of all wastes not cost-effective			

Table D-2
(Cont'd)
Wastewater Management Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
Plan VII-Similar to Plan II except minor urban and rural plants use land irrigation	Retain for further consideration	Same as Initial Plan VII. Major urban plants treat and discharge to one of three levels; all other plants use land treatment	2.A.3 Plan 3	Preferred plan for small communities to meet Level 2 or 3 treatment. Also includes zero discharge lagoons in final plan
Plan VIII-Basic Plan with the 3 major urban plants employing land treatment	Retain as a land treatment option for all final plans	Any plan above with major land irrigation; consider two land irrigation areas--Upper Blue River and Todd Valleys; eliminate-consideration of Council Bluffs plant; consider optional flow arrangements	2.A.4 Land Treatment Option	Land treatment option most cost-effective plan to meet Level 2 or 3 (zero discharge) treatment. Use with Plan 1, 2, or 3, or any combination of the above
2B. Omaha-Missouri River Combined Sewer Overflows				
Alt. 1-Buried storage at outfalls	Eliminate due to costs			
Alt. 2-Diked storage along levee	Retain for further consideration	Retain-Initial Alt. 2 design for 1-year storm secondary treatment	2.B.1 Alt. 2	Least cost, most unaesthetic alternative
Alt. 3-Upstream retention	Eliminate due to costs and disruptive effects			
Alt. 4A-Deep tunnel north to ground level storage	Retain for further consideration	Retain-Initial Alt. 4A; 1-year storm, secondary treatment	2.B.2 Alt. 4A	Moderate cost-moderate aesthetic problems
Alt. 4B-Excavated storage north-deep tunnel south to ground level storage	Retain for further consideration	Same as Initial Alt. 4B; 1-year storm, secondary treatment	2.B.3 Alt. 4B	Same as Alt. 4A
Alt. 5A-Deep tunnel with mined storage	Retain for further consideration	Retain-Initial Alt. 5A; 1-year storm, secondary treatment	2.B.4 Alt. 5A	Next to highest cost-most aesthetically pleasing alternative

Table D-2
(Cont'd)
Wastewater Management Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
Alt. 5B-Excavated storage north-deep tunnel to mined storage south	Eliminate-components same as in 4B and 5A			Should be reconsidered in further planning
Alt. 6-Flow-through treatment with storage at outfall	Retain as a possible alternative with reduced storage	Design for less than 1-year storm less than secondary treatment; New Alt.		Highest cost alternative Eliminate-does not meet water quality standards
Alt. 7-Sewer separation	Eliminate due to cost and disruptive efforts			
Alt. A-In-system attenuation device	Consider as a partial alternative	Eliminate-not cost-effective		
Alt. B-Deep tunnel to the Papillion Creek S.T.P.	Eliminate-not cost-effective			
Alt C-Flow-through treatment for first flush	Eliminate-not cost-effective			
2C. Little Papillion Creek Combined sewer overflow				
Upstream storage, treatment and discharge	Retain for further consideration	Retain for final evaluation	2.C.1	Retain for final evaluation-least cost alternative
Upstream storage with conveyance to Papillion S.T.P.	Retain for further consideration	Retain for final evaluation		Eliminate-not cost-effective
Sewer separation	Retain for further consideration	Retain for final evaluation		Eliminate-most costly and disruptive alternative

Table D-2
(Cont'd)
Wastewater Management Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
2D. Indian Creek Combined overflows				
Upstream storage, treatment and discharge	Retain for further consideration	Retain for final evaluation	2.D.1	Cost-effective only if stormwater treatment is required
Upstream storage and conveyance to Mosquito Creek S.T.P.	Retain for further consideration	Retain for final evaluation		Eliminate-not cost-effective
Sewer Separation	Retain for further consideration	Retain for final evaluation	2.D.2	Cost-effective plan for combined overflows
2E. Urban Storm Runoff treatment				
Upstream storage treatment and discharge	Retain for further consideration	Retain for final evaluation-provide retention of 1 year storm, Level 1 treatment	2.E.1	Final Plan component
Upstream storage with conveyance to central treatment plant	Eliminate-conveyance of stormwater is not cost-effective			
Non-Structural approaches	Retain for further evaluation	Effective only at lower precipitation events	2.E.2	Combine with 2.E.1 above; requires additional study
2F. Agricultural Runoff				
Land conservation measures	Retain for Final Plan inclusion	Retain for Final Plan inclusion	2.F.1	Final Plan component

Table D-2
(Cont'd)
Wastewater Management Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
2G. Industrial Wastes				
Rehabilitate pretreatment plant	Retain for Final Plan inclusion	Retain for Final Plan inclusion	2.G.1	Final Plan component-required to meet 1977 effluent standards at Missouri River Plant
2H. Sewer System Developments				
Install 8 additional grit chambers	Retain for Final Plan inclusion	Retain for Final Plan inclusion	2.H.1	Final Plan component-high priority

irrigation for the three major urban facilities. All areawide plans contain the three major urban treatment facilities of Omaha-Missouri River, Omaha-Papillion Creek, and Council Bluffs-Mosquito Creek.

6. Areawide Plan 1, component 2.A.1, envisions maximum regionalization of the sewer systems, supports Growth Concept A or D, and reduces the number of minor urban treatment plants with the incorporation of Gretna, Elkhorn, Bennington, and Bellevue wastewaters into Omaha's system.

7. Areawide Plan 2, component 2.A.2, limits the extension of the sewer systems, supports Growth Concept B or C, and maintains 11 minor urban facilities. The four minor urban plants incorporated into Omaha's system in Plan 1 are retained as independent plants in Plan 2.

8. Areawide Plan 3, component 2.A.3, has the same sewer configuration as Plan 2. The minor urban and non-urban plants employ land treatment in Plan 3. The major urban facilities employ conventional treatment technology.

9. The Land Treatment Options, component 2.A.4, evaluate the use of land treatment for the major urban treatment plants. Two major land irrigation areas, the Todd Valley and the Upper Blue River Basin are considered potential areas for land irrigation.

10. Initially over 30 concepts were considered for eliminating combined sewer overflows from the Omaha-Missouri River drainage area. The 30 concepts were narrowed to the 12 initial plans indicated in table D-1. The 12 plans were further narrowed by interagency review to the final four alternatives.

11. Alternative 2, component 2.B.1, involves 5 diked storage areas and the Missouri River flood protection levee to capture the overflows and gradually release them back to the interceptor for treatment at the Missouri River plant. Alternative 2 is the least-cost alternative that meets the planning objectives. Alternatives 4A and 4B, components 2.B.2, and 2.B.3, involve a combination of surface storage facilities and deep tunnels to capture the overflows with subsequent conveyance to the Missouri River Treatment Plant. These two alternatives are moderate in cost and reduce aesthetic problems associated with Alternative 2.

12. Alternative 5A, component 2.B.4, involves deep tunnels and subsurface-mined storage to capture the overflows prior to treatment. This alternative is expensive but aesthetic problems are minimized with all facilities located below ground.

13. Further studies will be required to define the optimum design parameters and solutions to the Omaha-Missouri River combined overflows.

14. Using the results of the Omaha-Missouri River combined sewer overflow study, only three initial plans were formulated for the Little Papillion Creek and Indian Creek combined sewer problems. The first two alternatives collect and store the overflows with either treatment and discharge back to the stream or conveyance to a central treatment plant. A third alternative is separation of combined sewers. Collection, storage, treatment, and discharge, component 2.C.1, appear most cost-effective for the Little Papillion Creek overflows. Separation, component 2.D.1, is most cost-effective for the Indian Creek overflows.

15. Two alternatives were initially considered for urban storm runoff treatment. Collection, storage, treatment, and discharge back to the receiving waters, component 2.E.1, were found cost-effective over conveyance to a central treatment plant and component 2.E.1 is included as a component of all plans. The selected alternative also allows more flexibility and application of non-structural approaches of reducing urban runoff pollution. The non-structural approaches are not totally effective unless used in combination with a structural approach.

16. Alternatives for agricultural runoff basically involve better land management practices. The practices are well known but are only being partially applied. Conservation measures for agricultural runoff are included in all plans.

17. Rehabilitation of Omaha's pretreatment plant for meat-packing wastes and installation of dual grit removal facilities are items included in all the wastewater management alternative plans.

WATER SUPPLY

18. Table D-3 displays the plan formulation iteration for water supply. Initial alternative water supply plans were formulated to serve non-metropolitan areas, and metropolitan areas, to investigate the feasibility of water use reduction and the use of alternative sources for supply.

19. Four non-metropolitan water supply plans were formulated. All plans are based on county-wide water distribution systems recommended in individual county water and sewer reports. Based on analysis of costs and institutional impacts, Plans I and II were selected as final alternatives.

Table D-3
Water Supply Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
3. Water Supply				
3A. Outlying Area Plans				
Plan I-Thirty rural water systems; 27 treatment plants; county-wide distribution systems	Retain for further consideration	Retain for further consideration	3.A.1 Plan I	Highest cost-most probable plan
Plan IB-Same as Plan I except sized for Growth Concept B	Retain for further consideration	Retain for final evaluation	3.A.2 Plan IB	Highest cost-most probable plan for implementation
Plan II-County-wide water systems; 10 treatment plants	Retain for further consideration	Retain for final evaluation	3.A.3 Plan II	Intermediate cost plan; good implementation possibilities
Plan IIB-Same as Plan II except sized for Growth Concept B	Retain for further consideration	Retain for final evaluation	3.A.4 Plan IIB	Intermediate cost plan for Concept B; good implementation possibilities
Plan III-County-wide water systems; six treatment plants	Retain for further consideration	Retain for final evaluation	3.A.5 Plan III	Cost-effective plan; institutional problems; poor implementation possibilities
Plan IIIB-Same as Plan III except sized for Growth Concept B	Retain for further consideration	Retain for final evaluation	3.A.5 Plan IIIB	Same as Plan III
Dual water systems	Retain for further consideration	Eliminate-dual systems not cost-effective		
3B. Metropolitan Area Distribution Plans				
Maximum extension of systems to serve Growth Concept A	Retain for public selection of a growth concept	Retain for final evaluation	3.B.1	Selected plan for Growth Concept A
Limited system extension to serve Growth Concept B	Retain for public selection of a growth concept	Retain for final evaluation	3.B.2	Selected plan for Growth Concept B

Table D-3
(Cont'd)
Water Supply Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
Limited system extension to serve Growth Concept C	Retain for further consideration	Retain for final evaluation	3.B.3	Selected Plan for Growth Concept C
Maximum extension to serve Growth Concept D	Retain for further consideration	Retain for final evaluation	3.B.4	Selected Plan for Growth Concept D
3C. Water Use Reduction				
Voluntary action	Retain for further consideration	Retain for final evaluation	3.C.1	Included in Final Plan as an Option
Legal actions	Retain for further consideration	Eliminate-not a plan but part of implementation requirements		
Industrial development promotion	Eliminate-not publicly acceptable			
Pricing policy	Retain for further consideration	Eliminate-not publicly acceptable		
Individual metering	Retain for further consideration	Eliminate-significant savings questionable		
Water conserving fixtures	Retain for further consideration	Retain for further evaluation	3.C.2	Retain as Final Plan Option
Water eliminating toilets	Eliminate-technology not perfected			
System pressure reduction	Eliminate-largest systems have pressure control			

Table D-3
(Cont'd)
Water Supply Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
Leakage and loss control	Eliminate-largest systems have effective programs			
Dual supply and distribution systems	Retain for further consideration	Eliminate-not cost-effective		
Unitized residential recycling	Eliminate-technology not available for widespread application			
Housing density	Retain for further consideration	Relates to growth concept	3.C.3	Final Plan inclusion
3D. Alternative Sources				
Missouri River surface	Retain for further consideration	Missouri River surface versus ground; equal trade-off up to 10 M.G.D. Surface economically preferable above 10 M.G.D	3.D.1	Least expensive source if Platte River unavailable
Missouri River ground	Retain for further consideration	Ground supply preferable south of Omaha due to waste discharges	3.D.2	Preferred source south of Omaha's wastewater discharges
Platte River ground	Retain for further consideration	Retain for final evaluation	3.D.3	Least-cost source for additional Omaha water supply
Urban storm runoff	Eliminate-technically and economically infeasible			
Wastewater reuse	Retain for further consideration	Retain for agricultural and industrial use if zero discharge required		See Wastewater Management-Land Treatment Option

20. Plan III involved development of water supplies across State lines, did not produce significant economic advantages, and was excluded because of institutional problems. Plan IV evaluated dual water systems which were found not to be cost-effective.

21. Plan I, component 3.A.1, evaluates the existing county plans. Thirty rural water systems served by 27 treatment plants serve the non-metropolitan areas.

22. Plan II, component 3.A.2, evaluates regionalization to one supply source per county and county-wide distribution networks.

23. Plans I and II are designed to achieve all the water supply planning objectives and to accomodate Growth Concepts A, C, or D, which have the same future rural population, or Growth Concept B with substantial population increases in the rural areas.

24. Four metropolitan area distribution plans, components 3.B.1 through 3.B.4, were formulated. Each of the four corresponds to one of the four growth concepts. The distribution plans differ in the amount of system expansion required to service the four growth concepts.

25. Eleven methods of water use reduction are included in the initial plans. Two of these methods were considered to be practical enough to retain as optional components of the final plans. These two are voluntary action stimulated through public education programs, component 3.C.1, and water-conserving fixtures and appliances, component 3.C.2. Housing density, component 3.C.3, was added as a plan component to reduce lawn watering requirements based on smaller lot sizes under Growth Concepts B or C.

26. Six alternative sources for metropolitan water supplies were included as initial plans. The traditional sources are currently the only practical sources. Urban storm runoff would not be available during periods of critical need. Wastewater reuse, in light of the Missouri River, has practicality only for irrigation, or possibly for industrial use at tertiary treatment levels. Powerplant heated discharge does have some merit particularly for use in water treatment plant operations and aquaculture.

27. Development of an additional Platte River ground water source west of Omaha, component 3.D.3, is being contemplated by the Omaha Metropolitan Utilities District as the least expensive, highest quality source for Omaha's future water supplies. Source reliability and environmental problems may preclude use of the Platte River in which case an additional Missouri River source, component 3.D.1 or 3.D.2, must be developed.

FLOOD CONTROL

28. Table D-4 displays the plan formulation iterations for flood control. Nine alternatives were considered for flood problems at Missouri Valley, Iowa. All structural alternatives are economically infeasible. The Soil Conservation Service is completing a flood hazard map for the area. The flood hazard area should be zoned and existing property owners should apply for flood insurance, component 4.A.1.

29. Seven alternatives were considered for the Platte-Elkhorn flood problem. Structural solutions are economically infeasible. Flood plain mapping should be prepared with hazard areas zoned and flood insurance should be applied for, component 4.B.1.

Table D-4
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
4. Flood Control				
4A. Boyer River at Missouri Valley				
Dams on Boyer River	All alternatives not cost-effective except for flood plain zoning and flood insurance	Conclusion: adopt flood plain zoning and flood insurance	4.A.1	Adopt flood plain zoning and flood insurance; SCS preparing flood hazard maps
Dams on tributaries	"	"	"	"
100 year channel on Boyer River and Willow Creek	"	"	"	"
Ring levees around Missouri Valley	"	"	"	"
Combination of channel and levees on Boyer River and Willow Creek	"	"	"	"
Flood plain evacuation	"	"	"	"
Flood plain zoning, and insurance	"	"	"	"
Flood proofing	"	"	"	"
No action	"	"	"	"

Table D-4
(Cont'd)
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
4B. Platte-Elkhorn Rivers				
Levee	All alternatives not cost-effective except for flood plain zoning and insurance	Conclusion: adopt flood plain zoning and flood insurance	4.B.1	Adopt flood plain zoning, and insurance; flood plain mapping regional
Dams	"	"	"	"
Evacuation	"	"	"	"
Flood insurance and flood plain zoning	"	"	"	"
Flood proofing	"	"	"	"
No action	"	"	"	"
4C. Missouri River				
Levee Unit L-611-614; R-616 additional levees	Complete levee protection authorized, all alternatives to be considered pending completion of the Missouri River Floodway Study. Levee L-611-614 in engineering stages; R-616 in planning stage	Same as First Iteration Include L-611-614 and R-616 in Final Plan	4.C.1 4.C.2 4.C.3	Complete floodway study Include L-611-614 in Final Plans Include R-616 in Final Plans
Evacuation	"	"	"	"
Flood insurance	"	"	"	"
Flood plain zoning	"	"	"	"
Flood proofing	"	"	"	"
No action	"	"	"	"

Table D-4
(Cont'd)
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
4D. Papillion Creek				
Authorized 20-dam flood control and recreation project	**Reevaluate project based on** Flood Disaster Protection Act of 1973. Subdivide the Papio Project and consider the following alternatives:			
	4.D.1 Little Papillion Creek			
	Dams 11 and channel	Constructed		Constructed
	Dam 10	Justified for flood control	4.D.1	Proceed with construction at Dam Site 10 as Final Plan component
	No action	Eliminate		
	4.D.2 Big Papillion Creek			
	Dam 16	Constructed		Constructed
	Authorized Plan Dams 1 thru 9	Eliminate, not cost-effective		
	Dams 1, 2, 3, and 4 only	Retain for further consideration	4.D.2.1	Dams 1, 2, 3, and 4
	Dam 3A replacing 1 thru 9	Retain for further consideration	4.D.2.2	Dam 3A
	100 year channel	Retain for further consideration	4.D.2.3	100 year channel
	No action	Retain for further consideration		

Table D-4
(Cont'd)
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
4.D.3. West Papillion Creek				
	Authorized Plan Dams 12-15 and 18-21	Eliminate-not economically justified		
	Selected dams	Alternatives to be evaluated during FY 76	4.D.3.1	Alternative to be selected during FY 76
	Channel improvements at Millard and Papillion	"	"	"
	Evacuation	"	"	"
	Acquisition of Flood Plain	"	"	"
	Flood proofing	"	"	"
	Combination of above	"	"	"

Table D-4
(Cont'd)
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
4E. Indian Creek				
Large dam	Retain for further analysis	Retain for further analysis	4.E.1	Second best cost-effectiveness
10 small dams w/spillways	More expensive than without spillways	Justified with recreation benefits added. More expensive than 4-dam system		
4 small dams w/spillways	More expensive than without spillways			
4 small dams w/o spillways	Retain for further analysis	Retain for further analysis	4.E.2	Best cost-effectiveness
1% channel	Retain for further analysis	Costly-disruptive relocations		
4 small dams w/spillway plus 1% channel	More expensive than without spillways			
4 small dams w/o spillway plus 1% channel	Retain for further analysis	Not cost-effective		
Large dam plus 1% channel	Retain for further analysis	Justified with recreation benefits added. Less cost-effective than any dam systems		
Evacuation	Retain for comparative purposes	Not cost-effective		
Flood proofing	Retain for further analysis	Marginal justification, uncertain implementation		
Diversion	Retain for further analysis	Less cost-effective than 1 and 4 dam systems		

Table D-4
(Cont'd)
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
1% Levees	Impractical due to relocations			
Flood plain management and insurance	Retain for further analysis	Retain for further analysis	4.E.3	Recommend if no further local cooperation
10 small dams w/spillway and 1% channel	Not cost-effective			
10 small dams w/o spillway and 1% channel	Not cost-effective			
4F. Mosquito Creek				
Flood proofing	No feasible solutions except flood plain zoning and flood insurance	Conclusion: adopt flood plain zoning and flood insurance	4.F.1	Adopt flood plain zoning and flood insurance
Evacuation	"	"		"
Systems of 4 large dams	"	"		"
Chataqua Dam	"	"		"
Underwood Dam	"	"		"
County Line Dam	"	"		"
Portsmouth Dam	"	"		"
58 small tributary dams	"	"		"
1% channel	"	"		"
1% levee	"	"		"
Flood plain regulation and insurance	Recommend-prevents increased future damages			

Table D-4
(Cont'd)
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
4G. Cole Creek				
Channel clearing	Retain for further consideration	Retain for inclusion in final plans	4.G.1	Adopt a program of channel maintenance
Channel Improvement	Eliminate-not cost-effective			
Flood proofing	Retain for further consideration	Retain for inclusion in final plans		
Flood insurance	Retain for further consideration	Retain for inclusion in final plans		
Flood plain zoning	Retain for further consideration	City has adopted regulations	4.G.2	Flood insurance
Evacuation	Eliminate-economically and socially undesirable			
No action	Retain for further consideration	Eliminate since city has adopted zoning		
4H. Mud Creek				
Channel enlargement	Retain for further analysis	8-year channel marginally feasible	4.A.1	Low protection channel combined with zoning and flood insurance
Levees	Eliminate based on costs			
Channel relocation	Eliminate based on costs			
Flood proofing	Retain for further consideration	Retain		

Table D-4
(Cont'd)
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
Flood insurance	Retain for further consideration	Retain		
Flood plain zoning	Retain for further consideration	Retain		
Evacuation	Eliminate due to costs			
No action	Retain for final plan inclusion	Zoning required to qualify for flood insurance		
4I. Hell Creek				
Channel enlargement	All alternatives infeasible except for flood insurance and zoning	Conclusion: City has adopted flood plain regulations	4.I.1	Continued flood plain management with purchase of flood insurance
Flood plain zoning and insurance	"	"		"
Flood proofing	"	"		"
No action	"	"		"
4J. Betz Road Ditch				
Flood plain zoning and insurance	All alternatives economically infeasible except for flood zoning and insurance	Conclusion: adopt flood plain zoning and flood insurance	4.J.1	Flood plain zoning and flood insurance; flood plain maps available
Flood plain evacuation	"	"		"

Table D-4
(Cont'd)
Flood Control Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
Flood proofing	All alternatives economically infeasible except for flood zoning and insurance	Conclusion: adopt flood plain zoning and flood insurance	4.J.1	Flood plain zoning and flood insurance
Diversion	"	"		"
Levees	"	"		"
Increased road crossing drainage structure capacities (1% flood)	"	"		"
Channel improvements (1% flood)	"	"		"
Closed conduit	"	"		"

30. A Missouri River floodway study is currently under preparation by the Omaha District. Three levee units are programmed for construction (L-611-614 and R-616). Additional flood control alternatives will be evaluated pending the outcome of the floodway study.

31. The initial plan for flood control in the Papillion Creek basin consisted of 21 flood control structures, limited channel improvements, and some flood plain restrictions. Rising costs, the Flood Disaster Protection Act of 1973, and local zoning measures are the basis for the current reevaluation.

32. For reevaluation purposes, the Papillion basin is subdivided into the *Little Papillion*, *Big Papillion*, *and West Papillion Creek* basins. The Flood Control Plan for Little Papillion Creek is composed of 2 dams and channel improvements. One dam, Site 11, and the channel improvements are in place. A dam, Site 10, component 4.D.1, needs to be constructed to complete the Little Papillion Creek Plan.

33. The authorized project provided for 10 dams on Big Papillion Creek. Only one of these dams, Site 16, has been completed. The remaining 9 dams, when constructed as a package, are not cost-effective when compared with other alternatives. Three alternatives plus a "no action" alternative have been formulated.

34. Dams 1, 2, 3, and 4, component 4.D.2.1, would provide nearly the same degree of flood protection as the authorized plan. Site 4 is justified only when recreation is added. Therefore, component 4.D.2.1, may only include Dams 1, 2, and 3.

35. A large dam, 3A, component 4.D.2.2, would provide nearly identical flood protection as would the authorized project. The dam at Site 3A would be located south of authorized Dam 3 on the Big Papillion Creek.

36. A 100-year channel from Blondo to Q Street, component 4.D.2.3, is also under consideration. The channel would provide the least degree of flood protection.

37. The authorized Papillion Creek project provided for eight dams on West Papillion Creek. The eight dams as a package have been found to be economically unjustified. A number of other alternatives, including the possibility of some dam construction, will be evaluated during FY 76. Since the West Papillion Creek dams had received strong local support, possibilities exist for multi-purpose dams, cost shared locally, and designed for flood control, recreation, and land enhancement.

38. Sixteen initial alternatives were considered for Indian Creek flood problems. A large dam, component 4.E.1, and four smaller dams, component 4.E.2, appear to be economically justified alternatives for flood control alone. Local participation could be up to 50 percent of total project costs, which, based on past experience, has made an Indian Creek project publicly unacceptable. Flood plain management and flood insurance, component 4.E.3., is perhaps the only feasible alternative for Indian Creek.

39. Eleven alternatives were considered for flood control on Mosquito Creek. Due to low annual benefits, no structural solution is economically justified. The flood hazard areas should be mapped, zoned, and flood insurance applied for, component 4.F.1.

40. Seven alternatives were considered for Cole Creek. Omaha has adopted flood plain regulations. A channel maintenance program, combined with flood insurance, components 4.G.1. and 4.G.2., is the most practical program for Cole Creek.

41. Eight alternatives were considered for Mud Creek. An 8-year flood control channel is marginally feasible. The flood hazard area should be mapped, flood plain regulations adopted, and flood insurance applied for, component 4.H.1.

42. Six alternatives were considered for Hell Creek. Omaha has adopted flood plain regulations. Continued enforcement of the regulations and flood insurance are the most practical solutions, component 4.I.1.

43. Eight alternatives were considered for Betz Road Ditch. All structural alternatives are economically infeasible. The flood plain has been mapped. Flood plain regulations and flood insurance are the most practical solutions for Betz Road Ditch, component 4.J.1.

RECREATION

44. Table D-5 displays the plan formulation iterations for recreation. The majority of the recreation plans were formulated by other agencies, and by the Corps of Engineers prior to the urban study. The plans, with some additions and modifications, are included and evaluated in the urban study to provide a Comprehensive Water and Related Land Management Plan for the study region. The majority of the plans either have a direct or indirect relationship to water management.

Table D-5
Recreation Plan Formulation

Initial Plans		First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
5. Recreation					
5A. Platte-Elkhorn Plans					
MAPA Open Space Plan		Reproduce MAPA Plan	Combine MAPA and Platte Level "B" Plans; consider National Recreation Area or Scenic River Designation . Add three sites along the Elkhorn in Washington County and along the Platte in Cass County	5.A.1	Total of 20,000 acres of general parks and natural areas to be included in final plans
Platte Level "B" Plan		Reproduce Platte Level "B"	"		"
5B. Missouri River Plans					
MAPA Open Space Plan		Reproduce MAPA Plan	Combine MAPA and Riverfront Plans to form Missouri River Plans	5.B.1	Total of 21,000 acres of general parks and recreation areas to be included in Final Plans
MAPA/Riverfront Plan		Reproduce Riverfront Plan	"		"
5C. Papillion Creek Plans					
Authorized Project 20 Flood Control/ Recreation Lakes	5.C.1	Add flood plain park possibilities to Papio Plan	Retain flood plain areas as part of Papio Recreation Plans	5.C.1	12,000 acres of undeveloped flood plain lands offering community park potential. Examples to be included in the final plans

Table D-5
(Cont'd)
Recreation Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
	Based on the flood control reevaluation, subdivide the Papillion Creek basin into three parts:			
	5.C.2 Little Papio			
	Dam 11 (constructed)	Develop recreation at Site 11	5.C.2.1	1,552 acres of park lands to be included in Final Plans
	Dam 10	Develop recreation at Site 10	5.C.2.2	510 acres of park lands to be in-included in Final Plans
	5.C.3 Big Papio			
	Dam 16 (constructed)	Development in at Site 16	5.C.3.1	531 acres of park lands to be included in Final Plans
	Dams 1 thru 9	Eliminate Dams 1-9 as not cost-effective		
	or Dams 1, 2, 3, and 4		5.C.3.2	Dams 1, 2, 3, and 4 (1,695 acres water; 5,555 acres land)
	or Dam 3A		5.C.3.3	Dam 3A (1,500 acres water; 3,650 acres land)
	5.C.4 West Branch			
	Dams 12-15 and 18-21 and Other alternatives	Recreation development depends on alternatives selected during FY 76	5.C.4	Same as Second Iteration
Increase recreation surface acres by decreasing flood control storage or increasing dam height		Consider in West Branch reevaluation		

Table D-5
(Cont'd)
Recreation Plan Formulation

Initial Plans	First Iteration	Second Iteration	Final Plan Component No.	Third Iteration
5D. Indian Creek Plans				
Large dam	Provides 990 acres open space - retain	Favorable b/c ratio	5.D.1	Include as alternatives in Final Plan; large dam 990 acres open space
Ten small dams	Provides 1,270 acres open space - retain	Lowest b/c ratio	5.D.2	Eliminate
Four small dams	Provides 935 acres open space - retain	Highest b/c ratio	5.D.3	Include as alternatives in Final Plan; 4 small dams, 935 acres open space
Channel	Eliminate-not cost-effective for flood control, no recreation			
Diversion	Provides 543 acres open space, eliminate-not cost-effective for flood control			
Evacuation	Provides 1,268 acres open space, eliminate-not cost-effective for flood control			
5E. Rural Park Plans				
I. Use County Plans, SCS, multi-purpose structure, BOR recommendations, and MAPA Plans	Same as Initial Plans	Same as Initial Plans-add additional acres to Cass County	5.E.1	Include in Final Plans as alternative identified in Initial Plans

45. Two major plans for the Platte-Elkhorn Rivers in the study area are included. The MAPA Open Space Plan, adopted in 1972, identified specific recreation and natural environment areas along the Platte-Elkhorn flood plains and bluff lands. The Platte Level "B" Study, nearing completion, identifies several access-development nodes to the Platte River and one large general recreation area. Both the MAPA and Platte Level "B" Plans are combined into a Lower Platte-Elkhorn Recreation Plan, component 5.A.1, with the possibility of either a National Recreation Area or Scenic River designation. According to the Platte Level "B" Study, the Lower Platte-Elkhorn qualifies for such designations.

46. The Missouri River Plan, component 5.B.1, is a combination of MAPA's 1972 Open Space Plan and the current MAPA/Riverfront planning efforts. Recreational or preservation use of the Missouri River flood plains and bluff lands is envisioned. Several small lakes and recreation areas could be created to obtain fill materials for Missouri River Levee Units L 611-614 and R-616.

47. The Papillion Plan is composed of elements of the authorized project, alternatives under consideration, and flood plain park development. Dams 11 and 16 are constructed. The final plans, components 5.C.2.1 and 5.C.3.1, call for recreation development at each. Construction of Site 10 will be initiated in the fall of 1975 with recreation development to follow in 1977, component 5.C.2.2.

48. Two final alternatives, components 5.C.3.2 and 5.C.3.3, that would provide recreation in addition to flood control are being considered for the Big Papillion Creek. A third alternative, a channel, would not provide any recreational benefits.

49. The West Branch of the Papillion Creek will be reevaluated during FY 76. The authorized project provided eight flood control/recreation reservoirs. Flood plain parks and the possibility of some flood control/recreation reservoirs are alternatives to be considered that would provide recreational opportunities.

50. There are over 1,2000 acres of undeveloped Papillion Creek flood plain. These lands would provide opportunities for community parks. The flood plains, component 5.C.1, are indicated in Omaha's Recreation Plan as future parkways.

51. Five alternatives considered for flood control along Indian Creek have the capability of providing recreational opportunities. Two of the alternatives were eliminated because they were not cost-effective for flood control. Three alternatives that provide recreation and flood control are included as recreation alternatives. The best alternatives fro flood control and recreation appear to be one large dam, recreation component 5.D.1, or four smaller dams, recreation component 5.D.3.

52. Recreation plans for the rural counties, component 5.E.1, were obtained from county plans, SCS multi-purpose structure locations, recommendations made by BOR, and the MAPA plans for Pottawattamie County. All alternatives for the rural counties are included byt not evaluated as part of the final plans for the seven-county area.

Comprehensive Urban Water Resource Plan Formulation

53. Table D-6 lists the final plans and alternatives in the Omaha-Council Bluffs Urban Study. Four comprehensive urban water resource management plans are indicated as Plans A, B, C, and D.

54. The four urban growth concepts form the basis for development of the four urban water resource management plans. Single-purpose plans contained within each of the four comprehensive plans are indicated with an (x). The single-purpose plans are identified with plan component numbers from tables D-1 through D-5. The urban water resource plans are differentiated mainly by the water and sewage systems. Most single-purpose plans are common to all four comprehensive plans. Number of facilities and facility sizing do vary, as indicated in Section F under capital improvements.

55. The common elements that do not differ between plans either in configuration, sizing, or number of facilities are briefly outlined below and detailed in each of the plan formulation annexes.

COMMON PLAN COMPONENTS

WASTEWATER MANAGEMENT

56. Alternatives for component 2.B. to solve the Omaha-Missouri River combined sewer overflow problems are common to all plans. The four alternatives were described earlier. Sizing of the alternatives is dependent on storm runoff rates and volumes. Since the drainage area is highly developed, population variances of Growth Concepts A through D will not materially affect sizing of the alternatives.

Table D-6
Comprehensive Urban Water Resource Plan Formulation

Final Plan Components	Plan A	Plan B	Plan C	Plan D
1. Land Use and Urban Growth				
1A. - Concept A	X			
or				
1B. - Concept B		X		
or				
1C. - Concept C			X	
or				
1D. - Concept D				X
2. Wastewater Management				
2A. - Areawide Plans				
2.A.1 - Plan 1	X			X
or				
2.A.2 - Plan 2		X	X	
or				
2.A.3 - Plan 3	X *	X	X	X *
or				
2.A.4 - Land Treatment Option	X	X	X	X
2B. - Omaha-Missouri River Combined Overflows				
2.B.1 - Alternative 2	X	X	X	X
or				
2.B.2 - Alternative 4A	X	X	X	X
or				
2.B.3 - Alternative 4B	X	X	X	X
or				
2.B.4 - Alternative 5A	X	X	X	X
2C. - Omaha-Little Papillion Combined Overflows				
2.C.1 - Upstream Storage, Treatment, and Discharge	X	X	X	X

* - land treatment portion only

Table D-6
(Cont'd)
Comprehensive Urban Water Resource Plan Formulation

Final Plan Components	Plan A	Plan B	Plan C	Plan D
2D. - Council Bluffs-Indian Creek Combined Overflows				
2.D.1 - Separation Plan	X	X	X	X
2E. - Urban Storm Runoff Treatment				
2.E.1.2 - Upstream Storage Treatment and Discharge	X	X	X	X
2F. - Agricultural Runoff				
2.F.1 - Land Conservation Measures	X	X	X	X
2G. - Industrial Waste				
2.G.1 - Rehabilitate O.P.C.C. Plant	X	X	X	X
2H. - Sewer System Improvements				
2.H.1 - Install 8 Grit Chambers	X	X	X	X
3. Water Supply				
3A. - Outlying Area Plans				
3.A.1 - Plan 1	X		X	X
or				
3.A.2 - Plan IB		X		
or				
3.A.3 - Plan II	X		X	X
or				
3.A.4 - Plan IIB		X		
3B. - Metropolitan Area Water Distribution				
3.B.1 - Concept A	X			
or				
3.B.2 - Concept B		X		
or				
3.B.3 - Concept C			X	
or				
3.B.4 - Concept D				X

Table D-6
(Cont'd)
Comprehensive Urban Water Resource Plan Formulation

Final Plan Components	Plan A	Plan B	Plan C	Plan D
3C. - Water Use Reduction				
3.C.1 - Voluntary Actions	X	X	X	X
and/or				
3.C.2 - Water Conserving Fixtures and Appliances	X	X	X	X
or				
3.C.3 - Housing Density		X	X	
3D. - Alternative Sources				
3.D.1 - Missouri River Surface	X	X	X	X
and/or				
3.D.2 - Missouri River Ground	X	X	X	X
and/or				
3.D.3 - Platte River Ground	X	X	X	X
4. Flood Control				
4A. - Boyer River				
4.A.1 - Zoning, Flood Insurance	X	X	X	X
4B. - Platte-Elkhorn Rivers				
4.B.1 - Flood Plain Mapping, Zoning, Insurance	X	X	X	X
4C. - Missouri River				
4.C.1 - Missouri River Floodway Study	X	X	X	X
and				
4.C.2 - Levee Unit L-611-614	X	X	X	X
and				
4.C.3 - Levee Unit R-616	X	X	X	X
4D. - Papillion Creek				
4.D.1 - Little Papillion Creek				
4.D.1.1 - Dam 10	X	X	X	X

Table D-6
(Cont'd)
Comprehensive Urban Water Resource Plan Formulation

Final Plan Components	Plan A	Plan B	Plan C	Plan D
4.D.2 - Big Papillion Creek				
4.D.2.1 - Dams 1, 2, 3, 4	X	X		X
or				
4.D.2.2 - Dam 3A	X	X		X
or				
4.D.2.3 - 100 year Channel			X	
4.D.3 - West Papillion Creek				
4.D.3.1 - Define and evaluate alternatives during FY 76	X	X	X	X
4E. - Indian Creek				
4.E.1 - Large Dam	X	X	X	X
or				
4.E.2 - Four Small Dams	X	X	X	X
or				
4.E.3 - Mapping, Zoning, Flood Insurance	X	X	X	X
4F. - Mosquito Creek				
4.F.1 - Mapping, Zoning, Flood Insurance	X	X	X	X
4G. - Cole Creek				
4.G.1.2 - Channel Clearing, Flood Insurance	X	X	X	X
4H. - Mud Creek				
4.H.1 - Low Protection Channel	X	X	X	X
and				
Mapping, Zoning, Flood Insurance	X	X	X	X
4I. - Hell Creek				
4.I.1 - Flood Insurance	X	X	X	X
4J. - Betz Road Ditch				
4.J.1 - Zoning, Flood Insurance	X	X	X	X

Table D-6
(Cont'd)
Comprehensive Urban Water Resource Plan Formulation

Final Plan Components	Plan A	Plan B	Plan C	Plan D
5. Recreation				
5A. - Lower Platte-Elkhorn				
5.A.1 - 28,000 + acres, Parks and Natural Areas	X	X	X	X
5B. - Missouri River				
5.B.1 - 21,000 Acres of General Parks and Recreation Areas	X	X	X	X
5C. - Papillion Creek Basin				
5.C.1 - Papillion Creek Flood Plain Parks 12,000 Acres Community Parks	X	X	X	X
5.C.2 - Little Papillion Creek				
5.C.2.1 - Dam Site 11 (390 Acres **Water**; 1,162 Acres Land)	X	X	X	X
and				
5.C.2.2 - Dam Site 10 (120 Acres Water; 390 Acres Land)	X	X	X	X
5.C.3 - Big Papillion Creek				
5.C.3.1 - Dam Site 16 (135 Acres Water; 390 Acres Land)	X	X	X	X
and				
5.C.3.2 - Dams 1, 2, 3, 4 1,695 Acres **Water**; 5,555 Acres Land)	X	X		X
5.C.3.3 - 3A (1,500 Acres Water; 3,650 Acres Land)	X	X		X
5.C.4 - West Papillion Creek				
5.C.4.1 - Recreation Potential to be Determined During FY 76	X	X	X	X
5D. - Indian Creek				
5.D.1 - Large Dam (900 Acres Open Space)	X	X	X	X
or				
5.D.3 - 4 Small Dams (935 Acres Open Space)	X	X	X	X
5E. - Rural Parks	X	X	X	X

57. Implementing one of the alternatives is required under all plans but is more critical under Water Resource Plan C. Increased domestic and industrial loads on the sewer system under this plan would result in water quality effects more severe than currently exists.

58. Component 2.D, separation of the 1,000 acres of combined sewers in Council Bluffs, is common to all plans. Council Bluffs currently has a sewer separation plan for this area. Separation will also help the problems of temporary street ponding and defective sewer lines.

59. Component 2.F, calling for land conservation measures for controlling agricultural runoff, is common to all plans. The amount of land acres requiring treatment measures is so large (1,272,000 acres) that differences caused by the four urban growth concepts amount to only 3 percent of total land requiring treatment.

60. Component 2.G, rehabilitation of Omaha's meat processing pretreatment plant, is required in all plans. The main problem at the plant is corrosion of equipment. The source of corrosion will need to be determined prior to formulation of a solution.

61. Component 2.H, calling for installation of eight grit removal chambers along the Omaha-Missouri River Interceptor, is required in all plans. Increased flows under Water Resource Plan C make installation of the grit chambers more critical.

WATER SUPPLY

62. Components 3.C.1 and 3.C.2, voluntary actions and water-conserving fixtures to reduce water use, are common options that can be used with all water resource plans.

FLOOD CONTROL

63. All flood control plan components with the exception of the Papillion Creek alternatives, are common to all water resource plans for the planning period.

RECREATION

64. In order to fulfill the regional recreation planning objectives, all recreation plans would be required. Therefore, all recreation plans are common to all four urban water resource plans with the exception of the Papillion Creek plans.

65. The following discussion describes the major components of the four comprehensive urban water resource plans. Additional detail on the components is contained in the Plan Formulation Annexes and in the Supporting Technical Reports Appendix.

WATER RESOURCE PLAN A

66. Plan A is based on urban Growth Concept A which requires maximum extension of the sewer and water systems.

WASTEWATER MANAGEMENT

67. Areawide wastewater management Plan 1, component 2.A.1, is selected for Water Resource Plan A. Three major urban treatment plants will serve the metropolitan area. Maximum regionalization to Gretna, Elkhorn, and Bennington is the preferred sewer system. All municipal waste loads are conveyed to sewage treatment plants that discharge to the Missouri River after secondary treatment. Treatment beyond secondary (Levels 2 or 3) can either be provided by additional treatment plant facilities or by employing the Land Treatment Option, component 2.A.4 which is the preferred method

with the exception of the Council Bluffs Mosquito Creek plant which would employ conventional treatment technologies.

68. Under Water Resource Plan A, 7 minor urban and 34 rural treatment plants treat to one of the 3 treatment levels and discharge to the receiving stream or use land irrigation (minor urban and rural) or zero discharge lagoons (rural only).

69. Two buried concrete storage basins and treatment facilities, component 2.C.1, for the Omaha-Little Papillion Creek combined overflows are included in Water Resource Plan A. Total storage volume of the basins would be 479 acre-feet for the one-year storm. This size will vary among the water resource plans. Stormwater Level 1 treatment of the one-year storm appears cost-effective for the combined sewer overflows.

70. In Water Resource Plan A, 35 storage and treatment basins, component 2.E.1, for separate stormwater runoff, are required. Stormwater Level 1 treatment of the one-year storm appears cost-effective. Approximately 8,330 acre-feet of stormwater retention volume would be required by the year 2020.

71. Wastewater management capital improvements for Water Resource Plan A are displayed in Table F-1.

WATER SUPPLY

72. The two alternative plans for serving the rural areas (Plan I, component 3.A.1 or Plan II, component 3.A.3 are common to Water Resource Plans A. C. and D. For Water Resource Plan B, facility size varies to accomodate the increased population living in

satellite cities. Both Plans I and II include implementation of rural water systems covering most rural areas in the seven counties.

73. Metropolitan area water distribution system Concept A, component 3.B.1, is used with Water Resource Plan A. The distribution system would involve maximum regionalization of the water distribution network.

74. Water Resource Plan A, using a low-density growth concept, is incapable of achieving water use reduction through housing density, component 3.C.3.

75. The use of a new Platte River source over another Missouri River source has a $750,000 annual economic advantage in Water Resource Plan A at 1995 demand levels. Table E-1 lists the water supply capital improvements for Water Resource Plan A.

FLOOD CONTROL

76. The majority of the flood control final plan components are common to all four water resource plans. All four plans were formulated with the assumption that flood plain regulations are in force. The exception is the Papillion Creek flood control alternatives. The authorized 21 dam system would have been most compatible with Water Resource Plan A or D.

77. Dams 1, 2, 3, and 4, component 4.D.2.1 or 3A, component 4.D.2.2, are included in Water Resource Plans A, B, or D, particularly if built as wet dams. As wet dams they become magnets to attract growth.

78. Dam 10, component 4.D.1.1, is included in all Water Resource Plans. The small size of Dam 10 will have little effect on growth patterns.

79. On the West Papillion Creek, dams and reservoirs would attract growth; channel improvements probably would not.

80. Table F-1 lists the flood control capital improvements for Water Resource Plan C.

RECREATION

81. Basically, the comments made concerning flood control apply to recreation. The Papillion Creek dams under Water Resource Plan A would serve primarily as community parks in a suburban setting.

WATER RESOURCE PLAN B

82. Water Resource Plan B is based on urban Growth Concept B which envisions limited extension of water and sewer systems for the urban area and substantial capital improvement programs for water and sewer facilities in selected satellite cities.

WASTEWATER MANAGEMENT

83. Areawide Wastewater Management Plan 2, component 2.A.2, or Plan 3, component 2.A.3, are the alternatives for Water Resource Plan B. Three major urban treatment plants will serve the metropolitan area. Limited sewer extension is the preferred sewer system to limit the expansion of the metropolitan area. For the three major urban treatment plants, treatment beyond secondary (Levels 2 or 3) can be provided either by additional treatment plant facilities or by employing the Land Treatment Option, component 2.A.4, which is the preferred method with the exception of the Council Bluffs Mosquito Creek plant. Water Resource Plan B

maximizes the amount of land irrigation and nutrient recycle possible within the study area, if areawide Wastewater Management Plan 3 is adopted.

84. Under Water Resource Plan B, 13 minor urban and 34 rural treatment plants treat to one of three levels and either discharge to receiving streams, use land treatment, or use zero discharge lagoons. Either land treatment or zero discharge lagoons is the preferable method for treatment Levels 2 or 3. Bennington, Elkhorn, and Gretna require Level 2 treatment as a minimum to meet water quality standards. Two of the minor urban plants in Water Resource Plan B are required for the new towns of Deer Creek and East of Bellevue.

85. Two buried concrete storage basins and treatment facilities for the Omaha-Little Papillion Creek combined overflows, component 2.C.1, are included in Water Resource Plan B. Stormwater Level 1 treatment of the one-year storm appears cost-effective. Total storage volume required is 489 acre-feet.

86. In Water Resource Plan B, 32 storage and treatment basins, component 2.E.1, for separate stormwater runoff are required. Stormwater Level 1 treatment of the one-year storm appears cost-effective. Approximately 7,670 acre-feet of stormwater retention volume would be required by 2020.

87. Table F-1 lists the wastewater management capital improvements for Water Resource Plan B.

WATER SUPPLY

88. Outlying Area Plan I-B, component 3.A.2, or Plan II-B, component 3.A.4, are the preferred alternatives for rural water supply under Water Resource Plan B. These alternatives are identical to Water Resource Plan A except for increased facility sizing caused by the increased population in the satellite cities. Metropolitan area water distribution Concept B, component 3.B.2, is used with Water Resource Plan B. This plan limits the extent of the metropolitan area distribution system but includes transmission lines extending to the satellite communities of Springfield, Gretna, Elkhorn, and Bennington.

89. Water Resource Plan B, using a higher density growth concept than Water Resource Plan A, is capable of achieving total water use reduction by reducing lawn-watering needs. The reduction is most significant in peak-hour and peak-day demands, component 3.C.3.

90. The use of a new Platte River source over an additional Missouri River source has a $400,000 annual economic advantage in Water Resource Plan B at 1995 demand levels. Table F-1 lists the major water supply capital improvements for Water Resource Plan B.

FLOOD CONTROL

91. Comments made under Water Resource Plan A also apply to Water Resource Plan B. In a temporary fashion, the authorized 21 dam project may stimulate Growth Concept B, particularly for the communities of Elkhorn and Bennington. Over time, vacant areas would "fill-in" creating Growth Concept A or D.

92. Dam 3A, component 4.D.2.2, could probably help promote Bennington as a satellite city.

93. Table F-1 lists the flood control capital improvements for Water Resource Plan B.

RECREATION

94. Water Resource Plan B enivisons a shift of recreation usage at individual sites. Dispersing population to satellite cities has the effect of locating people closer to the major proposed recreation sites. Some of the regional parks and general recreation areas could take on a dual function of regional/community parks.

WATER RESOURCE PLAN C

95. Water Resource Plan C is based on urban Growth Concept C which envisions limited extension of the water and sewer systems. Plan C maximizes use of existing utility systems and minimizes additional capital improvements.

WASTEWATER MANAGEMENT

96. Areawide Wastewater Management Plan 2, component 2.A.2, or Plan 3, component 2.A.3, are the alternatives for Water Resource Plan C. Three major urban treatment plants will serve the metropolitan area. Limited sewer extension is the preferred sewer system to limit the expansion of the metropolitan area. For the major urban plants, treatment beyond secondary (Levels 2 or 3) can be provided either by additional treatment plant facilities or by employing the Land Treatment Option, component 2.A.4, which is the preferred method with the exception of the Council Bluffs Mosquito Creek plant. Under Water Resource Plan C, 11 minor urban and 34 rural treatment

plants treat to one of three levels and either discharge to receiving streams, use land treatment, or use zero discharge lagoons. Either land treatment or zero discharge lagoons is the preferable method for treatment Levels 2 or 3. Bennington, Elkhorn, and Gretna require Level 2 treatment as a minimum to meet water quality standards.

97. Two buried concrete storage and treatment basins for the Omaha-Little Papillion Creek combined overflows, component 2.C.1, are included in Water Resource Plan C. Stormwater Level 1 Treatment of the one-year storm is cost-effective. Total storage volume required is 487 acre-feet.

98. In Water Resource Plan C, 32 storage and treatment basins, component 2.E.1, for separate stormwater runoff are required. Stormwater Level 1 treatment of the one-year storm appears cost-effective. Approximately 5,735 acre-feet of stormwater retention volume would be required.

99. Table F-1 lists the major wastewater management capital improvements for Water Resource Plan C.

WATER SUPPLY

100. Outlying Area Plan I, component 3.A.1, or Plan II, component 3.A.3, are the preferred alternatives for rural water supply under Water Resources Plan C. These alternatives are identical to Water Resource Plan A. Metropolitan area water distribution, Concept C, component 3.B.3, is used with Water Resource Plan C. This plan limits the extent of the distribution system but includes transmission lines extending to the communities of Springfield, Gretna, Elkhorn, and Bennington.

101. Water Resource Plan C, using a higher density growth concept than Water Resource Plan A, is capable of achieving total water use reduction by reducing lawn-watering needs. The reduction is most significant in peak-hour and peak-day demands, component 3.C.3.

102. The use of a new Platte River source over an additional Missouri River source has a $420,000 economic advantage in Water Resource Plan C at 1995 demand levels. Table F-1 lists the major water supply capital improvements for Water Resource Plan C.

FLOOD CONTROL

103. The majority of the flood control final components are common to all four water resource plans with the exception of the Papillion Creek alternatives.

104. Generally, the Papillion Creek flood control dams, with the exception of Sites 11, 16, 15, 18, 20, and 21, would be incompatible with Water Resource Plan C because of induced growth effects. The above sites are within Growth Concept C and actually would be responsible for creating higher density development around the lakes based on the experience of Lake Candlewood, formerly Dam 17.

105. The other dams including Alternatives 1 through 4 and 3A would act as magnets, accelerating the rate of urban expansion. A channel, component 4.D.2.3, in lieu of additional dams on the Big Papillion Creek is part of Water Resource Plan C.

106. Table F-1 lists the flood control capital improvements for Water Resource Plan C.

RECREATION

107. The compact nature of Water Resource Plan C would cause some shifts in recreational usage of specific sites. Recreation at the Missouri River sites would probably see increased usage than under the other three water resource plans. Papillion Creek Lakes 11, 16, 15, 18, 20, and 21 would serve as suburban community parks. All other Papillion Lakes are not considered part of Water Resource Plan C; therefore, increased emphasis would be on the Missouri River and Platte-Elkhorn recreation plans for regional parks and natural areas.

WATER RESOURCE PLAN D

108. Water Resource Plan D is based on urban Growth Concept D which requires maximum extension of the water and sewer systems. Plan D is almost identical to Plan A with minor shifts required in facility location and mixing. Table F-1 lists the capital improvements for Water Resource Plan D. Areawide Wastewater Management Plan 1, component 2.A.1, with or without the Land Treatment Option, component 2.A.4, and Metropolitan Area Water Distribution Concept D, component 3.B.4, were used. Flood control and recreation are identical to Water Resource Plan A.

SECTION E

PLAN EVALUATION

PLAN EVALUATION

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SECTION E

PLAN EVALUATION

1. A detailed plan evaluation is contained in each of the Plan Evaluation Annexes. This section summarizes each of the four water resource plans in terms of the relationships of the final plan components to the two national objectives of National Economic Development (NED) and Environmental Quality (EQ), in terms of the plan component contributions to the regional planning objectives, and in terms of public acceptance. The NED plan components are selected on the basis of maximum net NED benefits. The EQ plan component is selected on the basis of maximum preservation of the environment.

2. This section concludes with the formulation of the NED and EQ urban water resource management plans.

Land Use and Urban Growth

3. Table E-1 lists some of the public costs and environmental effects of the four growth concepts used in the study. The four water resource plans are oriented to the four urban growth concepts. Growth Concept C is both the NED and EQ plan component. It also fulfills more of the regional planning objectives listed in table E-1 than any other growth concept.

Table E-1
Effects of Alternative Growth Concepts

	Concept A		Concept B		Concept C		Concept D	
	1995	2020	1995	2020	1995	2020	1995	2020
Land								
Urban Land Required (Acres)	49,000	72,000	22,000	30,000	29,000	43,000	45,000	71,000
Public Costs[1] (all costs in million $)								
Utility Costs[2]								
Water Lines[2]	113.4	175.0	97.5	142.0	90.0	136.0	117.6	176.0
Sewer Lines[2]	56.0	91.0	45.0	64.0	41.0	62.0	54.0	83.0
Storm Drainage	84.8	135.5	67.5	99.8	62.0	98.8	80.9	134.7
Gas Lines[3]	8.7	13.8	7.0	10.5	6.5	10.4	8.3	13.8
Electricity[3]	25.0	33.7	19.0	31.7	17.0	30.3	21.7	34.3
Telephone	14.9	23.7	9.7	20.0	12.9	20.0	14.4	23.6
Streets and Roads[4]	205.8	328.6	175.3	266.8	165.0	264.4	199.7	327.6

1/ Capital costs to service population at 1995 and 2020 estimates.
2/ Does not include water and sewage treatment costs which are relatively equal for the four concepts.
3/ Distribution costs only.
4/ Does not include major arterials such as expressways, interstates, etc.

Table E-1
(Cont'd)
Effects of Alternative Growth Concepts

	Concept A	Concept B	Concept C	Concept D
Environmental Effects				
Air Pollution	Total amount increases with increased sprawl due to dependence on auto. Concentration in any one area decreases due to low concentration of activities.	Similar to C.	Total amount decreases with increased density due to less travel time and distance. Concentration in particular area may increase due to increased concentration of activities.	Similar to A.
Water Pollution (Erosion)	Greatest amount due to largest percentage of disturbed soils.	Similar to C.	Substantially less than A due to differences in developed acres.	Similar to A.
Noise Pollution	Higher transportation activity; however, noise is diffused over larger area. Decrease in neighborhood noise.	Planned buffers and dwelling location can isolate traffic noise. Traffic on arterials less subject to stop and go motion. Increase in interior noise levels due to multi-family units unless adequately constructed.	Higher density causes concentrated traffic flows. Noise sensitive land uses should be located along quiet side streets. Interior noise similar to B.	Traffic noise irritation likely unless dwelling adequately buffered.
Resource	Greatest water use due to effort to keep lawns green. Single family units greatest user of natural gas and electricity. Higher gasoline use due to distances traveled and infeasibility of mass transit for all residential areas.	Water use similar to C. Gas and electricity similar to C. Good potential for mass transit results in decreased gasoline consumption.	Lowest water use due to decreased lot size and increased multi-family units. Lowest user of gas and electricity. Greatest potential for mass transit.	Water, gas, and electricity use similar to A. Potential for mass transit along transportation corridors could reduce gasoline consumption.

4. Growth Concept C is followed by Concept B as a desirable concept. Concept B is also a combination NED and EQ plan. Implementation difficulties and the difficulty of controlling Concept B lessen its likelihood of occurrence.

5. Growth Concepts A and D are neither NED nor EQ plans. Both are expensive in terms of public costs and environmental effects.

6. Public preferences for the growth concepts in order of preference are: Concept C, B, D, and A. It should be stated, however, that only a minor segment of the public expressed a preference. Land developers contend that the majority of the public prefers Concept A. The city of Omaha Planning Department favors Concept C as being most representative of their growth goals. Several agencies favor either Growth Concept B or C. No agency or public interests have expressed a desire for Growth Concept A or D.

Wastewater Management

AREAWIDE PLAN

7. Present worth of the net NED benefits for the areawide wastewater management plans is presented in table V-2. The benefits are for sewage treatment plans and the large interceptor sewers and are given for each of the three treatment levels. The land treatment options have been applied to Plan 3 although they could also be applied to Plans 1 or 2. Option 1 uses both the Todd Valley and

Big Blue River areas for land irrigation. Option 3 uses only the Big Blue River area.

8. All values given in table E-2 are negative indicating that water quality monetary benefits do not equal the costs.

Table E-2
Net NED Benefits - Areawide Wastewater Management Plans
(millions of dollars)

Component Number	Plan	Treatment Level 1	2	3
2.A.1	1	$-190.0	$-270.3*	$-302.8
2.A.2	2	-185.8	-267.8*	-301.1
2.A.3	3	-193.1	-276.8*	-289.5
2.A.4	3-Land Treatment Option 1	--	-218.7	-218.7
2.A.4	3-Land Treatment Option 3	--	-240.7	-240.6

* Assumes Level 2 implemented in 1977. Reduce by $20.5 million if Level 2 is implemented in 1983.

9. Treatment Level 1 would maintain current water quality standards with current river flows. Plan 2 is the least-cost plan although the economic differences are not great enough to select the areawide plan on economics alone. At treatment Level 1, all plans are essentially equivalent in overall pollutant removal.

10. Plan 2 compliments Growth Concept B or C, is the most cost-effective plan, and achieves the Level 1 (secondary treatment) objectives equally with the other plans. Plan 2 would be the NED plan.

11. As treatment levels increase, either of the land treatment options become preferrable. Land Treatment Option 3 is publicly preferred because of water shortage problems in the Blue River basin.

12. The land treatment options are capable of achieving better overall pollutant removals at all levels. They would provide maximum environmental protection and are therefore labeled the EQ plan components.

13. The public favored the interceptor sewer configuration in Plan 2 which is consistent with their selection of a growth pattern. The city of Omaha Public Works Department and the Water Quality Section of the Nebraska Department of Environmental Control favored Plan 2. One other State agency and MAPA favored Plan 1 if combined with land use controls and restricted hookups.

14. The Land Irrigation concepts are supported by the public, and by State and local agencies. The Nebraska Natural Resources Commission on 27 March 1975 passed a motion to ". . . consider all aspects of the concept of land application of wastewater effluent, promote awareness of the concept throughout the state, and cooperate fully with the Corps of Engineers and others interested in this concept." The Upper Big Blue Natural Resources District encourages more detailed investigation of the land application concept and is prepared to assist and cooperate in planning and implementing a demonstration project in their area. Plan 3, with a major land irrigation option, is therefore publicly acceptable.

OMAHA - MISSOURI RIVER COMBINED OVERFLOWS

15. Table E-3 presents the present worth of the net NED benefits for each of the four alternatives. All benefits are negative indicating a lack of economic values for water quality.

Table E-3
Net NED Benefits - Omaha-Missouri River Combined Overflows
(millions of dollars)

Component No.	Plan	Net NED Benefits
2.B.1	Alternative 2	-96.5
2.B.2	Alternative 4A	-137.0
2.B.3	Alternative 4B	-125.9
2.B.4	Alternative 5A	-158.6

16. All alternatives assure equal protection for water quality by providing secondary treatment levels for the one-year design storm. The ranking of alternatives does not change if higher design storms or higher treatment levels are selected. This level of water quality protection would maintain State water quality standards for dissolved oxygen plus provide substantial reduction in other pollutants.

17. Alternative 2 is the least-cost alternative and is therefore the NED plan component. Aesthetic impacts are significant and public acceptance is marginal.

18. The other three alternatives are more costly but have improved aesthetics and public acceptability. Any of the three could be

labeled the EC plan although Alternative 5A would be least disruptive upon existing land uses.

19. The public is equally split in its choice of the alternatives. Several people favored sewer separation in spite of the costs ($930 million). Public reaction has tended to run against all alternatives that involve open storage of the overflows. State and local agencies, with the exception of the Omaha Public Works Department, generally favored Alternatives 2, 4A, and 4B. The exception does not favor any type of open storage.

OMAHA - LITTLE PAPILLION CREEK COMBINED OVERFLOWS

20. Three alternatives for the combined overflows in Little Papillion Creek were evaluated. The present worth of the net NED benefits for each alternative is given in table E-4.

Table E-4
Net NED Benefits - Little Papillion Creek Overflows
(millions of dollars)

Component No.	Plan	NED Benefits
2.C.1	Upstream Storage, Treatment and Discharge	-49.9
2.C.2	Upstream Storage and Conveyance	-93.4
2.C.3	Separation	-130.6

21. All alternatives would improve water quality conditions in the Little Papillion Creek, Papillion Creek, and minor tributaries. The two storage alternatives would provide treatment of both combined and separate stormwater - resulting in the greatest reduction in annual pollutants. Separation insures that all sanitary wastes would receive treatment but would do nothing to reduce separate stormwater loadings.

22. Upstream storage, treatment, and discharge meets the planning objectives at least-costs and therefore comprises the NED plan component. Level 1 stormwater treatment (40 percent BOD_5 and 70 percent SS removals) meets the planning objectives for water quality. Level 2 stormwater treatment (70 percent BOD_5 and 90 percent SS removals) can be provided at an additional cost of $13 million. Conveyance would result in a slightly higher degree of pollutant removal to Papillion Creek but not to the Missouri River. Storm flows from Papillion Creek have been shown to adversely affect Missouri River water quality.

23. Based on the above, it appears that upstream storage, treatment, and discharge with Level 2 stormwater treatment comprises the EQ plan component. The selection of this EQ plan component will have to be verified, however, by additional planning activities. It is probable that a combination of the three alternatives in table E-6 could be used based on detailed studies of the problem. The Omaha Public Works Department feels that conveyance may be necessary for a portion of the Little Papillion Creek overflows in order to maintain water quality.

INDIAN CREEK COMBINED OVERFLOWS

24. Three alternatives for combined overflows in Indian Creek were evaluated. Present worth of the net NED benefits are indicated in table E-5.

Table E-5
Net NED Benefits - Indian Creek Overflows
(millions of dollars)

Component No.	Plan	NED Benefits
2.D.1	Separation	- 3.2
2.D.2	Upstream storage, treatment, and discharge	- 8.6
2.D.3	Upstream storage and conveyance	-12.6

Separation is clearly the NED plan component.

25. One of the two storage alternatives would be the EQ component. However, Indian Creek was not modeled to determine stormwater impacts. Land uses along Indian Creek are industrial and agricultural. Because of physical characteristics, Indian Creek could not support a diverse aquatic environment. Based on the environmental analysis, it is doubtful that an improvement in environmental quality would result from implementation of the storage alternatives.

URBAN STORM RUNOFF TREATMENT

26. Treatment of separate stormwater runoff is required to maintain water quality standards particularly in the Papillion Creek basin. Component 2.E.1, upstream storage, treatment, and discharge was the

only alternative retained from the plan formulation process. Net NED benefits amount to -$100.3 million. All agencies favored the upstream storage, treatment, and discharge approach. The City of Omaha Public Works Department felt that separate stormwater runoff should be exempted from water quality standards. Generally, the other agencies favored stormwater treatment.

27. The size and number of stormwater treatment facilities vary among water resource plans as indicated in table E-1. Water Resource Plan C requires the least investment in stormwater treatment facilities.

AGRICULTURAL RUNOFF

28. Treatment of urban waste sources would only be partially effective without the control of agricultural runoff. Annual pollutant loadings attributable to agricultural runoff in the study area amount to 1,800,000 tons suspended solids, 3,000 tons BOD, 100 tons phosphorous, and 3,000 tons nitrogen. Reductions of approximately 80 percent of all pollutants are achievable through land conservation measures, (Component 2.F.1). Costs of these measures were not determined. Land conservation measures are both an NED and EQ plan component.

INDUSTRIAL WASTES

29. Rehabilitation of Omaha's meat-processing pretreatment plant, Component 2.G.1, is both an NED and EQ plan component. Additional studies are required to pinpoint the cause of current operating problems and the rehabilitation measures required. Rehabilitation of this plant is required for the Missouri River Treatment plant to meet effluent standards.

SEWER SYSTEM IMPROVEMENTS

30. Installation of **eight additional grit removal facilities**, Component 2.H.1, along the Omaha-Missouri River interceptor is both an NED and EQ plan component. Net NED benefits of the grit facilities are -$5.2 million. The facilities would reduce annual BOD loadings to the Missouri River by 5,400 tons per year and suspended solids loadings by 3,700 tons per year. Reductions in all other pollutants would be of comparable magnitude.

31. The relatively small investment required for these facilities would produce substantial environmental quality improvements downstream. Implementation of the grit removal facilities is considered a high priority among all the agencies.

Water Supply

OUTLYING AREA PLANS

32. Two basic plans for the non-metropolitan areas, Plans I and II, are final plan components, 3.A.1 thru 3.A.4. A third plan, Plan III, offered slight economic advantage to Plan II but was eliminated because of implementation problems.

33. Plans I and II are designed either to serve Growth Concepts A, C, and D which have the same non-metropolitan population, or Growth Concept B which distributes additional population growth to rural communities.

34. The net NED benefits of Plans I and II amount to -$37.3 and -$31.9 million respectively compared to the "do-nothing" alternative. The negative benefits of each plan are reduced substantially but in the same proportion, when designed for Growth Concept B. This is accounted for by economics of scale and indicate that population dispersion is beneficial to non-metropolitan water supply.

35. Plan II is economically attractive over Plan I and also provides increased supply reliability. Plan II is selected as the NED plan component that meets the planning objectives.

36. Environmental quality effects are not significant to be a deciding factor in selecting one of the above plans. Both plans, except "do-nothing", would greatly improve the quality and reliability of water supply in most communities in the study area. Both plans are EQ plan components.

37. There is some public concern that implementation of any of the water supply plans could induce further urban sprawl. The outlying area water supply plans would produce growth characteristics consistent with Growth Concepts A, B, or D, depending on the controls exerted on growth. The "do-nothing" alternative would limit the quantity and quality of water supplied outside the metropolitan area and would tend to promote Growth Concept C.

METROPOLITAN AREA AND WATER DISTRIBUTION PLANS

38. Four metropolitan area water distribution plans, Components 3.B.1 thru 3.B.4 were fromulated to service the four urban growth concepts. Each water resource plan is therefore characterized by a different distribution plan.

39. Table E-6 contains the present worth of future water supply investments to 2020 according to the four distribution plans. For the purpose of analysis, each distribution plan uses the same supply sources.

Table E-6
Present Worth Costs - Metropolitan Area Water Distribution Plans
(millions of dollars)

	Distribution Concept			
	A	B	C	D
Present Worth Costs	340.1	309.5	303.0	335.6

Distribution Concept B includes the differential present-worth costs caused by increased population in the satellite communities.

40. Since all plans provide the same function, their NED benefits are similar. Distribution Concept C, Component 3.B.3, is selected as the NED plan component. Since Growth Concept C is the EQ growth concept, Distribution Concept C is also the EQ metropolitan area water distribution plan. The public supported the water distribution plan consistent with the preferred growth concept. In most instances, Distribution Concept C was favored.

WATER USE REDUCTION

41. Three water use reduction techniques are listed as final plan components, 3.C.1 thru 3.C.3. The total effects of these techniques on water use, water treatment costs, and wastewater management are indicated in table E-7.

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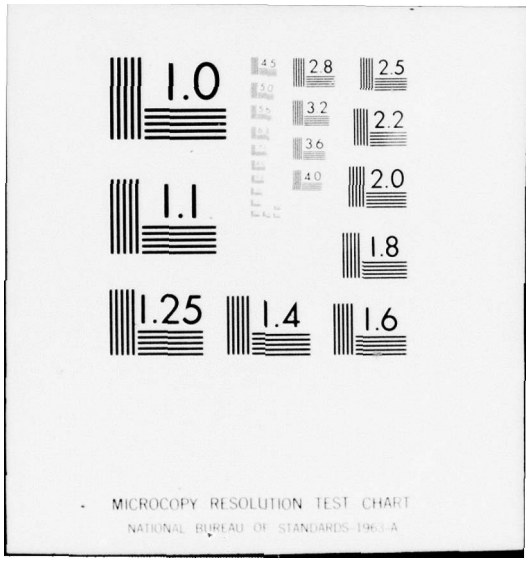
1.0
1.1
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3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Table E-7
Water Use Reduction Effects

Item	Amount of Reduction
Water conserving fixtures	31 percent reduction in-house water use and wastewater flow.
Water conserving fixtures	$300,000 annual water supply O&M by 2020; $2,900,000 present worth of capital savings.
Water conserving fixtures	$1,070,000 annual wastewater O&M by 2020; $7,170,000 present worth of capital savings.
Housing density	Maximum 6.9 percent and 10.4 percent reduction in maximum day and maximum hour load factors respectively.
Housing density	$330,000 annual water supply savings by 1995.

42. The water conserving fixtures were applied to new residential growth only. Housing density relates to the four growth concepts and also applies to areas of new residential growth only. Monetary benefits of the housing density effects on system design were not quantified. The $330,000 annual water supply savings under housing density relates to the savings that would be achieved if the Platte well field could not be developed and if Growth Concept C were followed instead of Growth Concept A.

43. Since all water conserving concepts result in cost savings and in beneficial secondary environmental impacts they are included as both NED and EQ plan components.

44. Public response to the water reduction concepts was favorable, with some agencies strongly supportive of conservation measures.

ALTERNATIVE SOURCES

45. Three alternative major supply sources, Components 3.D.1 thru 3.D.3, for metropolitan Omaha are indicated as final plan components. A new supply source must be developed during the 1980's to serve Omaha's needs. Two alternative locations were considered; the Missouri River (either surface or ground) south of Omaha and a Platte River ground source west of Omaha.

46. The present value of water supply savings if the Platte west site is developed amounts to $4,600,000 and is therefore labeled the NED plan component.

47. Projected low surface flows for the Platte River, competing interests for Platte River water usage, and possible urban sprawl effects indicate either the Missouri River surface or ground source to be the EC plan component.

48. The public generally favors that additional supplies be obtained from the Missouri River. Some opposition can be expected if the Platte West site is developed. Maintenance of the Platte River as a wet stream is required to insure the reliability of the Platte West well field, and as such, is supported by the water utility. This support could produce environmental benefits which may counter any adverse environmental effects.

Flood Control

49. Structural and non-structural alternatives for all flood prone areas were investigated. In several instances structural solutions were found to be infeasible according to current policies and procedures. The non-structural solutions generally involve flood plain zoning and flood insurance. Where the analysis concluded that non-structural approaches are appropriate, flood plain zoning and insurance are considered to be both the NED and EQ plan components. The Boyer and the Platte-Elkhorn Rivers; Mosquito, Cole, Mud, and Bell Creeks; and Betz Road Ditch are flood-hazard areas where the non-structural approach is appropriate.

50. It should be recognized that, when subjected to economic analysis, flood insurance will always have negative net NED benefits. Flood insurance must collect premiums that at least equal flood damages. Costs of administering the program result in premiums in excess of flood damages and hence a benefit to cost ratio of less than 1.

MISSOURI RIVER

51. Two levee units and a floodway study are indicated as final plan components, 4.C.1 thru 4.C.3. Levee units L 611-614 and R-616 have favorable benefit to cost ratios and are included as NED plan components. By reducing the flooding of valuable agricultural land, the levee units can also be considered as EQ plan components. Levee units L 611-614 and R-616 both have local sponsors. Units L 611-614 are generally highly favored by the local public. Unit R-616 has encountered both support and opposition. The opposition is

centered among seasonal and permanent residents who would be on the riverward side of R-616. Implementation of L 611-614 and R-616 does not appreciably affect flood stages in the concerned area. The Missouri River floodway study will be a useful tool in guiding the implementation of the Missouri Riverfront Corridor Land Use Plan. As a land use planning tool, the floodway study will have both NED and EQ merits and is included as a component of each.

LITTLE PAPILLION CREEK

52. Three of the four elements for flood control on Little Papillion Creek are in effect or are under construction. Site 10, Component N.E.D.1.1, is the fourth and last element of the plan and is justified under existing conditions for flood control alone. As such it is an NED plan component.

53. Site 10 would have both beneficial and adverse environmental quality aspects. Providing protection from floods, providing a recreational lake, and providing open space lands would be the beneficial aspects. Removal of farmland and possible contributions to urban sprawl could be the adverse environmental impacts.

54. Site 10 has received considerable opposition from landowners and others in the affected area. Support for Site 10 comes primarily from those interests desiring maximum downstream flood protection.

BIG PAPILLION CREEK

55. The authorized plan for Big Papillion Creek consists of 10 dams and reservoirs and flood plain regulation. Only Dam 16 has been constructed. The current analysis considers six alternatives

to the remaining nine dams. Dams 1, 2, 3, (wet and dry) are modifications of the basic alternative of Dams 1 thru 4. Dam 3A (dry) is a modification of basic Alternative 3A. Table E-8 contains the net NED benefits and the benefit to cost ratio of the Big Papillion Creek alternatives for flood control only.

Table E-8
NED Comparison - Big Papillion Creek Alternatives

Component Number	Alternative	Annual Net NED Benefits	B/C Ratio
4.D.2.1	Dams 1, 2, 3, 4 (wet)	$ 765,000	1.8
4.D.2.1	Dams 1, 2, 3, (wet)	824,000	2.1
4.D.2.1	Dams 1, 2, 3 (dry)	824,000	2.1
4.D.2.2	Dam 3A (wet)	905,000	2.0
4.D.2.2	Dam 3A (dry)	905,000	2.0
4.D.2.3	Channel	-103,000	0.9

56. All of the dam alternatives have comparable net NED benefits and benefit/cost ratios. The dam alternatives are all NED plan components.

57. Table E-9 contains the EQ attributes of each alternative.

Table E-9
EQ Comparison - Big Papillion Creek Alternatives

Component Number	Alternative	Open Space Preserved (acres)	Water Surface (acres)	Wildlife Lands (acres)	Natural Channel Destroyed (miles)
4.D.2.1	1 - 4 (wet)	7,250	1,695	2,350	20
4.D.2.1	1 - 3 (wet)	6,321	1,500	2,150	16
4.D.2.1	1 - 3 (dry)	5,250	0	946	10
4.D.2.2	3A (wet)	5,150	1,500	1,000	10
4.D.2.2	3A (dry)	4,150	0	750	7
4.D.2.3	Channel	265	0	0	9

58. When considering flood control alone, Dams 1, 2, 3, and 4 and the 1-3 dam modification are the superior EQ alternatives followed by Dam 3A. Dry dams in all cases would be preferable to the channel.

59. Residential development encouraged by the lakes could result in inefficient and uncontrolled urban sprawl if effective regional land use controls are not implemented. Growth Concept C is the EQ growth concept; the wet dam alternatives would be more consistent with Growth Concepts A, B, or D. If Growth Concept B was promoted by the dams, favorable EQ effects would result.

60. The Big Papillion dams would also contribute to the recreation planning objectives as discussed later.

61. Public input is still being received on the Big Papillion alternatives. The vocal opposition to the authorized project favors

the channel alternative. Site 3A (wet) appears to be favored by downstream residents and recreation interests. Residents and local officials in the lower part of the Papillion Creek basin are opposed to the channel. A compromise between all interests would appear to indicate Dam 3A (wet) as the preferred alternative.

WEST PAPILLION CREEK

62. Alternatives to the authorized project for this portion of the Papillion Creek basin will be evaluated during Fiscal Year 1976. The authorized project for West Papillion Creek, consisting of 8 dams and reservoirs, was found to be economically infeasible during the current reevaluation. Generally, strong support has been aired for flood control along West Papillion Creek. Results of the current reevaluation were received with disappointment by residents and officials in the affected county.

INDIAN CREEK

63. A large dam or four smaller dams for flood control on Indian Creek are included as final plan components. Table E-10 contains the net NED benefits and the benefit/cost ratio for the two structural alternatives. A non-structural alternative consisting of flood plain regulations and insurance is also included.

Table E-10
NED Comparison - Indian Creek Alternatives

Component Number	Alternative	Annual Net NED Benefits	B/C Ratio
4.E.1	One large dam	$ 42,000	1.05
4.E.2	Four smaller dams	$178,000	1.4
4.E.3	Flood plain regulations and insurance	$ -37,000	0.8

The four small dams produce the maximum net NED benefits and have the highest benefit/cost ratio. This alternative is the NED plan component.

64. The EQ comparisons of the alternatives are contained in table E-11. The comparisons are based primarily on the amount of open space provided. The two structural alternatives contribute almost equally to environmental quality and would both qualify as EQ plan components.

Table E-11
EQ Comparison - Indian Creek Alternatives

Component No.	Alternative	Open Space Provided (acres)
4.E.1	One large dam	992
4.E.2	Four smaller dams	935
4.E.3	Flood plain regulations and flood insurance	0

Recreation

65. All the recreation plans presented in the Recreation Plan Formulation Annex are required to satisfy the recreation planning objectives. Table E-12 contains the net NED benefits and internal rate of return on investment for the recreation plans. Only the wet dam alternatives for Big Papillion Creek are included in table E-12.

Table E-12
NED Comparison - Recreation Plans

Component Number	Plan	Annual Net NED Benefits (thousands)	Internal Rate of Return on Investment
5.A.1	Platte-Elkhorn	$8,095.0	22.4
5.B.1	Missouri River	4,593.0	19.6
	Papillion Creek		
(5C)2.2,2.1,3.1	Sites 10, 11, 16	558.9	29.5
5.C.3.2	Sites 1, 2, 3, 4	1,171.4	17.4
5.C.3.2	Sites 1, 2, 3	999.0	17.7
5.C.3.3	Site 3A	1,070.2	18.9

66. All plans have comparable, order-of-magnitude rates of return on investment. The Platte-Elkhorn Plan produces the largest net NED benefits and is therefore the NED plan.

67. Papillion Creek Sites 1-4, 1-3, and 3A are flood control alternatives for Big Papillion Creek and are almost an equal recreation tradeoff. Table E-13 contains the IO contributions of each recreation plan.

68. The Platte-Elkhorn Plan is the superior IO plan followed by the Missouri River Plan. Papillion Creek Sites 1-4 produce a better IO plan than Sites 1-3 or 3A.

69. Table E-14 contains each recreation plan's contribution to the regional planning objectives in terms of annual recreation days provided.

70. No consensus on public preferences to the recreation plans is available. Those desiring additional recreation opportunities are almost equally divided among the three plans. Concern and opposition have been expressed by landowners, particularly in the upper Papillion basin. Favorable response was received for future studies of the feasibility of a National Recreation Area along the lower Platte-Elkhorn Rivers. The Mayor of Omaha has expressed his support for recreation on Big Papillion Creek. Environmental groups tend to favor the Platte-Elkhorn Plan. Local planning has proceeded further on the Riverfront Development portion of the Missouri River Plan than on the Platte-Elkhorn Plan.

Table E-13
EQ Comparisons - Recreation Plans

Component Number	Recreation Plan	Wildlife Acres	Protected River Miles	Water Surface Acres	Preserved Total Open Space Acres
5.A.1	Platte-Elkhorn	18,700	56.8	----	28,750
5.B.1	Missouri River	14,100	16.5	----	21,000
	Papillion Creek				
(5.C)2.2,2.1,3.1	Sites 10, 11, 16	741	----	650	2,510
5.C.3.2	Sites 1, 2, 3, 4	2,350	----	1,695	7,250
5.C.3.2	Sites 1, 2, 3	2,150	----	1,500	6,321
5.C.3.3	Site 3A	1,000	----	1,500	5,150

Table E-14
Plan Contribution to Recreation Planning Objectives

Component Number	Recreation Plan	Annual Recreation Days Provided
5.A.1	Platte-Elkhorn	5,275,600
5.B.1	Missouri River	4,509,000
	Papillion Creek	
(5.C)2.2,2.1,3.1	Sites 10, 11, 16	545,300
5.C.3.2	Sites 1, 2, 3, 4	1,333,000
5.C.3.2	Sites 1, 2, 3	1,154,000
5.C.3.3	Site 3A	1,175,000

The NED and EQ Plans

71. Table E-15 lists the NED and EQ final plan components. The NED plan is that plan which maximizes net NED benefits and provides the maximum rate of return on investment. The NED Plan must also achieve an acceptable level of the planning objectives.

72. The EQ plan is that plan which achieves an acceptable level of the planning objectives and at the same time, provides for maximum environmental protection.

73. Overall Urban Water Resource Plan C is the NED and EQ plan. Components under Urban Water Resource Plan C vary between the NED and EQ plans.

Table E-15
NED and EQ Plans

Functional Area	Final Plan Component No.	NED Plan Component Description	Final Plan Component No.	EQ Plan Component Description
Land Use and Urban Growth	1C	Growth Concept C	1C	Same as NED
Wastewater Management				
Areawide Plans	2.A.2	Plan II with Level 1 Treatment	2.A.4	Areawide Plan II with Land Treatment Option
Missouri River Overflows	2.B.1	Alt. 2 - Diked Storage	2.B.4	Alt. 5A - Tunnel with Below Ground Storage
Little Papillion Creek Overflows	2.C.1	Upstream Storage, Treatment, Discharge with Level 1 Treatment	2.C.1	Upstream Storage, Treatment and Discharge w/Level 2 Treatment
Indian Creek Overflows	2.D.1	Sewer Separation	2.D.1	Same as NED
Urban Storm Runoff Treatment	2.E.1	Upstream Storage, Treatment and Discharge	2.E.1	Same as NED
Agricultural Runoff	2.F.1	Land Conservation Measures on 1,272,000 Acres	2.F.1	Same as NED
Industrial Waste	2.G.1	Rehabilitate O.P.C.C. Plant	2.G.1	Same as NED
Sewer System Improvements	2.H.1	Eight Grit Removal Facilities	2.H.1	Same as NED
Water Supply				
Outlying Area Plans	3.A.3	Plan II	3.A.1 or 3.A.3	Either Plan I or II
Metropolitan Area Distribution	3.B.3	Concept C	3.B.3	Same as NED

Table E-15
(Cont'd)
NED and EQ Plans

Functional Area	Final Plan Component No.	NED Plan Component Description	Final Plan Component No.	EQ Plan Component Description
Water Use Reduction	3.C.1, 3.C.2, 3.C.3	Voluntary Actions, Fixtures, Housing Densities	3.C.1-3	Same as NED
Alternative Sources	3.D.1 and 3.D.3	Missouri River Surface and Platte River Ground	3.D.1 and 3.D.2	Missouri River Surface and Ground
Flood Control				
Boyer River and Betz Road Ditch	4.A.1, 4.J.1	Zoning, Flood Insurance	4.A.1, 4.J.1	Same as NED
Platte-Elkhorn, Mosquito Creek, Mud Creek	4.B.1, 4.F.1, 4.H.1	Mapping, Zoning, Flood Insurance	4.B.1, 4.F.1, 4.H.1	Same as NED
Cole Creek and Hell Creek	4.G.1, 4.I.1	Flood Insurance	4.G.1, 4.I.1	Same as NED
Missouri River	4.C.1, 4.C.2, 4.C.3	Missouri River Floodway Study, Levee Units L 611-614 and R-616	4.C.1-3	Same as NED
Little Papillion Creek	4.D.1	Dam 10		See Text
Big Papillion Creek	4.D.2.1 or 4.D.2.2	Dams 1, 2, 3 or 3A		See Text
Indian Creek	4.E.2	Four Small Dams	4.E.1 or 4.E.2	One Large Dam or 4 Small Dams
Recreation*	5.A.1 or 5.B.1	Platte-Elkhorn or Missouri River Recreation Plans	5.A.1	Platte-Elkhorn Recreation Plan

* All Alternative Plans Required to Fulfill Recreation Planning Objectives

SECTION F

THE SELECTED PLANS

THE SELECTED PLANS

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TABLE OF CONTENTS (Cont'd)

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SECTION F

THE SELECTED PLANS

1. The selection of an urban water resource management plan is largely dependent on selection of an urban growth pattern. Since no growth pattern has been formally adopted, the four urban water resource plans and their components constitute the selected plans.

2. This section describes the: (1) capital improvements, (2) management programs, (3) planning activities, and (4) implementation programs for each of the four plans and their components.

Capital Improvements

3. Capital improvements are the structures required for plan implementation. Table F-1 lists the capital improvements required for each urban water resource plan. The improvements are outlined briefly below and are discussed in detail in each of the Plan Formulation Annexes. Where two numbers are indicated, the first represents 1995 requirements and the second 2020 requirements.

Table F-1
Urban Water Resource Plans - Capital Improvements

Functional Area	Plan A	Plan B	Plan C	Plan D
WASTEWATER MANAGEMENT				
Major Urban Facilities				
Omaha-Missouri River (Expansion to secondary capacity MGD)	47.0;64.4	43.3;60.2	51.3;67.5	48.4;60.3
Omaha-Papillion Creek (New plant capacity MGD)	61.2;98.0	45.2;73.4	56.8;90.7	60.7;97.8
Council Bluffs-Mosquito Creek (Additional plant capacity MGD)	1.4;14.9	0;11.6	1.5;14.9	0.6;15.1
New Interceptors (feet)	392,000	330,000	330,000	392,000
Minor Urban and Non-Urban Facilities				
Additional Plants Required	0	2	0	0
Plant Expansions Required to Meet Future Flows	31	34	34	31
Plant Expansions to Meet Effluent/Water Quality Standards	43	46	46	43
Total Additional 1995 and 2020 Flow Capacity required (MGD)	5.0;7.6	26.3;35.6	5.0;7.6	4.8;7.6
Land Treatment Options				
Total Storage (Surface Acres)	1,809;2,619	2,409;3,117	1,816;2,539	1,867;2,597

Table F-1
(Cont'd)
Urban Water Resource Plans - Capital Improvements

	Plan A	Plan B	Plan C	Plan D
Miles of Force Main	102	108	108	102
Major Pumping Stations	10	10	10	10
Omaha-Missouri River Combined Overflows				
Storage Volume Required (Acre-Feet)	1,964	1,964	1,964	1,964
Papillion Creek Combined Overflows				
Storage and Treatment Facilities	2	2	2	2
Storage Volume (Acre-Feet)	449	476	377	356
Indian Creek Combined Overflows				
Sewer Separation	1,000 Acres	1,000 Acres	1,000 Acres	1,000 Acres
Urban Storm Runoff				
Storage and Treatment Facilities	14;36	15;33	15;33	14;36
Storage Volume (Acre-Feet)	4,637;8,300	4,423;6,108	3,881;5,625	5,042;8,232
Industrial Wastes	1 Plant rehabilitation	Same as A	Same as A	Same as A
Sewer System Improvements	8 Additional grit removal facilities	Same as A	Same as A	Same as A

Table F-1
(Cont'd)
Urban Water Resource Plans - Capital Improvements

	Plan A	Plan B	Plan C	Plan D
WATER SUPPLY				
Total Rural Plant Capacity (MGD)				
Plan I (25 plants)	48.59;51.59	74.34;82.49	48.59;51.59	48.59;51.59
Plan II (5 plants)	24.55;29.60	35.30;42.10	24.55;29.60	24.55;29.60
Urban Water Treatment Plants				
Narrows Treatment Plant				
Plan I (Additional Capacity MGD)	3.5;13	6.0;11.0	3.0;10.5	3.5;14.0
Plan II (Additional Capacity MGD)	11.5;21	15.0;20.5	12.5;20.0	13;20.0
Missouri River Florence Plant				
Additional Capacity (Plans I and II MGD)	50;100	50;115	70;120	45;95
Platte River South				
Additional Capacity (Plans I and II MGD)	0;20	0;0	0;15	0;15
New Missouri River South				
Plant Capacity (MGD)	95;170	55;100	75;130	100;165
New Platte River West				
Plant Capacity (MGD)	95;175	65;120	75;135	100;170
Miles of New Major Water Lines				
Plan I-Urban	176;196	127;138	132;156	168;189
Plan 1-Rural	593;593	604;604	593;593	593;593
Plan II-Urban	184;198	148;163	154;177	196;213
Plan II-Rural	617;617	628;628	617;617	617;617

Table F-1
(Cont'd)
Urban Water Resource Plans - Capital Improvements

	Plan A	Plan B	Plan C	Plan D
New Booster Stations				
Urban	6;0	5;0	5;1	6;0
Rural	29;0	29;0	29;0	29;0
New Storage Facilities				
Urban	8	7	8	8
Volume (MG)	146.0	110	141.7	144.2
Rural	114	117	114	114
Volume (MG)	40.3	57.7	38.8	40.3
Expanded Storage Facilities				
Urban	8	8	8	8
Volume (MG)	59.5	59.5	59.5	59.5
FLOOD CONTROL				
Missouri River	18.0 miles-Levee L 611-614 4.5 miles - Levee R-616	Same as A	Same as A	Same as A
Little Papillion Creek	1 Dam-Site 10	Same as A	Same as A	Same as A
Big Papillion Creek	3 Dams-Sites 1, 2, 3 or 1 Dam-Site 3A	Same as A	9 miles of 100-year channel	Same as A
Indian Creek	1 large Dam or 4 small Dams	Same as A	Same as A	Same as A
RECREATION				
Little Papillion Creek	Recreation facilities at Sites 10 and 11	Same as A	Same as A	Same as A

Table F-1
(Cont'd)
Urban Water Resource Plans - Capital Improvements

	Plan A	Plan B	Plan C	Plan D
Big Papillion Creek	Recreation facilities at Site 16 and Sites 1, 2, 3 or 3A	Same as A		Same as A
Indian Creek	Recreation facilities at 1 large Dam or 4 small Dams	Same as A	Same as A	Same as A
Platte-Elkhorn and Missouri River	Recreation facilities at regional park and natural areas	Same as A	Same as A	Same as A

WASTEWATER MANAGEMENT

MAJOR URBAN FACILITIES

4. All plans envision three major urban treatment plants. The Omaha-Missouri River plant requires expansion to secondary treatment using conventional processes. Required plant capacities for 1995 and 2020 under each plan are given in table F-1. Additional equipment can be added to achieve Level 2 or 3 treatment; however one of the land treatment options is preferred for treatment beyond Level 1 (secondary).

5. The Omaha-Papillion Creek plant is a new facility with a 50 M.G.D. primary portion currently under construction. The plant will employ conventional processes. Flow capacities required are given in table F-1. Land treatment is the preferred method beyond secondary treatment at this plant.

6. The Mosquito Creek plant is a new secondary facility with a design flow of 15 M.G.D. Required plant expansions to meet 1995 and 2020 flows are indicated in table F-1. Land treatment is not practical for this plant. Therefore, additional plant equipment will be required for Level 2 or 3 treatment.

7. New interceptor sewers, primarily in the Papillion Creek basin, are required to serve new urban growth in each plan. Lengths of the interceptors vary as indicated in table F-1.

MINOR URBAN AND NON-URBAN FACILITIES

8. Water Resource Plan B is the only plan requiring additional sewage treatment plants. The two plants are required to serve the new towns of Deer Creek and East of Bellevue indicated in Growth Concept B.

9. The majority of publicly-owned sewage treatment plants (34 of 46) require expansions to meet anticipated future flows prior to 1995. Most plants will require expansions to meet 1977 federal effluent standards or state water quality standards. Water Resource Plans A and B indicate a reduction of 3 plants with the incorporation of Gretna, Elkhorn, and Bennington wastewaters into Omaha's system.

10. Water Resource Plan B indicates substantial additional flow capacity for minor urban plants attributable to population dispersion into rural growth centers under Growth Concept B.

LAND TREATMENT OPTIONS

11. The land treatment options require the construction of storage facilities, force mains, and major pumping stations. Storage and force main requirements are given for an all-land wastewater irrigation plan (Areawide Plan w/ Land Treatment Option) with the major urban wastewater delivered to both the Todd Valley and Big Blue River areas or to the Big Blue River area only.

OMAHA-MISSIOURI RIVER COMBINED OVERFLOWS

12. All four alternatives for the combined overflows involve combinations of conveyance, storage, and treatment facilities. Any of the alternatives could be used with each of the four urban water resource plans. Capital improvements for each alternative are contained in the Wastewater Management Plan Formulation Annex.

PAPILLION CREEK COMBINED OVERFLOWS

13. Two storage and treatment facilities plus conveyance sewers are required for these overflows. The storage volume is given for the 1-year storm and varies between urban water resource plan.

Water Resource Plans B and C reflect higher runoff volumes due to increased population density in the drainage area served by the combined sewer system.

INDIAN CREEK COMBINED OVERFLOWS

14. All urban water resource plans indicate separation of 1,000 acres of combined sewer in the urban portion of the Indian Creek basin.

URBAN STORM RUNOFF

15. The number of storage and treatment facilities and required storage volume vary with urban water resource plans. The volume indicated is for the 1-year storm. Water Resource Plans B and C indicate reduced facility requirements based on the lesser amount of urbanized land indicated for Growth Concepts B and C.

INDUSTRIAL WASTES

16. All plans indicate rehabilitation of Omaha's pretreatment facility for meat processing wastes.

SEWER SYSTEM IMPROVEMENTS

17. Eight additional grit removal facilities along the Omaha-Missouri River interceptor are required under all plans. These facilities would be installed in parallel to the existing grit removal facilities.

WATER SUPPLY

RURAL FACILITIES

18. Water Supply Plans I and II indicate construction of 25 and 5 new treatment plants respectively. The plants are equipped to

provide a finished water quality meeting United States Public Health Service recommendations. Similar total plant capacity is indicated for Water Resource Plans A, C, and D. Increased capacity is required for Water Resource Plan B due to population dispersion to rural growth centers. A reduction in rural capacity is indicated in Plan II with the Narrows Treatment Plant of Council Bluffs serving all of Pottawattamie County.

19. Approximately 600 miles of water lines, 4-inch and larger, are required for the county-wide distribution systems.

URBAN FACILITIES

20. The Council Bluffs Narrows Treatment Plant has an existing capacity of 17 M.G.D. Expansion of this plant is required in all plans by the capacities indicated in table F-1. Water Supply Plan II indicates the increased capacity required at the Narrows Plant to serve Pottawattamie County.

21. The Missouri River Florence Plant has an existing capacity of 140 M.G.D. For Water Resource Plans A and D, required expansions by 1995 and 2020 are about 50 M.G.D. and 100 M.G.D. respectively. Under Water Resource Plans B and C, larger expansions are required to serve increased population densities in the central urban area.

22. The Platte River South Plant has an existing capacity of 60 M.G.D. which is adequate in all plans through 1995. Water Resource Plans A, C, and D call for a 15-20 M.G.D. expansion after 1995 to meet 2020 requirements.

23. An additional new treatment facility will be required to meet Omaha's needs prior to 1995. Two alternatives are the Missouri River

south of Omaha and the Platte River west of Omaha. Water Resource Plans B and C indicate reduced capacity requirements at the new plant based on greater capacities provided at the expanded Florence Plant and reduced overall water demands due to increased housing densities under Growth Concepts B and C.

24. Table F-1 indicates the miles of new major water lines, 24-inch and larger, to serve each urban water resource plan. Water Resource Plans B and C indicate a lesser amount of major water line construction.

BOOSTER STATIONS

25. The number of new booster stations required is similar in all plans. Water Resource Plan B indicates one less urban booster station. Water Resource Plan C indicates a delay in the need for one booster station until after 1995.

STORAGE FACILITIES

26. Water Resource Plans A, C, and D indicate fairly equivalent requirements for storage facilities. Plan C reflects somewhat reduced requirements based on reduction in peak day demands caused by a reduction in lawn watering. Plan B indicates a reduction in urban water storage requirements with an increase in rural requirements caused by population dispersion.

FLOOD CONTROL

MISSOURI RIVER

27. The construction of two levee units along the Missouri River is indicated in all plans. Units L-611-614 involve 17 miles of levee construction; Unit R-616 includes 4.5 miles of levee construction.

LITTLE PAPILLION CREEK

28. All plans call for the construction of Dam 10 as part of the Little Papillion Creek flood control program.

BIG PAPILLION CREEK

29. Urban Water Resource Plans A, B, and D include construction of either Dams 1, 2, 3, and 4 or 3A as part of the Big Papillion Creek flood control program. Dams 1, 2, 3 only and dry versus wet dams are modifications of the two basic alternatives. Water Resource Plan C calls for construction of a 100-year channel in lieu of the dams.

INDIAN CREEK

30. All plans include two alternatives for flood control on Indian Creek. The alternatives would involve construction of either one large dam or four smaller dams in the Indian Creek basin north of Council Bluffs.

RECREATION

31. Capital improvements for the recreation plans would involve the construction of facilities at individual sites. Approximate development costs have been included in the recreation plan's economic evaluations.

Management Programs

32. Management programs are distinguished from capital improvements in that they do not necessarily involve major construction or engineering activities. The management programs outlined below are consistent with all four urban water resource plans.

WASTEWATER MANAGEMENT

33. The following prargraphs describe the programs that are included to provide efficient management of wastewaters in the study area:

- The creation of additional point-discharges from new wastewater treatment plants should be avoided. New subdivisions and industries should connect to existing systems. Land use planning, zoning, and control of sanitary and improvement districts could facilitate this management program.

- All wastewater treatment plant operators should be trained and certified by the appropriate State agency. Smaller communities could share operators and maintenance personnel possibly by contract for this service with the Natural Resource Districts.

- A State law in Nebraska, similiar to Iowa's, is needed to control sediment from both rural and urban areas.

- Sewer use charges for all communities should be developed based on the requirements of PL 92-500 to avoid future delays in grants applications.

- Some industrial flow and quality monitoring now exists in the study area. Intensified and expanded industrial waste monitoring is needed to develop a data base for industrial sewer use charges and future designs of treatment systems.

- Open space land areas should be set aside in new subdivisions for possible implementation of structural and non-structural urban storm runoff control measures.

WATER SUPPLY

34. The following programs are included to provide more efficient management of water supply systems in the study area:

- Public education programs on water conservation should be initiated by the major water suppliers. Such a program should include the benefits of using water-conserving fixtures and appliances in the home including water bill and sewer-use fee savings.

- Local building codes should be reviewed and legislation enacted where required, to permit the use of water-conserving fixtures.

- Legislation should be enacted in Nebraska to include recreation, aesthetics, and fish and wildlife habitat as beneficial uses of water. Protected minimum flows should be established for the lower Platte-Elkhorn Rivers.

- Legislation and appropriate funding should be pursued to provide a sound and workable system of surface and groundwater management particularly along the lower Platte River.

- The Natural Resource Districts should provide assistance to small communities in meeting the requirements of the Safe Drinking Water Act of 1974.

FLOOD CONTROL

35. Management programs for flood control involve flood plain mapping, zoning, and flood insurance. The following paragraphs describe the management programs included for flood hazard areas in the study area.

36. Flood plain mapping and zoning are required for the following areas:

- Platte-Elkhorn Rivers in Douglas and Sarpy Counties
- Mosquito and Indian Creeks in Council Bluffs, Iowa
- Mud Creek at Bellevue, Nebraska

37. The following areas either have a flood plain map or have one under preparation but require zoning by the appropriate local government:

- Boyer River at Missouri Valley, Iowa
- Missouri River through all study area counties
- Betz Pond Ditch at Bellevue, Nebraska

38. The following areas are mapped and zoned but need continued enforcement of flood plain ordinances:

- Little Papillion, Big Papillion, and West Papillion Creeks

- Cole Creek and Hell Creek

RECREATION

30. The following is a list of management programs which could aid in implementation of recreation plans and a reduction in recreation needs:

- All levels of government should adopt common resource units, definitions, leisure-time activities, standards, and methodologies in order to measure net needs on a local or regional basis or to implement programs that will be complementary in meeting needs of adjoining planning entities.

- Where practical, the smaller local entities should initiate a coordinated effort with county, regional, or State recreation planning entities to obtain assistance in planning and development.

- Local governments could designate a single entity with overall responsibility for recreation planning, coordination, and implementation. Funds could be earmarked to provide a stable financial base for such efforts.

- Planning for recreation facilities should emphasize year-round use rather than on a peak-use basis.

- Open space use of capital improvement projects should be considered during the planning of such projects. Utility and street

rights-of-way, open space around storm drainage projects and around water and sewage treatment plants are examples.

- Proper management of flood plains will almost always lead to recreation and open space opportunities. The Papillion Creek flood plan provides excellent opportunities for community parks.

- Operating and maintenance budgets should be increased for existing facilities possibly thru user fees.

Revision Program

40. In order to keep the urban water resource plans current, periodic revisions and updating should be performed. This should be done at a minimum of once every five years or sooner if substantive changes become evident that could alter the plans.

41. The general plan revision should be carried out jointly between the Corps of Engineers and the Metropolitan Area Planning Agency with MAPA eventually assuming the larger role.

42. One substantive change which will cause a plan revision is the selection of a regional comprehensive land use plan. MAPA has initiated a two-year land use planning process with a required adoption date of August, 1977. Following adoption of the land use plan, the Urban Study should be revised to enforce that land use plan.

43. Implementation of a 208 wastewater management planning agency would place the responsibility for the wastewater management revision with that agency. The Corps could provide technical assistance to the 208 planning agency if requested. The Corps should anticipate providing assistance to the 208 planning agency in order to insure that the results of the wastewater management studies undertaken for the Urban Study are used to the maximum extent possible.

44. The final wastewater plans incorporated the Bellevue No. 1 minor urban plant with the Papillion Creek major urban plant. Revisions should reflect the recent decision not to combine the plants. The number of plants indicated for each plan in this volume is consistent with the recent decision.

Planning Activities

45. The Omaha-Council Bluffs Urban Study has developed alternative solutions to the study area's water management problems. Because of the complex nature of the problems studied and the large investments required, several additional planning activities are recommended. Some of these activities could be classified as research or pre-engineering.

46. In addition to water management planning activities, several key local planning activities, currently underway, are important to the selection of an urban water resource management plan.

LAND USE

47. The Metropolitan Area Planning Agency has three important land use planning activities underway. The Environmental Resource Analysis Program will define land use suitability for the future growth of the urban area. The mapped overlays of significant land features and constraints will be a useful tool in guiding future growth and the selection of a growth pattern.

48. On 1 July 1975, MAPA initiated a two-year Comprehensive Land Use Planning Process. This process will be using an alternative futures approach paralleling that used in the Urban Study.

49. MAPA has underway a continuing Omaha Area Transportation Study for the year 2000. This study is based on the use and analysis of alternative futures similar to those used in the Urban Study.

50. The above three efforts will significantly contribute to the ultimate public selection of a growth policy and pattern.

WASTEWATER MANAGEMENT

51. Future planning activities for wastewater management should be directed to storm-related sources (combined sources and urban storm runoff), the land treatment options, and water quality/ ecological impacts.

52. Treatment requirements for combined sewer overflows and urban storm runoff are not well defined. The problem is threefold:

(1) identifying the pollution potential; (2) identifying its water quality effects; and (3) the tremendous cost involved in correctional measures.

53. The **Urban Study** has simulated pollution potential from the combined sewers based on available data and has measured pollutant potential from urban storm runoff. Water quality effects were evaluated for dissolved oxygen using a water quality model. A range of data input, design storms, and treatment levels were used to determine cost-effectiveness.

54. While the alternatives developed are valid, additional studies are required to define optimum design parameters. Additional studies should be directed to:

- Define the assimilative capacity of the receiving stream for all water quality constituents.

- Define by sampling the range of overflow and storm runoff qualities and in-stream water quality effects.

- Determine rainfall-runoff quantities based on field gaging and measurements.

- Determine the treatability of overflow and storm runoff pollutants.

- Define acceptable treatment and technological requirements based on water quality effects and policy.

- Further define the role of non-structural solutions particularly in developing areas.

55. Until the additional planning activities are completed, the final alternatives for combined sewer overflows and stormwater runoff should be considered as tentative solutions.

56. Alternative plans involving land treatment are cost-effective when considering levels of treatment beyond secondary. Prior to engaging in any large-scale land treatment, alternative demonstration projects using effluents from communities in the land treatment areas should be initiated. Such projects could be initiated at low cost and would help define design parameters for large-scale projects. The demonstration projects would also aid in public involvement and environmental assessments.

57. Water quality and ecological impacts are not well defined, particularly for intermittent pollutant discharges. Biological studies will be required to define the relationships.

WATER SUPPLY

58. Water Supply Plan I involves well fields located throughout the rural counties. Exploratory well drilling will be required to assure that aquifers of sufficient capacity are available to meet projected demands.

59. An effective management and "protected flow" system for the Platte River is required to protect existing supply sources for Omaha and Lincoln and to insure the reliability of a potential additional supply source for Omaha (Platte West site). Planning at the State level should be accomplished in the immediate future to determine legal priorities of Platte River water use and to ascertain the feasibility of streamflow maintenance. Recreation and fish and

wildlife habitat should be included as beneficial uses. Flows necessary to maintain the aquatic environment should be determined.

FLOOD CONTROL

60. The West Branch of the Papillion Creek flood control program will be undergoing reevaluation during FY 77. The analysis will include the authorized dams and reservoirs, additional dams and reservoirs, channel improvements, levees, flood proofing, evacuation, and flood plain regulations.

61. Flood plain mapping is required for the lower Platte-Elkhorn Rivers, the Missouri River, Indian Creek, Mosquito Creek, and Mud Creek.

RECREATION

62. Studies are required to determine the carrying capacities for land and water resources that support recreation activities. Lack of these data results in over or under use of resources and handicaps planning entities in developing a program obtaining the optimum use of the resources.

63. A congressionally authorized study should be initiated to determine if the lower Platte-Elkhorn River area qualifies as a National Recreation Area and to determine the appropriate level of Federal involvement.

64. The Corps of Engineers has recently initiated a Missouri River Recreation Master Plan which includes the study area. Federal

assistance could be available to help plan and implement several of the recreation sites indicated along the Missouri River.

65. Most of the recreation sites in the plans have only a general indication of site location and use. Site facility plans will be required prior to implementation. Modifications to existing plans should be performed to avert, where possible, the taking of food producing land for recreation.

Implementation Arrangements

66. Implementation arrangements describe the actions necessary to place a plan into operation. Implementation arrangements include required institutions, funding arrangements, and time-phasing of activities.

INSTITUTIONS

67. Existing institutions are capable of plan implementation. Each plan formulation annex contains alternative institutional modifications which could result in more efficient resource management. Volume VIII - Institutional Arrangements Appendix, contains a detailed data base concerning institutional capabilities in the study area.

68. The institutional analysis indicated that the creation of a single multifunctional regional agency is neither desirable nor possible in the foreseeable future. Therefore, institutional

arrangements for the urban study are mainly directed at functionally defined agencies of varied geographic scope.

69. The following paragraphs summarize the alternative institutional arrangements to implement plans in each functional water resource area.

WASTEWATER MANAGEMENT

70. Implementation of the wastewater management plans can be accomplished within the framework of existing institutions. The Omaha sewerage system is the largest system involved and is already well into the process of developing a regional system. Additional staffing would be required for operation and maintenance of the combined sewer overflow and storm runoff projects.

71. The major land treatment options could be implemented jointly by the city of Omaha and the Natural Resource Districts. The Districts are empowered to manage such systems.

72. Some subdivisions and small communities do not provide adequate operation and maintenance of their sewage treatment plants. State certification of sewage treatment plant operators, and sharing of operators by communities or through the Natural Resource Districts, could be a simple institutional modification which would produce substantial water quality benefits.

73. Three alternative institutional arrangements were analyzed for areawide wastewater management. These were: (1) one agency for the entire study area; (2) one agency in each State covering the study area; and (3) two urban management agencies (Omaha and Council

Bluffs) plus areawide agencies in the rural areas consisting of the Natural Resource Districts in Nebraska and Sanitary Districts in Iowa.

74. The first two alternatives could possibly have some economies of scale merit. There is no indication, however, that one agency crossing State lines would produce enough benefits to overcome political and institutional constraints. One agency for each State would help improve operation and maintenance in rural areas but would have to overcome rural/urban political constraints. The second alternative could eventually be achieved incrementally through the third alternative which is the most desirable management alternative that has some chance of implementation.

75. Under the third alternative, the concept of a regional wastewater management district for Omaha similar to the Metropolitan Utilities District (gas and water) was explored. Creation of such a district is legally possible and would probably be preferred to Omaha's operation of the regional urban system. Both the Omaha Public Works Department and the Metropolitan Utilities District (MUD) indicated the concept has merit. It is possible that wastewater management could be added to MUD's functions. MUD currently collects sewer use fees for Omaha.

WATER SUPPLY

76. Implementation of all water supply plans can be accomplished within the framework of existing laws in both States.

77. In Nebraska, MUD is a regional water supplier for the metropolitan area and for some rural areas. Expansion of MUD's system is

generally a matter of economics. Rural water systems can be implemented by the Natural Resource Districts in Nebraska.

78. The Iowa Code authorizes the establishment of benefitted water districts. These districts would be capable of implementing either Water Supply Plan I or II.

79. The development of additional well fields in both States requires a permit from either the Iowa Natural Resources Council or the Nebraska Department of Water Resources.

80. Establishment of supply sources from the Missouri River requires a permit from the Corps of Engineers. Pending declaration of other streams as navigable, wells installed in flood plains below the high water mark may also require a permit from the Corps.

81. Legal questions concerning development of an additional Platte River source for Omaha are not clear primarily because the legal connection between ground water and surface waters has not been recognized. Although there is no present prohibition on transbasin diversion of ground water, it is probable the development of this source would bring court actions.

FLOOD CONTROL

82. Implementation of flood plain management measures is institutionally feasible within the study area. Structural measures indicated in the plans are implementable through Federal action or through a combination of Federal action and a local sponsor. Nonstructural measures involve land use controls implemented by local entities.

83. The Flood Control Plan Formulation Annex and the Institutional Arrangements Appendix should be consulted for definition of the Federal, State, and local roles in flood control and flood plain management.

RECREATION

84. Responsibility for implementing recreation plans is divided among a multitude of agencies. Current organizations are adequate to implement the recreation plans.

85. The urban study has suggested the creation of a regional recreation authority. Such an authority could reduce difficulties in coordination, need identification, and planning and at the same time enhance the region's capability to implement recreation plans.

FUNDING ARRANGEMENTS

86. The total costs and cost-sharing arrangements for each plan are indicated in the evaluation sections of the Plan Formulation Annex. The cost-sharing arrangements are summarized here along with a brief discussion of alternative methods of funding.

WASTEWATER MANAGEMENT

87. Currently, the Federal Government pays 75 percent of the capital costs. In Nebraska, the State provides 12.5 percent and the local government pays the remaining 12.5 percent. In Iowa, the State provides 5 percent and the local government 20 percent. Local governments pay all operation and maintenance costs.

88. Costs for major interceptor sewers have been included in the total costs according to the cost-share arrangements indicated above.

The Environmental Protection Agency's current policy appears to be not to fund that portion of the interceptors required for new growth. Therefore, most of the interceptor costs would be paid by local governments. Interceptor cost data can be obtained from Annex H of the Supporting Technical Reports Appendix.

90. Storm sewer collection costs have not been included for the urban storm runoff plans. Storm sewers are entirely a local cost.

90. Cost-sharing arrangements for the Land Treatment Options are dependent on treatment requirements. If Level 1 (secondary) treatment is maintained through the planning period, all costs of land treatment would have to be paid by the irrigators. If a higher level of treatment is ultimately required, the land treatment costs could be cost-shared between pollution control authorities and the irrigators.

91. The normal method of raising the local share of wastewater management costs is through the issuance of long-term revenue bonds repaid from service charges.

WATER SUPPLY

92. Water supply costs are normally a local responsibility with monies raised through revenue bonds repaid by service charges. All institutions listed for water supply have the legal authority to issue such bonds. Federal grants or 5 percent, 40-year loans, administered by the Farmers Home Administration, may be available for a portion of the capital improvements for rural water systems. The determination of Federal grants is based on needs and on the costs to the consumer versus the ability to pay. The Federal grant is based on the amount of money necessary to bring the rural

water supply costs in line with a regional average. Revenues from service charges must cover the cost of operation and maintenance of new and existing systems.

FLOOD CONTROL

93. The costs of preparing flood plain maps are borne by the Federal Government. Insurance rates are subsidized by the Federal Government with the remainder being paid by the individual property owner.

94. For the Papillion Creek dams, the Federal Government provides 100 percent of the capital and operation and maintenance costs for the flood control portion. The Federal Government provides 50 percent of the recreation capital costs; local sponsors pay the remainder of the capital costs and all recreation operating and maintenance costs.

95. For the Big Papillion channel alternative, local interests would be required to provide lands, easements, and rights-of-way and to operate and maintain the project. Local costs would amount to approximately $9 million out of a total cost of $21 million. The local costs would probably be raised by bond issue repaid either through general obligation assessments or special assessments to those property owners in the protected area.

96. Funding arrangements for the Indian Creek structural flood control alternatives would be similar to those for the Big Papillion Channel.

97. Local costs for Missouri River Levee Unit L 611-614 amount to $900,000 out of a total $5,700,000. The local sponsor is the

Mills-Pottawattamie County Levee District. The remainder of the costs will be paid by the Federal Government.

[illegible]. Local and Federal costs for Missouri River Levee Unit L-[illegible] are $[illegible] and $[illegible] respectively. The Papio Natural Resources District is the project sponsor and it would obtain its money from a mill levy on property tax.

RECREATION

99. Fund sources and cost-sharing arrangements for recreation are divided between several Federal, State and local programs. The following paragraphs describe the most probable arrangements for each recreation plan.

100. The Platte-Elkhorn Plan could be implemented with two alternative funding arrangements. Under the first arrangement, the Bureau of Outdoor Recreation (BOR) would provide 50 percent of the acquisition and development costs through its Land and Water Conservation Fund. The State of Nebraska would provide 25 percent matching through its Land and Water Conservation Fund and perhaps could provide more using the Nebraska Resource Development Fund. Local governments would pay the remainder of the acquisition and development costs. State and local governments would pay for operation and maintenance costs.

101. Under the second arrangement, acquisition and development costs could be 100 percent Federal under National Recreation Area designation. The Federal Government would also provide all or part of the operating and maintenance costs.

102. The Missouri River plans could be funded through the Corps of Engineers, the BOR, the States of Nebraska and Iowa, and through local governments. The role of BOR and the State of Nebraska would be similar to that discussed above. Iowa does not provide matching funds to BOR's funding for local parks but does appropriate money for State parks. The Corps, in conjunction with the Missouri River Channel Stabilization and Navigation Project, can provide 50 percent of the recreation development costs for sites directly connected to the river. A local sponsor must provide the land, the value of which can be used as part of the sponsor's 50-percent share.

103. Recreation development costs for the Papillion Creek Project are divided 50/50 between the Corps of Engineers and a local sponsor. Acquisition and development of flood plain parks would normally be the responsibility of BOR, the State, and local entities. If the flood plain is required as a non-structural flood control alternative, however, the Federal Government can provide up to 80-percent cost-sharing in acquisition.

104. Sources of local funds for all recreation plans normally involve some method of taxation. There are also a number of ways to acquire or preserve lands in lieu of outright purchase. These methods are defined in the Recreation Plan Formulation Annex.

TIME PHASING

105. The time phasing for construction and associated design activities of plan components is given in table F-2. Intervals are divided into five-year increments with specific years indicated in parenthesis where more certainty exists regarding time for implementation.

106. Time phasing for wastewater management is geared to meet the goals and objectives of PL 92-500 and is based on achieving the highest levels of treatment.

107. Expansion of the water and sewerage systems is dependent on growth patterns. MAPA will develop a land use plan by August 1977. Prior to that date, only limited system expansion should be undertaken. Preferably the MAPA plan will indicate time-zoned areas for development. The water and sewer systems can be used to enforce adherence to the time zones.

108. All flood control measures should be in place by 1985. With the adoption of flood plain regulations, there should not be additional major flood control needs.

109. Implementation of initial recreation facilities in the Papillion Creek flood control program will follow construction of the flood control elements. Implementation of the other recreation plans will be dependent on the availability of funds. MAPA has defined a priority schedule for implementation of most recreation sites along the Platte-Elkhorn and Missouri Rivers. The Recreation Plan Formulation Annex should be consulted for the individual site priority listing. The Riverfront Development portion of the Missouri River plan is scheduled for implementation prior to 1995.

Table F-2
Time Phasing of Design and Construction Activities

Time Frame	Activity: Wastewater Management	Water Supply	Flood Control	Recreation
1975 - 1980	Initiate construction of Omaha Missouri River and Papillion Creek secondary facilities (1975-1977).	Select a rural water supply plan; if Plan I selected, conduct exploratory well drillings.	Design Missouri River Levee Units L-611-614 (1975) and construct (1976-1978).	Complete construction of initial recreation facilities at Dam 16 (1975).
	Initiate facility plans, design, and construction of minor urban and non-urban facilities not meeting 1977 effluent requirements (1975-1977).	Conduct exploratory well drillings at Platte West and Missouri South new urban treatment plant sites.	Design Missouri River Levee Unit R-616 (1975) and construct (1977-1978).	Design initial recreation facilities at Dam 11 (1976) and construct (1977-1978).
	Continue interceptor implementation but not beyond that required for areawide Plan 2 (1975-1977).	Design new Platte West or Missouri South treatment plant.	Design Dam Site 10 (1975) and construct (1977-1978).	Design initial recreation facilities at Dam 10 (1977) and construct (1977-1978).
	Implement Land Treatment Demonstration Projects at Boys Town and Blue River (1975-1977).	Design new Platte West or Missouri South Treatment plant.	Design Big Papillion Creek Alternative (1977) and construct (1977-1978).	Design initial recreation facilities at Big Papillion Alternative (1979) and construct (1979-1980).
	Design and construct 8 grit removal facilities.	Design and construct urban distribution expansions but not beyond Distribution Concept C.		
	Determine source of corrosion at meat packing pre-treatment plant and determine corrective measures (1975-1977) Implement measures (1977-1980).		Reevaluate West Branch Papillion Creek Flood Control (1975-1976).	Conduct feasibility study for Platte-Elkhorn National Recreation Area.
	Conduct additional studies on storm related sources of pollution. Select design storms, treatment levels and optimum alternative (1975-1977) Design alternative (1977-1980).		Prepare flood plain maps for the lower Platte-Elkhorn, Missouri River, Indian Creek, Mosquito Creek, and Mud Creek.	See Recreation Plan Formulation Anned for Platte-Elkhorn and Missouri River time phasing.

Table F-2
(Cont'd)
Time Phasing of Design and Construction Activities

Time Frame	Activity: Wastewater Management	Water Supply	Flood Control	Recreation
1975-1980	Expand industrial waste flow and quality monitoring. Continue to implement agricultural runoff control measures. Complete construction of secondary facilities (1977-1980). Design tertiary treatment facilities; if land demonstration results positive, design transmission, storage, and distribution facilities (1977-1980). Separate Indian Creek combined sewers. Continue interceptor implementation consistent with new MAPA land use plan (1977-1980).			
1980-1985	Construct tertiary treatment facilities, land irrigation option or zero discharge lagoons. Storage and distribution for land treatment sized for 1995 flows. Construct facilities for Omaha Missouri River and Papillion Creek overflows and urban storm runoff.	Construct new Platte West or Missouri South treatment plant. Design expansions to the Omaha Florence and Council Bluffs Narrows Treatment Plants.	Complete Papillion Creek flood control project.	See Recreation Plan Formulation Annex for Platte-Elkhorn and Missouri River time phasing.

Table F-2
(Cont'd)
Time Phasing of Design and Construction Activities

Time Frame	Activity: Wastewater Management	Water Supply	Flood Control	Recreation
1980-1985	Design and construct interceptor expansions consistent with new MAPA land use plan.	Design rural treatment and distribution systems.		
		Design and construct urban distribution systems consistent with MAPA land use plan.		
1985-1990	Design 1995 plant expansions at Mosquito Creek, and minor urban facilities.	Construct Omaha Florence and Council Bluffs Narrows treatment plant expansions.		See Recreation Plan Formulation Annex for Platte-Elkhorn and Missouri River time phasing.
	Continue design and construction of urban runoff treatment facilities.	Construct rural treatment and distribution systems.		
	Design and construct interceptor expansions consistent with MAPA land use plan.	Design expansion to the Platte South plant.		
		Design and construct urban distribution systems consistent with MAPA land use plan.		
1990-1995	Design required facility expansions and additions.	Construct Platte South expansion.		See Recreation Plan Formulation Annex for Platte-Elkhorn and Missouri River time phasing.
	Design and construct interceptor expansions consistent with MAPA land use plan.	Design and construct urban distribution systems consistent with MAPA land use plan.		

Table F-2
(Cont'd)
Time Phasing of Design and Construction Activities

Time Frame	Activity: Wastewater Management	Water Supply	Flood Control	Recreation
1995 and Later	Design and construct facility expansions and replacements as determined by the revision program and/or Sec. 208 continuing planning process.	Design and construct facility expansions consistent with MAPA land use plan.		**See Recreation Plan Formulation Annex for Platte-Elkhorn and Missouri River time phasing.**