MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

CHATFIELD DAM TO BASELINE ROAD

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B – VOLUME 1

PRELIMINARY ENGINEERING DESIGN

PROJECT SPONSORS

- ADAMS COUNTY
- ARAPAHOE COUNTY
- DOUGLAS COUNTY
- JEFFERSON COUNTY
- CITY AND COUNTY OF DENVER
- TOWN OF COLUMBINE VALLEY
- CITY OF BRIGHTON
- COMMERCE CITY
- CITY OF ENGLEWOOD
- CITY OF LITTLETON
- CITY OF SHERIDAN
- CITY OF THORNTON
- GREENWAY FOUNDATION

PROJECT ADVISORS

- DENVER REGIONAL COUNCIL OF GOVERNMENTS
- COLORADO WATER CONSERVATION BOARD
- SOUTH SUBURBAN PARKS AND RECREATION DISTRICT
- COLORADO DIVISION OF WILDLIFE
- U.S. ARMY CORPS OF ENGINEERS
- COLORADO DIVISION OF PARKS AND OUTDOOR RECREATION

WRIGHT WATER ENGINEERS, INC.

URBAN ENVIRONMENTS, LTD.

DENTON HARPER MARSHALL, INC.

NOVEMBER 1985

WWE
Wright Water Engineers, Inc.

DENVER OFFICE
2490 West 26th Ave., Suite 55A
Denver, Colorado 80211
(303) 480-1700

TULSA OFFICE
707 South Houston, Suite 302
Tulsa, Oklahoma 74127
(918) 584-7136

GLENWOOD SPRINGS OFFICE
818 Colorado Avenue
P.O. Box 219
Glenwood Springs, Colorado 81602
(303) 945-7755
Denver Direct Line: 893-1608

November 11, 1985

Mr. L. Scott Tucker
Executive Director
Urban Drainage & Flood Control District
2480 West 26th Avenue, Suite 156B
Denver, CO 80211

Re: South Platte River Corridor Preliminary Design and Master Plan - Phase B Agreement No. 83-04.01

Dear Mr. Tucker:

The preliminary design of the 40 mile reach of the South Platte River from Chatfield Reservoir to Brighton has been completed. The river corridor master plan covers many functions and uses of this river valley, including:

- o River flow
- o Water rights
- o Water quality
- o Mineral resources
- o Geomorphology
- o Sedimentation
- o Flood hazard mapping (FHAD)
- o Groundwater
- o Parks and recreation inventory
- o Open space inventory
- o Trail and access road needs
- o Proposed parks and recreation
- o Boating inventory and needs
- o Gravel mining standards

The overall effort by Wright Water Engineers, Inc. is represented by a total of four separate documents. These are:

1. Phase A: Development of Alternative Plans
2. Phase B: Preliminary Engineering Design, Volumes I and II
3. Flood Hazard Area Delineation
4. Gravel Mining Criteria Report

There are two report volumes to this Phase B design and master plan. Volume I contains engineering and flood related aspects of the river and its corridor. Volume II is a presentation of the master plan for recreation, landscaping, and wildlife in the corridor.

This project was undertaken and completed with the assistance and cooperation of the thirteen Project Sponsors listed on the cover. In addition, the assistance of the six project advisors was invaluable. The leadership of Mr. Ben Urbonas of the District was instrumental in our meeting the objectives of the work.

KENNETH ROBERT WRIGHT REGISTERED 3084 PROFESSIONAL ENGINEER STATE OF COLORADO

Wright Water Engineers is particularly grateful for the guidance and advice of the many landowners, gravel company interests and innumerable local government staff people who gave unselfishly of their time in assisting us.

The purpose of this preliminary design is to provide guidance for the solution of flood problems while maintaining a balance with respect to the uses of the river. While the foremost and primary use of the South Platte River is for drainage and flood control, the development of this use must be coordinated with water supply, sewerage, land use, building development, recreation, transportation, wildlife, and open space.

The management of the South Platte River corridor is important. In fact, it is key to upgrading the corridor. We have included a section in the report on River Corridor Management.

The master planning included the detailed study of eight distinct river reaches. For each reach numerous alternatives were considered and select alternatives were studied in detail. The study of alternatives included engineering evaluation, construction costing, determination of flood damages and damage reduction, and economic analysis.

This report contains the preliminary design for the plan selected by the sponsors from those presented in the Phase A report.

The South Platte River preliminary design is practical and achievable. It will result in a unified approach to control of the flooding problem within the framework of a valuable regional linear amenity. The South Platte River corridor is an asset for all local governments and their citizens and can be made to serve them better.

Submitted by,

WRIGHT WATER ENGINEERS, INC.

By _____
Leo M. Eisel, P.E.
Principal in Charge

By _____
W. Curtis Chandler, P.E.
Project Engineer

By _____
Kenneth R. Wright, P.E.
Project Manager

By _____
Mark W. Glidden, P.E.
Project Engineer

By _____
Rick Lamoreaux
Urban Environments, Ltd.

By _____
Robert Smith
Denton Harper Marshall

VOLUME I - PRELIMINARY ENGINEERING DESIGN
TABLE OF CONTENTS

SECTION	DESCRIPTION	PAGE
I	INTRODUCTION	I-1
	Purpose of the Study	I-2
	Special Issues	I-3
	River Flow	I-3
	River Management	I-3
	Study Reaches	I-4
	Phase A	I-4
II	STUDY AREA DESCRIPTION	II-1
	Geographic Location	II-1
	Historical Perspective	II-1
	Geologic Setting	II-1
	Previous Studies	II-1
III	HYDROLOGY	III-1
	Flood Control Storage	III-1
	Drainage Basin	III-1
	Peak Flows	III-1
	Average River Discharge	III-2
	Groundwater	III-4
	Water Rights	III-6
	Sewage Plant Discharges	III-6
IV	HYDRAULICS AND SEDIMENTATION	IV-1
	Hydraulic Analysis	IV-1
	Existing Conditions	IV-1
	Split Flow Calculations	IV-1
	Dams	IV-1
	Improved Conditions	IV-2
	Historical Floods	IV-2
	Sedimentation and Erosion	IV-2
	Erosion	IV-3
	Impacts of Erosion	IV-3
	Effect of Recommended Plan	IV-3
V	FLOOD PROBLEMS	V-1
	Reach 1: Chatfield to Columbine Valley	V-1
	Reach 2: Columbine Valley to Oxford	V-1
	Reach 3: Oxford to Bates	V-1
	Reach 4: Bates to Colfax	V-1
	Evans Avenue	V-1
	Vallejo to Colfax	V-1
	8th Avenue	V-2
	Reach 5: Colfax to Cherry Creek	V-2
	Reach 6: Cherry Creek to Franklin	V-2
	Reach 7: Franklin to Sand Creek	V-2
	Reach 8: Sand Creek to Baseline Road	V-2
VI	MASTER PLAN DEVELOPMENT	VI-1
	Introduction	VI-1
	Phase A Study	VI-1
	Purpose	VI-1
	Goals	VI-3
	Alternatives Evaluated	VI-3
	Phase B Direction	VI-3
	Reaches 1, 2, 3, and 4 - Chatfield to Colfax	VI-4
	Reach 5 - Colfax to Cherry Creek	VI-4
	Reach 6 and 7 - Cherry Creek to Sand Creek	VI-4
	Reach 8 - Sand Creek to Baseline Road	VI-4
	Phase B Plan	VI-5
	Reach 1 - Chatfield to Columbine	VI-5
	Reach 2 - Columbine to Oxford	VI-5
	Reach 3 - Oxford to Bates	VI-5
	Reach 4 - Bates to Colfax	VI-5
	Reach 5 - Colfax to Cherry Creek	VI-6
	Reach 6 - Cherry Creek to Franklin	VI-6
	Reach 7 - Franklin to Sand Creek	VI-6
	Reach 8 - Sand Creek to Baseline Road	VI-6
VII	MASTER PLAN COSTS	VII-1
	Introduction	VII-1
	Unit Costs	VII-1
	Drainage Improvement Costs	VII-2
	Street Crossing Costs	VII-2
	Utility Relocation Costs	VII-3
	Total Construction Cost	VII-3
	Contingency	VII-3
	Property Acquisition Costs	VII-3
	Maintenance	VII-3
	Cost of Alternatives	VII-4
VIII	CRITERIA	VIII-1
	Introduction	VIII-1
	Planning and Design Criteria	VIII-1
IX	RESOURCES	IX-1
	Mineral Resources	IX-1
	Verdos Gravels	IX-1
	Slocum Gravels	IX-1
	Older Eolian Sand and Silt	IX-1
	Broadway-Louviers Alluvium	IX-1
	Piney Creek Alluvium	IX-1
	Younger Eolian Sand and Silt	IX-2

TABLE OF CONTENTS
(Continued)

TABLE OF CONTENTS
(Continued)

SECTION	DESCRIPTION	PAGE
	Post-Piney Creek Alluvium.	IX-2
	Sand and Gravel Resources in Adams County.	IX-2
	Groundwater Resources	IX-2
	Depth of Water Table	IX-2
	Chemical Water Quality	IX-3
	Well Yields.	IX-3
	River Flow and Reservoirs	IX-3
	Travel Time.	IX-4
	Water Quality	IX-4
	Recreation and Open Space	IX-4
	Geomorphology	IX-5
	Chatfield Reservoir to Columbine Valley.	IX-5
	Columbine Valley to West Hampden Avenue.	IX-5
	West Hampden Avenue to Sand Creek.	IX-5
	Sand Creek to East 104th Avenue.	IX-5
	East 104th Avenue to Baseline Road	IX-5
X	RIVER CORRIDOR MANAGEMENT.	X-1
	Statement of Policy	X-1
	Principles.	X-2
	Goals	X-2
	Objectives.	X-2
	Criteria.	X-3
XI	RECREATION AND WILDLIFE.	XI-1
	Introduction.	XI-1
	General.	XI-1
	REFERENCES	
	PRELIMINARY ENGINEERING DESIGN - (SHEETS 1 THROUGH 45)	

VOLUME I - PRELIMINARY ENGINEERING DESIGN
LIST OF TABLES

TABLE NO.	DESCRIPTION	PAGE
I-1	Study Reaches.	I-4
III-1	South Platte River Corridor Uses	III-1
III-2	Flood Control Reservoirs	III-1
III-3	Tributary Basin Peak Inflow.	III-2
III-4	South Platte River Peak Flood Flows.	III-2
III-5	Average South Platte River Discharges.	III-3
III-6	South Platte River Low Flow Hydrology.	III-3
III-7	Estiamtes of Future Dry Month Flow South Platte River	III-4
III-8	Water Rights of Mainstream South Platte Chatfield Reservoir to Brighton	III-7
III-9	South Platte River Corridor Sewage Treatment Plants.	III-6
IV-1	Sediment Yield - South Platte River.	IV-3
VII-1	Unit Costs	VII-1
VII-2	Right-of-Way Unit Costs.	VII-3
VII-3	Maintenance Costs and Frequency.	VII-4
VII-4	Project Costs by River Reach	VII-4
X-1	South Platte River Flood Hydrology	X-4
X-2	Low Flow Hydrology	X-4
X-3	Manning Roughness Values	X-4

VOLUME I - PRELIMINARY ENGINEERING DESIGN
LIST OF FIGURES

FIGURE NO.	DESCRIPTION	PAGE
III-1	Drainage Basin and Tributaries.	III-8
III-2	South Platte River Discharge Profiles	III-9
III-3	South Platte River Discharge Hydrograph Downstream of Sanderson Gulch.	III-10
III-4	South Platte River Discharge Hydrograph Upstream of Sand Creek	III-10
III-5	Schematic Straight-Line Diagram of the South Platte River from Chatfield Reservoir to Brighton	III-11

VOLUME II
RECREATION PLAN
SOUTH PLATTE RIVER MAJOR DRAINAGEWAY PLAN
PHASE B REPORT

TABLE OF CONTENTS

	PAGE
SECTION I - RECREATION AND WILDLIFE	
Introduction	I-1
General	I-1
SECTION II - PLANNING PROCESS	
General	II-1
Alternative Descriptions	II-1
SECTION III - Criteria	
General	III-1
Parks	III-1
Trails	III-2
Water Recreation	III-4
Wildlife/Fish/Aquatic Life	III-6
River Access	III-8
Landscaping	III-9
Views	III-9
Operation and Maintenance	III-9
SECTION IV - COMMENTARY, COST ESTIMATE AND PRELIMINARY DESIGN DRAWINGS	
General	IV-1
Reach 1	
Commentary	IV-2
Cost Estimate	IV-2
Reach 2	
Commentary	IV-3
Cost Estimate	IV-3
Reach 3	
Commentary	IV-4
Cost Estimate	IV-4
Reach 4	
Commentary	IV-5
Cost Estimate	IV-5
Reach 5	
Commentary	IV-6
Cost Estimate	IV-6
Reach 6	
Commentary	IV-7
Cost Estimate	IV-7
Reach 7	
Commentary	IV-8
Cost Estimate	IV-8
Reach 8	
Commentary	IV-9
Sub-Reach A - Cost Estimate	IV-10
Sub-Reach B - Cost Estimate	IV-10
Sub-Reach C - Cost Estimate	IV-11
Sub-Reach D - Cost Estimate	IV-11
Sub-Reach E - Cost Estimate	IV-12
Sub-Reach F - Cost Estimate	IV-12
CONCLUSION	IV-13
COST ESTIMATE SUMMARY	IV-13
RECREATION PLAN DRAWINGS	IV-14
FOOTNOTES	IV-37
APPENDIX A - VEGETATION AND WILDLIFE INVENTORY	A-1
APPENDIX B - EXISTING AND PROPOSED PARK TABLE	B-1
APPENDIX C - RIVER OBSTRUCTIONS TABLE	C-1
APPENDIX D - AKNOWLEDGEMENTS	D-1

SECTION II
STUDY AREA DESCRIPTION

GEOGRAPHIC LOCATION

The South Platte River Master Drainage Plan includes the South Platte River from Chatfield Reservoir in Jefferson County to Baseline Road in Brighton. The study area includes the Denver Metropolitan area.

HISTORICAL PERSPECTIVE

In the 1850's the South Platte River served as a waterway and trail route for transportation of supplies and immigrants to the west. It began to deteriorate in quality as the population of Denver increased.

The history of the South Platte River began to change for the better in 1974 when the Platte River Development Committee initiated the task of restoring the river to its former importance to the city. This group, using public and private funds, started this task with the development of Confluence Park at the confluence of Cherry Creek and the South Platte River. Later a system of trails and greenways along the river and a general cleaning up of the river environment encouraged the recreational use of the river corridor. In addition, boat chutes were constructed at several major dams to encourage boating on the river.

GEOLOGIC SETTING

The South Platte has been numerously described as "too thick to drink, too thin to farm, too shallow to sail on, too broad to shoot a rifle across." In its pristine state, the South Platte River adjusted its width, depth and sinuosity in response to the amount and type of sediment and amount of water supplied to it by its tributaries. In the 1880's agriculture began on the South Platte River and the character of the river was forever altered.

Prior to the advent of irrigation, the channel width ranged from 1,500 to 2,500 feet with multiple thalwegs. The raised water table and continuous stream flow resulting from irrigation caused the river to change to a single thalweg channel and reduced channel width.

The South Platte River flows in a valley cut into the landscape during Pleistocene or recent times. The valley floor is protohistoric and historic alluvium, mostly reworked gravel overlain by a few feet of dark humus.

The profile of the river from Chatfield to Brighton is generally concave downward as expected with alluvial rivers. The average river bed slope from Chatfield Dam to the mouth of Clear Creek is approximately 13 feet per mile. Thereafter, the average slope decreases to approximately 9 feet per mile to Brighton. Where there are no major tributaries, the general river bed slope of the South Platte River remains constant. Bed slopes of all major tributaries are much greater than that at the mainstem.

PREVIOUS STUDIES

There have been no previous master plan studies on the South Platte River through Denver. The U.S. Army Corps of Engineers completed studies of the South Platte River and its tributaries through Metropolitan Denver in 1974 and 1977. These studies were floodplain information reports which delineated the floodplain and identified flood problems. The main objective of these studies was to promote non-structural floodplain management. In 1977, Gingery Associates, Inc. prepared a flood hazard delineation for the South Platte River through Adams County. This study used hydrology prepared by the U.S. Army Corps of Engineers. In 1983, the Federal Insurance Administration prepared a draft flood insurance map for the City of Denver. This map also was based on previous Corps of Engineers studies. Numerous other flood insurance studies have been prepared for short reaches of the river for various municipalities through which the river flows.

Throughout the years individual communities bordering on the river have done studies of various aspects of the river including flooding, recreation, water quality, etc. The purpose of this Master Plan is to utilize these previous studies to the extent possible and fill in the gaps where necessary in order to provide a comprehensive master drainage plan for the entire Denver Metropolitan region.

Rafters enjoying whitewater in the heart of Denver.

Kayak slalom course at historic founding site of Denver, the Confluence of Cherry Creek and the South Platte River.

COMMUNITY AMENITIES. The South Platte has evolved from a waterway and trail route for transportation of supplies and immigrants to a focal point for a wide variety of community uses including boating and recreation. (left and above)

SECTION I
INTRODUCTION

The preliminary engineering design and the Master Plan for the South Platte River and its corridor are presented in this report. The design and plan provides a road map for the corridor development for the next twenty years.

The river from Chatfield Reservoir to the City of Brighton, 40 miles downstream, is the area represented by the work of this report. This 40 mile reach of the South Platte River involves the land of 12 local governmental jurisdictions plus the domain of the Greenway Foundation and the State of Colorado. The river is the focal point waterway for a metropolitan area containing 1.8 million people in 1985.

This plan provides for the optimization of the many conflicting uses of the South Platte River as it flows through the metropolitan area. The major use of the river is drainage and flood control. This plan provides a design which will eliminate, or reduce the flood hazards, while enhancing the other important functions of the river.

Wright Water Engineers acknowledges the project direction received from Ben Urbonas and the guidance and helpful suggestions from Messrs. Scott Tucker, Mark Hunter, Bob Hoffmasater, and Bill DeGroot of the Urban Drainage & Flood Control District. In addition, the following individuals directed the efforts for their communities:

Mr. Jim Considine	Adams County
Mr. Gary Davis	Adams County
Commissioner Duncan	Douglas County
Mr. Ernest Hamilton	Arapahoe County
Ms. Jeannie Rossillon	Jefferson County
Mr. Nick Skifalides	City and County of Denver
Mr. Del Preheim	Town of Columbine Valley
Mr. Larry Wyeno	City of Brighton
Mr. Jerry Nery	Commerce City
Mr. Kells Waggoner	City of Englewood
Mr. Charlie Blosten	City of Littleton
Mr. Eric Pahlke	City of Thornton
Mr. Joe Shoemaker	Greenway Foundation

The following individuals assisted by providing information, coordination and review during the planning process:

Mr. Roger Bardsley	Adams County
Mr. Dick Marino	Adams County
Mr. Ming Yeh	Adams County
Ms. Crystal Gray	Adams County
Mr. Jon Colt	Adams County
Mr. Gary Davis	Adams County
Mr. Dave Falconieri	Adams County
Mr. Bruce Leiser	City and County of Denver
Mr. Tom Nelson	City and County of Denver
Mr. Bill Lamont	City and County of Denver
Mr. Gordon Appell	City and County of Denver
Mr. Bill Bates	City and County of Denver
Mr. Todd Teachout	Commerce City
Mr. Jonathan Stein	Commerce City
Mr. Jerry Hittleman	Commerce City
Mr. Robert Presley	City of Thornton
Mr. Jeff Shoemaker	Greenway Foundation
Mr. Dave Meha	Denver Regional Council of Governments
Mr. Gary Mast	Denver Regional Council of Governments
Mr. Larry Mugler	Denver Regional Council of Governments
Mr. Mark Matulik	Colorado Water Conservation Board
Mr. Larry Lang	Colorado Water Conservation Board
Mr. Brian Hyde	Colorado Water Conservation Board
Ms. Mary Carter	So. Suburban Metropolitan Recreation and Park District

Mr. Bob Searns	Urban Edges
Mr. Al Whitaker	Colorado Division of Wildlife
Mr. John Woodling	Colorado Division of Wildlife
Ms. Ann Hodgson	Colorado Division of Wildlife
Mr. Gregory Moore	U.S. Army Corps of Engineers
Mr. Jack Unitt	U.S. Army Corps of Engineers
Col. John Coats	U.S. Army Corps of Engineers
Mr. Ralph Schell	Colorado Div. of Parks & Outdoor Rec.
Mr. Stuart MacDonald	Colorado Div. of Parks & Outdoor Rec.
Mr. Roger Hartman	Metro Denver Sewage District
Mr. Bill Woodcock	So. Suburban Metropolitan Recreation and Park District
Mr. Jim Sells	Colorado Rock Products Assoc.
Mr. Mel Flanagan	Walt Flanagan & Company
Mr. Paul Gesso	Cooley Gravel
Mr. Albert R. Frei	Albert Frei and Sons
Mr. Michael A. Stevens	Consultant
Mr. George Chelwick	Mile High Land Associates
Mr. Davis Sellards	Sellards & Grigg
Ms. Deborah Dixon	Sellards & Grigg

Personnel of the Wright Water Engineers team includes the following:

Dr. Leo M. Eisel, P.E. Vice President, Wright Water Engineers	Principal-in-Charge
Kenneth R. Wright, P.E. Chief Engineer, Wright Water Engineers	Project Manager
W. Curt Chandler, P.E. Flood Control Engineer, Wright Water Engineers	Project Engineer
Mr. Mark W. Glidden, P.E. Hydraulic Engineer, Wright Water Engineers	Assistant Project Engineer
Robert Smith Denton Harper Marshall, Inc.	Landscape Architect/ Planner
Rick Lamoreaux Urban Environments, Ltd.	Recreational Planner

PURPOSE OF THE STUDY

The purpose of the South Platte River Master Plan is to provide a plan for optimization of the uses of the South Platte River corridor.

The number one use of the South Platte River corridor is for flood control and drainage. It must continue to serve as the major drainageway for the Denver metropolitan region. This primary use has the senior prescriptive right in the South Platte River corridor. This master plan provides a floodplain management plan which can be implemented over the course of the next decade.

Other uses of the corridor include:

- Water supply
- Transportation of irrigation water
- Transportation and dilution of sewage effluent
- Providing cultural and recreational opportunities
- Mineral resources
- Water exchanges
- Cooling water for industry
- Wildlife habitat
- Whitewater boating
- Running and biking trail
- Parks and general recreation

Special Issues

Many special issues needed consideration as a part of this master planning effort to achieve the stated goal. These include:

- o Flood hydrology and low flow hydrology
- o Hydaulic characteristics of channel
- o Flood problems
- o Water rights
- o Water quality
- o Mineral resources
- o Geomorphology and sedimentation
- o Groundwater
- o Parks, recreation, and boating needs
- o River flow control
- o Sewage effluent discharges
- o Aesthetics and appearance
- o Wildlife and aquatic life

River Flow

It was realized early during the course of the study that most of the time there would not be enough water flowing in the river to satisfy all of the uses and at other times there would be too much (i.e., flooding). For that reason it was concluded that implementation of the master plan would require the cooperation of all participants. For river flow control in particular, the cooperation and assistance of the following agencies would be required:

- o Denver Water Board and Department
- o U.S. Army Corps of Engineers
- o State Engineer of Colorado
- o Irrigators of agricultural land
- o Colorado Water Conservation Board
- o Urban Drainage & Flood Control District
- o Central Colorado Water Conservancy District

The objective of the river flow control effort would be to optimize the South Platte River streamflow from Chatfield to Brighton for:

- o Water supply
- o Irrigation
- o Aquatic life
- o Recreation and aesthetics
- o Sewage dilution in order to assure good quality water for the above uses
- o Flood control.

River Management

In effect, the South Platte River Master Plan is to be a long-term road map for the South Platte River. It is to provide information to understand the problems of the river and to assist in managing and operating the South Platte River from Chatfield Reservoir to Brighton at Baseline Road.

STUDY REACHES

The South Platte River study area was divided into eight reaches for analysis of where problems and solutions tended to have common characteristics. These study reaches are as follows:

TABLE I-1
STUDY REACHES

Reach	Limits	Local Governments in Reach
1	Chatfield Dam to Columbine Dam	Jefferson County, Arapahoe County, Douglas County, Littleton
2	Columbine Dam to Oxford Avenue	Columbine Valley, Littleton, Englewood, Sheridan, Arapahoe County
3	Oxford Avenue to Bates Avenue	Englewood, Sheridan
4	Bates Avenue to Colfax Avenue	Denver
5	Colfax Avenue to Cherry Creek	Denver
6	Cherry Creek to Franklin Street	Denver
7	Franklin Street to Sand Creek	Commerce City, Adams County
8	Sand Creek to Baseline Road	Thornton, Adams County, Brighton

PHASE A

The Phase A report was published in August, 1984 after a lengthy review of the report draft by all project sponsors, project advisors, and many interested parties. The report was made available for review to individuals and organizations such as the Denver Audubon Society and the Colorado Whitewater Association.

The Phase A scope of work included detailed research and analysis of: study area; hydrology and hydraulics; flood problems; river flow; water rights; water quality; mineral resources; geomorphology; sedimentation and erosion; groundwater resources; parks; recreation; open space; design criteria; design alternatives, their evaluation and costing; a study of beneift-cost ratios; development of recommended alternatives, reach-by-reach; and development of a river management plan.

For each reach of the river nine alternatives were analyzed. The alternatives included:

1. Maintain existing configuration,
2. Natural type waterway,
3. Lined channels,
4. Limited structural improvements,
5. Acquisition of floodplain land,
6. Non-structural,
7. Relocation of channel,
8. Other,
9. Combinations.

It was in Adams County that selections of the best alternate was most difficult because of the desire to mine the river bed and have large lakes through which the river would flow. Water quality aspects of lake limnology and sediment starving of the river eliminated consideration of the on-stream lakes.

The master plan and alternatives selected by the District and Project Sponsors were then analyzed using detailed engineering and planning techniques in the Phase B scope of services. The final plans are presented in Section VI of this report and in detail on the 45 drawings appended.

For each of the 8 study reaches, the District and Project Sponsors selected the recommended alternate described in the Phase A report, but with several specific requests for Reaches 5 and 8 as described in Section VI.

The interested parties who wish to review the overall planning and engineering process utilized and to further study reasons for the alternative selections, are referred to the August, 1984 Phase A report available in the District offices.

Public meetings were held as follows to obtain guidance from government officials, citizens, and special interest groups.

City of Denver	November 8, 1983
Adams County	November 9, 1983
Englewood/Littleton	November 10, 1983

In addition, meetings were held after the Phase A report was completed to obtain public comment. These meetings were held:

City of Denver	November 28, 1984
City of Littleton	November 29, 1984
Adams County	December 11, 1984

A full day raft and kayak trip was conducted by the engineers for the project sponsors and State of Colorado officials, including Governor Lamm, on June 24, 1984. The purpose of the trip was to provide a first hand opportunity for the decisionmakers to inspect the river and location of recommended improvements. Valuable input was obtained from the sponsors and others on the trip.

Meetings with local sponsors and advisory groups were held at regular intervals during the conduct of the Phase A and Phase B work. Such meetings were held on the following dates at the offices of the District.

Meeting No.	Date	Meeting No.	Date
1	10/12/1983	7	02/08/1984
2	10/26/1983	8	02/22/1984
3	11/30/1983	9	03/07/1984
4	12/14/1983	10	01/31/1985
5	01/04/1984	11	02/27/1985
6	01/25/1984	12	03/27/1985
		13	05/01/1985

Minutes of the public meetings and the sponsors meetings contain important data on the river, as well as a record of decision making during the course of the study. These minutes are a part of the basic data and record of the South Platte River Master Plan.

A newsletter was published periodically during the Phase A report work. This newsletter, titled South Platte Currents, was mailed and distributed to all interested parties and individuals. The South Platte Currents form a part of the South Platte River planning record.

The South Platte River was field inspected over the full study reach by bicycle, foot, raft and/or kayak by the Wright Water Engineers, Denton Harper Marshall, Urban Environments project team as well as many representatives of the Urban Drainage & Flood Control District and sponsors.

Meetings and interviews were conducted with various agencies, industries, and parties as follows:

Colorado State Department of Highways
U.S. Geological Survey
U.S. Army Corps of Engineers

Federal Emergency Management Agency
Soil Conservation Service
Denver Water Department
Colorado Water Conservation Board
Audubon Society
Colorado Whitewater Association
Colorado Division of Wildlife
Colorado Division of Parks and Recreation
Public Service Company
Colorado Rock Products Association
Colorado Mined Land Reclamation Division
Metro Denver Sewage District

Specific personnel contacted and information obtained is available in the files of Wright Water Engineers.

SECTION III
HYDROLOGY

The optimization of the uses of the South Platte River corridor is closely related to the hydrology of the river and its floodplain area. A review of the tabulation of uses shows that peak flood flows, average flows, low flows, groundwater, water rights, return flow from lawn irrigation and other non-point discharges, and sewage effluent are all hydrologic factors which affect optimal use of the South Platte River corridor.

TABLE III-1
SOUTH PLATTE RIVER CORRIDOR USES

Flood control and drainage
Domestic water supply
Transportation of irrigation water
Transportation and dilution of sewage effluent
Cultural and recreation
Mineral resource extraction
Water exchanges
Industrial water supply
Wildlife habitat

Flood Control Storage

The South Platte River flood potential is mitigated by Chatfield, Cherry Creek and Bear Creek flood control reservoirs. The location of these reservoirs is shown on Figure III-1. Tributaries enter the mainstem of the South Platte River downstream of these reservoirs which increases the flood potential below the reservoirs. Flood control storage available in these reservoirs is shown in Table III-2.

TABLE III-2
FLOOD CONTROL RESERVOIRS

Reservoir	Storage (Acre-feet) Total	Permanent* Pool	Flood Control	Surcharge	Closure Date
Chatfield	235,000	26,661	208,370	119,900	08/1973
Cherry Cr.	93,920	13,960	79,960	134,470	10/1948
Bear Creek	30,810	1,990	26,570	46,410	07/1977

*Permanent pool storage includes recreational/multipurpose pools and sediment control volumes.

Drainage Basin

The South Platte River drainage basin consists of approximately 4,850 square miles of land extending from the Continental Divide in the Rocky Mountain Range to the high plains and foothills of eastern Colorado as shown on Figure III-1. The characteristics and hydrologic impact of the mountainous region and the high plains and foothills region are quite different. The mountainous western portions of the basin produce heavy snowmelt runoff during late spring. On the other hand, the high plains and foothills portions of the basin are more susceptible to high runoff during summer thunderstorms.

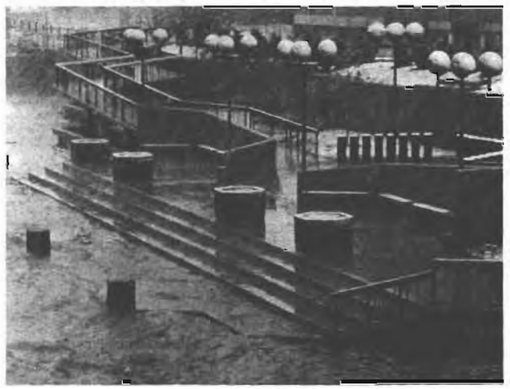
The metropolitan Denver area is heavily developed and outlying areas are sparsely developed. The mountainous areas are generally unsuited for dense development and will probably remain sparsely developed. The foothill and high plains areas are more likely to develop but not to the extent of the existing metropolitan area. Existing development in the metropolitan area consists primarily of residential and commercial areas with minimal industrial regions.

Peak Flows

A majority of the precipitation which falls over the South Platte River basin consists of snowfall in the mountainous region and thunderstorm

activity in the high plains and foothills portions of the basin. Snowfall in the mountains and higher foothills results in runoff peaks in the late spring, however, these peaks are reduced by Chatfield Dam. Snowmelt in the lower foothills and high plains is not normally associated with large flood peaks. Most major floods on the South Platte River have been associated with thunderstorm activity. Recurrent major storm tracks have been identified which cross the South Platte River watershed and generate most flood flows.

COMMUNITY AMENITIES. Most floods occurring downstream of Chatfield Reservoir are the result of thunderstorms. Some structures such as Shoemaker Plaza have been designed to withstand the ravages of the river when thunderstorms occur.



Peak flows from South Platte tributaries in the study reach are shown in Table III-3. These tributaries are shown on Figure III-1. The flood peak flows presented in Table III-4 are based on future development conditions and existing channel and floodplain conditions as is typical of Urban Drainage & Flood Control District practices. The flood flows were computed without making an allowance for on-site detention of storm water by Merrick & Company under a separate contract with the District. The discharge profile developed for the South Platte from Chatfield to Brighton is shown on Figure III-2. Hydrographs for two locations, near Sanderson Gulch and near Sand Creek, are shown in Figures III-3 and III-4.

Average River Discharge

The regime of the South Platte River can be characterized in terms of average monthly flows at selected points along the forty mile long corridor. An analysis of the average monthly flows over the period of record indicates that the three flood control reservoirs have minimal effect on average monthly flows.

TABLE III-3
TRIBUTARY BASIN PEAK INFLOW

Tributary	Peak 100-year Inflow (cfs)
Dutch Creek	7,400
Big Dry Creek	12,600
Bear Creek	8,200
Little Dry Creek	7,100
Sanderson Gulch	3,300
Weir Gulch	1,900
Lakewood Gulch	7,400
Cherry Creek	9,700
First Creek	7,400
Sand Creek	30,500
Clear Creek	23,000
Grange Hall Creek	2,200

TABLE III-4
SOUTH PLATTE RIVER
PEAK FLOOD FLOWS

Location	Discharge (cfs) Recurrence Interval			
	2-Year	10-Year	50-Year	100-Year
D/S Dutch Creek	*	*	5,060	6,400
S. Platte @ Littleton	*	3,100	6,170	7,940
D/S Big Dry Creek	*	4,350	9,600	12,600
D/S Little Dry Creek	*	5,750	12,200	16,000
D/S Cherry Creek	3,580	9,700	18,000	22,500
S. Platte at 19th Ave.	3,580	9,700	18,000	22,400
U/S Sand Creek	3,580	9,700	17,400	21,700
D/S Clear Creek	3,550	13,000	28,600	38,000
D/S First Creek	3,550	12,700	27,500	36,000
S. Platte at Henderson	3,400	12,300	27,000	35,500
Baseline Road	3,130	11,400	25,500	33,600

*Snowmelt and dam releases predominate

TABLE III-5
AVERAGE SOUTH PLATTE RIVER DISCHARGES

Average Monthly Flows in cfs
(1972-1981)

Month	Littleton Gage	Denver Gage at 19th St.	Henderson Gage Near Henderson
January	51	111	247
February	57	118	272
March	72	153	305
April	192	317	439
May	687	1,021	1,314
June	579	770	1,088
July	400	489	668
August	214	305	460
September	91	141	300
October	62	131	293
November	63	133	254
December	55	118	220

Low Flow Hydrology

During drought years the flow in the South Platte River is low. Monthly average discharges for 1978 (dry year) at three locations in the corridor are shown in Table III-6.

TABLE III-6
SOUTH. PLATTE RIVER LOW FLOW HYDROLOGY

Average Monthly flows in cfs
Dry Year
(1978)

Month	Littleton Gage	Denver Gage at 19th St.	Henderson Gage Near Henderson
January	39	78	163
February	44	84	229
March	56	95	168
April	51	102	197
May	82	218	405
June	164	229	539
July	274	294	519
August	146	197	311
September	58	88	215
October	42	67	144
November	60	116	173
December	36	84	221

For the future, the prospect for flows through Denver to accommodate sewage treatment plant effluent dilution, satisfy irrigation needs, flush petroleum products, maintain aquatic and terrestrial wildlife habitat and provide adequate flow for boating activities appears poor.

The reason for this projection is urban water management optimization for municipal water supply. Because the urban water supply managers have done an excellent job of planning and executing water management strategies for municipal water supply purposes, there may be little or no release of South Platte River water from Chatfield Reservoir for lengthy periods.

For the Denver municipal water system there are large diversion structures on the South Platte River upstream from Chatfield Reservoir. These facilities have the capacity to divert more water than they have historically. The water diverted into the Denver municipal system travels through a network of water distribution lines and sewage collection lines and returns to the South Platte near Sand Creek below Denver as treated sewage effluent. This route bypasses the river channel between Denver's intake and the Denver Metro Sewage Treatment Plant.

Downstream irrigation demands would be met with sewage effluent releases from Denver Metro, with Clear Creek and Sand Creek natural flow, and with other inflow from downstream tributaries. As the Denver municipal water system and its service area grows the Denver Metro sewage effluent discharges will increase. Ultimately, practically all of the South Platte flows upstream of Denver could bypass the reach between Chatfield and Sand Creek.

An estimate has been made of the probable low flow of the South Platte River during a dry year at about the Year 2000, assuming an extension of the current water management practices.

TABLE III-5
AVERAGE SOUTH PLATTE RIVER DISCHARGES

Average Monthly Flows in cfs
(1972-1981)

Month	Littleton Gage	Denver Gage at 19th St.	Henderson Gage Near Henderson
January	51	111	247
February	57	118	272
March	72	153	305
April	192	317	439
May	687	1,021	1,314
June	579	770	1,088
July	400	489	668
August	214	305	460
September	91	141	300
October	62	131	293
November	63	133	254
December	55	118	220

Low Flow Hydrology

During drought years the flow in the South Platte River is low. Monthly average discharges for 1978 (dry year) at three locations in the corridor are shown in Table III-6.

TABLE III-6
SOUTH PLATTE RIVER LOW FLOW HYDROLOGY

Average Monthly flows in cfs
Dry Year
(1978)

Month	Littleton Gage	Denver Gage at 19th St.	Henderson Gage Near Henderson
January	39	78	163
February	44	84	229
March	56	95	168
April	51	102	197
May	82	218	405
June	164	229	539
July	274	294	519
August	146	197	311
September	58	88	215
October	42	67	144
November	60	116	173
December	36	84	221

For the future, the prospect for flows through Denver to accommodate sewage treatment plant effluent dilution, satisfy irrigation needs, flush petroleum products, maintain aquatic and terrestrial wildlife habitat and provide adequate flow for boating activities appears poor.

The reason for this projection is urban water management optimization for municipal water supply. Because the urban water supply managers have done an excellent job of planning and executing water management strategies for municipal water supply purposes, there may be little or no release of South Platte River water from Chatfield Reservoir for lengthy periods.

For the Denver municipal water system there are large diversion structures on the South Platte River upstream from Chatfield Reservoir. These facilities have the capacity to divert more water than they have historically. The water diverted into the Denver municipal system travels through a network of water distribution lines and sewage collection lines and returns to the South Platte near Sand Creek below Denver as treated sewage effluent. This route bypasses the river channel between Denver's intake and the Denver Metro Sewage Treatment Plant.

Downstream irrigation demands would be met with sewage effluent releases from Denver Metro, with Clear Creek and Sand Creek natural flow, and with other inflow from downstream tributaries. As the Denver municipal water system and its service area grows the Denver Metro sewage effluent discharges will increase. Ultimately, practically all of the South Platte flows upstream of Denver could bypass the reach between Chatfield and Sand Creek.

An estimate has been made of the probable low flow of the South Platte River during a dry year at about the Year 2000, assuming an extension of the current water management practices.

station is the boundary between District Numbers 8 and 2 of Water Division Number 1 as administered by the State Engineer of Colorado.

In Water District No. 8 (Chatfield to 19th Street) development of the South Platte alluvial groundwater resources is accomplished via wells constructed for municipal, irrigation, and other purposes. Nearly 100 alluvial wells in this reach have been used for water table measurements between 1954 and 1976.

Alluvial groundwater development along the South Platte River has been extensive downstream of 19th Street to Baseline Road. In 1968 a survey of all alluvial wells in Water District No. 2 showed 1,552 irrigation well registrations each having an average yield of 1.8 cfs. Bittinger estimated that there were also an additional 260 commercial, industrial, and municipal wells each having an average yield of approximately 0.5 cfs. Within the reach from 19th Street to Baseline Road (City of Brighton) lies approximately 30 percent of the mainstem of the South Platte River in District No. 2. Bittinger estimated that in this same reach the average pumping withdrawals from this portion of the river alluvium amounted to 40,000 acre-feet per year.

The water table adjacent to the mainstem of the South Platte River, from Sand Creek to Brighton, is designated by the U.S. Geological Survey as being less than 5 feet below the ground surface. Surrounding, and adjacent to this zone of shallow water, and along the full reach of the river in the floodplain, the water table is designated as being from 5 to 10 feet deep. Along the right bank for the full river length from Sand Creek to Brighton, the alluvial groundwater extends eastward for, in some places, as much as 7 miles. Through the City of Denver from Sand Creek to Big Dry Creek in Englewood, the depth to water table adjacent to the river is from 10 to 20 feet. From Big Dry Creek to Chatfield Reservoir the water table is again shallow, ranging from 10 feet to less than 5 feet.

The chemical quality of groundwater as measured by dissolved solids concentrations is less than 500 mg/l from Chatfield Reservoir to Columbine Valley. From Columbine Valley to Brighton the groundwater in the alluvium of the South Platte River has a dissolved solids concentration in excess of 500 mg/l.

More detailed analyses which have been performed for specific water supply investigations indicate that, commencing at about I-70 the dissolved solids concentration is approximately 1,000 mg/l. Some variations in dissolved solids concentration is found laterally within the aquifer, the better water quality existing in some places near the west edge of the alluvium.

Well yields from the South Platte alluvium are satisfactory for the entire 40 mile study reach. Individual pumping rates of from 500 to 1,000 gpm are common. There are at least 15 zones where the well yields range between 1,000 and 1,500 gpm, with some wells pumping in excess of 1,500 gpm.

The alluvium is hydraulically connected to the surface stream of the South Platte River. Pumping of water from the wells causes a depletion to the surface flow, but the depletion is lagged over time.

Pumping for one month, for instance, may cause a depletion to the river of ten to twenty percent of the amount pumped during the first month. The balance of the total depletion may cause an additional six to twelve months of river depletion while the drawdown aquifer is refilled, i.e., refilled by direct recharge from the river or from interception of lateral recharge from the adjacent lands.

Within the aquifer, the water table slope is both towards the river and downstream. The downstream component of the slope is generally parallel to the slope of the river.

Water Rights

A schematic straight-line diagram showing decreed water rights on the South Platte River from Chatfield Reservoir to Brighton is presented in Figure III-5.

A knowledge of water rights is necessary in water flow management of the South Platte River for multiple-use purposes. Specific water rights are listed in Table III-8 in a downstream order.

Sewage Plant Discharges

Wastewater treatment plants in the South Platte River corridor contribute both a river base flow and pollutants. The four plants listed in Table III-9 will be increased in capacity over the years as the population grows. It is uncertain whether or not the quality of the effluent will improve in the future, this being dependent upon state and federal water pollution control regulations.

III-9
SOUTH PLATTE RIVER CORRIDOR SEWAGE TREATMENT PLANTS[1]

Facility	Average Daily Discharge in Cubic Feet per Second in 1985	in 2000
Mission Viejo-Marcy Gulch	1	8
Littleton-Englewood	38	47
Denver Metropolitan	225	284
South Adams County	4	6
TOTAL	268	345

[1]Projections made by Denver Regional Council of Governments

WASTEWATER TREATMENT PLANT. Metropolitan Denver Sewage Disposal District No. 1 wastewater treatment plant near confluence with Sand Creek which discharges over 200 cfs into the South Platte River. This is the major wastewater treatment plant serving the Denver metropolitan area. During low flow periods this discharge represents a large portion of the flow in the river.

TABLE III-8
WATER RIGHTS OF MAINSTREAM SOUTH PLATTE
CHATFIELD RESERVOIR TO BRIGHTON

Ditch	1981 Basin Rank*	Amount (cfs)	Appropriation Date	Adjudication Date
Last Chance No. 2**	110	4.668	12/30/1863	12/10/1883
	165	0.549	12/30/1865	12/10/1883
	217	17.574	03/03/1868	12/10/1883
		22.791 cubic feet per second		
City Ditch	23	30.000	11/28/1860	12/10/1883
	50	1.108	08/30/1861	12/10/1883
	165	1.132	12/30/1865	12/10/1883
	361	13.000	11/01/1873	12/10/1883
	637	42.950	03/07/1882	12/10/1883
		88.920 cubic feet per second		
Nevada Ditch	50	18.266	08/30/1861	12/10/1883
	165	22.383	12/30/1865	12/10/1883
		40.649 cubic feet per second		
Brown	85	16.5	11/30/1862	12/10/1883
Rough and Ready	25	37.00	12/31/1860	12/10/1883
	214	31.27	12/31/1867	12/10/1883
		68.27 cubic feet per second		
Littleton Galleries	50	1.23	08/30/1861	12/10/1883
	165	1.50	12/30/1865	12/10/1883
		2.73 cfs		
Petersburg (Englewood P/L)	50	8.40	08/30/1861	12/10/1883
	54	21.60	11/30/1861	12/10/1883
	110	5.40	12/30/1863	12/10/1883
	110	1.00	12/30/1863	12/10/1883
	165	5.29	12/30/1865	12/10/1883
	363	27.00	12/30/1873	12/10/1883
		68.69 cubic feet per second		
Epperson	9	2.25	05/01/1860	12/10/1883
Lacombe Power Plant	1,595	300	12/31/1900	06/09/1924
Farmers & Gardeners	90	13.72	03/15/1863	04/28/1883
	365	10.28	04/01/1874	04/28/1883
		24.00		
Burlington (Reithman)	71	3.0 cfs	06/02/1862	08/14/1918
Burlington (Duggan)	114	27.4 cfs	04/01/1864	04/28/1883
Burlington	902	350.0 cfs	11/20/1885	07/08/1893
		380.4 cfs		
O'Brian Ditch	1,892	600.0 cfs	03/09/1908	08/02/1918
Denver-Hudson Canal	1,879	300.0 cfs	11/28/1907	08/02/1918
Barr Lake	902	11,081 AF	11/20/1885	07/08/1893
	1,943	21,930 AF	01/13/1909	08/02/1918
		33,011 AF		
Horse Creek Res.	2,050	12,000 AF	03/17/1911	08/02/1918
	2,608	4,965 AF	07/20/1922	11/12/1924
	2,608	2,550 AF	07/20/1922	11/12/1924
		19,515 AF		
Prospect Reservoir	2,040	5,970 AF	11/21/1910	08/02/1918
	2,608	1,690 AF	07/20/1922	11/12/1924
		7,660 AF		
Gardeners	33	4.0	05/01/1861	09/19/1907

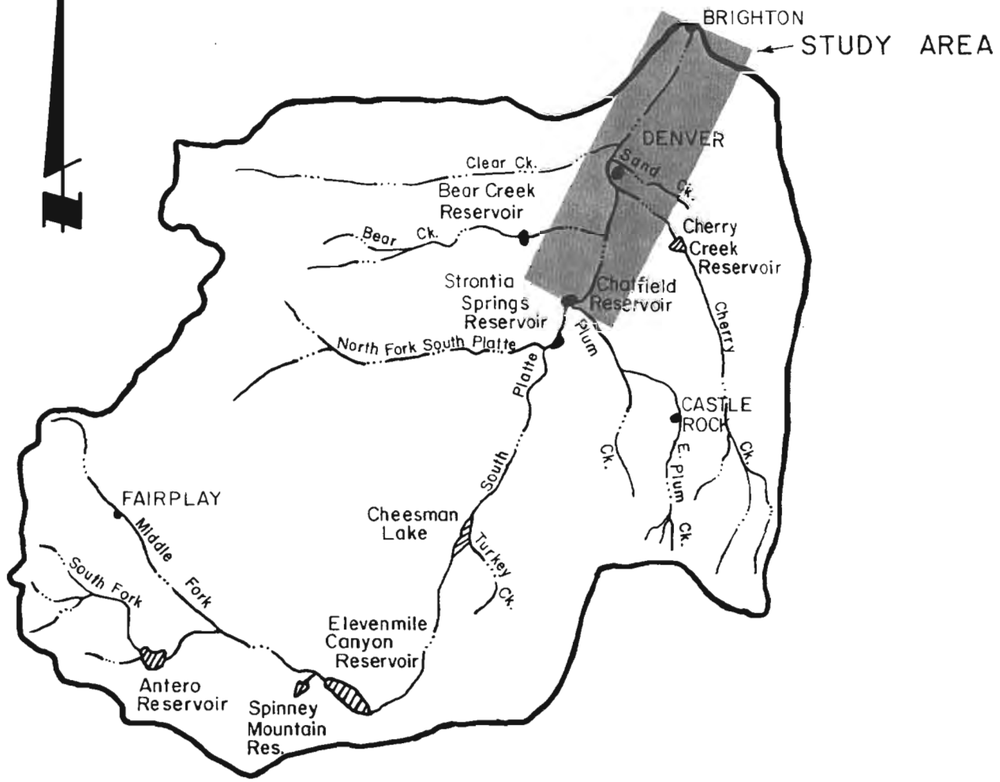
TABLE III-8
WATER RIGHTS OF MAINSTREAM SOUTH PLATTE
CHATFIELD RESERVOIR TO BRIGHTON
(Page 2)

Ditch	1981 Basin Rank*	Amount (cfs)	Appropriation Date	Ajudication Date
Platte Valley	1,047	6.00	05/15/1862	06/17/1892
	507	14.50	09/10/1878	12/10/1883
		20.50		
Fulton	143	79.70	05/01/1865	04/28/1883
	451	74.25	07/08/1876	04/28/1883
	551	50.23	11/05/1879	04/28/1883
		204.18		
Brantner	8	29.77	04/01/1860	04/28/1883
	94	5.93	05/01/1863	04/28/1883
	315	12.18	07/01/1872	04/28/1883
	593	63.30	01/15/1881	04/28/1883
		111.18		
Brighton	109	22.22	12/01/1863	04/28/1883
	298	22.58	11/01/1871	04/28/1883
		44.80		

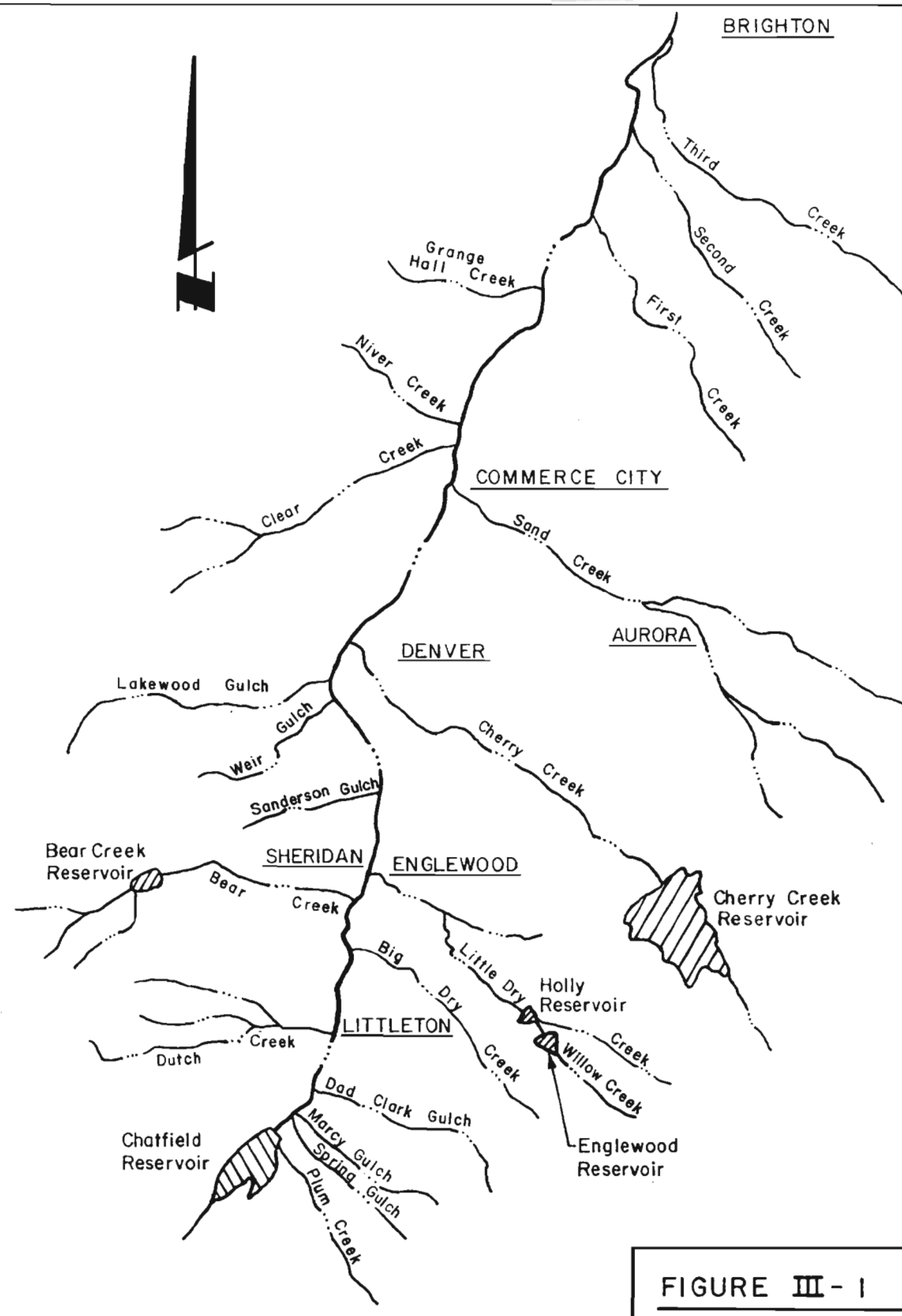
* The "basin rank" numbers were assigned by the State Engineer's Office during the course of the 1981 tabulation and reflect the relative seniority of the water rights: the lower the number the more senior the right. The basin rank numbers have been included in this section since they provide a common basis for comparing the seniority of all the water rights discussed.

**The Denver Water Department has provided the probable breakdown of the amounts of water shown in the table above for each of the decrees in the Last Chance No. 2 Ditch as follows:

Appropriation Date	Columbine Country Club (6.9%)	Via Chatfield (40.4%)	Via Original Diversion (52.7%)	Total (cfs) (100%)
12/30/1863	0.320 cfs	1.887 cfs	2.461 cfs	4.668 cfs
12/30/1865	0.038 cfs	0.221 cfs	0.290 cfs	0.549 cfs
03/03/1868	1.205 cfs	7.101	9.268	17.574 cfs
Total	1.563 cfs	9.209 cfs	12.019 cfs	22.791 cfs



SOUTH PLATTE RIVER WATERSHED



STUDY AREA

FIGURE III-1

DRAINAGE BASIN AND TRIBUTARIES

WRIGHT WATER ENGINEERS, INC.
2490 W. 26TH AVE, 55A
DENVER 80211 480-1700

NOTE:

THE 10,50, AND 100-YEAR FLOWS UPSTREAM OF DUTCH CREEK, AND THE 2-YEAR FLOOD UPSTREAM OF CHERRY CREEK ARE EXCEEDED BY CHATFIELD MAXIMUM RESERVOIR RELEASES. THEREFORE, THESE RELEASES SHOULD BE CONSIDERED IN ESTABLISHING DESIGN FLOWS IN THESE REACHES.

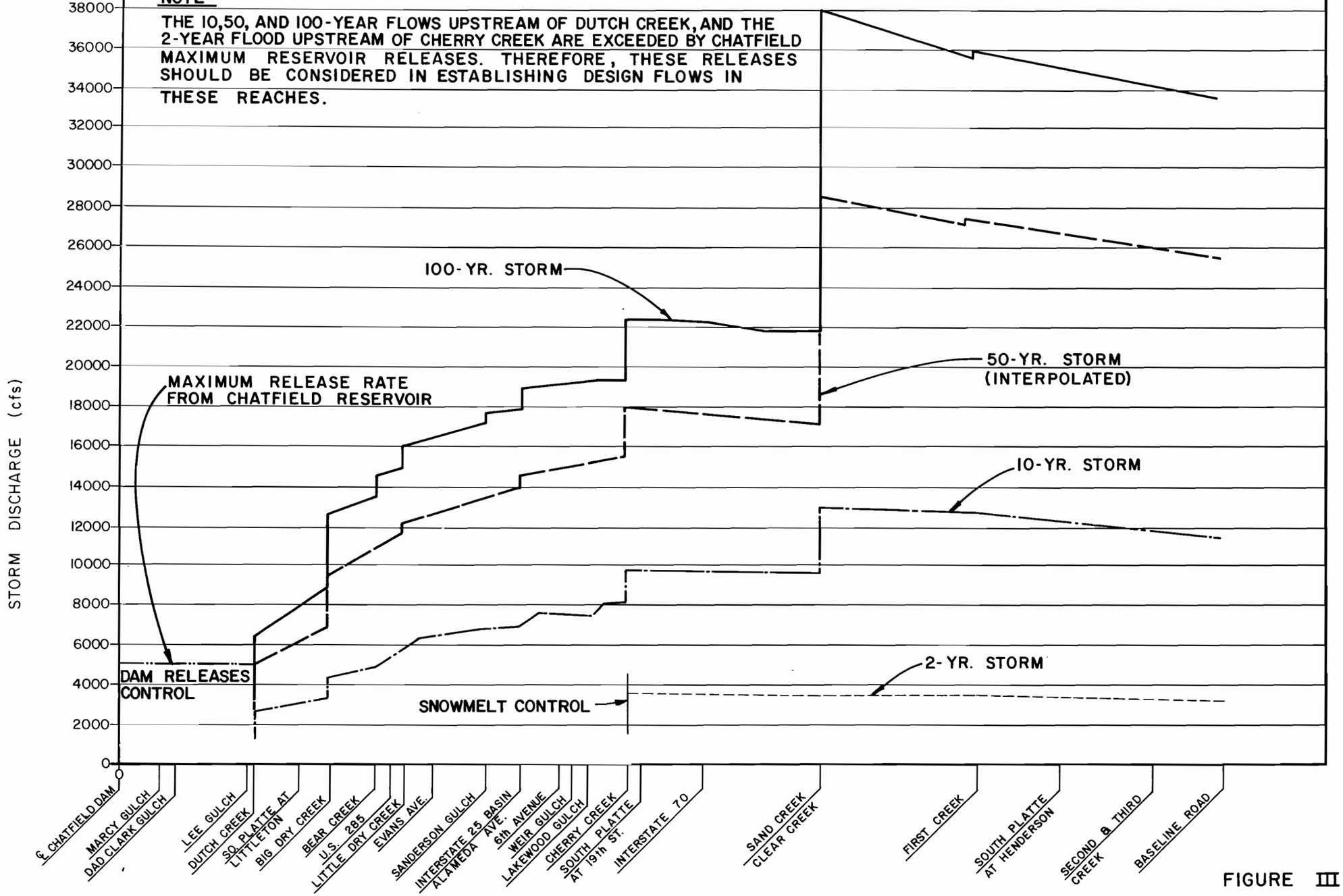
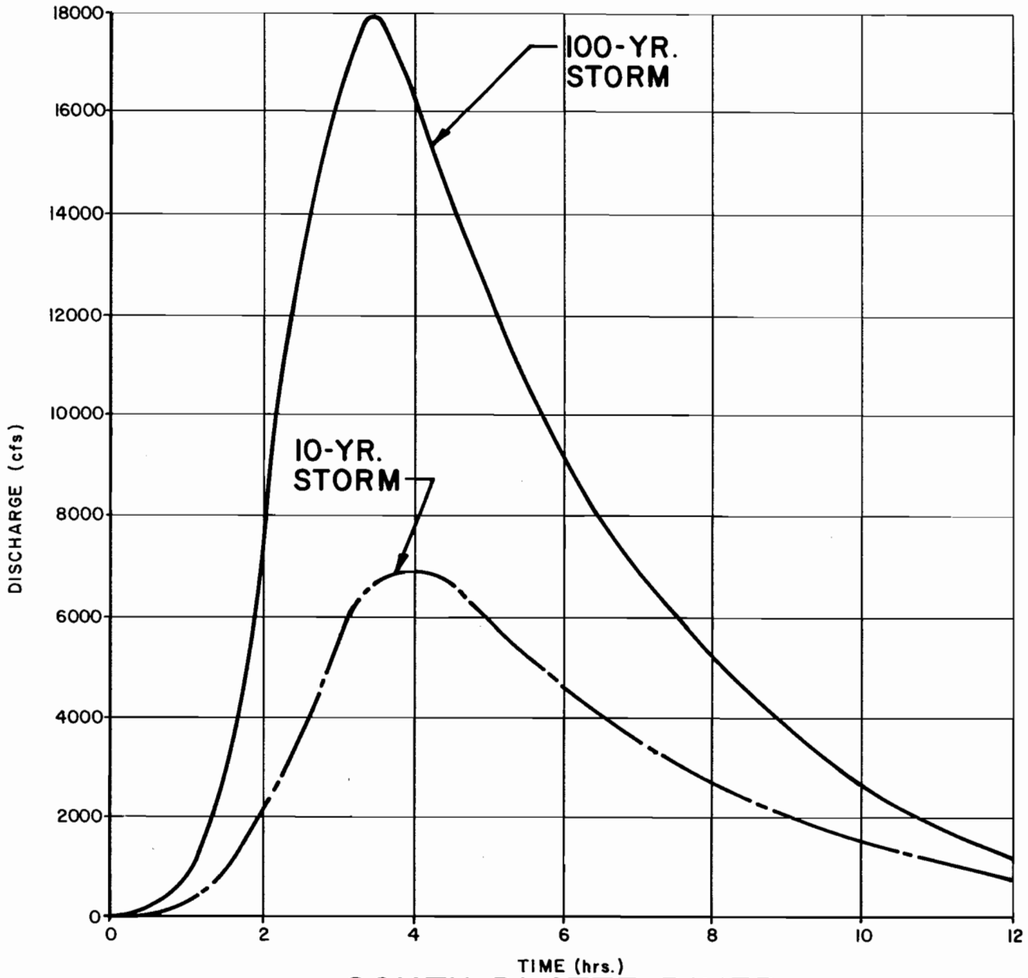


FIGURE III - 2

SOUTH PLATTE RIVER DISCHARGE PROFILES

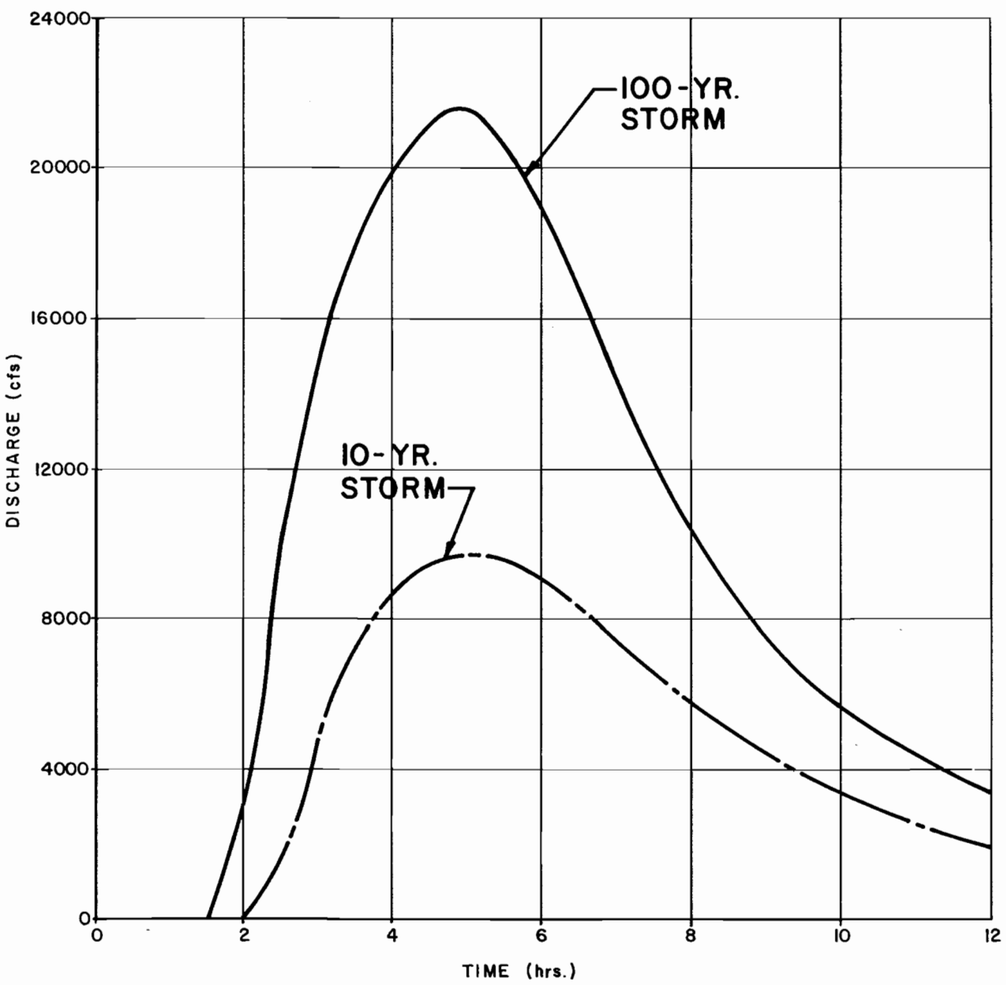
WRIGHT WATER ENGINEERS, INC.
2490 W. 26th AVE. - 55A
DENVER, COLORADO 80211



SOUTH PLATTE RIVER
DISCHARGE HYDROGRAPH
DOWNSTREAM OF
SANDERSON GULCH

FIGURE III – 3

WRIGHT WATER ENGINEERS, INC.
2490 W. 26TH AVE. - SUITE 55A
DENVER, COLORADO 80211



SOUTH PLATTE RIVER
DISCHARGE HYDROGRAPH
UPSTREAM OF SAND CREEK

FIGURE III – 4

WRIGHT WATER ENGINEERS, INC.
2490 W. 26TH AVE. - SUITE 55A
DENVER, COLORADO 80211

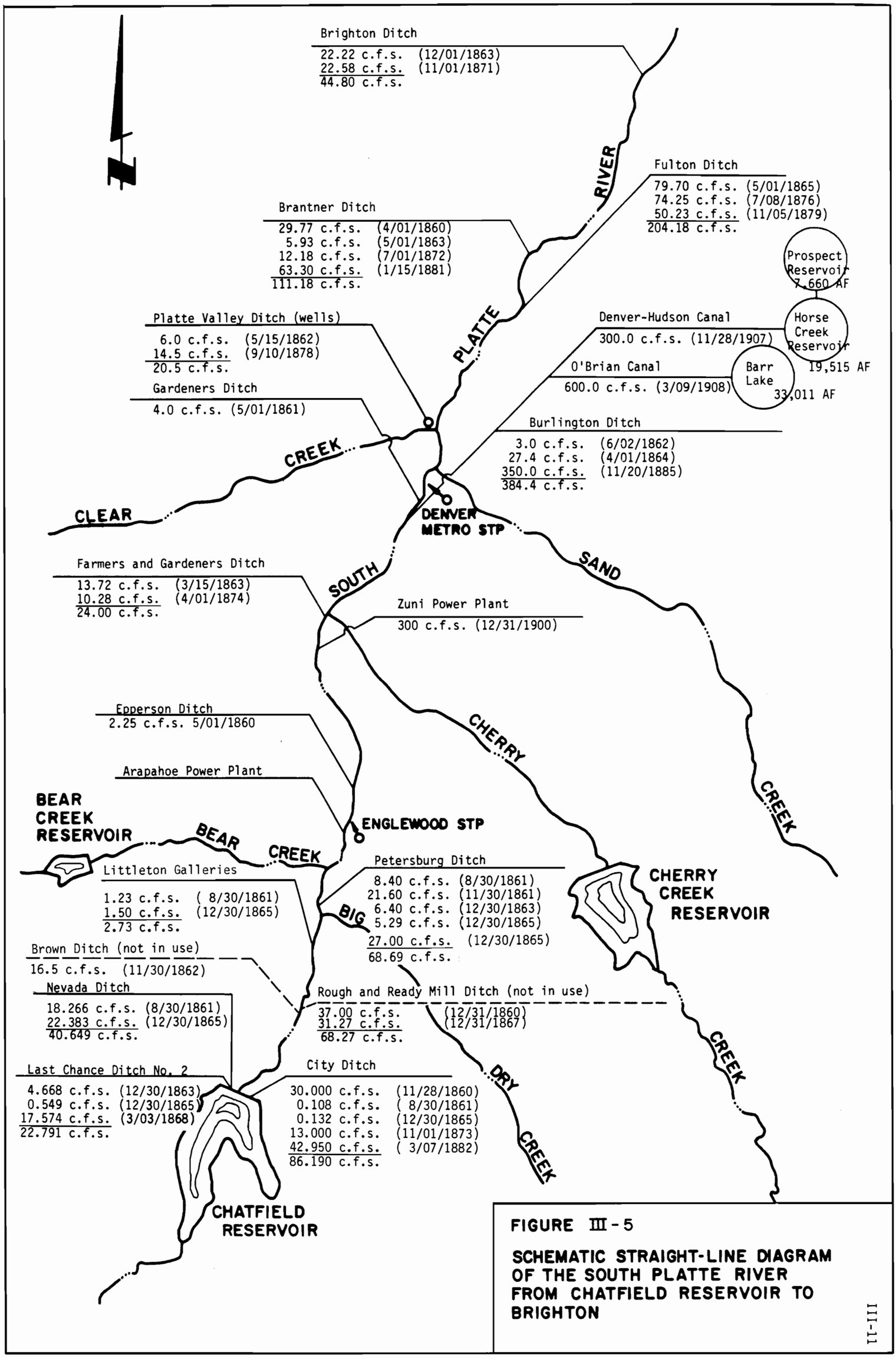


FIGURE III-5

SCHEMATIC STRAIGHT-LINE DIAGRAM OF THE SOUTH PLATTE RIVER FROM CHATFIELD RESERVOIR TO BRIGHTON

SECTION V
FLOOD PROBLEMS

REACH 1: CHATFIELD TO COLUMBINE DAM

This reach, immediately below Chatfield Dam, is characterized by active and inactive gravel pits and a regional floodplain park. The channel in this reach is relatively undisturbed by man. Flood damages that occur are to utility crossings, bridges, gravel pit lakes, and include extensive erosion to the river banks. Damages could be significant to active and inactive gravel mines due to berm erosion and potential failure.

The Reach 1 floodplain under existing conditions shown on Sheets 4 to 7, is based on Federal Emergency Management Agency floodplain mapping.

The major flood problem is erosion which would cause a breach in the berms protecting and separating the gravel mining lakes resulting in the release of water which could increase peak flows in the South Platte River.

REACH 2: COLUMBINE DAM TO OXFORD AVENUE

The U.S. Army Corps of Engineers has designed a channel improvement project for this reach of the river. Construction was begun in 1984 on the channel improvement project which is designed to prevent flood damages outside the channel for the 100-year event. The proposed channel alignment for the Corps project is shown on Sheets 8 to 11.

REACH 3: OXFORD AVENUE TO BATES AVENUE

In this reach the 100-year flood would be confined to the channel except for a small portion of floodplain at the mouth of Bear Creek. Because this area is currently in a natural state and is expected to remain so, the damages from flooding are expected to remain minimal.

Erosion is the most significant potential cause of damage in this reach. The USACE has one drop structure for this reach.

REACH 4: BATES AVENUE TO COLFAX AVENUE

Evans Avenue

The 100-year flood is contained within the channel from Bates to Evans Avenue. The Evans Avenue bridge will pass the 100-year flood without overtopping. It does, however, cause a backup of about 2 feet as the result of inefficient piers and a low chord elevation 4 feet below the 100-year flood. This 2 foot rise, combined with the low banks upstream of the bridge on the left bank, results in flooding on the left bank which includes retail stores, warehouses, offices, and small manufacturing facilities.

On the right bank water leaves the channel, crosses Evans Avenue, and either flows down South Huron Street into the Overland Golf Course, or returns to the channel immediately downstream.

No structures would be damaged by this flooding.

Vallejo to Colfax

From the Evans Avenue bridge to the 3rd Avenue Dam the 100-year flood is contained within the channel. The 6th Avenue bridge is overtopped by the 100-year flood, resulting in almost a 2 foot rise in the 100-year flood elevation. When combined with the low left bank upstream of the bridge, extensive flooding occurs on the left bank from Vallejo Street to the 6th Avenue bridge. The area flooded includes warehouses, retail stores, and small fabricating shops. Depth of flooding is generally less than 2 feet.

The South Platte River channel is narrow from about 10th Avenue to 13th Avenue, in some places only 150 feet wide and 13 feet deep. As a result, flooding also occurs on about 50 acres on the left bank between 6th Avenue and Colfax. The structures located in this floodplain include a Public Service Power plant, public housing structures, food industries, and warehouses.

On the right bank between 8th Avenue and Colfax and west of Interstate 25 the 100-year floodplain includes about 30 acres, and is approximately 500 feet wide. Flood depths are about 2 feet. A floodplain area east of Interstate 25 includes about 40 acres and flood depths up to 4 feet. Water enters this area by flowing underneath the Interstate 25 embankment at 13th Avenue and at the railroad underpass downstream of 13th Avenue.

8th Avenue

A low spot in the river bank at the Frog Hollow parking lot allows water to leave the South Platte channel, flow down 8th Avenue and flood an area on the east side of Interstate 25. Flood depths in this area would generally be shallow.

REACH 5: COLFAX AVENUE TO CHERRY CREEK

Flooding in this reach is caused by the low banks, a sewer crossing, low elevation of the ground next to the river, inadequate channel capacity, and the Farmers and Gardners diversion dam.

Approximately 30 acres on the left bank of the South Platte River from Colfax to I-25 are flooded during the 100-year flood. Flood water leaves the South Platte channel on the right bank between Colfax and Interstate 25 creating a floodplain up to 1,000 feet wide.

In this same reach, flood water which has left the channel in the 13th Avenue area and at the I-25/Colfax Avenue interchange flows east of the interstate embankment in a hydraulically separate channel. This water joins overflow from the South Platte below Interstate 25 and flows to Speer Boulevard. This flood area includes about 180 acres.

REACH 6: CHERRY CREEK TO FRANKLIN STREET

The 100-year flood is contained within the channel from Cherry Creek to Interstate 70. The Franklin Street bridge at the downstream end of this reach is overtopped in the 100-year flood. This bridge along with an adjacent railroad bridge causes a 1 to 2 foot rise in the 100-year flood water surface elevation. This rise, coupled with the low banks in several places along this reach, causes flooding along the left bank. The floodplain covers about 300 acres with shallow flooding about 2,400 feet wide. The sewage treatment plant located in this reach is not included in the flooded area.

REACH 7: FRANKLIN STREET TO SAND CREEK

The Burlington Dam causes a 4 to 5 foot rise in the 100-year flood water surface elevation which is carried upstream of the Franklin Street bridge. In addition, the York Street drop structure causes a 3 foot rise in water surface elevation. Depths of flooding are from 2 to 3 feet. The floodplain is 2,400 feet wide in this reach and includes several major streets and railroads.

REACH 8: SAND CREEK TO BASELINE ROAD

The reach of the South Platte River between Baseline Road and Sand Creek experiences flooding due primarily to insufficient channel capacity. Crossings of less than 100-year capacity also contribute to some minor degree to the flooding situation in this reach. Levees exist in much of this reach to protect agricultural land and on-going and past gravel mining operations from flood flows, but they are largely ineffective in containing flood events within the channel for flows in excess of about 6,000 cfs.

The floodplain width is generally between 4,000 and 5,000 feet and many agricultural and gravel mining lands are flooded. The limits of overbank flooding are generally determined by the natural topography of the floodplain rather than man-made levees of constraints. From Sand Creek to Steele Street there is generally little flooding in the overbank. Overbank flooding does occur between East 74th Avenue and Steele Street and is caused primarily by backwater from the Union Pacific Railroad bridge downstream of Steele Street and the severe meander associated with the bridge.

Degradation upstream of the bridge of approximately 4 feet has, to some extent, mitigated the flooding problem. From Sand Creek to I-76 the channel is confined by levees approximately 400 feet apart. The overbank areas outside of the levees are susceptible to shallow flooding during the 100-year event. Between I-76 and East 74th Avenue the overbank areas are mined and the levees are, for the most part, ineffective.

From Steele Street to East 88th Avenue the river is confined by levees on the east side and natural topographic features on the left. The City of Thornton controls the bulk of the floodplain land and has municipal water storage facilities outside the levees on the east side. Downstream of the storage facilities the 100-year flood flows overtop to levees and over 12,000 cfs leaves the channel and flows overland to 88th Street. These flows re-enter the main body of flow downstream of 88th Street. Overtopping may be due in part to 3 feet of channel aggradation upstream of East 88th Street resulting from the construction of a 4 foot drop.

From East 88th Avenue to Baseline Road the overbank flooding is due primarily to insufficient channel capacity. The East 104th Avenue and East 160th Avenue bridges are of less than 100-year capacity, but they do not have a large impact on the extent of overbank flooding. In general, this reach has degraded approximately 4 feet with the exception of the river immediately upstream of the Brantner Ditch diversion dam which has aggraded 2 feet.

From East 88th Avenue to East 104th Avenue, the river is confined by levees, many of which are associated with gravel mining operations. The levees are above the 100-year water surface elevation, but discontinuities result in significant flooding outside the levees.

The river between East 104th Avenue and Adams County Regional Park (East 120th Avenue extended) is generally braided and unconfined. The floodplain limits are defined by the natural topography rather than levees.

From East 120th Avenue to East 136th Avenue the river is sinuous and braided with no significant levees confining the flows. This reach passes east of the Adams County Regional Park. The floodplain consists primarily of agricultural land and gravel mining operations. From East 136th Avenue to Baseline Road the river and floodplain are essentially natural.

JUNE 1965 FLOOD. An example of a common flood problem along many reaches of the South Platte River is insufficient channel capacity and debris blockage as demonstrated by this picture of the June 1965 flood showing an area near Alameda Avenue.

SECTION IV
HYDRAULICS AND SEDIMENTATION

HYDRAULIC ANALYSIS

Existing Conditions

For reaches 3, 4, 5, 6 and 7 which extend from Oxford Avenue to Sand Creek, a hydraulic analysis was performed to determine the water surface elevations for the 10-, 50-, and 100-year flood events. Hydraulic computations were not performed for the first two reaches of this study, from Chatfield Dam to Oxford Avenue. The 100-year water surface profiles and 100-year floodplains shown on Sheets 4 to 7 were based on Flood Insurance Studies for Littleton and Arapahoe County. Where the two studies overlapped, the data from the most recent study were used. Reach 2, from Columbine Valley to Oxford Avenue, is part of the Army Corps of Engineers channel project and the Corps has developed the 100-year profile for this reach. For Reach 8, from Sand Creek to Baseline Road in Brighton, the 10-, 50-, and 100-year flood profile were obtained from the 1977 flood hazard area delineation study.

For Reaches 3, 4, 5, 6, and 7 flood profiles were computed using the U.S. Army Corps of Engineers HEC-2 water surface profile computer program. Valley cross sections were developed using digitized cross sections obtained from aerial photography flown on April 16, 1983. Since there was a significant flow in the South Platte River on that day, the channel bottom elevation of the cross sections was actually the water surface elevation on that day, rather than the actual stream thalweg. Because it was believed that in certain cases as much as 2 feet of difference could exist between the water surface elevation on April 16, 1983 and the actual stream thalweg, the thalweg was surveyed in the field or adjusted by assuming a 1 1/2 foot depth of flow in critical areas. Critical areas were considered to be those locations where the computations showed that overbank flooding would occur and in those locations where the channel bottom profile obtained from the April 16, 1983 mapping varied significantly from the channel inverts used by the Army Corps of Engineers in their floodplain analysis in 1977.

All hydraulic analyses were done on the basis of existing channel conditions. Estimates of channel and overbank roughness factors were made by field inspections and use of photographs. Typical roughness, or Mannings "n", used in this study are: for the channel, .03 to .035, and for the overbank .04 to .07. It was assumed that none of the bridges would be blocked by debris. Large bridges which were expected to have no effect on flood profiles were not modeled in this study. Most small foot bridges constructed as part of the South Platte River trail system were not modeled because they are designed to break away in times of floods. An exception was the Bronco footbridge at I-25 which creates backwater in a critical area of the river.

Split Flow Calculations

Significant split flows occur between York Street and I-70, in the central Platte Valley area, and near Evans Avenue. Split flows occurs where water flows in two distinct and hydraulically separate channels. Where split flow is expected, the 100-year water surface profile was calculated assuming that all flow would be contained in the South Platte River channel. Weir flow calculations were made to determine the amount of flow into the overbank. Multiple flows were run through the overbank areas to determine tailwater elevations.

In the Central Platte Valley area (between I-25 and Cherry Creek) analysis rating curves were developed for both the main channel and the overbank areas, which, along with a weir flow equation, were used to determine channel and overbank elevations.

Dams

The following dams and drop structures were surveyed to establish crest elevations: the York Street drop structure, the Burlington dam, the 3rd

Avenue dam, drop structures at Santa Fe and Mississippi Avenue, the drop structure downstream of Florida Avenue and the dam upstream of Florida Avenue used to divert water by the Denver Parks Department. The Public Service Company dam downstream of 13th Street is an inflatable dam which would be in its collapsed position in time of flood. The collapsed elevation of the dam was assumed to be 1 foot above the concrete foundation.

The 3rd Avenue dam was given special attention because a boat chute was recently added which significantly increased the capacity of the dam to pass flood flows. Calculations of the flow over the dam were done and a rating curve established for use in the HEC-2 model.

Improved Conditions

The study reaches are described in Table I-1.

In Reach 1 - Chatfield Reservoir to Columbine Dam, no hydraulic computations were performed since no channel improvements affecting water surface elevations are included in the Phase B plan. In Reach 2 - Columbine Dam to Oxford, the U.S. Army Corps of Engineers project design profiles are considered adequate.

The HEC-2 model was modified in Reaches 3 through 7 - Oxford to Sand Creek, to reflect proposed improvements. Channel improvements were modeled using CI cards, and modifications to bridges were reflected on appropriate SB and X2 cards. Water surface elevations for flow over dams which would have boat chutes added under the recommended plan were calculated by hand. Only the 100-year profile was determined in Reaches 3 through 7, since the channel will be designed to contain the 100-year flood.

In Reach 8 - Sand Creek to Baseline Road, the Gingery HEC-2 model was modified to reflect the recommended channel alignment, profile, and width using the same cross sections as under existing conditions. The 100-year and 10-year profiles were calculated since the recommended channel would contain the 10-year flood. Relocated diversion dams were modeled by hand.

HISTORICAL FLOODS

Flood damages in the study reach have been caused by high peak flows that inundate land adjacent to the river, and by sustained high flows that may not inundate the floodplain, but cause damage by erosion and undercutting of structures. High peak flow floods are most often associated with thunderstorms and sustained rains. Long duration flooding is most often associated with snowmelt. Some significant past floods are described in the accompanying Flood Hazard Area Delineation Study for the South Platte River.

SEDIMENTATION AND EROSION

Prior to development by man, the South Platte River regime, channel and floodplain characteristics were controlled by alternative periods of drought and wet cycles. Its width, depth, bends, bank height and slope were constantly readjusting to natural phenomena. The current regime began to develop about the time of the Civil War with diversions of water for irrigation.

Later, through Denver, the river was fixed between permanent banks and channelized. The U.S. Army Corps of Engineers channelization project will fix the bed and banks of the river from Columbine Valley to Oxford Avenue. The river will, to an extent, be controlled from Columbine Valley upstream to Chatfield Reservoir to control bank erosion through the Littleton Floodplain Park.

The Adams County portion of the South Platte River, will to some extent, be fixed between protected banks with the bottom elevation of the stream controlled via drops.

The sediment load of the South Platte River in the 40 mile study reach, prior to construction of the Tri-Lakes (Chatfield, Bear Creek, and Cherry Creek Reservoirs), is shown in Table IV-1.

TABLE IV-1
SEDIMENT YIELD - SOUTH PLATTE RIVER

River	Location	Annual Sediment Load Tons
South Platte River	Chatfield	33,000
Bear Creek	Mouth	40,000
Cherry Creek	Mouth	300,000
Sand Creek	Mouth	150,000
Clear Creek	Mouth	100,000
Other tributaries	Mouth	80,000
South Platte River	Henderson	1,000,000

Within Denver, the sediment load has been reduced 95 percent due to Trilakes. At Henderson, the estimated sediment load has been reduced 80 percent, to 200,000 tons/year.

Erosion

The South Platte River is actively eroding its banks wherever it is free to do so with the absence of controlled drops and adequate bank riprap.

An inventory of conditions and structures in the river channel is presented in Table VIII-2 of the Phase A report. The inventory was based upon a field inspection of the entire forty mile study reach. Estimates of bed erosion have been made by Stevens (1983) by comparing historical 1963 data with 1983 river bed conditions.

Impacts of Erosion

The erosion of the South Platte River has consequences. Damages experienced include the following:

Exposed utility lines
Bridge pier scour
Caving river banks
Eroded trees and resulting debris
Lost agricultural land
Breached gravel pits
Erosion downstream of dams and drop structures
Headcutting on tributaries
Lowered groundwater tables
Increased channel capacities
Lost aquatic habitat
Lost riparian habitat
Changes in benthic invertebrate species

Effect of Recommended Plan

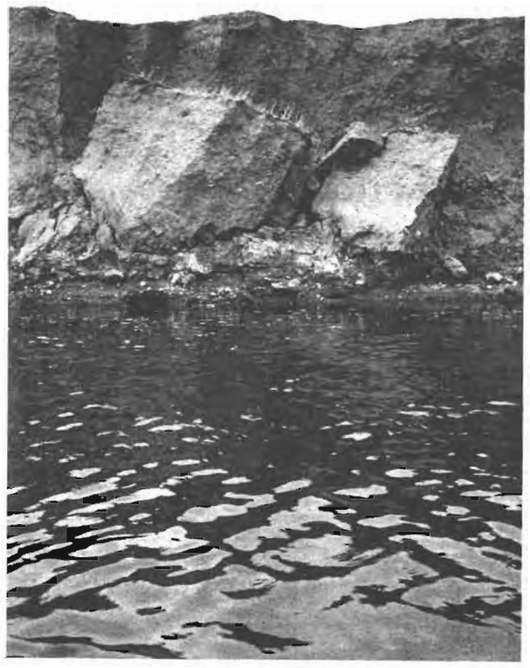
The recommended plan will provide protection against erosion in Reach 1 primarily through use of natural vegetation in keeping with the natural character of the river. In areas where the river is in danger of eroding berms protecting gravel lakes, riprap should be used. No measures to prevent channel degradation are included in the plan. This plan recommends managing downcutting to achieve the goals of the design plan.

In Reach 2, the Corps project will prevent erosion and degradation of the channel.

In Reaches 3 through 7 erosion will be controlled by using rock riprap in areas where degradation is expected and in areas where there are existing problems. This protection will be provided at the 2 to 5 year flood levels. Above that level natural vegetation and grass will provide needed protection except in a few problem areas and will stop the loss of riparian habitat occurring at this time. The existing tendency of the channel to degrade, except behind check structures, will be utilized to deepen the channel in a controlled fashion by removing or lowering control structures.

In some areas, particularly in the vicinity of Evans Avenue, it may be necessary to rip the channel bottom to allow the degradation process to occur. In Reach 4 drop structures should be provided between 3rd Avenue and 13th Avenue to maintain a stable channel. These drops should be designed to provide riffles for aeration of the water and to pass small water craft.

Erosion control in Reach 8 will be accomplished using a Minimum Maintenance Alignment, stabilization of banks and protection of crossings between bends. Erosion control measures should be implemented, whenever appropriate, when the natural channel phenomena have brought the channel into the desired alignments. In some instances, the channel may have to be realigned using construction techniques. At that time the channel banks will be stabilized using vegetation, riprap or a combination of riprap with vegetation. Channel invert degradation will be allowed to occur until the ultimate elevation is achieved and then will be stabilized with rock armoring of crossings.



STREAM BANK EROSION. An example of the existing severe stream bank erosion as a result of natural uncontrolled river dynamics.

BEAVER DAM. An example of a temporary control is a beaver dam built across the South Platte River near Littleton.

MAN-MADE HYDRAULIC CONTROLS. An example of a man-made hydraulic control is the distensible dam with boat chute at the Public Service Company Zuni power plant.

SECTION VI
MASTER PLAN DEVELOPMENT

INTRODUCTION

The South Platte River serves many functions as it passes through the Denver metropolitan area. Because the river flows through the highly urbanized Denver metropolitan area, it provides a convenient source of recreation to its residents including boating, fishing, jogging paths, and an ideal setting for pocket parks. Another service provided by the river is the transport of water from the upstream basin and mountain reservoirs to supply the needs of the municipal, industrial and agricultural water users. The river also provides a means of diluting and carrying off sewage effluent. Finally, the river throughout its history has carried sand and gravel from the foothills and mountains and deposited them in the floodplain. This sand and gravel is now being mined, particularly in the area downstream of Denver. It provides a significant source of income to the area as well as providing the raw materials for the concrete used for paving and construction of buildings.

The varied uses of the river and the resulting conflicts presented by these uses determined the need for a metropolitan sponsored Master Plan. This Master Plan for the South Platte River represents a major intergovernmental effort of four counties, seven cities, and the Greenway Foundation. The UD&FCD has undertaken this Master Plan on behalf of the local governments and the District because of a determined need for such a plan to provide a road map for the future. The forty mile study reach of the South Platte River is entirely within the statutory boundaries of the District.

Phase A Study

The Phase A report covers the South Platte River from Chatfield Reservoir to Baseline Road in Brighton. The reach is approximately 40 miles long. The Phase A study involved problem area identification and alternative development, along with associated hydraulic, hydrologic, water quality and recreation studies. The only area for which alternatives were not developed is from Columbine Valley to Oxford Avenue. This reach will be incorporated into the U.S. Army Corps of Engineers channel improvement project.

In addition to the Phase A report, the master planning process included the preparation of a Flood Hazard Area Delineation report for the reach from Oxford Avenue to Sand Creek, a distance of approximately 15 miles. It is expected that this flood hazard area study will provide the basis for floodplain regulation along the river by those communities through which it flows. This report has been provided to the Urban Drainage & Flood Control District.

An important part of this Master Plan study is a gravel mining study performed for the reach from Baseline Road to Interstate 270, near the confluence of Sand Creek. The purpose of this study is to develop gravel mining standards, criteria and guidelines which can be used by Adams County in the administration of gravel mining operations.

Purpose

The purpose of the South Platte River Master Plan is to provide a plan for optimization of the uses of the South Platte River corridor.

The number one use of the South Platte River corridor is for flood control and drainage. It must continue to serve as the major drainageway for the Denver metropolitan region. This primary use has the senior prescriptive right in the South Platte River corridor. The master plan is to provide a floodplain management plan which can be implemented over the course of the next decade or two.

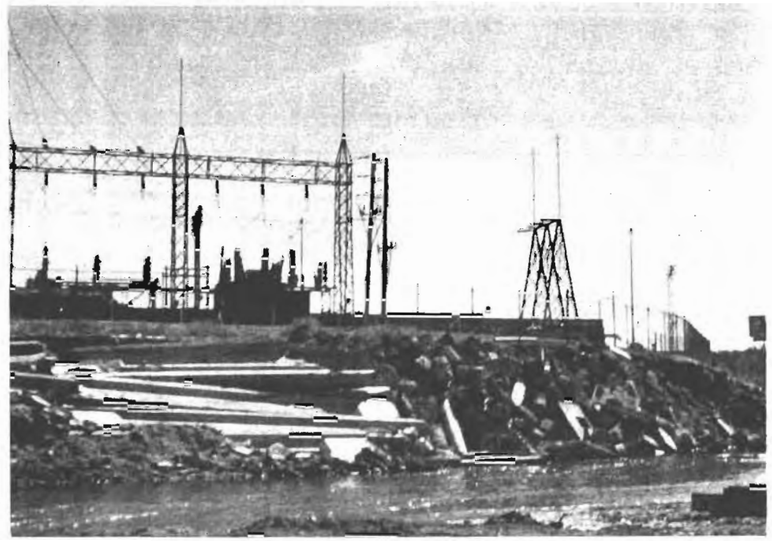
Other uses of the corridor include:

- Water supply
- Transportation of irrigation water
- Transportation and dilution of sewage effluent
- Providing cultural and recreational opportunities
- Mineral resources
- Water exchanges
- Cooling water for industry
- Wildlife habitat

Many special issues needed consideration as part of this master planning effort to achieve the stated goal. These include:

- Flood hydrology and low flow hydrology
- Hydraulic characteristics of channel
- Flood problems
- Water rights
- Water quality
- Mineral resources
- Geomorphology and sedimentation
- Groundwater
- Parks, recreation, and boating needs
- River flow control
- Sewage effluent discharges
- Aesthetics and appearance
- Wildlife and aquatic life

The South Platte River Master Plan will provide information to help understand the problems of the river and to assist in managing and operating the South Platte River from Chatfield Reservoir to Brighton at Baseline Road.



MULTI-USE IMPROVEMENTS. A primary goal of this drainage master plan is to provide for the optimization of the many uses of the South Platte River corridor. One example of this process is the development of an aesthetic amenity for the community at the confluence of Cherry Creek with the South Platte River while providing an increased level of erosion protection through the use of buried concrete and rubble. In this way, the goals of erosion resistent flood control and recreational and aesthetic benefits are both realized.

Goals

In order to achieve the desired purpose of the master plan, goals had to be established. These goals were specific items which all alternatives evaluated were weighed against. The ultimate recommended plan was determined based on its ability to satisfy the goals.

The goals of the master planning work for the South Platte River are listed as follows:

- Preserve and improve the South Platte River's drainage and flood control capacity.
- The master plan should reduce to the extent possible future flood damages while systematically reducing existing flood damage potential.
- Existing flood problems should be mitigated by applying the proper combination of non-structural and structural methods.
- The plan should reduce the exposure of people and property to flood hazard.
- The drainage and flood control program for the South Platte River should be coordinated with water supply, sewerage, land use, building development, recreation, transportation, and open space planning programs of the metro area.
- The existing floodplains from Chatfield Dam to Columbine Valley and from Sand Creek to Brighton should be permanently managed and regulated, while elsewhere regulation would constitute an interim presence until channel improvements are made.
- The potential of the river corridor for parks and recreation should be exploited to increase land values, social harmony, health, and reduce dependence on the automobile.
- Conflicting demands on the limited water of the South Platte River must be optimized within constraints imposed by Colorado law and the various needs related to the river.
- Wildlife and riparian vegetation conditions should be improved.
- The plan should insure that proposals and recommendations are consistent with overall regional goals and objectives.
- Erosion and sedimentation problems should be minimized.

Alternatives Evaluated

A total of nine alternatives were considered for each of the reaches. Not all of the alternatives were studied in detail for each reach, however. In some reaches it was determined that only a few of the available alternatives would be practical. The alternatives studied for each reach are presented on Table VI-1. The alternatives were chosen on the basis of the definition of flood problems performed as part of this master plan study.

Alternatives studied include the do nothing alternative, natural type waterway, lined channels, limited structural improvements, land acquisition or floodplain relocation, non-structural, channel relocation, and combinations of the above. All alternates include the enforcement of adequate floodplain regulations within the jurisdiction along the river.

Phase B Direction

The recommendations made in the Phase A report generally were adopted by the sponsors and, with the following additions and modifications, notice to proceed was issued on January 14, 1985.

The specific direction given for the Phase B work was as follows:

Reaches 1, 2, 3, and 4 - Chatfield to Colfax. Develop a preliminary design in accordance with the Phase A report recommendations.

Reach 5 - Colfax to Cherry Creek. Develop a preliminary design in accordance with the Phase A report recommendations; however, in the process, develop possible alternatives to the use of a collapsible dam at the Farmers and Gardners diversion dam. A collapsible dam could result in costly operation and maintenance cost commitments that need to be further clarified and other options evaluated before the preliminary design is completed.

Reach 6 and 7 - Cherry Creek to Sand Creek. Develop a preliminary design in accordance with the Phase A report recommendations.

Reach 8 - Sand Creek to Baseline Road. Develop a preliminary design in accordance with the Phase A report recommendations. As part of the preliminary design, show the recommended alignment, profile, cross section South Platte River in this reach. The preliminary design shall be based on the minimum maintenance alignment channel recommendations contained in the "Final Report, Stream Stability Investigation, South Platte River, Chatfield Dam to Baseline Road," November 1983 by M.A. Stevens.

In addition to the specific direction given for each reach, more generic requirements were imposed by the sponsors on the preliminary design. These 12 items are listed below and supplemented the goals and criteria presented in Section VI.

1. Enforce the existing floodplain regulations and regulate the identified 100-year floodplain.

2. There is a need for regulating the residual 100-year floodplain that remains after the Phase B plan is implemented. The existing 100-year floodplain has to be regulated until such time it is modified by physical changes to the existing drainageway facilities. Planning for or anticipating such changes does not justify regulating anything other than the floodplain defined using existing channel conditions.

3. Encourage purchase of flood insurance.

4. There must be adequate maintenance access to all reaches of the river. Maintenance trails should have a minimum flat surface width of 12 feet and, if paved, the paved portion should consist of an 8 foot wide concrete surface.

5. Adequate erosion control for all channel improvements and structures is required.

6. All new development in the watershed must provide on-site erosion control during construction to limit the amount of fine silt and topsoil washed into the drainageway during the more frequently occurring runoff events.

7. A recommended general prioritization of improvements is necessary to assist local governments in implementation.

8. Where land adjacent to the river is subject to development or redevelopment, the development and redevelopment should follow master plan recommendations and be in accordance with floodplain regulations.

9. Reestablishing riparian vegetation in combination with, and without rock bank channel stabilization, is important. The enhancement of wildlife habitat shall be included. Wildlife habitat advantages to the community as a whole will be considered.

10. The short-term and long-term water quality and aquatic habitat impacts of the recommended plan are to be presented.

11. All new or reconstructed bridges should be built with at least 2 feet of freeboard above the 100-year water surface to reduce the probability of clogging by floatable debris.

12. Random, uncoordinated filling of the channel with rubble, trash materials or earth must be stopped immediately and enforced by the local governments. All channel bank modifications by individuals along the river should comply with the recommended alignment, channel profile and cross section recommended in this Phase B Master Plan.

Phase B Plan

The preliminary engineering design for the South Platte River is presented below. The overall recommended master drainageway plan for the South Platte River also includes a recreation plan which is presented in Volume II. The recommended plan was developed from the Phase A report recommendations based on cost effectiveness, public input, meeting flood control needs, meeting regional recreation needs, public health and safety concerns, as well as the goals of the Urban Drainage & Flood Control District and sponsors.

The adopted plan and designs are described in detail on the 45 drawings appended to the report. The drawings are full 22"x34" size at a scale of 1 inch to 200 feet and are available for printing at the District offices in Denver. Please note that for each drawing there is a narrative description given on the back of the preceding drawing. The general plan is described following.

REACH 1 - CHATFIELD TO COLUMBINE

The recommended alternative includes maintaining the existing channel alignment with riprap erosion protection in the vicinity of the gravel lakes. In other areas erosion protection would be provided by planting willows and other natural vegetation. The natural vegetation will enhance the recreation alternative which is to develop a regional park reserve. The regional park reserve would preserve the natural river corridor by offering an undisturbed area for wildlife habitat and passive recreation uses.

REACH 2 - COLUMBINE TO OXFORD

The Corps of Engineers channel improvement project includes a realignment of the existing channel, replacement of the Union Avenue drop structure and the Brown Ditch diversion at Columbine Valley, and creating a channel capable of containing the 100-year flood. Floodplain management will prevent unwise development until the Corps project is completed.

REACH 3 - OXFORD TO BATES

In this reach the engineering alternative is to maintain the natural channel while providing erosion protection at the outside of bends and where high velocities occur. Erosion protection would be provided by riprap and natural vegetation. Floodplain management will reduce the likelihood that unwise development will result in increased future flood damages.

REACH 4 - BATES TO COLFAX

The limited structural improvements in this reach include erosion protection using natural vegetation and riprap. Bridge improvements at the Evans Avenue bridge include the addition of a new bay on the left bank. Downstream of the Evans Avenue bridge, the Florida Avenue dam would be removed and the channel bottom allowed to degrade. Immediately downstream of the Evans Avenue bridge the channel will be widened as well as deepened. The Florida Avenue dam, which is used to divert irrigation water for the Overland Park Golf Course would be replaced by a new diversion upstream or by a wellfield in the same vicinity.

The channel from Colfax Avenue to 3rd Avenue would be lowered up to 6 feet. This would require rebuilding the Public Service Company's inflatable dam at the Zuni Power Plant. The channel would be widened in several areas by cutting the banks and providing a low bench, or by using vertical concrete walls. Bridges in this reach would be modified to accommodate the deepened channel and many would have the maintenance trail modified to be adjacent to an abutment and placed on vertical retaining walls to increase flow area under the bridges.

REACH 5 - COLFAX TO CHERRY CREEK

Between Interstate 25 and Colfax Avenue the South Platte River would be widened in several locations by moving the banks back about 20 feet under the limited structural improvements proposed. Widening of the river is limited by the railroads and roads that are parallel to the river. The pedestrian bridge upstream of Interstate 25 should be relocated or rebuilt to provide a wider cross section. Under the Interstate 25 bridge the rock armoring would be removed and replaced with vertical concrete walls. Downstream of the Interstate 25 bridge the sewer line crossing should be removed or lowered. The alternative chosen will depend on plans for the Central Platte Valley Development.

Downstream of the sewer crossing the channel would be widened on the right bank by providing a 150 foot wide channel and a 50 foot bench at about the 10-year flood level. The left bank would remain undisturbed. The Farmers and Gardeners Dam at Confluence Park would be lowered to about 3 feet and rebuilt to provide the sound of falling water. A new diversion dam would be constructed about 1,000 feet upstream with a boat chute incorporated to provide a 820 foot crest length. The new diversion dam boat chute and the rebuilt Farmers and Gardners Dam boat chute would be connected to provide a boat chute almost 1,000 feet long. The area below the confluence with Cherry Creek will remain relatively undisturbed.

REACH 6 - CHERRY CREEK TO FRANKLIN

The limited structural improvements in this reach include erosion protection. The channel between Interstate 70 and Franklin Street would be deepened and improved. In addition, the Franklin Street bridge and the adjacent railroad bridge would be rebuilt. The Franklin Street bridge would be raised 3.5 feet, and the railroad bridge rebuilt with a single center pier. The Chicago Rock Island railroad bridge upstream of Denver metro should be rebuilt using a single center pier.

REACH 7 - FRANKLIN TO SAND CREEK

The recommended alternative of limited structural alternatives for this reach includes erosion protection. The major recommended structural improvement is the addition of a boat chute and pond flush gates to the Burlington Diversion Dam. The Gardners Ditch diversion structure at York Street would be lowered and a boat chute added. The Gardners Diversion should be moved upstream to a point just downstream of the Burlington Diversion Dam where the small structure required would also protect a sewer line crossing. The railroad bridge downstream of York Street should be rebuilt to provide a wider span with no piers in the river itself. In several areas the river channel should be widened by cutting back the banks.

REACH 8 - SAND CREEK TO BASELINE ROAD

The 10-year engineered stable channel alternative was chosen in this reach because it is effective and least costly for managing floods. It also is compatible with the continued extraction of mineral resources along the river. The alternative involves the stabilization of the river banks with riprap and vegetation when the alignment has reached the recommended configuration. The invert of the river would be allowed to degrade until the desired elevation has been attained at which time it would be stabilized to prevent further degradation. Bridge foundations would be protected to eliminate damage associated with degradation.

SECTION VII
MASTER PLAN COSTS

INTRODUCTION

Cost estimates were developed for the proposed drainage improvements such as channels, drop structures, and erosion protection which are included under drainage improvement cost estimates. Bridge and street improvements are included in street crossing costs. Utility relocations were also estimated. A contingency of 30 percent has been applied to all costs. Maintenance costs for the various alternatives were estimated and are included in the costs. Right-of-way acquisition costs, when required to construct improvements, are included in the cost development information.

The proposed improvements are based on the recommended Phase A plan with modifications requested by the sponsors. The preliminary design of the improvements was completed and is presented in this report.

UNIT COSTS

Cost estimates are based on the drawings contained herein. Unit prices were based on recent bid tabulations, adjusted to 1985 when necessary, estimating guides, and phone calls to suppliers and contractors. Unit costs used for this study are shown on Table VII-1.

TABLE VII-1
UNIT COSTS

Item	Unit Cost
EARTHWORK	
General excavation	$4.00/cy
General backfill	4.00/cy
Structural excavation	5.00/cy
Structural backfill	20.00/cy
General embankment	2.00/cy
Imported fill	15.00/cy
Topsoil and seeding	20,000/ac
Sodding	1.00/sf
Clear and grub	2,000/ac
Topsoil	15/cy
Seed	2,000/ac
	20/lb
Fertilizer and mulch	0.13/sf
EROSION CONTROL	
Riprap Type VL	30.00/cy
Riprap Type L	35.00/cy
Riprap Type M	40.00/cy
Riprap Type VH	45.00/cy
Concrete rubble	30.00/cy
Filter material	20.00/cy
Grouted type VH riprap	60.00/sy
STRUCTURAL IMPROVEMENTS	
Bridge construction	65.00/sf
Railroad bridge construction	2,000/track ft
Concrete flat work	250/cy
Concrete vertical work	350/cy
Pavement removal	3.00/sy
Curb and gutter removal	3.00/lf
Paving	3.50/sy/in
Base course	15.00/cy
Four curb and gutter	12.00/lf
Relay RR track	500.00/track ft
Guardrails	40.00/lf
Timber walls	35.00/sf
Sheet piling	16.00/sf
UTILITY RELOCATION	
60" water line	145.00/lf
MISCELLANEOUS ITEMS	
Maintenance Path	70.00/lf
Barbed wire fence	3.00/lf
42" chain link	7.00/lf
Pedestrian bridge - creek	50,000.00/ea
Pedestrian bridge - channelized	150,000.00/ea
Pedestrian bridge - unchannelized river	250,000.00/ea
Underpass	60,000.00/ea
Parks	
Major - active	30,000.00/ac
Major - passive	5,000.00/ac
Linear	200,000.00/mi
Pocket (general 1-10 acres)	40,000.00/ac
Focal point (generally 1-2 acres)	60,000.00/ac

Boating

Low flow channel	2,250.00/ea
Portage	6,000.00/ea
Check dam (weir type) boat chute	30,000.00/ea
Medium sized dam (rubble or sheet pile type) boat chute	60,000.00/ea
Large concrete dam	250,000.00/ea

Swimming

Unsupervised area	N/A
Supervised area	30,000.00/ea
Bank shaping	6.00/cy

River Access

Boat landing	15,000.00/cy
Trail access point	2,000.00/ea
Auto access point (parking)	40,000.00/ea

Fishing and aquatic life

(selective boulder placement)	50.00/cy

Landscaping

Buffer/screen planting	16.00/lf
Automatic irrigation system (tap fees are not included)	15,000.00/ac
Park landscaping (trees & shrubs)	15,000.00/ac
Native grass seeding	3,000.00/ac
Bluegrass seeding	6,000.00/ac
Native landscaping (trees & shrubs)	9,000.00/ac
Linear planting/thinning	21,000.00/mi
Wildlife planting	13,000.00/mi

Miscellaneous Amenities

Trail rest area	5,000.00/ea
Restroom facilities	50,000.00/ea
Picnic shelter	30,000.00/ea
Picnic tables	800.00/ea
Picnic grills	150.00/ea
Benches	500.00/ea
Signage - interpretative	250.00/ea
- safety	250.00/ea
Wildlife observation shelter	15,000.00/ea
Guard rail	18.00/lf

DRAINAGE IMPROVEMENTS COSTS

Drainage improvement costs include all construction improvements associated with the channel. These costs usually are for modification and construction of the channel, including excavation, backfill and revegetation. In instances where no formal channel improvements are proposed, it may be necessary to protect slopes. Where slope stabilization is required, costs associated with that item are included in the drainage improvement costs. Quantities used to prepare the cost estimate were based on the assumption that the channel should be stable. Stabilization is the placement of riprap and/or vegetation to provide an erosion resistant layer. Excavation and backfill quantities are estimated based on a cross section which would safely convey the design flow.

In addition to channel improvements, drainage improvement costs include the cost of replacing dams, constructing chutes to improve flood flow conditions over dams, structural improvements to dams and diversion structures including quantity estimates for concrete foundations and other necessary appurtenances.

Drainage improvement costs in Adams County include costs for the stabilization of side slopes. They also include the costs required to stabilize the channel invert when it degrades to the point that the capacity desired is achieved in the channel.

STREET CROSSING COSTS

Street crossing costs include the improvement or replacement of bridges, improvements to streets and improvements to bridge foundations. Improvements to structures are recommended to increase conveyance or to protect the structures from future damage associated with flooding. In some cases improvements to street crossings are suggested in order to prevent future damage associated with channel degradation.

UTILITY RELOCATION COSTS

Utility relocation costs include work required to relocate or reroute utility lines, including sanitary, water, gas and electric and telephone. In most cases, the relocation consists of lowering the affected utilities to a sufficient depth below the channel to avoid exposing them during subsequent degradation. Utility relocation costs also include the relocation of irrigation canal diversion dams.

TOTAL CONSTRUCTION COST

This cost represents the total capital outlay necessary for the construction of improvements to the drainageway and street crossings and the necessary utility relocations.

CONTINGENCY

A contingency has been applied to all construction related costs to account for uncertainties associated with the preliminary design. The contingency accounts for unknowns in design of the facilities and in uncertainties and inaccuracies associated with the quantity estimates. They also include, to some extent, uncertainties in the unit cost estimates. The contingency also accounts for engineering and design costs, inspection of construction activities and administration of contracts. The contingency used for this project is 30 percent of the construction costs.

PROPERTY ACQUISITION COSTS

Estimates of land acquisition costs associated with the improvements have been made including the purchase of right-of-way necessary for the construction of permanent improvements along the drainageway. The costs also include temporary construction easements to allow access and working space for equipment. Estimates of the value of property and easements required for this project were made by contacting real estate agents, county assessors offices, and county extension agents when agricultural land was involved. The unit costs are summarized in Table VII-2.

TABLE VII-2
RIGHT-OF-WAY UNIT COSTS

Item	Unit Cost
Right-of-way acquisition	
Agricultural	$ 6,000/acre
Commercial/industrial	150,000/acre
Easement acquisition	
Open space	2,000/acre
Residential	40,000/acre
Commercial/industrial	50,000/acre

MAINTENANCE

Maintenance of the river falls into three primary categories; routine, annual and flood related. Responsibilities fall onto various agencies with levels of maintenance varying between municipalities and the funds available.

Routine maintenance consists of trash pickup along the banks of the river and mowing and weed control of grassed areas along the channel greenway. These routine operations are performed between three and five times per year on average.

Annual maintenance and repair consists of the replacement of damaged or deteriorating sections of improvements, in channel or channel bank debris removal, repair and reseeding of minor erosion damage, bank stabilization of areas subject to continued erosion, and thinning and pruning of vegetation.

Flood related maintenance operations can be described as damage repair. As such, these items will not be included.

Annual costs for the various maintenance items are summarized in Table VII-3. These values were obtained from the Urban Drainage & Flood Control District.

TABLE VII-3
ANNUAL MAINTENANCE COSTS

Item	Cost
Channel and structural maintenance	1% of construction cost
Grass slope protection - flatter than 3:1	$200/acre
- steeper than 3:1	$300/acre
Debris pickup	$0.80/linear foot
Boat chutes	$100/vertical foot
Concrete walls	$200/mile
Weed control	$0.36/linear foot

COST OF ALTERNATIVES

The cost associated with the various alternatives studied have been separated into categories generally following the preceding discussion. Each sheet of the preliminary design drawings has a facing sheet presenting the improvements and the associated costs. Costs presented on a reach by reach basis are shown on Table VII-4.

TABLE VII-4
PROJECT COSTS BY RIVER REACH
x $1,000's

Reach	Drainage Improvement Costs	Street Crossing Costs	Utility Relocation Costs	Total Construction Costs	Engr. & Contingency	Property Acquisition Costs	Total Improvements Costs	Annual Operation & Maintenance Costs
1	1,024.0	---	---	1,024.0	307.2	---	1,331.2	37.9
2			CORPS OF ENGINEERS CHANNEL					50.0
3	65.8	---	---	65.8	19.7	---	85.5	13.9
4	6,375.9	1,578.8	528.2	8,482.9	2,544.9	847.2	11,875.0	101.2
5	2712.7	98.9	377.7	3,189.3	956.8	750.0	4,896.1	27.8
6	575.7	2,617.2	---	3,192.9	957.8	17.0	4,167.7	34.2
7	1411.9	1,000.0	---	2,411.9	723.6	62.0	3,197.5	30.0
8	19,912.4	11,188.0	414.6	31,515.0	9,454.5	2,383.0	43,352.5	341.2
TOTAL	32,078.4	16,482.9	1,320.5	49,881.8	14,964.5	4,059.2	68,905.5	636.2

THIRD AVENUE BOAT CHUTE. The Third Avenue Boat Chute has been incorporated into the Denver Wood products water diversion dam.

SECTION VIII
CRITERIA

INTRODUCTION

There are many demands on the land and water resources of the South Platte River corridor. The demands are associated with efforts to achieve a variety of objectives such as economic development, regional development, transportation, social well-being, and environmental quality. The land and water resources of the corridor are limited, but the demands are not. The objectives compete with each other. Competing objectives must be reconciled through a formal planning strategy for the South Platte River.

This major drainageway planning study for the South Platte River is unique in its scope and potential impact. No other river or stream in the Denver metropolitan area is subject to as many varied demands as the South Platte River. The river is truly a multi-use, multi-jurisdictional resource.

The criteria used during the Phase B preliminary design build upon those developed during the Phase A portion of this study. The general goals and objectives remain unchanged and have been used in the development of the preliminary plans contained in this document. These goals have determined which direction the proposed improvements took. The goals are repeated below:

- o The foremost and primary use of the South Platte River is for drainage and flood control.
- o The Master Plan should reduce to the extent possible future flood damages while systematically reducing existing flood damage potential.
- o Existing flood problems should be mitigated by applying the proper combination of non-structural and structural methods.
- o The plan should reduce the exposure of people and property to flood hazard.
- o The drainage and flood control program for the South Platte River should be coordinated with water supply, sewerage, land use, building development, recreation, transportation, and open space planning programs of the metro area.
- o The existing floodplains, where improvements do not entirely eliminate the danger of residual flooding during the 100-year flood, should be permanently managed and regulated, while elsewhere regulation should constitute an interim measure until channel improvements are made.
- o The potential of the river corridor for parks and recreation should be exploited to increase land values, social harmony, health, and to reduce dependence on the automobile.
- o Conflicting demands on the limited waters of the South Platte River must be optimized within constraints imposed by Colorado law and the various needs related to the river.
- o Wildlife and riparian vegetation conditions should be improved.
- o The plan should insure that proposals and recommendations are consistent with overall regional goals and objectives.
- o Erosion and sedimentation problems should be minimized.

PLANNING AND DESIGN CRITERIA

The following criteria describe specific planning and design aspects which were included in the development of the preliminary design. All criteria

cannot be satisfied in all cases, however, all were considered during the design and an attempt was made to optimize the plan.

One-Hundred Year Design Flood. The 100-year flood will be the basis for all floodplain master planning in the South Platte River corridor. The one percent criterion means that effects on the 100-year flood must always be evaluated as to impact and land use optimization. It does not mean that overbank flooding during the 100-year flood must be eliminated.

Bridge Freeboard. All proposed bridges crossing the South Platte River should maintain a minimum two foot freeboard between the lowest elevation of the bridge, or attached utility pipes, and the 100-year flood water surface elevation.

Erosion and Sedimentation. Bed and bank cutting by the river, and related sediment deposition effects should be minimized.

Access Trail. Access to the river should be included for operational and maintenance purposes, and to afford ready inspection of problem areas. Such access trails shall, where practical, serve a multi-use function for hiking and running, biking, and non-motorized transportation.

Continuous Linear Boating. All dams and check dams should have safe boat chutes suitable for the typical boater for river flows up to 1,500 cfs. Use of the river may be restricted to protect the public safety whenever flows exceed safe limits.

Aquatic Life. Means to protect and enhance fishing and all forms of aquatic life should be included in plans.

Birds and Terrestrial Wildlife. Enhancement of a riverine environment suitable for birds and terrestrial wildlife should be included in the plans.

River Flow Management. The South Platte River flow should be managed as a multi-purpose river to optimize the many uses of the river within the confines of Colorado law.

Utility Crossings. The design and construction of utility crossings, should not cause increased flood hazards or an increase in flood water surface. Existing crossings which already create or contribute to flood or erosion problems will be modified.

Drops and Check Dams. Design of river flow obstructions such as drops and check dams must consider the impact of construction on the flood carrying capacity of the channel.

Groundwater. The quality and quantity of the alluvial groundwater in the natural floodplain of the South Platte River should be protected from deterioration and diminution.

Inactive Gravel Mines. Old gravel mines should be made safe so as not to increase flood hazards or adversely impact the quality or quantity of surface and groundwater.

Active Gravel Mines. Mining of gravel in the natural floodplain of the South Platte River should be undertaken in a manner so as not to increase flood hazards or adversely impact the quality or quantity of surface and groundwater.

Floodplain Management Program. The South Platte River corridor will have a viable floodplain management program throughout its entire 40 mile reach. Emphasis should be placed upon floodplain management between Sand Creek and Baseline Road (Brighton) because the channel is designed for only the 10-year flood.

Regional Recreational Plans. South Platte River parks and recreation development plans, gravel mine operations and permits, and river corridor development shall be fully coordinated with regional recreational plans of the various governmental entities, or groups of entities.

Flood Hydrology. All planning and design for the South Platte River shall be compatible and in accordance with the design floods given in the Hydrology Chapter (III) of this report.

Low Flood Hydrology. Average monthly low flows in the South Platte River, based on a dry year analysis must be considered for near term planning and design purposes.

Criteria for Non-Structural Methods. The following measures may be considered in managing flood damages by other than structural means.

a) Floodproofing of commercial and industrial structures. (Considered in both structural and non-structural methods.)

b) Early warning systems in conjunction with emergency plans.

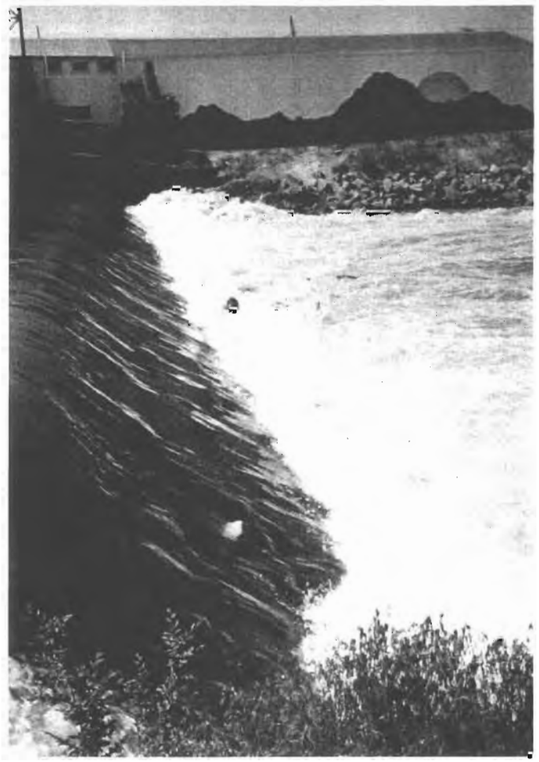
c) Flood insurance for flood prone properties.

d) Reconstruction plans for land purchase and post-disaster plans.

e) Floodplain management programs prepared and adopted for the frequent floods with appropriate consideration of the potential for larger floods which are in excess of 100-year event.

Low Flow Hydrology. Average monthly low flows in the South Platte River, based on a dry year analysis, for near term planning and design purposes are listed below.

Roughness. Hydraulic computations for the flow in the South Platte River channel should utilize the Manning "n" roughness coefficients which are based on USACE and Wright Water Engineers calibrations shown in Table X-3.



THIRD AVENUE DIVERSION DAM. This structure provides an example of a hydraulic control which required modification. By evaluating goals and criteria similar to those presented in this section, the structure was modified by the inclusion of a boat chute. This improvement resulted in increased improved recreational access without disrupting the original function of the dam.

SECTION X
RIVER CORRIDOR MANAGEMENT

Management of the South Platte River corridor should be a unified and coordinated effort based on adopted policy, goals, objectives and criteria.

Maintenance of the river corridor would most efficiently be handled by one agency because of resulting cost savings and uniformity of the degree of maintenance from area to area. Furthermore, drainage and flood control oriented maintenance is substantially different from the normal parks and recreation maintenance operations. It requires training not normally available in most municipal departments.

The Urban Drainage & Flood Control District has been identified by the consultant as being the most qualified agency to handle maintenance of the South Platte River corridor. However, the District's funding resourses may need to be increased for it to take on this additional effort.

STATEMENT OF POLICY

The South Platte River through the Denver metropolitan area is a connecting link for the twelve local governments through whose jurisdictions the river flows. An action on, or change to, the South Platte River in one jurisdiction has an effect on other jurisdictions; therefore, unified actions are desirable, and coordination is essential between jurisdictions.

Since flood control is the number one use of the river, unified flood control management is imperative for its full length.

Under a unified management plan the many other functions of the South Platte River would be enhanced and managed in a manner to be consistent with the needs of the total urban system as articulated in the policies of the Denver Regional Council of Governments.

MANAGEMENT SCOPE. The management of the South Platte River corridor entails many varied functions ranging from flood emergency management and clean up operations, as illustrated in the upper picture, to recreational enhancement and park development, as shown in the lower picture.

PRINCIPLES

Flood control is a subsystem of the total urban system.

- o Flood control is a space allocation and runoff management problem.
- o Flood waters and urban runoff are resources which, when managed, should contribute to the well being of the Denver region.
- o The flood control management strategy should be a multi-purpose and multi-means effort.

GOALS

The planning and engineering for the South Platte River should reduce future flood damage while systematically reducing existing flood damage potential.

Well balanced, non-structural and structural means should be utilized to reduce flood problems. Exposure of people and property to flood hazards should be reduced.

The flood management of the South Platte River should be coordinated with water supply, sewerage, land use, building development, recreation, transportation, wildlife, and open space planning programs of the metro area.

The existing floodplains from Chatfield Dam to Columbine Valley, and from Sand Creek to Brighton should be permanently managed and regulated. Elsewhere, regulation should constitute an interim measure until 100-year channel improvements are made.

The potential of the river corridor for parks and recreation should be exploited to increase land values, social harmony, health and to reduce dependence on the automobile.

Erosion and sedimentation problems should be minimized.

Conflicting demands on the limited waters of the South Platte River should be optimized. Wildlife and riparian vegetation conditions should be improved. Changes to the river should be consistent with overall regional goals and objectives.

OBJECTIVES

One-Hundred Year Design Flood. The 100-year flood should be the basis for floodplain planning in the South Platte River corridor. The one percent criterion means that ramifications of the 100-year flood must always be evaluated as to impact and land use optimization. It does not mean that overbank flooding during the 100-year flood must be eliminated.

Transportation. Roads, highways, and bridges should not cause flood problems or increase flood related damages. Transportation should not conflict with the recreational and park use of the corridor without mitigation measures. Bridge crossings of the South Platte River should not cause backwater effects and should have piers and abutments designed to resist erosion by the river.

Erosion and Sedimentation. Bed and bank cutting by the river, and related sediment deposition effects should be minimized. Erosion and sedimentation causing activities affect safe flood carrying capacity and therefore should be subject to flood control regulations.

Access Trail. Access to the river should be maintained for operational and maintenance purposes, and to afford ready inspection of problem areas. Such access trails shall, where practical, serve a multi-use function for hiking and running, biking, and non-motorized transportation.

Continuous Linear Boating. Safety and enjoyment of the river should be provided for continuous boating through the Denver area. All dams and check dams should have safe boat chutes suitable for the typical boater for

river flows up to 1,500 cfs. Use of the river may be restricted by peace officers (as defined by state law) to protect the public safety whenever flows exceed safe limits.

Aquatic Life. Measures to protect and enhance fishing and aquatic life should be implemented where feasible.

Birds and Terrestrial Wildlife. Enhancement of the riverine environment suitable for birds and terrestrial wildlife should be achieved.

River Flow Management. The South Platte River flow should be managed as a multi-purpose river to optimize the many uses of the river within the confines of Colorado law.

Utility Crossings. The design and construction of utility crossings, either under the riverbed or overhead, should not cause increased flood hazards or an increase in flood water surface. Such crossings should allow for riverbed degradation of at least three feet without causing an obstruction. Existing crossings which already create or contribute to flood or erosion problems should be modified.

Drops and Check Dams. Design of river flow controls such as drops and check dams should consider the impact of construction on the flood carrying capacity of the channel.

Groundwater. The quality and quantity of the alluvial groundwater in the natural floodplain of the South Platte River should be protected from deterioration and diminution.

Inactive Gravel Mines. Mining of gravel in the natural floodplain of the South Platte River should be undertaken in a manner so as not to increase flood hazards or adversely impact the quality or quantity of surface and groundwater.

Floodplain Management Program. The South Platte River corridor should have a viable floodplain management program throughout its entire 40 mile reach. Particular emphasis should be placed upon floodplain management between Sand Creek and Baseline Road (Brighton).

Mining Requests. All applications for gravel permits should include enforceable post mining reclamation plans containing post mining land use proposals.

Regional Recreational Plans. South Platte River parks and recreation development plans, gravel mine operations and permits, and river corridor development should be fully coordinated with regional recreational plans of the various governmental entities, or groups of entities.

Posted Signs. A coordinated system of signs, both on the bike trail and in parks, as well as along the river should exist. The river signs are important from a safety aspect, advising boaters of upcoming whitewater, boat chutes, portages, etc.

Boat Obstacles. Drop structures and check dams should be improved or notched, with portages before each chute, to permit scouting to occur prior to running the chute.

Facilities. Restroom facilities with public telephones and drinking fountains at regular intervals, all handicap accessible, should be installed.

CRITERIA

Flood Hydrology. All planning and design for the South Platte River shall be compatible and in accordance with the design floods given in the following table.

TABLE X-1
SOUTH PLATTE RIVER
FLOOD HYDROLOGY

Location	Discharge (cfs) Recurrence Interval 2-Year	10-Year	50-Year	100-Year
D/S Dutch Creek	*	*	5,060	6,400
S. Platte @ Littleton	*	3,100	6,170	7,940
D/S Big Dry Creek	*	4,350	9,600	12,600
D/S Little Dry Creek	*	5,750	12,200	16,000
D/S Cherry Creek	3,580	9,700	18,000	22,500
S. Platte @ 19th Ave.	3,580	9,700	18,000	22,400
U/S Sand Creek	3,580	9,700	17,400	21,700
D/S Clear Creek	3,550	13,000	28,600	38,000
D/S First Creek	3,550	12,700	27,500	36,000
S. Platte @ Henderson	3,400	12,300	2,700	35,500
Baseline Road	3,130	11,400	25,500	33,600

* Snowmelt and dam releases predominate

Normal flood period releases from Chatfield, Bear Creek, and Cherry Creek Reservoirs may be up to 5,000 cfs. Such releases for planning and design are not to be added to floods generated downstream of the dams due to rainfall occurrences.

Low Flow Hydrology. Average monthly low flows in the South Platte River, based on a dry year analysis, for near term planning and design purposes are shown in Table X-2.

TABLE X-2
LOW FLOW HYDROLOGY

Month	Littleton Gage (cfs)	Denver Gage (cfs)	Henderson Gage (cfs)
January	39	78	163
February	44	84	229
March	56	95	168
April	51	102	197
May	82	218	405
June	164	229	539
July	274	294	519
August	146	197	311
September	58	88	215
October	42	67	144
November	60	116	173
December	36	84	221

Hydraulic Roughness. Hydraulic computations for the flow in the South Platte River channel utilizes the following Manning's "n" roughness coefficients which are based on USACE and Wright Water Engineers calibrations.

TABLE X-3
MANNING'S ROUGHNESS VALUES

Reach	Location	Manning's n Channel	Overbanks
1	Chatfield to Columbine	.030	.06 - .07
2	Columbine to Oxford	.030	.045 - .05
3	Oxford to Bates	.030	.045 - .05
4	Bates to Colfax	.030	.045 - .055
5	Colfax to Cherry Creek	.030	.04 - .05
6	Cherry Creek to 23rd	.035	.04 - .05
	23rd to Franklin	.030	.04 - .055
7	Franklin to Sand Creek	.035	.04 - .055
8	Sand Creek to Baseline	.035	.06 - .07

Floodplain Determinations. Water surface profiles are calculated using the Corps of Engineers HEC-2 computer model. Profiles are determined using the following criteria:

a) Peak discharges as noted should be used to determine water surface profiles.

b) The floodway in Denver should be determined assuming equal encroachment into the existing floodplain which results in a 1 foot rise in the energy grade line elevations.

c) Friction between cross sections should be calculated by averaging the friction slopes at each section.

d) A contraction coefficient of 0.1 and expansion coefficient of 0.3 should be used unless special factors warrant modification, such as defined in the HEC-2 Users Manual.

e) The HEC-2 special bridge routine should be used for all bridges.

f) A factor of 1.65 should be used for total loss calculations in the HEC-2 model. This is the equivalent of c = 0.8 in the orifice flow equation.

g) A coefficient of 2.6 should be used for typical weir calculations.

h) The bridge opening should be based on the projected area normal to the flow direction.

i) No debris blockage of bridges across the South Platte River is assumed, because of Tri-Lakes.

Damage Estimates. Damage estimates were made for the 10-year, 50-year and 100-year storms assuming ultimate flow conditions and existing channel and floodplain configurations. These damage estimates provide the baseline against which to evaluate the benefits associated with alternative flood improvement plans. In evaluating damages, the following general criteria should be observed:

a) Residential and commercial damages are to be based on actual property values and curves developed by the Flood Insurance Administration and the Corps of Engineers.

b) Agricultural damages are to be based on information obtained from Soil Conservation Service.

c) Other damage estimates will be based on the total reconstruction cost.

Bridge Freeboard. All proposed bridges crossing the South Platte River should maintain a minimum two-foot freeboard between the lowest elevation of the bridge, or attached utility pipes, and the 100-year flood water surface elevation.

Channel Design; Sand Creek to Baseline Road. For planning and design of the South Platte River in Adams County (Sand Creek to Baseline Road) the following channel design criteria shall be used:

Design Parameter	10-Year Event
Bottom width	250 feet
Normal depth	8.1 feet
Channel depth	9 feet
Manning's n	0.035
Side slope of banks	4:1
Slope of river beds between drops	7 feet per mile

New Gravel Pits. Future gravel mining in the South Platte River corridor has been determined to have a long-term impact on the geomorphology, hydraulics, stability, meandering, water quality, and sediment characteristics of the South Platte River. Engineering criteria for the design and construction for new gravel pits have been presented in a separate report on Gravel Mining Standards.

Criteria for Non-Structural Methods. The following measures should be considered in managing flood damages.

a) Floodproofing of commercial and industrial structures. (Considered in both structural and non-structural methods.)

b) Early flood warning systems in conjunction with emergency evacuation and damage reduction plans.

c) Flood insurance for flood prone properties.

d) Reconstruction plans for land purchase and post-disaster mitigation plans.

e) Floodplain management programs prepared and adopted for the frequent floods with appropriate consideration of the potential for larger floods which are in excess of 100-year event.

COMMUNITY ASSET. The South Platte River can perform many functions including its principal function of safe conveyance of flood waters through the metropolitan Area. It can also become a valuable amenity to not only property adjacent to the river but also all residents of the Denver metropolitan area. To a large extent this opportunity is already being realized in many areas along the river. For example, the Greenway Foundation in the Confluence Park area (photograph above), the work Littleton has done in their floodplain park, and Adams County in their regional park complex.

SECTION IX
RESOURCES

The South Platte River corridor is well endowed with natural resources. The natural resources help create jobs, they provide the Metro area with amenities and convenience, and the resources make available opportunities for economic and cultural growth in the future.

MINERAL RESOURCES

Gravel operations exist for several miles immediately downstream from Chatfield Reservoir, in Englewood, in Denver and most extensively in Adams County.

The mineral resources have a direct effect upon many aspects of the preliminary design for the South Platte River corridor. Given enough time, unregulated gravel mining in Adams County would result in additional erosion and/or headcutting moving upstream. This would be first noticed by bridge piers being undermined and degradation below diversion dams. Gravel pits can provide recreational opportunities on a region-wide basis.

The South Platte River historically flowed in a valley cut into the landscape during Pleistocene times. The valley floor is mostly reworked gravel overlain by a few feet of rich sandy silt. The valley floor is from 1/2 to 2 miles wide in the Denver area. The average width is approximately 3/4 mile. Upstream from 6th Avenue in Denver, there are a few outcrops of Wisconsin Stage gravel fills in the valley floor. One is at the Overland Park Municipal Golf Course. These gravels are chiefly granitic pebbles mostly less than 1 inch in diameter, well-bedded and well-sorted.

The Denver formation underlies the alluvium and granitic gravels. The Denver and underlying Arapahoe Formations consist of nearly flat-lying shale and sandstone.

The alluvial deposits of the South Platte River are from 5 to 30 feet thick with a maximum in excess of 50 feet. The Denver Formation outcrops in the riverbed at a number of locations through the study reach.

The surficial deposits in the Adams County reach of the study area include the following.

Verdos Gravels

The Verdos gravels are the oldest surficial deposits. The Verdos deposits occupy the uppermost surfaces on a line of hills lying west of the South Platte River valley, and are also found near Barr Lake.

Slocum Gravels

Thin deposits of gravels mixed with fine grained materials are occasionally exposed at elevations below the Verdos surface west of the South Platte River valley. The deposits are thin, generally being only two to four feet thick.

Older Eolian Sand and Silt

The upland surfaces west of the South Platte valley are extensively mantled by Eolian fine sand and silt and some clay deposits.

Broadway-Louviers Alluvium

Within the Brighton quadrangle a single large terrace, in places over one mile wide, lies 30-35 feet above the river along the east side of the South Platte valley.

Piney Creek Alluvium

Deposits of humic sand, silt and clay with some smaller gravels form terraces and straths along both sides of the South Platte valley.

Younger Eolian Sand and Silt

Extensive deposits of wind blown sand and silt are found southeast of the South Platte valley.

Post-Piney Creek Alluvium

The deposits found within the modern floodplains of the South Platte River and the alluvial materials along the tributary creeks are Post-Piney Creek.

Sand and Gravel Resources in Adams County

The entire alluvial floodplain of the South Platte River through Adams County is comprised of sand and gravel suitable and desirable for mineral extraction. These South Platte River corridor resources range up to 70 feet in depth and average two miles in width along the river in Adams County.

The average potentially extractable quantity of aggregate amount to 73,000,000 cubic yards per mile of river valley in Adams County.

Turner (1974) has estimated that due to various land use constraints, such as urban development, extraction of the reserves will be limited to about two-thirds of the potentially extractable quantities, or roughly 50,000,000 cubic yards per mile of river valley, based on a Brighton quadrangle map detailed study.

The South Platte River corridor through Adams County is one of the last large remaining Denver metropolitan area sources for gravel according to the the Colorado Geological Survey.

GROUNDWATER RESOURCES

The transient groundwater storage in the alluvial aquifer of the South Platte River between Chatfield Reservoir and Brighton total approximately 330,000 acre-feet. Of this total, approximately 30,000 acre-feet are in transient storage between Chatfield Reservoir and the 19th Street gaging station in Denver (Wright, 1968). From 19th Street to Brighton, the groundwater within the alluvial aquifer of the South Platte River is approximately 300,000 acre-feet (Bittinger, 1968). The 19th Street gaging station is the boundary between Water District Nos. 8 and 2 of Irrigation Division No. 1 as administered by the State Engineer of Colorado.

Development of the South Platte alluvial groundwater resources in Water District No. 8 (Chatfield to 19th Street) is accomplished via wells constructed for municipal, irrigation and other purposes. There are nearly 100 alluvial wells in this reach which have been used for water table measurements between 1954 and 1976 (Hillier, 1983).

Downstream of 19th Street to Baseline Road, alluvial groundwater development along the South Platte River has been extensive. A survey of all alluvial wells in all of Water District No. 2 performed in 1968 listed 1,552 irrigation well registrations having an average yield of 1.8 cfs each (Bittinger, 1968). In addition, Bittinger estimated that there were an additional 260 commercial, industrial and municipal wells having an average yield of approximately 0.5 cfs each. Between 19th Street and Baseline Road Bittinger estimated that the average pumping withdrawals from this portion of the river alluvium amounted to 40,000 acre-feet per year.

Groundwater and gravel pit storage in the South Platte River alluvium provides a major source of water for the City of Thornton. This same aquifer is the water supply for the City of Brighton.

Depth of Water Table

The water table adjacent to the mainstem of the South Platte River, from Sand Creek to Brighton, is designated by the U.S. Geological Survey as being less than 5 feet deep. Surrounding, and adjacent to this zone of shallow water, and along the full reach of the river in the floodplain, the water table is designated as being from 5 to 10 feet deep. Along the right

bank for the full river length from Sand Creek to Brighton, the alluvial groundwater extends eastward for, in some places, as much as 7 miles. Through the City of Denver, from Sand Creek to Big Dry Creek in Englewood, the depth to water table adjacent to the river is from 10 to 20 feet. From Big Dry Creek to Chatfield Reservoir the water table is again shallow, ranging from 10 feet to less than 5 feet.

Evaluation of depth to water table indicates that river channelization, and confining of the river within narrow fixed banks, results in lower water tables due to the fact that the deep channel serves as a deeper groundwater drain. A deeper river channel means lowered water tables.

Chemical Water Quality

The chemical quality of groundwater as measured by dissolved solids concentrations is less than 500 mg/l from Chatfield Reservoir down to Columbine Valley. From Columbine Valley to Brighton the groundwater in the alluvium of the South Platte River has a dissolved solids concentration in excess of 500 mg/l.

Well Yields

Well yields from the South Platte alluvial aquifer are satisfactory for the entire 40 mile study reach. Individual pumping rates of from 500 to 1,000 gpm are common. There are least 15 zones where the well yields range between 1,000 and 1,500 gpm, with some wells pumping in excess of 1,500 gpm.

RIVER FLOW AND RESERVOIRS

The South Platte River from Chatfield to Brighton is a mostly controlled river, though for flood purposes the effect of the flood control reservoirs is significantly diminished below the Cherry Creek confluence. The flow of the river is controlled by releases from Chatfield Reservoir, Bear Creek Reservoir, and Cherry Creek Reservoir, which are referred to as the Tri-Lakes.

These three reservoirs were built and are operated by the U.S. Army Corps of Engineers. For each of the reservoirs, releases are controlled by federal and state personnel.

There is a need for an adequate base flow in the South Platte River to accommodate several needs and activities, including:

- Dilution of sewage effluent to reduce the deleterious impact of sewage effluent flow through the heart of Denver and Adams County.
- Dilution of polluted drainage water discharged from metropolitan storm sewers and gulches.
- Provision of minimum flows to carry off petroleum products such as gasoline (from vehicular accident site flushing) and oil which find their way to the river.
- Provision of flows to support the aquatic life which exists in the river for its full length, ranging from trout in Littleton, catfish in Denver, to fish and bottom-living crustaceans downstream of Sand Creek.
- Adequate flows to support rafting, kayaking, canoeing, and special boating events, which draw as many as 100 boaters and in excess of 1,000 spectator/participants per event in central Denver.
- Swimming, though it is not sponsored, or supervised. Swimming occurs mostly among inner-city youth, primarily at the confluence of the South Platte River with Cherry Creek.

A reasonably adequate minimal base flow for boating purposes would range from 100 cubic feet per second (cfs) in Littleton to 200 to 300 cfs at the Speer Boulevard bridge, just upstream from the Denver gaging station. Speer Boulevard is at the entrance to the Confluence Park Whitewater Slalom Boat Chute. The maximum safe flow for general public boating is about 1,500 cfs as measured at the Littleton gage. At flows above 1,500 cfs boating should be limited to experienced people.

Travel Time

A release of water from Chatfield Reservoir must commence at least twelve hours prior to a scheduled water event at Confluence Park. The travel time of the water is estimated to be 10 to 12 hours. Travel times to other locations are dependent upon their distances downstream from Chatfield Reservoir. Therefore, if a boating event is to commence at Confluence Park at 9:00 a.m. on a particular day, the gate at Chatfield Reservoir must be opened by at least 9:00 p.m. the previous day.

WATER QUALITY

South Platte River water quality changes significantly in the study reach from Chatfield Reservoir to Brighton; such changes are attributable to point and nonpoint source pollution from the Denver Metropolitan area. From Chatfield Reservoir to approximately Bowles Avenue, South Platte River water quality is generally good. The river has moderate to high concentrations of dissolved oxygen, appropriate concentrations of nutrients, low concentrations of metal and other pollutants and maintains a good fishery and overall aquatic habitat.

Below Bowles Avenue, and extending to Brighton, however, water quality degrades as dissolved oxygen concentrations decrease, while concentrations of nutrients, metals, fecal coliform, organic and inorganic pollutants, and other substances associated with stormwater runoff, landfill leachate and sewage effluent increase.

The Colorado Water Quality Control Commission has established classifications and numeric standards for the South Platte River and associated tributaries.

The principal point sources of direct discharges into the South Platte River between Chatfield Reservoir and Brighton include:

(1) The Littleton/Englewood Sewage Treatment Plant
(2) Gates Rubber Company
(3) Public Service Company
(4) The Denver Metropolitan Sewage Disposal Plant
(5) The South Adams County Sewage Treatment Plant
(6) The Brighton City Sewage Treatment Plant

RECREATION AND OPEN SPACE (See Volume II for detail)

The South Platte River and its tributaries are important natural resources in the Denver Metropolitan area. Most of the region's population lives within walking distance of these waterways, making them key links from neighborhoods to a metro-wide recreation and transportation system.

Denver's Greenway from Bates Avenue to Franklin Street features a ten-mile hike/bike/maintenance trail and over 400 acres of open space containing formal parks, picnic grounds, wildlife areas, boat chutes and concert sites. Confluence Park, at 15th Street and Cherry Creek, annually serves host to many events. Nearby Gates-Crescent Park, formerly a city maintenance yard, is now the home of the new $3 million Children's Museum of Denver.

The City of Littleton, working with the South Suburban Metropolitan Recreation and Park District, has been successful in acquiring 640 acres of river property that is known as South Platte Park. Littleton has also created a special riverfront authority to aid in the development of quality commercial and business areas near Bowles Avenue.

Adams County is constructing high-quality recreational facilities by innovative funding and implementation methods. The Adams County Greenway currently includes a trail system from Rendezvous Park, at the confluence of the South Platte River and Clear Creek, to Steele Street Park.

GEOMORPHOLOGY

The South Platte River regime, channel and floodplain characteristics were controlled by alternative periods of drought and wet cycles. Its width, depth, bends, bank height and slope were constantly readjusting to natural phenomena.

Through Denver, the river was fixed between permanent banks and channelized. The U.S. Army Corps of Engineers channelization project will fix the bed and banks of the river from Columbine Valley to Oxford Street.

The Adams County portion of the South Platte River will be fixed between protected banks with the bottom elevation of the stream controlled via drops.

For purposes of morphological description of the South Platte River, the study area has been divided into five reaches.

Chatfield Reservoir to Columbine Valley

This reach is characterized by the Littleton Floodplain Park and gravel pits. It is 3.7 miles long with a slope of 10.87 feet/mile for a total drop of 40 feet.

Columbine Valley to West Hampden Avenue

In this 5.6 mile reach which drops 77 feet, the South Platte is a suburban river. The sinuosity is 1.25.

West Hampden Avenue to Sand Creek

This is the urban reach of the South Platte River. Over its length of 13.8 miles, the river falls 159 feet. The river has been straightened so that its sinuosity is only 1.09. There are numerous drops in the riverbed level through the urban reach.

Sand Creek to East 104th Avenue

From Sand Creek to East 104th Avenue, the river channel falls 64 feet in 6.8 miles. The sinuosity of the channel is 1.18. In this reach, there are low levees on one or both banks of the river over most of the distance.

East 104th Avenue to Baseline Road

The downstream reach of the South Platte River is rural in form. It falls 92 feet in a river distance of 11.4 miles. The sinuosity is 1.26.

The South Platte River is actively eroding its bed and banks wherever it is free to do so with the absence of controlled drops and adequate bank riprap.

NEEDED CORRECTIVE WORK. Erosion of the riverside berm in this old Littleton area gravel pit allows the river to flow into the lake, and out of the lake downstream. The berm must be reconstructed so that river borne sediments are not lost to the river in order to control the headcutting which is occurring.

SECTION XI
RECREATION AND WILDLIFE

INTRODUCTION

In this, Volume I of the Phase B Master Plan Report, a brief synopsis of recreation and wildlife is presented. Volume II is devoted to this subject in its entirety and includes a summary of the planning process, detailed design criteria and character sketches of typical improvements, a table summarizing existing and proposed parks along the river, detailed descriptions, preliminary design drawings and cost estimates for recommended improvements, and a comprehensive inventory of vegetation and wildlife along the 40-mile length of the study area.

General

The South Platte River and its tributaries are important natural resources in the Denver metropolitan area. Increasing urban pressures require that we preserve and enhance the river corridor's recreational, wildlife and aesthetic benefits.

The river's potential as a recreation resource for the region is unparalleled. Since it forms the area's backbone not only in terms of physical location, but also with respect to transportation, drainage and employment concentration, it is readily accessible by most of the urban population. Tributaries and major highways offer direct connections from the surrounding business and residential communities.

Like most rivers around which an urban area has grown, the South Platte has been overlooked and neglected. In many areas, encroachment has resulted in flood problems, blight and pollution. It is time to utilize this valuable resource for better purposes. If creatively restored and enhanced, the river can be a place to play, a wildlife refuge, an educational facility and a floodway, as well as a unique feature and focal point in the heart of the Denver metropolitan region.

The South Platte River is also an unparalleled resource for an incredible array of fish and wildlife. Though riparian ecosystems occupy less than two percent of Colorado's total land area, some 43 percent of the state's wildlife and over 50 percent of its bird species require a riparian ecosystem to exist and thrive. The river's continuous riparian habitat, anchored by South Platte Park and the Smith Natural Area at either end of the 40-mile corridor, is critical to the survival of hundreds of mammals, reptiles, birds and fish that inhabit or migrate through the area.

Urban wildlife is receiving increased attention across the nation. Its importance to maintaining the balance between man and nature cannot be underestimated. The South Platte and its tributaries form an important link in the preservation and enhancement of wildlife in the urban area.

When development in the river valley is authorized by local government, land areas adjacent to the river should be reserved in a natural state to provide both life-sustaining habitat to Colorado wildlife and enjoyment for those people using the river corridor. Where gravel mining has occurred, the remaining ponds can be reclaimed as a wildlife and acquatic resource where possible. A native riparian buffer should be provided between the river and the gravel ponds to encourage greater diversity in the riverine ecosystem.

The preservation of minimum stream flows is essential for the fish and wildlife that inhabit the river corridor. The need for in-channel improvements such as boat chutes, selective placement of large boulders in the river, wetland areas and native plantings adjacent to the water's edge is important to maintaining and increasing the number and variety of fish and wildlife species which require this habitat for life.

Where possible and necessary, artificial nesting boxes or structures should be provided as a supplement to the natural environment. Creation and preservation of nesting islands, protected from the influence of man, should be a high priority in the development of the riparian ecosystem. And, in order to provide for the enjoyment and education of the public, interpretive trails, special public facilities and appreciation areas dedicated to wildlife observation and peaceful interaction with the natural environment should be provided wherever possible.

Although beaver inhabit our urban environment along the river, the location of their colonies and their population needs to be controlled by an agency such as the Colorado Division of Wildlife. This is essential to preserve and protect the natural habitat so critical to other species which inhabit and depend upon the river's riparian ecosystem for survival. Key trees should be identified and protected from beaver feeding with wire mesh collars around their trunks.

The consultant has conducted an exhaustive inventory of existing and desired recreation improvements throughout the 40 miles of river being studied and has outlined a realistic, achievable improvement program for each reach of the river which, with minor adjustment, has been enthusiastically endorsed by each local sponsor.

It is now understood that improvements for recreation and wildlife enhancement should accompany any work accomplished along the river for flood control or other purposes. The South Platte is a resource for the metropolitan area, and its revitalization is important if we are to continue and improve our quality of life.

In general, a continuous hike/bike/maintenance trail for non-motorized transportation and wildlife observation should be built throughout the entire 40-mile corridor. For flood protection and maintenance economy over time, it should be built of concrete. Street/trail conflicts should be minimized to the fullest extent possible by constructing underpasses at automobile bridges. Convenient trail connections from tributary streams and local on-street bike routes should also be provided.

Parks and wildlife areas of varying types should be created adjacent to the river wherever the opportunity exists or presents itself in the future. Adequate auto parking areas should be incorporated at each park area and at major street crossings. The existing riparian vegetation along the river should be preserved and expanded for reasons of improved habitat for wildlife and general aesthetics. Plantings of cottonwood, willow and other indigenous riparian species should be systematically done in conjunction with other improvements throughout the entire corridor.

Safe passage for boats using the river should be provided through river obstructions wherever possible and economically feasible. Boat landings both up and downstream of every obstruction, whether or not it contains a boat chute, should also be provided. Frequent use of large boulders to create plunge pools, riffles and eddies is encouraged to improve the aquatic environment in the channel for fish life and to enhance the boating experience. Adequate safety signage should be included for the benefit of recreationists using the waterway. Efforts to improve water quality (where economically feasible) and minimum stream flows should be vigoriously pursued for both recreational and wildlife reasons.

Some highlights of the recommended recreation and wildlife program for each reach of the river are presented below.

Reach 1 - Chatfield to Columbine: A major regional park resource, South Platte Park, is currently under development. Much of it will be developed for passive uses such as wildlife observation, hiking and nature study. Two focal points with more active uses are planned. A major spine trail will be constructed on the river's east side, and numerous nature trails will be provided throughout the balance of the park.

The river will be made boatable by notching two obstructions and building boat landings. Both fish and wildlife habitat will be enhanced by selective rock placement in the channel and native plantings throughout the park. Access by car will be improved to the focal points planned in the area.

Wetlands should be created within the park wherever there is adequate water and level land to enhance the already superb wildlife habitat of the area. Wildlife snags should be identified and vigorously protected in accordance with up-to-date forest management practices. Tributary trail connections are recommended at or near Dutch Creek and Dad Clark Gulch. All of the land for the park has already been acquired, and it is open to the public

for primarily passive use at the present time.

Reach 2 - Columbine to Oxford: Several pocket parks will be developed in this section at focal points such as Lee Gulch, Riverfront Festival Center and the Riverwalk Development. The entire reach will be developed as a linear park with a continuous trail running on the river's east side until crossing to the west side via a new pedestrian bridge near Bowles. Tributary trail connections are suggested along Lee Gulch and Big Dry Creek.

After the Corps of Engineers completes channelization of the river in this reach, any remaining obstructions to continuous boating should be fitted with boat chutes and landings. In order to provide for a continuous riparian wildlife corridor, attention should be given to revegetating both river banks with indigenous species at the earliest possible opportunity. In focal point parks which are natural in character, wetlands areas should be created and maintained as native wildlife habitats.

Reach 3 - Oxford to Bates: The spine trail will cross from the west bank to the east bank at the Oxford pedestrian bridge and will skirt the Englewood Golf Course to a point south of Hampden where it will cross on a new bridge to join the existing trail which was built by the Greenway Foundation, State Parks Division and the South Suburban Parks Foundation in 1984. Under the Colorado Greenway program, 17 miles of tributary trail were linked together along the South Platte, Bear Creek, Kipling Parkway and Sanderson Gulch to form a loop trail connection to the major Platte River Greenway trail and providing access to the system for thousands of people near the corridors. This is a model which the consultant recommends be followed along most of the tributaries to the river. Corridor preservation should begin immediately.

A native wildlife preserve just south of the mouth of Bear Creek will be maintained and enhanced. Additional wetlands areas should be created in the preserve if at all possible. Access and auto parking should be provided at several locations convenient to the trail system and linear park through this reach. Once again, for wildlife and aesthetic purposes, attention should be given to revegetation of both riverbanks as soon as the Corps' construction is complete.

Reach 4 - Bates to Colfax: This area has already been developed by the Greenway Foundation and the City of Denver. Most of what remains to be done is relatively small in comparison to the $13 million expended to date in the successful 10-mile, 400-acre rehabilitation of the South Platte through Denver. However, several small park areas are in need of additional improvements and the existing trail could also be improved to some degree.

Since Denver forms the heart of the metropolitan region and will receive the heaviest trail use, an opposite-bank trail system is proposed. Boat chutes and landings are required at several locations to provide for continuous river passage, although most obstructions through the city have already been notched. The outstanding existing wildlife habitat along the river should be maintained and improved wherever possible.

Reach 5 - Colfax to Cherry Creek: An excellent opportunity exists in this reach to significantly expand the recreation, open space and wildlife habitat of the riparian ecosystem. Major redevelopment projects are slated for the area, and the provision of people-oriented improvements aimed at enhancing the visual attractiveness and recreational potential of the area should be a high priority. For wildlife enhancement, wetlands should be created both along the river and within the development areas to receive and naturally cleanse storm runoff from the projects before it reaches the river.

An opposite-bank trail system is essential in this reach to provide adequate capacity for expected heavy use. Miscellaneous boating improvements are recommended, together with improved access and parking facilities. Major relandscaping, as well as access trails through the new developments, should be included in the developers' and city's plans for the area. The existing tributary trail connection along Cherry Creek, built under the

auspices of the Urban Drainage and Flood Control District and the City of Denver, provides an excellent link to downtown and the neighborhoods of southeast Denver.

Reach 6 - Cherry Creek to Franklin: The major park opportunities in this section exist along the river's west bank, and they should be developed. An opposite-bank trail and improvements to Riverfront Park should be accomplished for passive recreation use and improved wildlife habitat. As vacant land areas become available between Washington Street and the river, they should be obtained and converted to park use.

Generally, river access should be improved throughout this reach. The trail connection to northwest Denver should be completed through the Rockmont Drive area, and its landscape character should be improved. Major relandscaping and native plantings are recommended throughout this entire section for wildlife and aesthetic improvement.

Reach 7 - Franklin to Sand Creek: Several pocket parks are proposed in this section, including those at Franklin and York. The trail is planned on the east bank until it crosses on a new pedestrian bridge south of Metro Sewer where it continues on the west bank to Sand Creek. Several river obstructions need to be improved with boat chutes and landings for continuous passage.

An opportunity exists for a Reserve Park for wildlife and passive recreation at the confluence with Sand Creek where additional wetlands can be created. An opportunity also exists for a tributary connection along Sand Creek to the Highline Canal which serves Aurora and other east-side metropolitan areas. Both opportunities should be taken advantage of before they are lost.

Reach 8 - Sand Creek to Baseline Road: Existing improvements, including the west bank trail in the southern portion of this reach and several pocket and regional parks, are a great beginning to the Adams County Greenway System. Corridor preservation and land acquisition for park and wildlife habitat expansion should be a high priority.

The trail system is planned for the west side throughout this reach until it crosses to the east bank to access the Smith Natural Area near Brighton. With appropriate advance planning, the trail can leave the riverbank entirely and meander through native wildlife habitats which can be acquired as the opportunity arises. A tributary connection along Clear Creek has the potential to link Golden and the Northwest metropolitan area into the system. Other potential links exist along Niver Creek, Grange Hall Creek and several canals in the area, and they should be utilized for trail corridors.

Significant expansion of the riparian and natural environment of the Colorado plains is possible through this reach, and it should be vigoriously pursued. The lakes remaining after gravel mining operations provide excellent habitat for fish and other wildlife, and they should be reclaimed for that purpose as well as recreation use whenever possible. Four boating obstructions need to be notched and landings built in order to provide continuous passage and improvement for fishlife in the river.

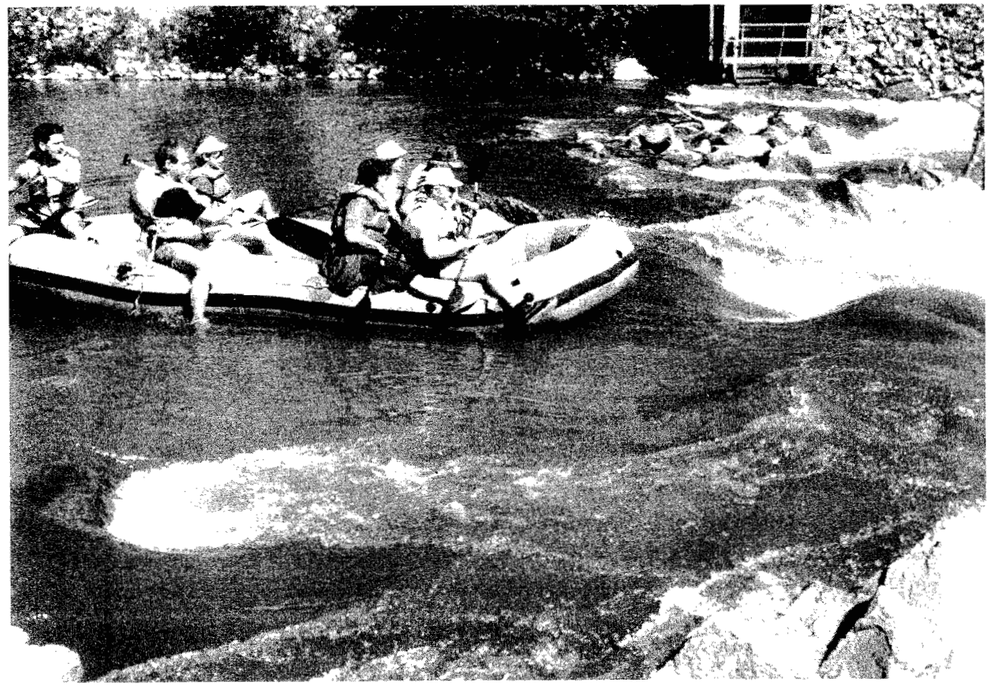
The development of major regional parks by Thornton and Adams County should be continued, and significant areas of wetland wildlife habitat should be incorporated into the specific designs for these facilities. Additional wetlands should be created on lands adjacent to the river as they are acquired. Significant revegetation of both the riverbanks and adjacent property should be a high priority.

There is already an abundance of high quality wildlife habitat throughout this reach, and it should be maintained and expanded for the benefit of the riparian species which frequent and inhabit the river corridor, as well as for the enjoyment and education of all those who use it for peaceful contemplation, nature study, bird watching and other similar passive activities. Particular attention to preserving and maintaining wildlife snags in this reach will insure the enhancement of the riparian habitat.

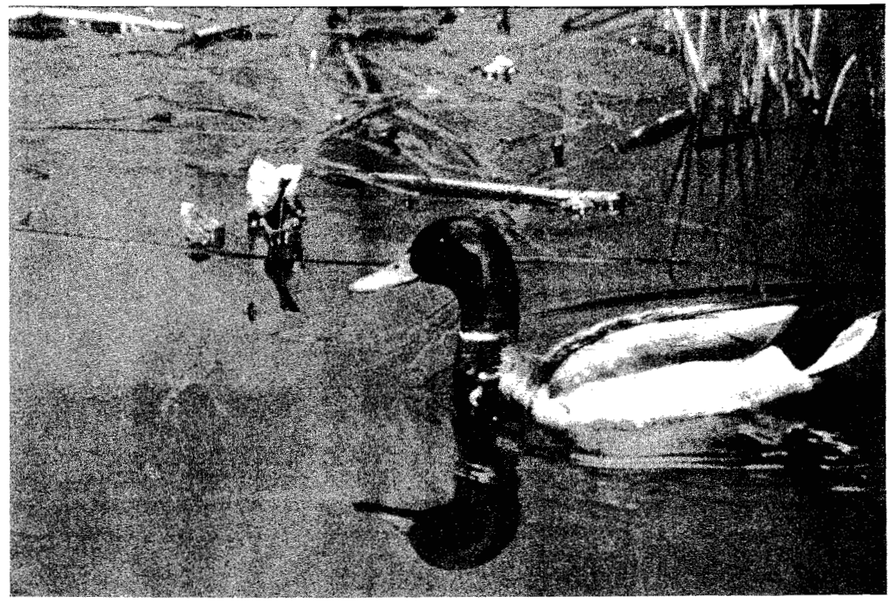
The reach of river in Adams County, as elsewhere in the Denver area, presents an incredible opportunity for recreation, open space and wildlife

habitat...if action is taken soon to insure that open lands adjacent and nearby are maintained in the public interest. As with the rest of the metropolitan Greenway system, corridor preservation along the South Platte and its tributaries should be a very high priority on every local jurisdiction's agenda, with improvement for recreation and wildlife close behind.

For a more detailed discussion of recreation and wildlife, please refer to Volume II of the Phase B master plan study.

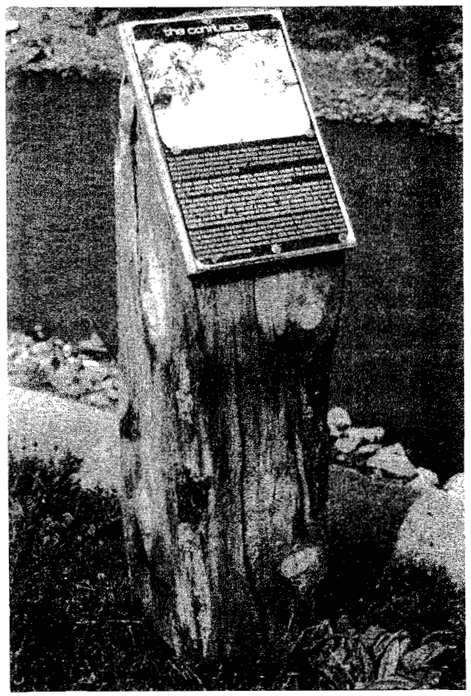


RECREATIONAL. The improvements proposed would enable the South Platte River to continue as a recreational amenity with improved access to the public and increased safety for users such as the rafters pictured above.



WILDLIFE. One of the primary goals of the master plan is to maintain or enhance the available habitat. Successful reestablishment of this habitat will encourage the use by fish, waterfowl, and other animals.

EDUCATIONAL OPPORTUNITY. Because of the improved public access, the entire South Platte River corridor can be used as an educational tool. Interpretive signs, as shown on the right, can enhance the educational experience.



REFERENCES

Adams County, Colorado, "Subdivision Regulations, Section 6."

Anderson, R.L. and Maass, A., "A Simulation of Irrigation Systems, The Effect of Water Supply and Operating Rules on Production and Income on Irrigated Farms," Technical Bulletin No. 1431, USDA, August 1978.

Bates, W. (Denver Water Department), "Control of Releases from Chatfield Reservoir and Management of Denver's Water Rights," personal communication, March 1984.

Bennett, M., "Debris Removal Costs", personal communications, February 1984.

Bittinger and Associates, "Water Utilization Study, Water District 2," Colorado Department of Natural Resources, July 1968.

City and County of Denver, Tax Assessors Office.

Clayton, J.T. (Water Commissioner District 8), "Current Locations and Amounts of Water Rights on South Platte River," personal communication, December 1983.

Colorado Department of Health, "Summary Report of the Water Quality Control Division of the South Platte River, July 1, 1976-June 29, 1977", Water Quality Division, August 1, 1978.

Colorado Geologic Survey, "Sand, Gravel, and Quarry Aggregate Resources, Colorado Front Range Counties," Department of Natural Resources, 1974.

Colorado State Engineer's Office, Stream Alpha List - Districts 8 and 2, 1981.

Denver Regional Council of Governments, "Urban Storm Drainage Criteria Manual, Volumes I and II," March 1969.

Downing, B., "Mining Damages and Values," personal communications, February 1984.

Engineering Consultants, Inc., "Major Drainageway Planning, First Creek," March 1977.

EPA 201 Facility Plans for the South Adams County Sewage Treatment Plant; Source: Adams County Government.

EPA 208 (Non-Point Source Pollution) Study of the Denver Metropolitan Area; Source: USEPA, Denver Office.

Eppinger, B., "Ditch Maintenance and Damages," personal communication, January 1984.

Federal Emergency Management Agency, Draft Flood Insurance Rate Review, Exhibit C, undated.

Federal Emergency Management Agency, "Draft Flood Insurance Study, City and County of Denver, Colorado," August 26, 1983.

Fonda, S. (City of Englewood), "Pending Transfer of Englewood's Water Rights in Petersburg Ditch," personal communication, March 1984.

"4-Quarterly Cost Roundup," Engineering News Record, Vol. 211, No. 25, December 22, 1983, pp. 53-75.

Gingery Associates, Inc., "Flood Hazard Area Delineation, Bear Creek," December 1979.

Gingery Associates, Inc., "Flood Hazard Area Delineation, Clear Creek," August 1979.

Gingery Associates, Inc., "Flood Hazard Area Delineation, South Platte River, Adams County," September 1977.

Gray, C., "Adams County Maintenance Program," personal communication, March 1984.

Hillier, D.E., Schneider, P.A., Hutchinson, E.C., "Depths to the Water Table (1976-1977) in the Greater Denver Area, Front Range Urban Corridor, Colorado," U.S. Geological Survey, 1983.

Hillier, D.E., Schneider, P.A,, Hutchinson, E.C., "Well Yields and Chemical Quality of Water From Water Table Aquifers in the Greater Denver Area, Front Range Urban Corridor, Colorado," U.S. Geological Survey, 1983.

Holland, H., "Agricultural Value and Damages," personal communication, January 1984.

Hunt, C.B., "Pleistocene and Recent Deposits of the Denver Area," U.S. Geological Survey Bulletin 996-C, 1954.

Hunter, M., "Urban Drainage and Flood Control District's Maintenance Program," personal communication, March 1984.

Hurr, R.T., Schneider, P.A., Jr., and Minges, D.R., "Hydrology of the South Platte River Valley, Northeastern Colorado," Colorado Water Resources Circular No. 28, prepared by USGS with CWCB and the Colorado Division of Water Resources, Office of the State Engineer, Denver, Colorado, 1975.

James, L.D., and Lee, R.R., "Economics of Water Resources Planning," McGraw-Hill Book Company, New York, 1971.

Korbobo, K., "Mining Operations and Damages," personal communications, February 1984.

McBride, T. "Crop Value," personal communication, February 1984.

McCall-Ellingson and Merrill, Inc., "Major Drainageway Planning, Little Dry Creek," March 1974.

McDonald, T. (Public Service Company of Colorado), "Cooling Water Requirements for Public Service Company Power Plants," personal communication, February 1984.

Merrick & Company, "Flood Hazard Area Delineation, Cherry Creek," July 1976

Merrick and Company, "Major Drainageway Planning, Cherry Creek," May 1977.

Merrick and Company, "South Platte River Hydrologic Study, Chatfield Dam to Sand Creek," May 1983.

Meehl, P.E. (Water Commissioner District 2), "Current Locations and Amounts of Water Rights on South Platte River," personal communication, February 1984.

Ongoing Study by the U.S. Geological Survey of the South Platte Water Quality from Chatfield Reservoir to 50th Avenue; Project Sponsors: Englewood, Littleton and the Colorado Department of Health (available in draft form in April or May, 1984).

Robert Snow Means Company, Inc., "1983 Means Building Construction Cost Data," 1982.

Sellards and Grigg, Inc., "Draft Utility and Floodplains Sections, Mile High Land Project Final Report," 1983.

Shoemaker, Jeff, "Maintenance of the Greenway," personal communication, March 1984.

Shoemaker, J., and Stevens, L.A., "Returning the Platte to the People," The Greenway Foundation, 1981.

Simons, Li and Associates, "Design Guidelines and Criteria, Channels and Hydraulic Structures on Sandy Soil," June 1981.

Steeber, G., "Ditch Maintenance and Damages," personal communication, January 1984.

Stevens, Michael A., "Final Report, Stream Stability Investigation, South Platte River, Chatfield Dam to Baseline Road," November 1983.

Tabor, N., "Distensible Dam Costs," personal communication, February 1984.

Telephone interview with Mr. Duane Humbel of Denver Metropolitan Wastewater Treatment Plant on 2/21/84.

Telephone interview with Mr. Bill Owen, Operator of the City of Littleton/-Englewood Sewage Treatment Plant, on 2/21/84.

Telephone interview with Mr. Joseph Stallsmith of Adams County on 2/21/84.

Turner, A.K., "Surficial Geology Investigations and Evaluation of the Sand and Gravel Deposits, Brighton Quadrangle, Colorado," 1974.

Unitt, J. (U.S. Army Corps of Engineers), "Operation of Tri-Lakes Project Reservoirs," personal communication, December 1983.

URS Company, "Major Drainageway Planning, Dutch Creek, Lilley Gulch, Coon Creek Drainage Basin Area," August 1979.

Urban Drainage and Flood Control District, "Methodology for Evaluation of Feasibility: Multi-jurisdictional Urban Drainage and Flood Control Projects," February 1977.

"Urban Runoff Quality in the Denver Region", Denver Regional Council of Governments, September 1983.

U.S. Department of Agriculture, Soil Conservation Service, "Analysis of Crop Damage Factors," Economics Memorandum EWP-8, January 1959.

U.S. Army Corps of Engineers, "Briefing Package, Denver Tri-Lakes Projects," undated.

U.S. Army Corps of Engineers, Omaha District, "Computer Modeling", 1972.

U.S. Army Corps of Engineers, Hydrologic Engineering Center," HEC-2, Water Surface Profiles, Users Manual," September 1982.

U.S. Army Corps of Engineers, Omaha District, "Depth Damage Relationships".

U.S. Army Corps of Engineers, Omaha District, "Post Flood Report, Platte River and Tributaries, Nebraska, Wyoming and Colorado, Floods of May-June, 1973," Volume I, July 1974.

U.S. Bureau of Reclamation, Project Files on Channelization of Middle Rio Grande, Flaming Gorge Dam, Sedimentation Section, Hydrology Office, Project Investigations, 1957 and 1958.

U.S. Department of Housing and Urban Development, Flood Insurance Administration, "Flood Insurance Study, Adams County, Colorado," August 1968.

VTN, "Major Drainage Master Plan, Big Dry Creek," June 1975.

"Water Body Assessment, Segment 14 of the South Platte River," Ongoing Study of the South Platte River Water Quality currently in draft form; Consultant: Camp, Dresser, McGee; Source: USEPA, Denver office.

Wright Water Engineers, "Design Memorandum," 1984.

Wright Water Engineers, "Study of Integrated Water Use, South Platte River Basin Water District No. 8," Colorado Department of Natural Resources, July 1968.

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

CHATFIELD DAM TO BASELINE ROAD

PRELIMINARY ENGINEERING DESIGN

INDEX OF DRAWINGS

1. TITLE SHEET & SHEET INDEX
2. SHEET INDEX, LEGEND & GENERAL NOTES
3. SHEET INDEX
4. PLAN & PROFILE STA. 2074+00 TO STA. 2130+00
5. PLAN & PROFILE STA. 2014+00 TO STA. 2074+00
6. PLAN & PROFILE STA. 1972+00 TO STA. 2014+00
7. PLAN & PROFILE STA. 1916+00 TO STA. 1972+00
8. PLAN & PROFILE STA. 1860+00 TO STA. 1916+00
9. PLAN & PROFILE STA. 1804+00 TO STA. 1860+00
10. PLAN & PROFILE STA. 1760+00 TO STA. 1804+00
11. PLAN & PROFILE STA. 1730+00 TO STA. 1760+00
12. PLAN & PROFILE STA. 1686+00 TO STA. 1730+00
13. PLAN & PROFILE STA. 1632+00 TO STA. 1686+00
14. PLAN & PROFILE STA. 1572+00 TO STA. 1632+00
15. PLAN & PROFILE STA. 1512+00 TO STA. 1572+00
16. PLAN & PROFILE STA. 1456+00 TO STA. 1512+00
17. PLAN & PROFILE STA. 1402+00 TO STA. 1456+00
18. PLAN & PROFILE STA. 1347+00 TO STA. 1402+00
19. PLAN & PROFILE STA. 1292+00 TO STA. 1347+00
20. PLAN & PROFILE STA. 1232+00 TO STA. 1292+00
21. PLAN & PROFILE STA. 1175+00 TO STA. 1232+00
22. PLAN & PROFILE STA. 1122+00 TO STA. 1175+00
23. PLAN & PROFILE STA. 1064+00 TO STA. 1122+00
24. PLAN & PROFILE STA. 1005+00 TO STA. 1064+00
25. PLAN & PROFILE STA. 960+00 TO STA. 1005+00
26. PLAN & PROFILE STA. 822+00 TO STA. 960+00
27. PLAN & PROFILE STA. 865+00 TO STA. 822+00
28. PLAN & PROFILE STA. 710+00 TO STA. 765+00
29. PLAN & PROFILE STA. 657+00 TO STA. 710+00
30. PLAN & PROFILE STA. 613+00 TO STA. 657+00
31. PLAN & PROFILE STA. 560+00 TO STA. 613+00
32. PLAN & PROFILE STA. 507+00 TO STA. 560+00
33. PLAN & PROFILE STA. 458+00 TO STA. 507+00
34. PLAN & PROFILE STA. 430+00 TO STA. 548+00
35. PLAN & PROFILE STA. 388+00 TO STA. 430+00
36. PLAN & PROFILE STA. 332+00 TO STA. 388+00
37. PLAN & PROFILE STA. 277+00 TO STA. 332+00
38. PLAN & PROFILE STA. 220+00 TO STA. 277+00
39. PLAN & PROFILE STA. 165+00 TO STA. 220+00
40. PLAN & PROFILE STA. 125+00 TO STA. 165+00
41. PLAN & PROFILE STA. 71+00 TO STA. 125+00
42. PLAN & PROFILE STA. 52+00 TO STA. 71+00
43. PLAN & PROFILE STA. 0+00 TO STA. 52+00
44. TYPICAL DETAILS
45. TYPICAL DETAILS

NOTE: SEE VOLUME II FOR RECREATIONAL PLAN

KENNETH ROBERT WRIGHT REGISTERED 3084 PROFESSIONAL ENGINEER STATE OF COLORADO

COLORADO REGISTERED WARREN CURTIS CHANDLER 18285 PROFESSIONAL ENGINEER

MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	PLAN SHEET INDEX	WRIGHT WATER ENGINEERS, INC. 2490 W. 26TH AVE., 55-A DENVER, CO. 80211	DESIGN WCC, MWG DETAIL PEM, EQZ CHECK WCC, MRW DATE 5/85	PROJECT NUMBER 831-036.00B	DRAWING NUMBER 1 OF 45

GENERAL NOTES:

NOTE: Utilities shown are approximate in location and elevation. During final design, it will be necessary to field locate or excavate for surveying in some cases. All utilities shown on plans are underground unless noted OVERHEAD.

48 hours before you dig call for the blue stakes

534-6700

Denver Inter-utility Group Gas, Electric and Telephone

KENNETH ROBERT WRIGHT REGISTERED 3084 PROFESSIONAL ENGINEER STATE OF COLORADO

COLORADO REGISTERED WARREN CURTIS CHANDLER 18285 PROFESSIONAL ENGINEER

LEGEND

PLAN

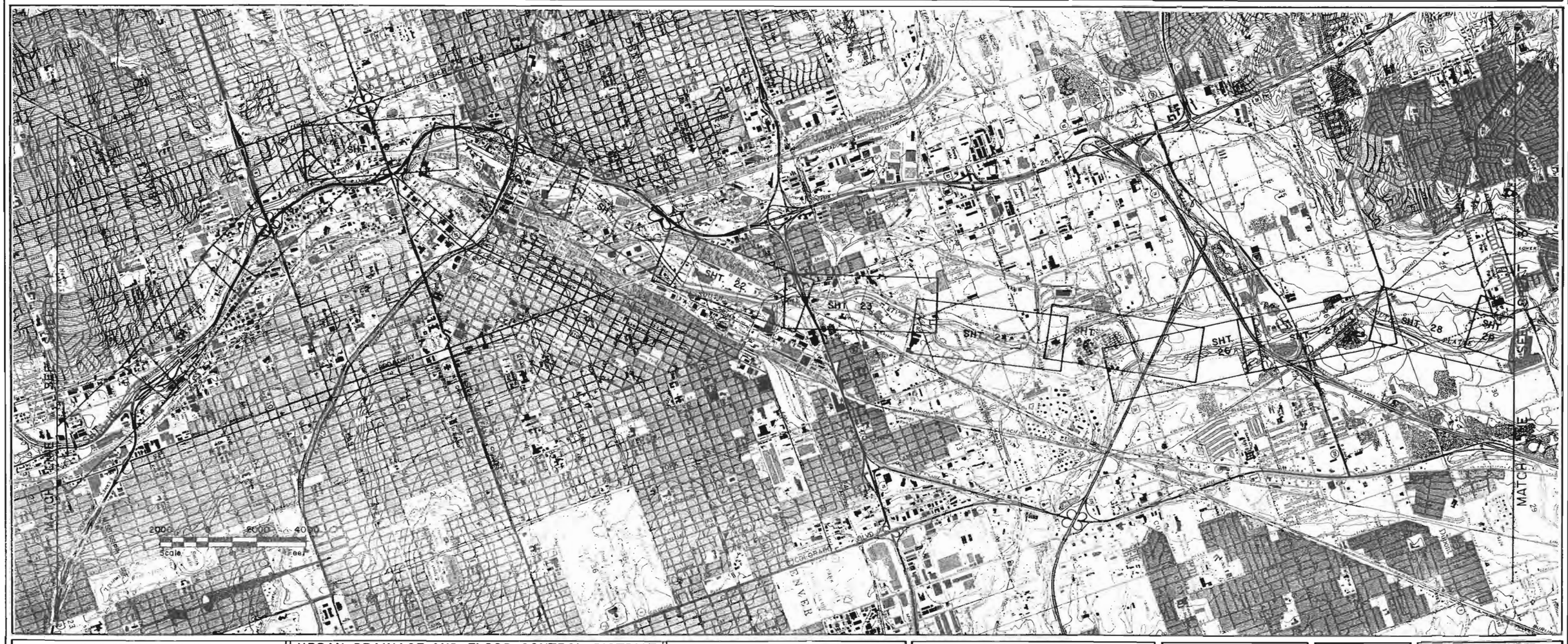
- PROPOSED IMPROVEMENTS
- RESIDUAL 100-YR. FLOODPLAIN
- ℄ IMPROVED OR EXISTING CHANNEL
- EXISTING 100-YR. FLOODPLAIN

PROFILE

- 100-YR. WATER SURFACE PROFILE IMPROVED
- EXISTING
- 10-YR. WATER SURFACE PROFILE
- IMPROVED MAIN CHANNEL INVERT
- EXISTING THALWEG

UTILITIES

- T — TELEPHONE
- G — GAS
- W — WATER
- E — ELECTRIC
- S — SANITARY SEWER
- ST — STORM SEWER



MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	PLAN SHEET INDEX	WRIGHT WATER ENGINEERS, INC. 2490 W. 26TH. AVE., 55-A DENVER, CO. 80211	DESIGN WCC, MWG DATE 5/85 DETAIL PCM, EQZ CHECK WCC, MWG, DRW	PROJECT NUMBER 831-036.00B	DRAWING NUMBER 2 OF 45

MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	PLAN SHEET INDEX	WRIGHT WATER ENGINEERS, INC. 2480 W. 26TH AVE., 55-A DENVER, CO. 80211	DESIGN / DETAIL / CHECK — DATE 5/85	PROJECT NUMBER 831-036.00B	DRAWING NUMBER 3 OF 45

COMMENTARY
SHEET 4 OF 45
STATION 2074+00 TO 2130+00
REACH 1

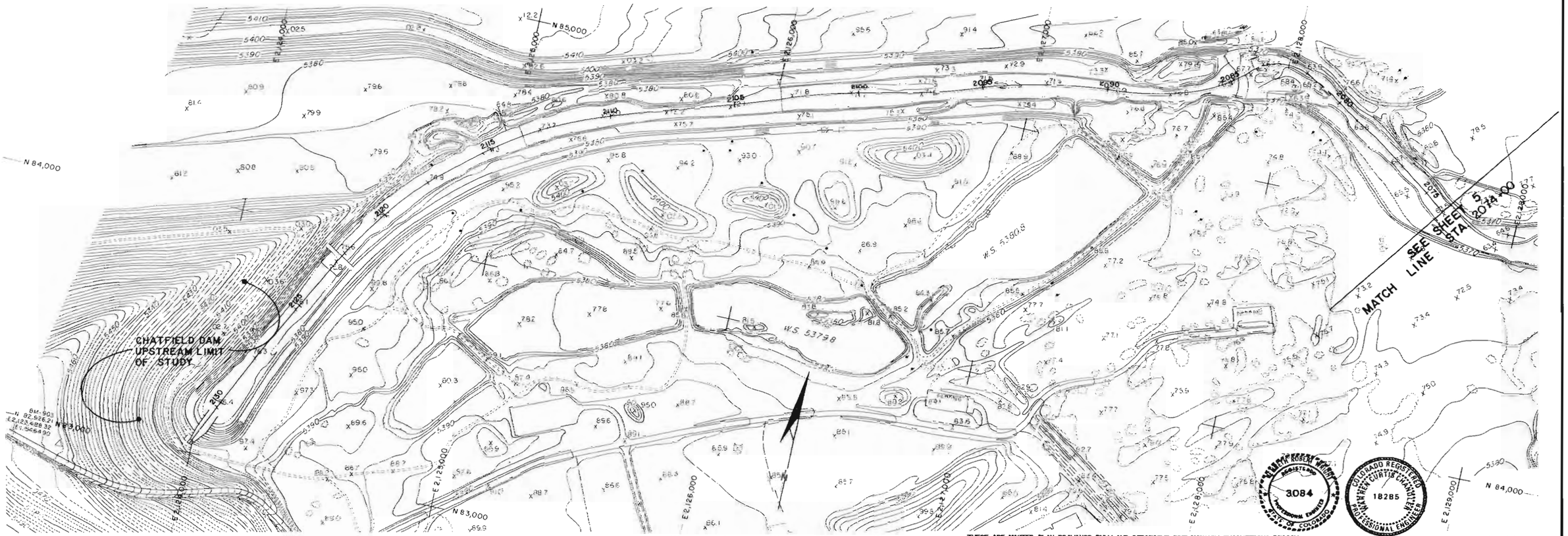
This is the upstream portion of the study reach. The embankment of Chatfield Dam and Reservoir is on the western portion of this area. The surface spillway discharges into a channel which is uniform and has been stabilized. The overbanks in this area are comprised of picnic and park areas. No floodplain has been delineated for the area upstream of C470. Flows through this area are the result of discharges from Chatfield Dam and Reservoir.

No improvements are proposed on this sheet.

COST ESTIMATE
SHEET 4 OF 45
SOUTH PLATTE RIVER
STATION 2074+00 TO STATION 2130+00

CONSTRUCTION

Drainage improvement costs	$ ---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	---
TOTAL IMPROVEMENT COSTS	---
Operation and Maintenance	$7,140



DATUM IS MEAN SEA LEVEL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.

NOTE: NO EXISTING 100-YR. FLOOD PROFILE AVAILABLE THIS SHEET

2130+00 2120+00 2110+00 2100+00 2090+00 2080+00 2074+00

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16,1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO FEDERAL BLVD SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN RE, MEO DATE 5/85
CHECKED WCC, MEO DATE 5/85
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 2074+00 TO STA. 2130+00

SHEET 4 OF 45

COMMENTARY
SHEET 5 OF 45
STATION 2014+00 TO 2074+00
REACH 1

The channel near Highway C470 is controlled, to some extent, by the bridge crossing. Downstream of C470 a drop structure has been constructed. Further downstream the channel exhibits a tendency to meander. There is evidence of bank erosion, the stream is braided and there is evidence of relocation of the river by as much as 400 to 500 feet. This portion of the river flows through the South Platte Park (Littleton Floodplain Park). The overbanks are vegetated with trees and brush. The western overbank has two gravel pit lakes.

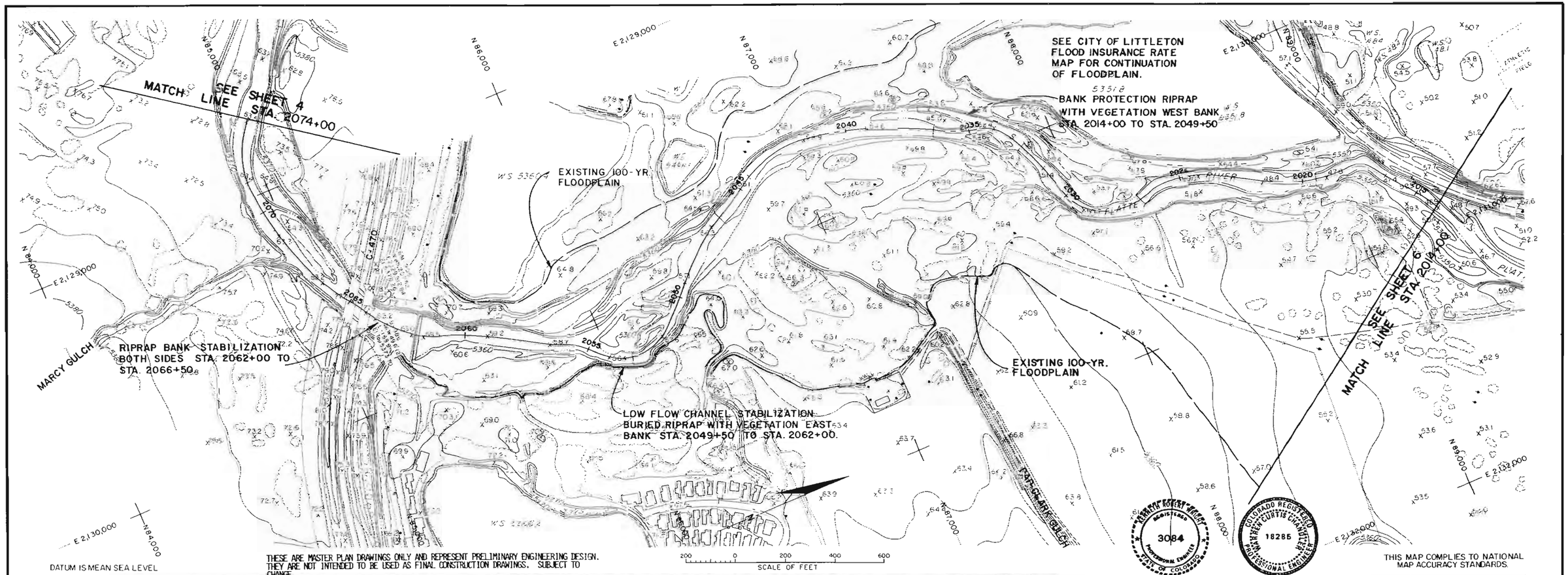
The proposed improvements on this sheet consist of bank stabilization. In the vicinity of the C470 crossing, riprap bank stabilization is proposed on both banks from Station 2062+00 to 2066+50. The proposed gradation is USDCM Type M and should be installed in accordance with Detail A shown on Sheet 44. Downstream of the drop structure, between Station 2049+50 and 2062+00, low flow bank protection is recommended along the east bank of the river. This area exhibits some instability and should be stabilized. The bank stabilization will consist of riprap with vegetation. The west bank of the South Platte River, between Stations 2014+00 and 2049+50 should be stabilized with riprap with vegetation. This bank protection will prevent erosion from jeopardizing the embankment adjacent to the gravel pit lake. The installation of this riprap with vegetation/slope protection should be in accordance with Detail B shown on Sheet 44.

The improvements proposed on this sheet do not decrease the 100-year delineated floodplain. As such, floodplain regulations should be enforced. This will insure that no imprudent development occurs in the 100-year floodplain.

COST ESTIMATE
SHEET 5 OF 45
SOUTH PLATTE RIVER
STATION 2014+00 TO STATION 2074+00

CONSTRUCTION

Drainage improvement costs	520,900
Street crossing costs	---
Utility relocation costs	---
Total construction costs	520,900
Engineering and contingencies (30% of total construction costs)	156,300
Property acquisition	---
TOTAL IMPROVEMENT COSTS	677,200
Operation and Maintenance	$14,320



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave, Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED DATE
DRAWN DATE
CHECKED DATE
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 2014+00 TO STA. 2074+00

SHEET 5 OF 45

COMMENTARY
SHEET 6 OF 45
STATION 1972+00 TO 2014+00
REACH 1

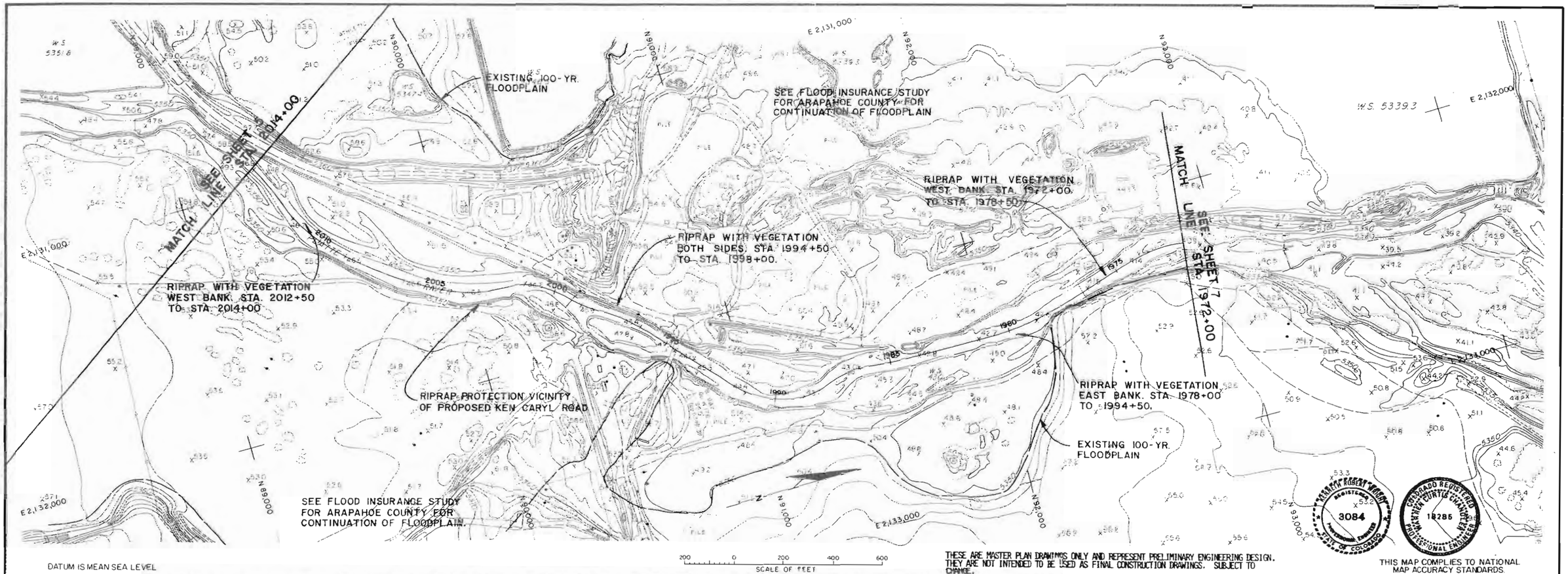
The South Platte Park (Littleton Floodplain Park) extends along both channel banks through this area. The western overbank contains a gravel pit lake. The channel is experiencing some lateral migration, however, the extent is fairly limited. The proposed Ken Caryl Road alignment crosses the South Platte River at approximately Station 2000+00.

The improvements proposed to this area consist of the stabilization of channel banks with riprap and vegetation. This installation extends from Station 2012+50 to 2014+00, 1978+00 to 1994+50 and 1972+00 to 1978+50. The area in the vicinity of the Ken Caryl crossing requires stabilization on both channel banks between Stations 1994+50 and 1998+00. In addition to the riprap with vegetation, vegetative bank protection has been recommended between Station 1978+00 and 1994+50 in order to prevent erosion from proceeding east of the existing channel. This vegetation should consist of native type grasses and trees. Trees include willows which help to anchor the soil mass along the channel overbank. The vegetation will not extend down below the low water line, but rather will be planted on embankments above the channel bottom itself. The riprap and vegetation used for stabilizing the banks should be in accordance with Detail B shown on Sheet 44.

COST ESTIMATE
SHEET 6 OF 45
SOUTH PLATTE RIVER
STATION 1972+00 TO STATION 2014+00

CONSTRUCTION

Drainage improvement costs	$290,000
Street crossing costs	---
Utility relocation costs	---
Total construction costs	290,000
Engineering and contingencies (30% of total construction costs)	87,000
Property acquisition	---
TOTAL IMPROVEMENT COSTS	377,000
Operation and Maintenance	$9,140

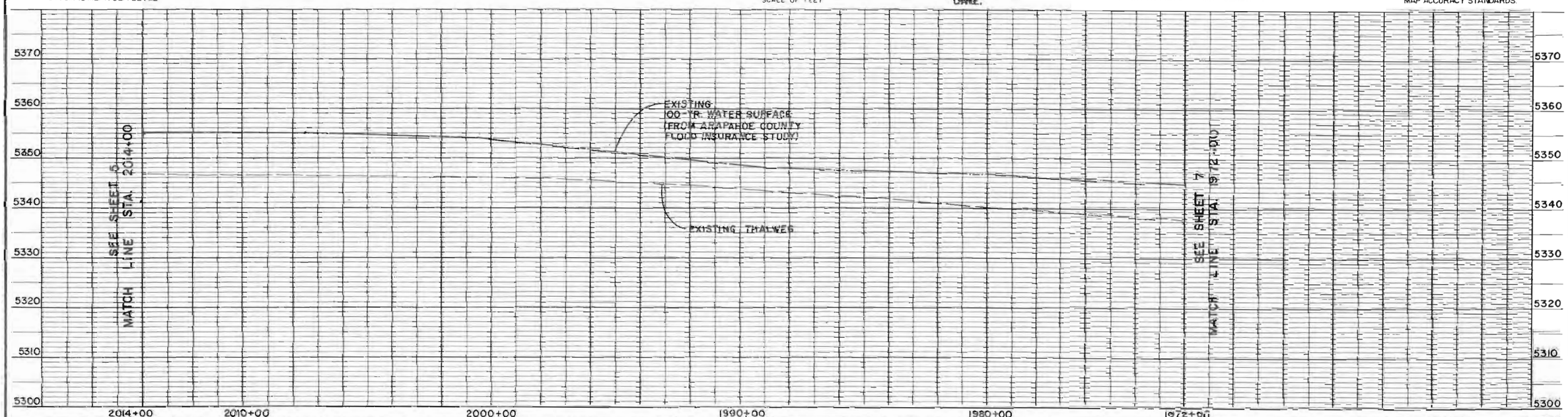


DATUM IS MEAN SEA LEVEL

200 0 200 400 600
SCALE OF FEET

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY: APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN PEM, EGJ DATE 5/85
CHECKED WCC, KEN DATE 5/85
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1972+00 TO STA. 2014+00

SHEET 6 OF 45

COMMENTARY
SHEET 7 OF 45
STATION 1916+00 TO 1972+00
REACH 1

The southern portion of the floodplain on this sheet consists of the South Platte Park (Littleton Floodplain Park). Further north the floodplain begins to encroach on the City of Columbine Valley. The river itself meanders considerably with several sharp bends. Lateral migration is evident in distances up to 800 feet. Bank erosion exists and in some places is severe.

The improvements proposed to the southern portion of this reach are limited to protection of bank from erosion. At Station 1940+00 the delineation between Reach 1 and Reach 2 exists. Reach 1 will be protected using primarily vegetation or riprap with vegetation in order to stabilize the channel banks. The northern portion of this sheet is located within Reach 2 and is the area of the Corps of Engineers proposed channel improvements. These improvements are being designed and constructed by the U.S. Army Corps of Engineers.

Bank protection provided in this study includes riprap with vegetation as shown on Detail B on Sheet 44 between Stations 1956+50 and 1972+00. This protection is located along the west channel bank as intended to protect the overbank gravel pit lake embankment from erosion. Between Stations 1940+00 and 1956+50 vegetation is proposed along portions of both banks in order to prevent erosion and meandering of the river. Only the portion of the banks exposed to less frequent floods will be protected solely by vegetation. The low flow channel will be protected with riprap.

In areas where there is no reduction in the floodplain limits, floodplain regulations should be enforced. This will insure that no imprudent development occurs in the 100-year floodplain. In areas where the floodplain

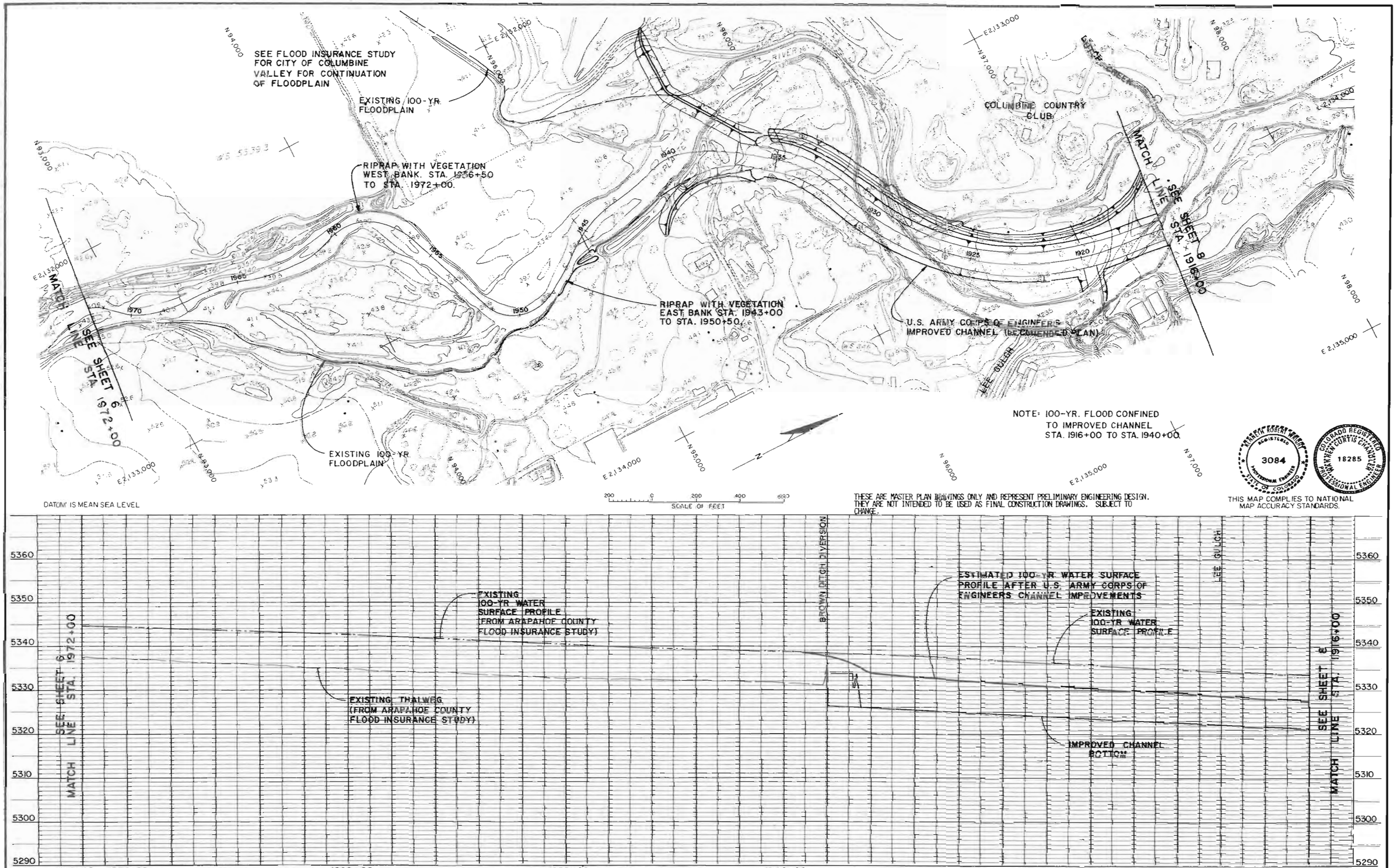
COMMENTARY
SHEET 7 OF 45
STATION 1916+00 TO 1972+00
REACH 1
(Continued)

will be reduced significantly, most specifically downstream of Station 1940+00, floodplain regulations should be superimposed on the recommended improvements. Prior to the construction of the recommended improvements, floodplain management practices should be in accord with the flood hazard identified for the existing channel conditions.

COST ESTIMATE
SHEET 7 OF 45
SOUTH PLATTE RIVER
STATION 1916+00 TO STATION 1972+00

CONSTRUCTION

Drainage improvement costs	$213,100
Street crossing costs	---
Utility relocation costs	---
Total construction costs	213,100
Engineering and contingencies (30% of total construction costs)	63,900
Property acquisition	---
TOTAL IMPROVEMENT COSTS	277,000
Operation and Maintenance	$13,320



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2645 SO. FEDERAL BLVD. SUITE 155
DENVER, COLORADO 80219
(303) 934-5300

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED NCC, MNG DATE 5/85
DRAWN AEM, EDZ DATE 5/85
CHECKED NCC, NRN DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1916+00 TO STA. 1972+00

SHEET 7 OF 45

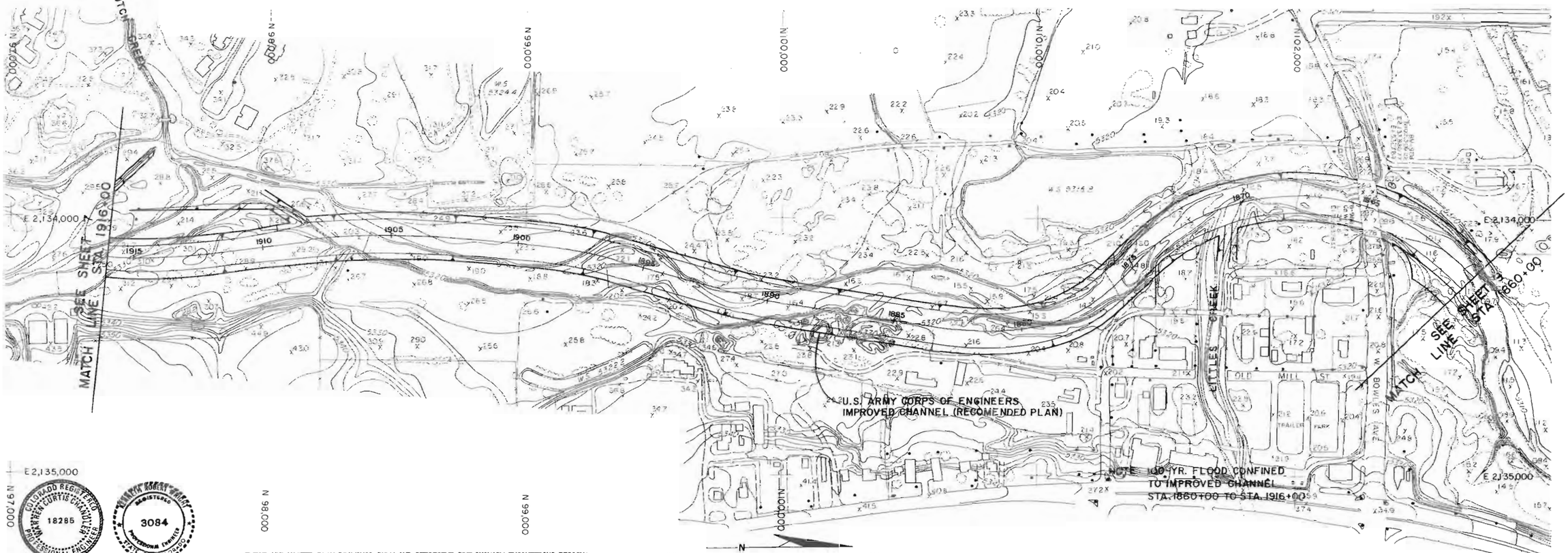
COMMENTARY
SHEET 8 OF 45
STATION 1860+00 TO 1916+00
REACH 2

The recommended plan is the U.S. Army Corps of Engineers channelization project which will provide channel stabilization and contain the 100-year flood within the improved channel.

COST ESTIMATE
SHEET 8 OF 45
SOUTH PLATTE RIVER
STATION 1860+00 TO STATION 1916+00

CONSTRUCTION

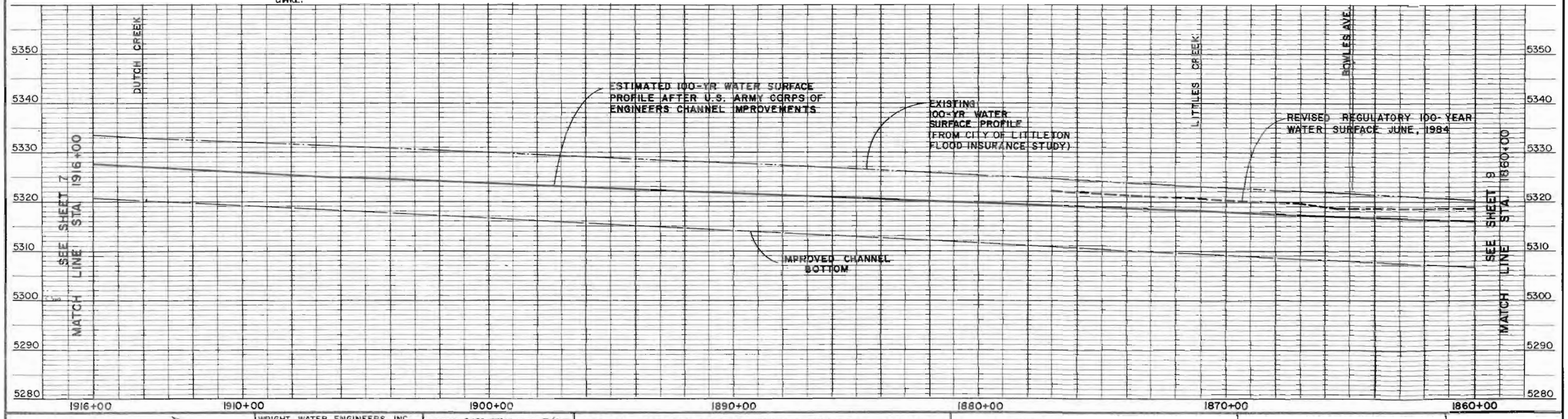
Drainage improvement costs	$ ---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	---
TOTAL IMPROVEMENT COSTS	---
Operation and Maintenance	$14,000



DATUM IS MEAN SEA LEVEL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL = 2 FEET

Delta Aerial Surveys, Inc.
2345 SO FEDERAL BLVD SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave, Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCG, JHH DATE 5/85
DRAWN JCM, EDH DATE 5/85
CHECKED WCG, JHH DATE 5/85
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1860+00 TO STA. 1916+00

SHEET 8 OF 45

COMMENTARY

SHEET 9 OF 45

STATION 1804+00 TO 1860+00

REACH 2

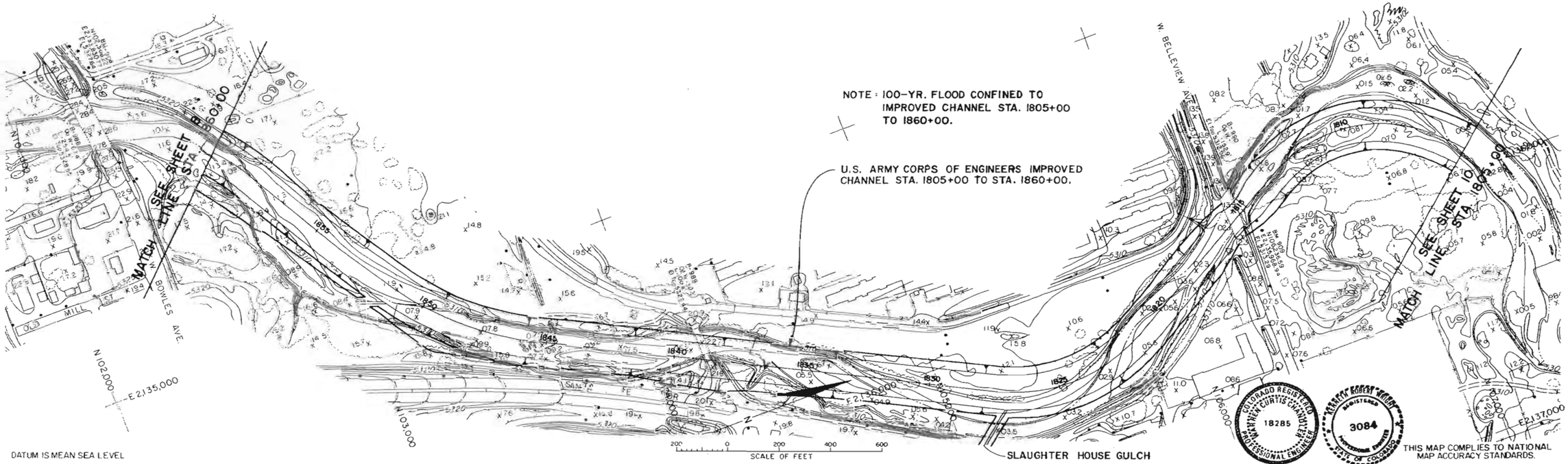
The recommended plan is the U.S. Army Corps of Engineers channelization project which will provide channel stabilization and contain the 100-year flood within the improved channel.

COST ESTIMATE
SHEET 9 OF 45
SOUTH PLATTE RIVER
STATION 1804+00 TO STATION 1860+00

CONSTRUCTION

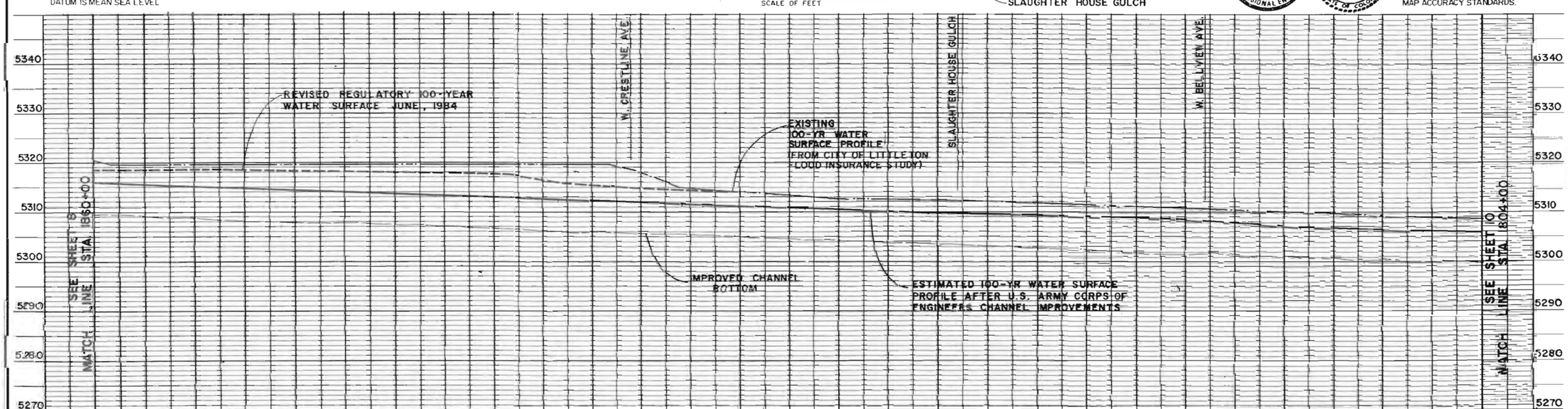
Drainage improvement costs	$ ---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	---
TOTAL IMPROVEMENT COSTS	---
Operation and Maintenance	$14,000

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.



DATUM IS MEAN SEA LEVEL

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY: APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN PEM, EOJ DATE 5/85
CHECKED WCC, MRN DATE 5/85
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1804+00 TO STA. 1860+00

SHEET 9 OF 45

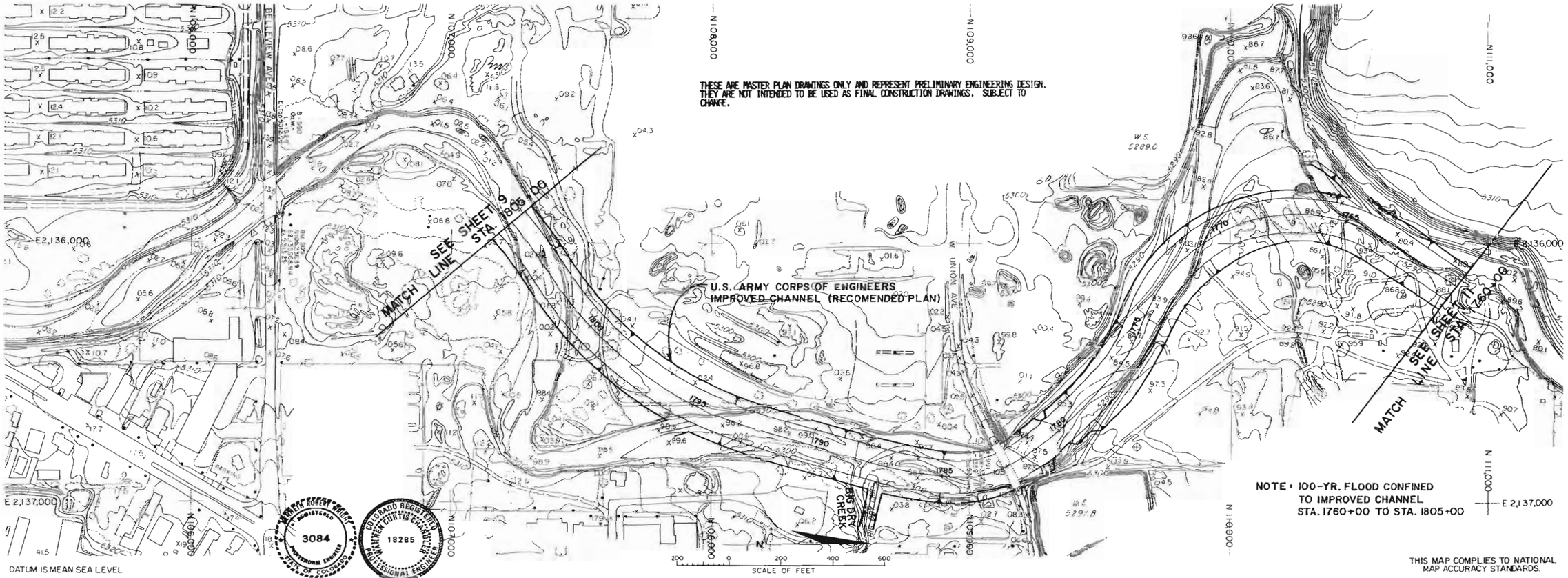
COMMENTARY
SHEET 10 OF 45
STATION 1760+00 TO 1804+00
REACH 2

The recommended plan is the U.S. Army Corps of Engineers channelization project which will provide channel stabilization and contain the 100-year flood within the improved channel.

COST ESTIMATE
SHEET 10 OF 45
SOUTH PLATTE RIVER
STATION 1760+00 TO STATION 1804+00

CONSTRUCTION

Drainage improvement costs	$ ---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	---
TOTAL IMPROVEMENT COSTS	---
Operation and Maintenance	$11,000



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MAG DATE 5/85
DRAWN JCM, EAG DATE 5/85
CHECKED WCC, MAG DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1760+00 TO STA. 1804+00

SHEET 10 OF 45

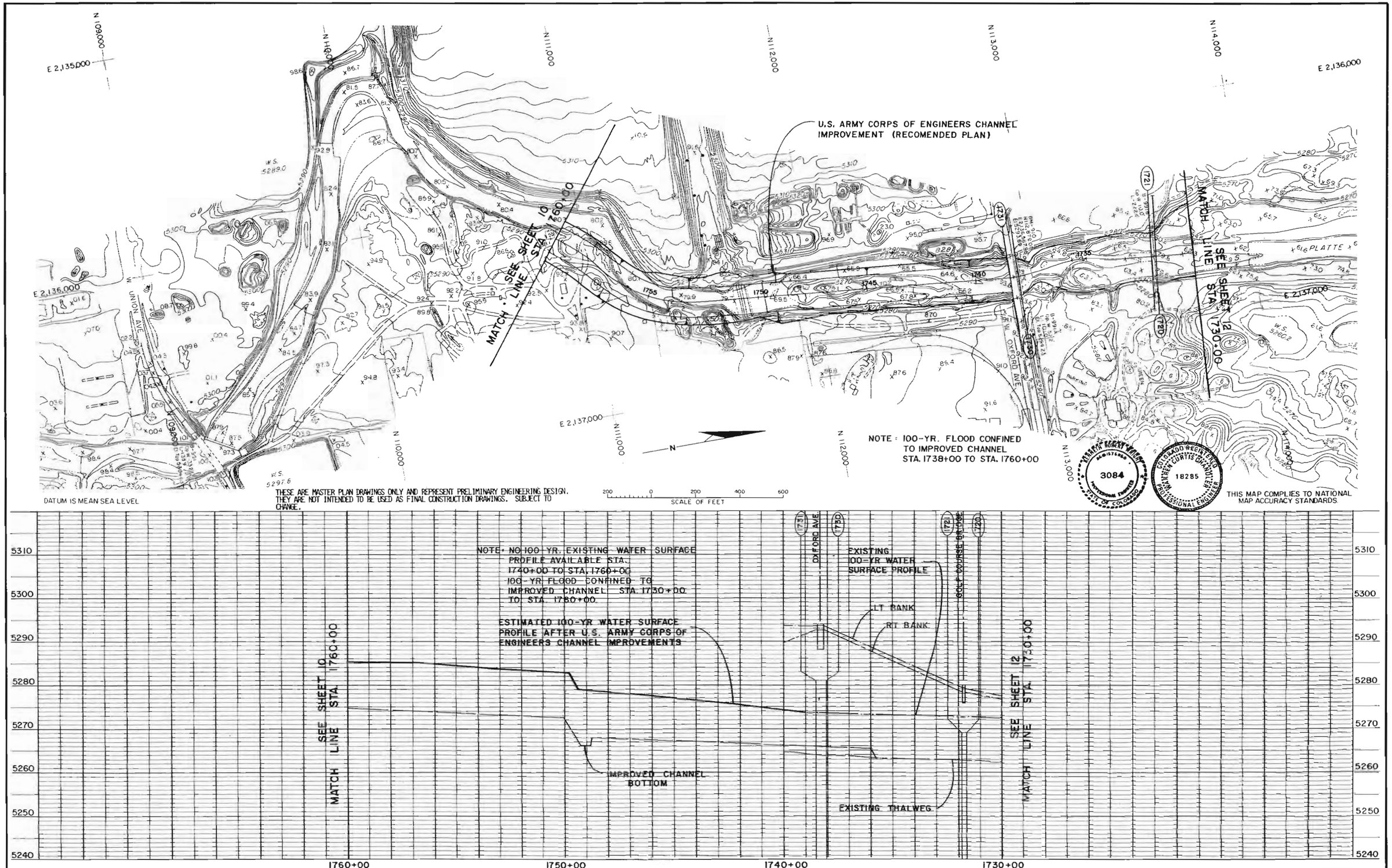
COMMENTARY
SHEET 11 OF 45
STATION 1730+00 TO 1760+00
REACH 2

The recommended plan is the U.S. Army Corps of Engineers channelization project which will provide channel stabilization and contain the 100-year flood within the improved channel.

COST ESTIMATE
SHEET 11 OF 45
SOUTH PLATTE RIVER
STATION 1730+00 TO STATION 1760+00

CONSTRUCTION

Drainage improvement costs	$ ---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	---
TOTAL IMPROVEMENT COSTS	---
Operation and Maintenance	$5,000



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983 TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL = 2 FEET	Delta Aerial Surveys, Inc. 2345 SO FEDERAL BLVD SUITE 195 DENVER, COLORADO 80219 (303) 934-5500	WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700 URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.	DESIGNED DATE 5/85 DRAWN DATE 5/85 CHECKED DATE 5/85 REVISED DATE	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER

PLAN AND PROFILE STA. 1730+00 TO STA. 1760+00

SHEET 11 OF 45

COMMENTARY
SHEET 12 OF 45
STATION 1686+00 TO STATION 1730+00
REACH 3

This reach includes a golf course and the confluence with Bear Creek on the left bank. The area on the left bank near the confluence with Bear Creek has been designated as a wildlife preserve and the channel on the right bank next to the golf course has retained its natural appearance. There are no flooding problems in this reach.

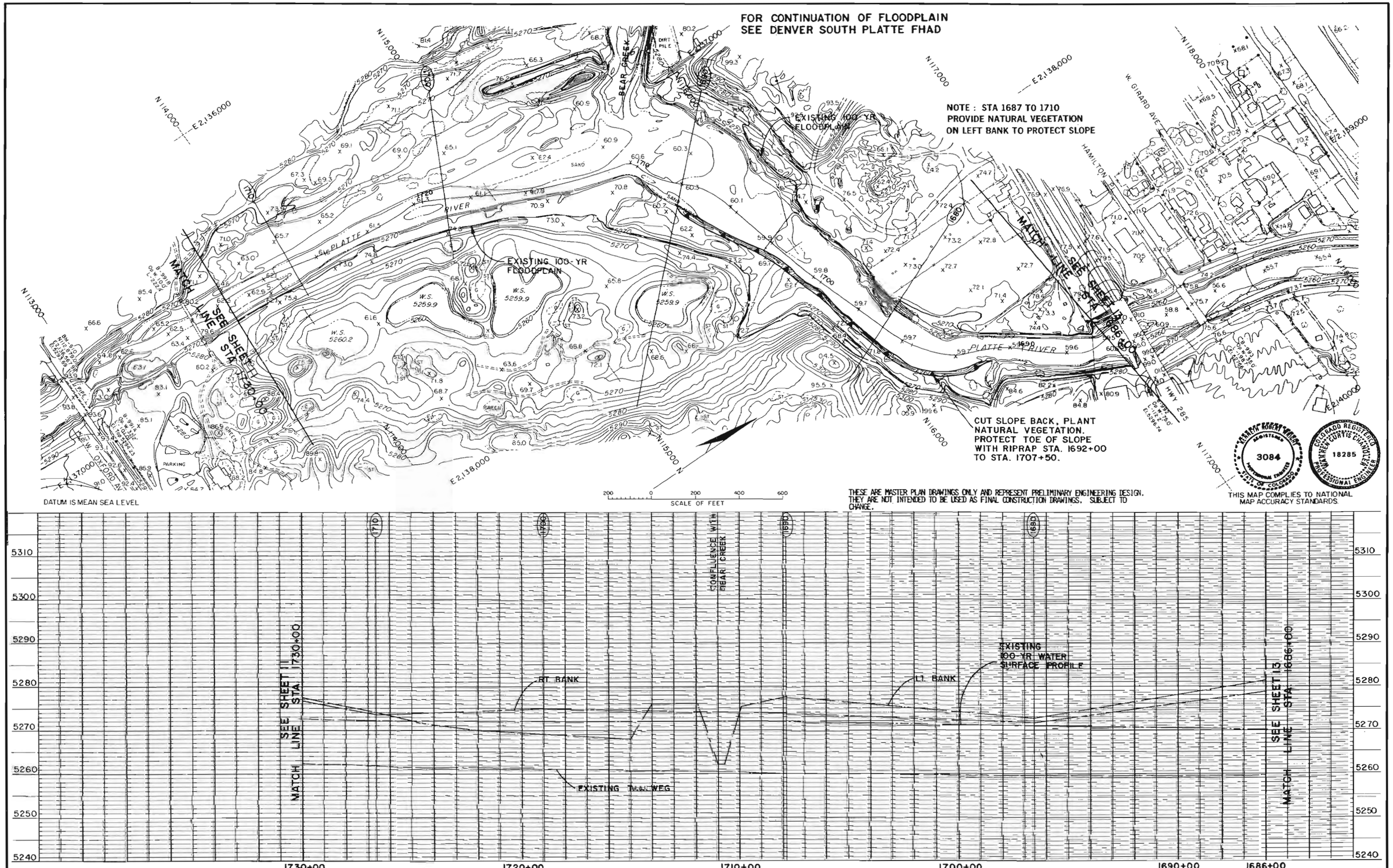
The recommended plan is to preserve the natural channel and prevent erosion damage. Between Stations 1692 and 1708 on the right bank the bank is being undercut. The recommendation is to cut back the slope to a more natural angle of repose and plant natural vegetation on the new slope. It may be necessary to place riprap at the toe of the slope to prevent further erosion. On the left bank between Stations 1687 and 1710 where the bank has been disturbed by construction it should be planted with natural vegetation. An existing jetty on the left bank at approximately Station 1696 should be preserved to provide erosion protection.

The floodplain management strategy for this reach is to preserve its open space character.

COST ESTIMATE
SHEET 12 OF 45
SOUTH PLATTE RIVER
STATION 1686+00 TO STATION 1730+00

CONSTRUCTION

Drainage improvement costs	$54,500
Street crossing costs	---
Utility relocation costs	---
Total construction costs	54,500
Engineering and contingencies (30% of total construction costs)	16,350
Property acquisition	
TOTAL IMPROVEMENT COSTS	$70,850
Operation and Maintenance	$6,130



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY: APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, WNG DATE 5/85
DRAWN PEM, FDM DATE 5/85
CHECKED WCC, KRN DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1686+00 TO STA. 1730+00

SHEET 12 OF 45

COMMENTARY
SHEET 13 OF 45
STATION 1632+00 TO STATION 1686+00
REACH 3

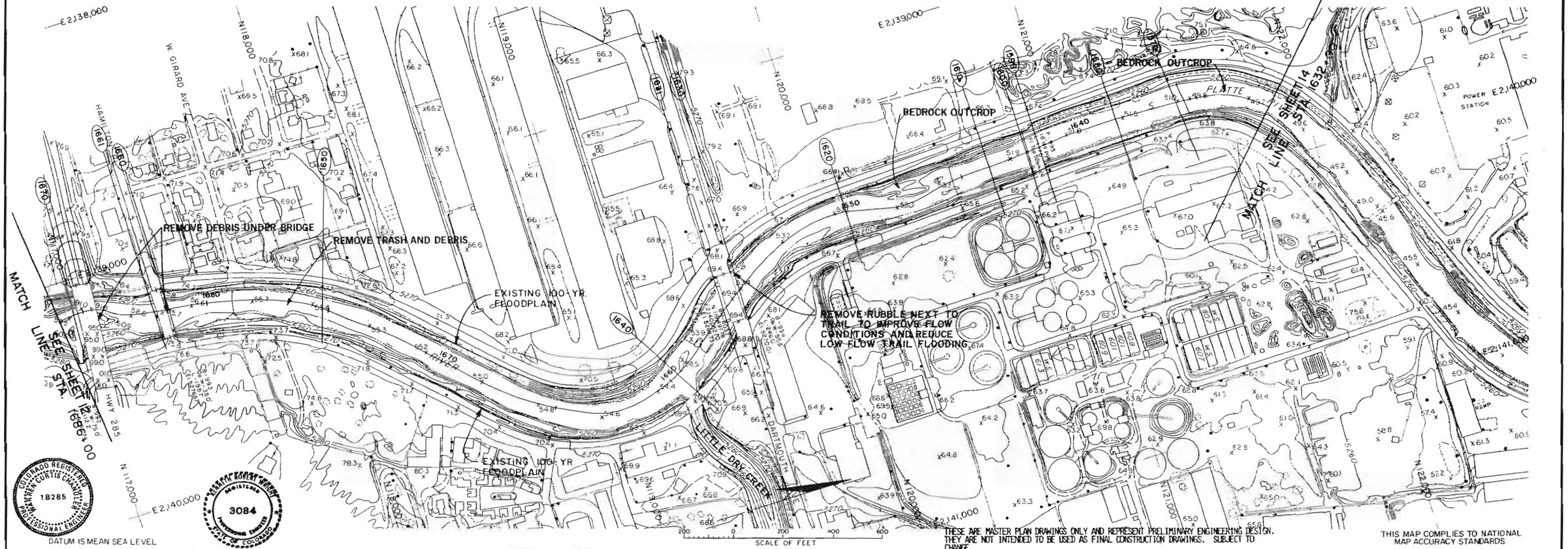
The land use on both sides of the river in this reach is primarily industrial, including the Littleton/Englewood sewage treatment plant on the right bank at approximately Station 1645. Little Dry Creek joins the South Platte River at Station 1616 on the right bank. There are no identified flooding problems in this reach.

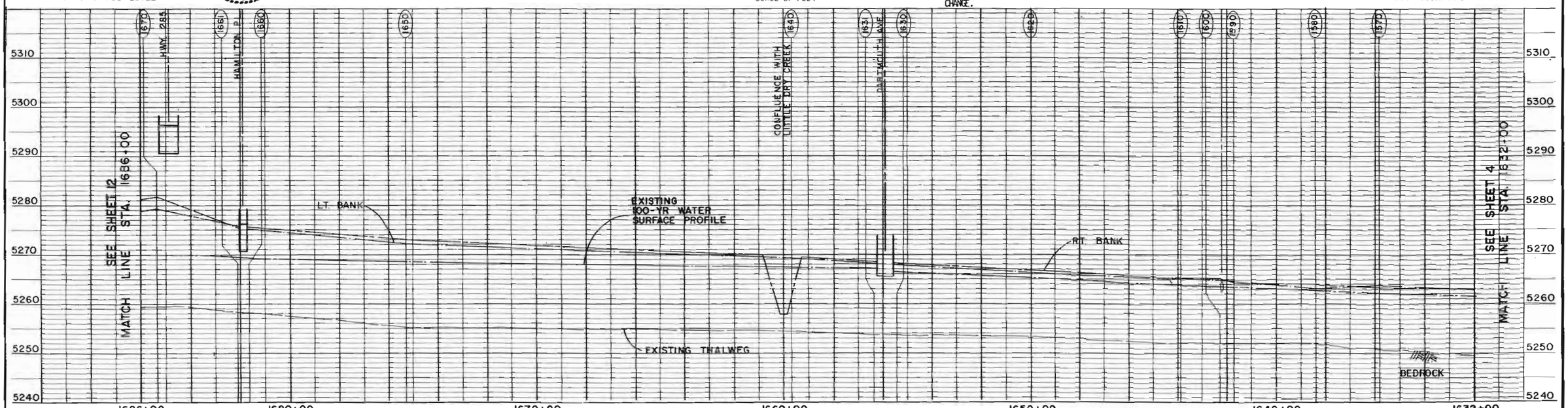
The recommended plan is to maintain the existing channel. Required improvements include removing the accumulated sediment and debris underneath the Highway 285 and Hamilton Place bridges between Stations 1680 and 1690 and removing the accumulation of trash and debris at approximately Station 1678.

COST ESTIMATE
SHEET 13 OF 45
SOUTH PLATTE RIVER
STATION 1632+00 TO STATION 1686+00

CONSTRUCTION

Drainage improvement costs	$11,333
Street crossing costs	---
Utility relocation costs	---
Total construction costs	11,333
Engineering and contingencies (30% of total construction costs)	3,440
Property acquisition	
TOTAL IMPROVEMENT COSTS	$14,733
Operation and Maintenance	$7,820





GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY: APRIL 16, 1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 SO. FEDERAL BLVD SUITE 195 DENVER, COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL: 2 FEET

WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, WWG DATE 5/85
DRAWN CM, CAD DATE 5/85
CHECKED WCC, WW DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1632+00 TO STA. 1686+00

SHEET 13 OF 45

COMMENTARY
SHEET 14 OF 45
STATION 1572 TO STATION 1632
REACH 4

This reach includes a Public Service Company generating plant as well as commerical, industrial, and residential land uses. There is a flood area of approximately 75 acres on the left bank caused by inadequate capacity downstream of Evans Avenue and the Evans Avenue bridge.

The recommended plan in this reach is limited structural improvements. These include lowering the channel bottom by approximately 2 feet from Stations 1572 to 1,598. It may be necessary to use heavy equipment to scrape the bedrock in order to lower the channel. From Station 1572 to Station 1576 the left bank should be moved to within 10 feet of the road and replaced by a vertical wall along the road 20 feet high and a bench 50 feet wide at about the 2-year flood level which would increase channel capacity and provide wildlife habitat. The Evans Avenue bridge should be improved by constructing an additional 30-foot bay on the left side of the bridge. On the right side of the bridge the existing trail should be moved adjacent to the right abutment and the material between the trail and the river replaced by a vertical retaining wall. Between Stations 1586 and 1593 the right bank should be moved back and covered with grass. Between Station 1613 and 1620 the rubble and concrete on the right bank being used for erosion protection shuld be replaced by riprap. The Public Service Company diversion dam at approximately Station 1626 should be repaired and a boat chute added.

The first priority in this reach is the channel lowering between Stations 1572 and 1598. The next priority is the construction of the vertical wall

COMMENTARY
SHEET 14 OF 45
STATION 1572 TO STATION 1632
REACH 4
(Continued)

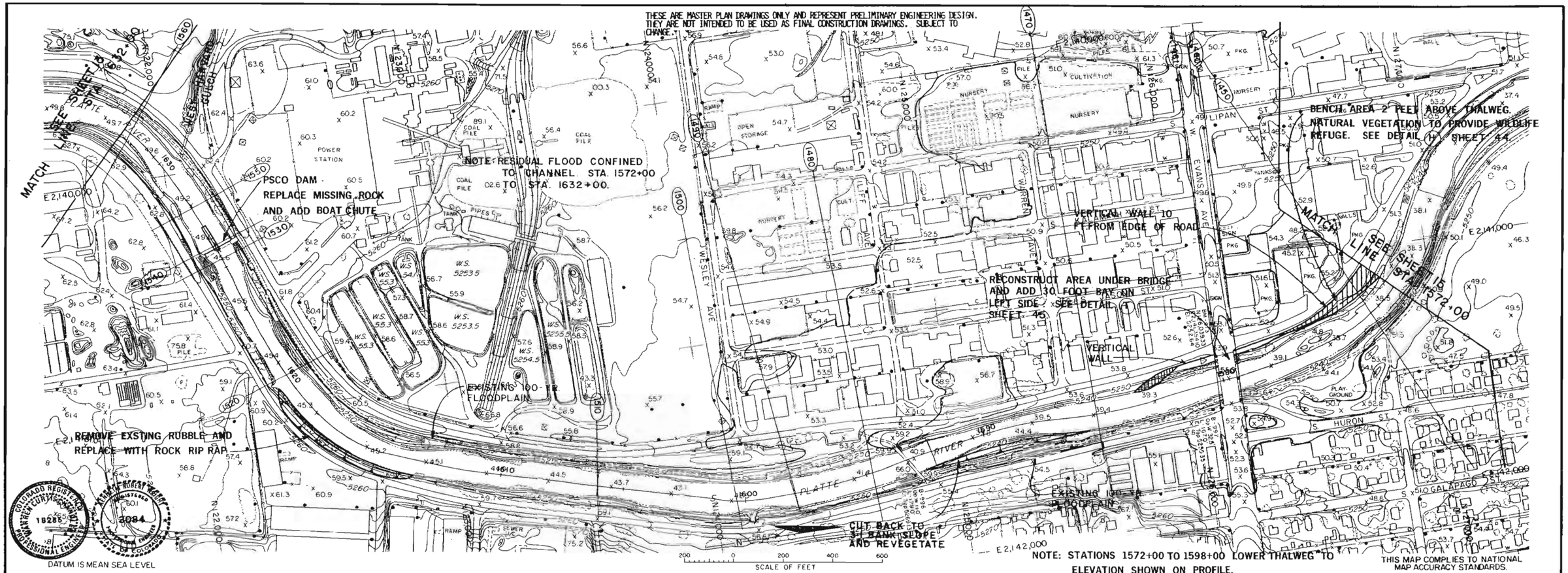
and bench from Station 1572 to 1576. Finally, the improvements to the Evans Avenue bridge should be made, including the addition of the bay on the left side. The additional recommended improvements could be implemented whenever funds or the opportunity exist.

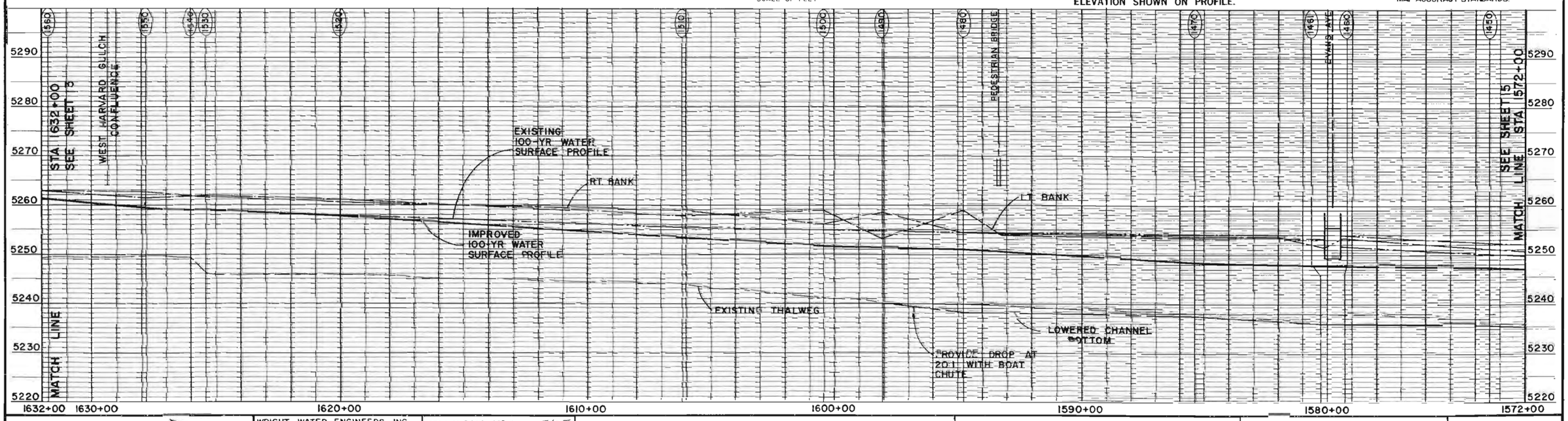
The floodplain management approach in this reach is to enforce floodplain management regulations in the identified flood area and encourage the purchase of flood insurance until the improvements recommended can be implemented.

COST ESTIMATE
SHEET 14 OF 45
SOUTH PLATTE RIVER
STATION 1572+00 TO STATION 1632+00

CONSTRUCTION

Drainage improvement costs	$603,421
Street crossing costs	252,200
Utility relocation costs	---
Total construction costs	855,621
Engineering and contingencies (30% of total construction costs)	256,686
Property acquisition	
TOTAL IMPROVEMENT COSTS	$1,112,307
Operation and Maintenance	$14,597





GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MDG DATE 5/85
DRAWN PEM, FDZ DATE 5/85
CHECKED WCC, RRD DATE 5/85
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1572+00 TO STA. 1632+00

SHEET 14 OF 45

COMMENTARY
SHEET 15 OF 45
STATIONS 1512+00 TO STATION 1572+00
REACH 4

This reach includes the Overland Park Golf Course on the right bank. There are no identified flood problems in this reach and other than a small area on the left bank which receives water from the overflow upstream of Evans Avenue.

The recommended plan in this reach is limited structural improvements which will provide a lower 100-year water surface elevation downstream of the Evans Avenue bridge. These limited structural improvements in conjunction with the Evans Avenue bridge improvements on Sheet 14 will eliminate the flooding on the left bank upstream of Evans Avenue. The left bank between Sanderson Gulch and Florida Avenue should be cut back to within 10 feet of the road. At the Florida Avenue bridge the existing trail should be moved closer to the right abutment and the material between the existing trail and the river replaced by a vertical retaining wall. The Florida Avenue dam, 300 feet upstream of the Florida Avenue bridge, should be removed and the channel widened on the right bank 100 feet upstream and downstream of the dam. The Florida Avenue dam is used by the Denver Parks Department to provide water for the Overland Park Golf Course and could be replaced by a wellfield in the general vicinity, or by pumping from the two lakes which are on the right bank of the South Platte River immediately downstream of Florida Avenue. In order to pump from these lakes, a diversion structure would be constructed upstream of the existing Florida Avenue dam. The right bank between Stations 1556 and 1568 should be moved back toward the golf course 50 feet. An abandoned sewer line crossing at Station 1563 should be removed. The left bank between Station 1567 and 1572 should be cut back to within 10 feet of the road and replaced by a vertical wall and bench. The bench should be at approximately the 2-year flood elevation. This bench and wall tie into the bench and wall which are downstream of the Evans Avenue bridge on Sheet 14.

The removal of the Florida Avenue dam will result in a lowering of the channel bottom in this reach. The occasional outcrops of bedrock may have to be loosened by heavy equipment and removed to allow this deepening process to occur. However, it is anticipated that the majority of the channel lowering could be accomplished through natural processes rather than through actual excavation and removal. As the channel lowers it will be necessary to provide bank protection as shown in Detail B, Sheet 44.

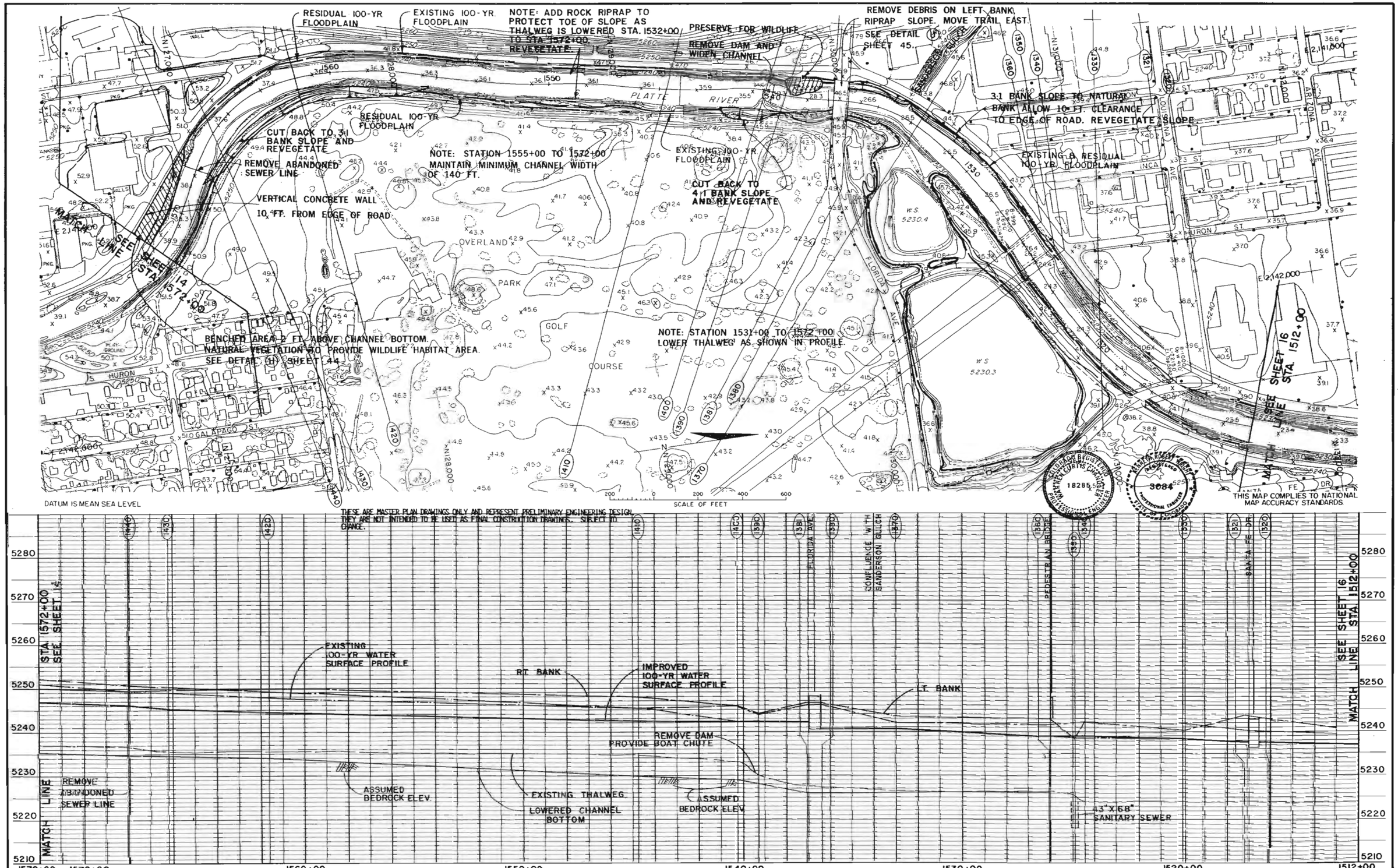
The first priority for structural improvements in this reach is the removal of the Florida Avenue dam in order to achieve the channel lowering upstream necessary to provide capacity under the Evans Avenue bridge. Cutting back the right bank next to the Overland Park Golf Course and the construction of the wall and bench area on the left bank will tie into improvements made on Sheet 14.

The floodplain management strategy in this reach is to encourage purchase of flood insurance and enforce floodplain management regulations.

COST ESTIMATE
SHEET 15 OF 45
SOUTH PLATTE RIVER
STATION 1512+00 TO STATION 1572+00

CONSTRUCTION

Drainage improvement costs	$849,633
Street crossing costs	15,773
Utility relocation costs	---
Total construction costs	865,406
Engineering and contingencies (30% of total construction costs)	259,622
Property acquisition	7,200
TOTAL IMPROVEMENT COSTS	$1,132,228
Operation and Maintenance	$16,863



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO FEDERAL BLVD SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN PEM, EQK DATE 5/85
CHECKED WCC, MKN DATE 5/85
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

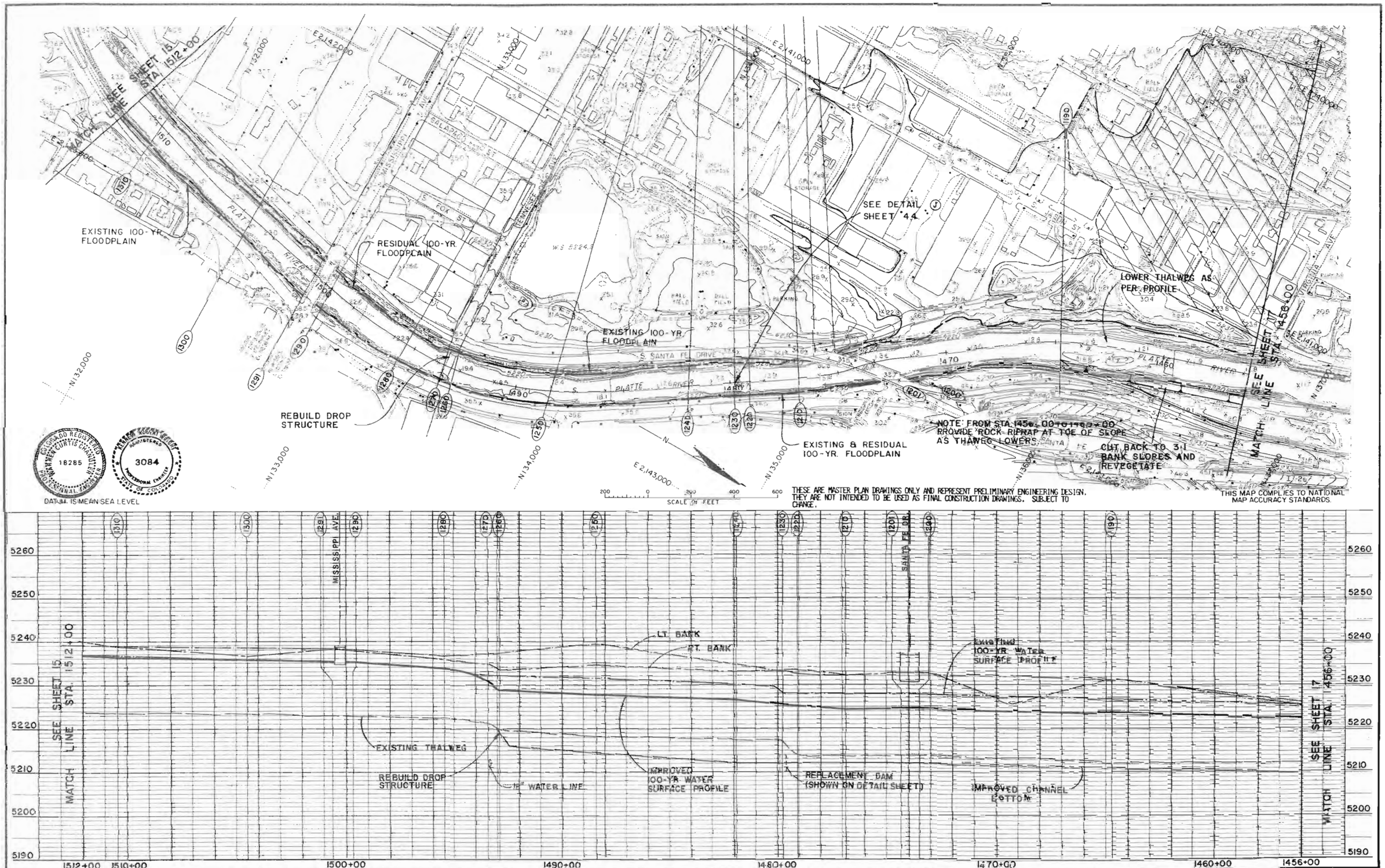
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1512+00 TO STA. 1572+00

SHEET 15 OF 45



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY: APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, WWC DATE 5/85
DRAWN PEM, FDR DATE 5/85
CHECKED WCC, DEN DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1456+00 TO STA. 1512+00

SHEET 16 OF 45

COMMENTARY
SHEET 17 OF 45
STATIONS 1402+00 TO STATION 1456+00
REACH 4

The South Platte River in this reach flows through a residential and industrial area with no flooding problems.

The recommended plan is limited structural improvements which would lower the water surface elevation and prevent overbank flooding on the left bank at Station 1470 on Sheet 16. The recommended improvements include lowering the weir located 100 feet downstream of the Alameda Avenue bridge and adding a boat chute. This weir was constructed to protect the foundation of the Alameda bridge and now presents an obstruction to flood flows. In order to provide protection to the Alameda Avenue bridge foundations, the channel should be excavated approximately 3 feet and grouted riprap placed on the lowered bottom between the weir structure and the bridge. It is expected that lowering the Alameda Avenue weir and the channel under the Alameda Avenue bridge will result in a lowering of the channel upstream. In addition to lowering the channel bottom, the recommended plan is to widen the channel to 150 feet and cut back the right bank between the Alameda Avenue bridge and Station 1456. In order to provide protection against erosion rock riprap should be provided at the toes of the slopes on both banks as the river degrades, as shown on Detail B, Sheet 44.

The first priority for improvements on this sheet is the lowering of the Alameda Avenue weir and installation of the boat chute. In order to protect the Alameda Avenue bridge it will be necessary to simultaneously excavate the channel and install grouted riprap. Widening the channel and cutting back the slopes can be implemented at a later date.

The floodplain management strategy for this reach is to enforcement of floodplain management regulations.

COST ESTIMATE
SHEET 17 OF 45
SOUTH PLATTE RIVER
STATION 1402+00 TO STATION 1456+00

CONSTRUCTION

Drainage improvement costs	$225,208
Street crossing costs	3,375
Utility relocation costs	---
Total construction costs	228,583
Engineering and contingencies (30% of total construction costs)	68,575
Property acquisition	210,000
TOTAL IMPROVEMENT COSTS	$507,158
Operation and Maintenance	$9,760

NOTE:
PROVIDE ROCK RIPRAP AT TOE OF SLOPE FROM STATION 1440+00 TO STATION 1456+00 AS THALWEG LOWERS.

WIDEN CHANNEL TO 150 FEET. LOWER CHANNEL BOTTOM TO ELEVATION SHOWN ON PROFILE. SEE DETAIL (E) & (F) ON SHEET 44.

RESIDUAL 100-YR FLOODPLAIN

ALAMEDA BRIDGE IMPROVE DRAINAGE FOR MAINTENANCE TRAIL REMOVE ROCK AND REPLACE WITH LOW CONCRETE WALL SEE DETAIL (R) SHEET 44.

CUT BACK TO 3:1 BANK SLOPES AND REVEGETATE

HIGHWAY DEPARTMENT DAM: REMOVE 3' FROM EXISTING SHEET PILES PROVIDE BOAT CHUTE 20' WIDE WITH SIGNAL ROCKS.

EXISTING 100 YR. FLOODPLAIN

MATCH LINE SEE SHEET 16 STA. 1456+00

MATCH LINE SEE SHEET 18 STA. 1402+00

CUT BACK TO 3:1 BANK SLOPES AND REVEGETATE

RESIDUAL 100-YR FLOODPLAIN

EXISTING 100-YR. FLOODPLAIN

PLATTE RIVER

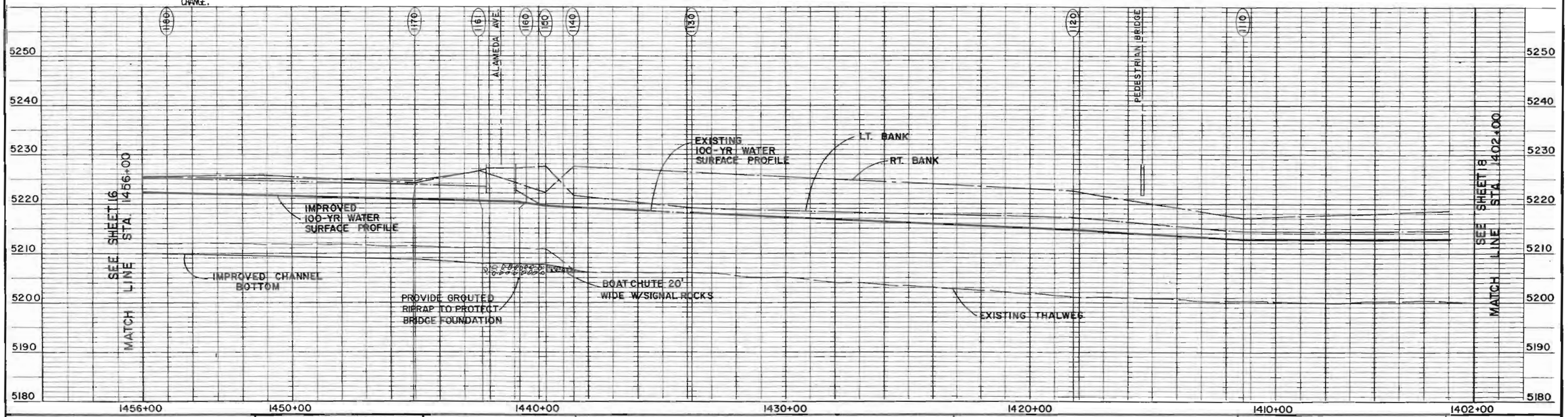
N

DATUM IS MEAN SEA LEVEL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

200 0 200 400 600
SCALE OF FEET

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL = 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED RCC, JWG DATE 5/85
DRAWN BCW, RDK DATE 5/85
CHECKED RCC, JWG DATE 5/85
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1402+00 TO STA. 1456+00

SHEET 17 OF 45

COMMENTARY
SHEET 18 OF 45
STATIONS 1347+00 TO STATION 1402+00
REACH 4

The river flows parallel to Interstate 25. The development on both banks of the river is primarily industrial. The 100-year floodplain includes 90 acres on the left bank between 6th Avenue and 3rd Avenue, 33 acres between 6th Avenue and the confluence of Weir Gulch on the left bank, and 11 acres on the right bank at 8th Avenue. In many locations the overbank areas are lower than the existing 100-year flood elevation, but are not flooded because of levees along the river.

The recommended plan for this reach is limited structural improvements including lowering the channel bottom by excavation from Station 1347 to the base of the 3rd Avenue dam at Station 1390. Lowering the channel bottom in this reach will require modifications to bridges at 8th Avenue, 6th Avenue, and the railroad at 3rd Avenue to accommodate the deeper channel. The channel should be widened to provide a minimum width of 120 feet through this reach. In order to maintain a stable slope, it will probably be necessary to provide rock drop structures which would be designed to provide riffles for fish and wildlife. To provide a wider channel, the existing pedestrian trail underneath 8th Avenue on the left bank should be moved next to the left abutment and set on a vertical retaining wall, and the pedestrian bridge upstream of 8th Avenue should be modified with a left span 20 feet wider. At the 6th Avenue bridge, the trail should also be moved adjacent to the right abutment and placed on top of a retaining wall. Two areas on the right bank should be benched to provide additional flow capacity and to provide a pocket park setting between Station 1347 and 1355 and upstream of 6th Avenue between Stations 1371 and 1376. The toes of the existing slopes should be protected using rock riprap. These improvements will permit the 100-year flood to be lowered sufficiently to allow some freeboard below the natural banks since much of the area on the left and

COMMENTARY
SHEET 18 OF 45
STATIONS 1347+00 TO STATION 1402+00
REACH 4
(Continued)

right banks through this reach is below the river banks. In addition, the abandoned 3rd Avenue bridge should be removed since it is impacted by the 100-year flood and could serve as a debris catcher.

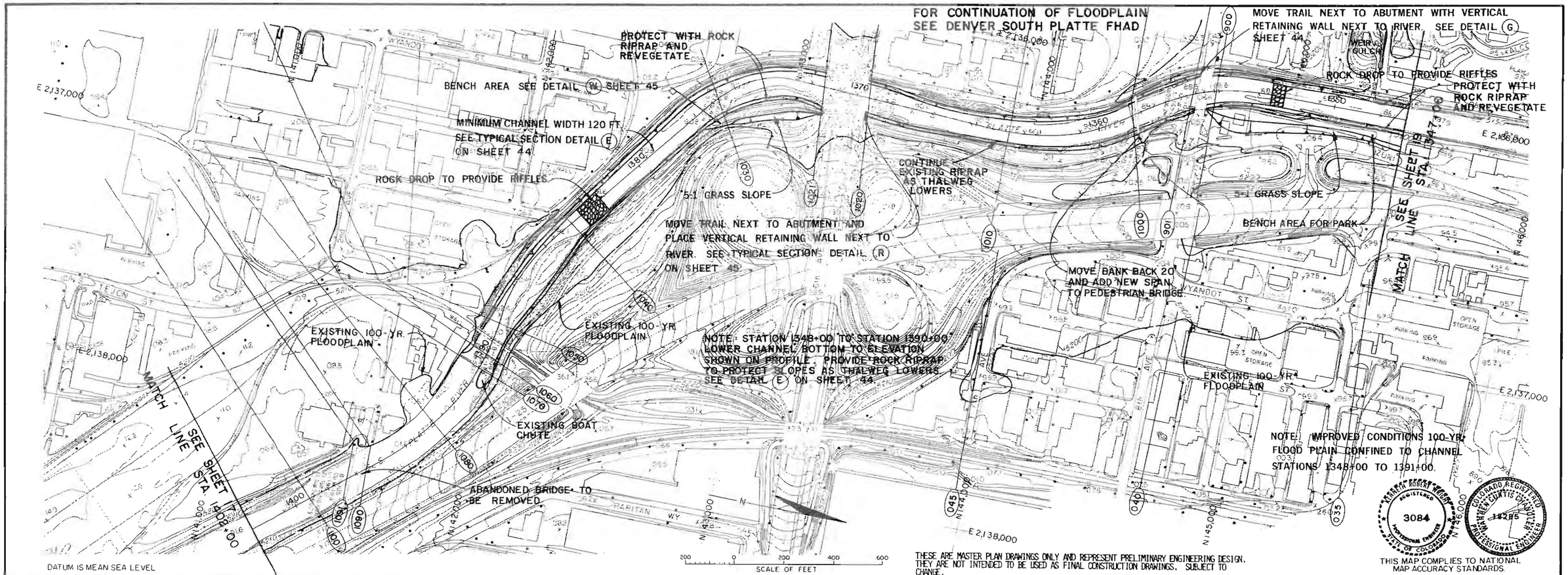
In this reach the channel lowering and deepening should receive first priority for implementation. All improvements in this reach should be tied closely to improvements carried out on Sheet 19 downstream.

The floodplain management strategy in this reach is to encourage purchase of flood insurance for those structures in the identified floodplain, and enforce floodplain management regulations.

COST ESTIMATE
SHEET 18 OF 45
SOUTH PLATTE RIVER
STATION 1347+00 TO STATION 1402+00

CONSTRUCTION

Drainage improvement costs	$1,392,778
Street crossing costs	289,556
Utility relocation costs	---
Total construction costs	1,682,334
Engineering and contingencies (30% of total construction costs)	504,700
Property acquisition	270,000
TOTAL IMPROVEMENT COSTS	$2,457,034
Operation and Maintenance	$21,970



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN PEM, EDD DATE 5/85
CHECKED WCC, KRW DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1347+00 TO STA. 1402+00

SHEET 18 OF 45

COMMENTARY
SHEET 19 OF 45
STATIONS 1292+00 TO STATION 1347+00
REACHES 4 AND 5

The overbanks in this reach include residential, commercial and industrial areas. A total area of 145 acres are in the 100-year floodplain. The Interstate 25 embankment serves as a barrier against flooding to the east except for areas at 13th Avenue, the railroad underpass 200 feet north of 13th Avenue, and at Colfax Avenue where breaks in the embankment allow flood waters to flow east and north and return to the South Platte River in the area between the Interstate 25 crossing of the River and the Speer Boulevard bridge.

The recommended plan for this reach is limited structural improvements. Between Station 1292 and the Interstate 25 bridge, the right bank should be benched 150 feet from the existing bank and include natural vegetation. The Interstate 25 bridge will be improved by removing the riprap protecting the abutments and replacing it with vertical retaining walls. The pedestrian bridge immediately upstream of the Interstate 25 bridge should be lengthened, or relocated. At Station 1314 an abutment from the old Colfax viaduct should be removed and the bank moved back to provide additional flow capacity. Underneath the 14th Avenue bridge the riprap protecting the right abutment should be removed and replaced with a vertical retaining wall, and the trail on the left bank relocated to be adjacent to the left abutment. The existing storm sewer, which has an outfall adjacent to the trail at the 14th Avenue bridge would be placed in a pipe underneath the trail. Between the Colfax viaduct and Station 1326 the right bank should be cut to within 15 feet of the railroad tracks. In order to maintain a minimum bottom width of 100 feet, the left bank between 14th Avenue and the Zuni Power Plant dam at Station 1326 should be cut back within 15 feet of the railroad on the left bank. Between Station 1326 and 1339 the left bank should be replaced with a vertical wall and the existing trail cantilevered from it or placed on a retaining wall. From Station 1337 to 1344 the right bank should be replaced by a vertical retaining wall. From Station 1344 to 1347 the right bank should be cut to form a bench approximately 100 feet wide. From Station 1292 to 1347 the channel bottom should be lowered by 4 feet requiring the relocation of an 18-inch sanitary sewer at Station 1298, a 48-inch water line at Station 1339, and the capping of a 54-inch water line at Station 1337. Once the channel is lowered, the toes of all slopes should be protected with riprap as shown in Detail B, Sheet 44. Lowering the channel bottom will require the replacement of the Public Service Company's collapsible diversion dam at Station 1326. The replacement structure should be 6 feet lower, and incorporate two sections; one with a boat chute, and a larger one without. An alternative to lowering this dam at its present location would be to relocate it upstream which would permit relocation of the maintenance trail under the 13th Avenue bridge.

The first priority in this reach is lowering the channel bottom and improving the conditions at Interstate 25 and the adjacent pedestrian bridge. Lowering the channel bottom should proceed upstream to at least the Public Service Company dam, in order to reduce the amount of water flowing east underneath Interstate 25. The recommendations from Station 1326 to Station 1347 should be accomplished after those downstream improvements.

The floodplain management strategy for this reach includes encouraging the purchase of flood insurance and enforcement of floodplain management regulations.

COST ESTIMATE
SHEET 19 OF 45
SOUTH PLATTE RIVER
STATION 1292+00 TO STATION 1347+00

CONSTRUCTION

Drainage improvement costs	$3,003,754
Street crossing costs	1,078,802
Utility relocation costs	555,167
Total construction costs	4,637,723
Engineering and contingencies (30% of total construction costs)	1,391,317
Property acquisition	225,000
TOTAL IMPROVEMENT COSTS	$6,254,040
Operation and Maintenance	$38,454

NOTE: IMPROVED CONDITIONS 100-YEAR FLOODPLAIN CONFINED TO CHANNEL STATIONS 1292+00 TO 1347+00.

FOR CONTINUATION OF FLOODPLAIN SEE DENVER SOUTH PLATTE FHAD

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

MINIMUM BOTTOM WIDTH 100 FT. SEE TYPICAL DETAIL (E) SHEET 44.

PUBLIC SERVICE CO. COLLAPSIBLE DAM TO BE LOWERED 6 FT.

115 KV UNDERGROUND TRANSMISSION LINE

13000 VOLT UNDERGROUND ELECTRICAL LINE

CANTILEVER TRAIL STA 1328+00 TO STA 1329+00

STATION 1330+00 TO 1340+00 BUILD RETAINING WALL ADJACENT TO RAILROAD AND PLACE TRAIL ON VERTICAL WALL SEE DETAIL (L) SHEET 44.

ROCK RIPRAP

MAINTAIN EXISTING TRAIL & BANK

BUILD VERTICAL RETAINING WALL

BENCH AREA AT 10-YEAR FLOOD ELEV.

5:1 GRASS SLOPE

DATUM IS MEAN SEA LEVEL

48" WATER LINE DWB NO. 12, 2ND EXT TO BE LOWERED

54" WATER LINE DWB NO. 18 TO BE CAPPED

CUT BACK TO 3:1 BANK SLOPE AND REVEGETATE

VERTICAL WALL

ROCK RIPRAP TOE PROTECTION

CUT BACK TO 3:1 BANK SLOPE AND REVEGETATE

REMOVE ROCK AND REPLACE WITH VERTICAL ABUTMENT SEE DETAIL (R) SHEET 45

EXISTING 100-YR FLOODPLAIN

RELOCATE TRAIL TO BENCH ON SLOPE

MOVE TRAIL CLOSER TO ABUTMENT AND PLACE SEWER OVERFLOW IN PIPE SEE TYPICAL SECTION (R) ON DETAIL SHEET 45

NOTE STATION 1302+00 TO STA. 1347+00 LOWER CHANNEL BOTTOM TO ELEVATION SHOWN ON PROFILE. PROVIDE ROCK RIPRAP FOR BANK PROTECTION AS THALWEG IS LOWERED AND REVEGETATE WITH RIPARIAN VEGETATION

ROCK RIPRAP TOE PROTECTION

REMOVE ABANDONED ABUTMENT AND MOVE BANK BACK 20 FT.

MOVE PEDESTRIAN BRIDGE ABUTMENT BACK 20 FT AND REPLACE RIGHT BRIDGE SPAN OR RELOCATE BRIDGE

3:1 GRASS SLOPE TOP OF SLOPE 15 FT FROM RAILROAD

EXISTING 100-YR FLOODPLAIN

REMOVE RIP RAP AND REPLACE WITH VERTICAL WALLS ALONG BRIDGE ABUTMENT SEE DETAIL (R) SHEET 45.

MOVE TRAIL ADJACENT TO RAILROAD AND PLACE VERTICAL WALL NEXT TO RIVER. SEE DETAIL (R) SHEET 45.

ROCK RIPRAP

BENCH WITH NATURAL VEGETATION

18" SAN. SEWER TO BE RELOCATED

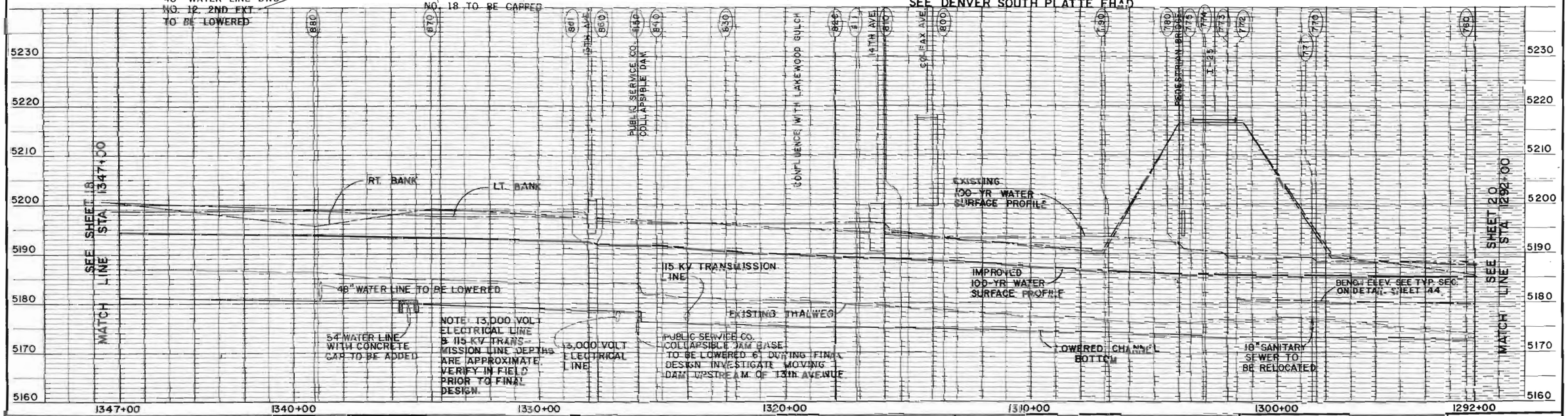
5:1 GRASS SLOPE

NOTE STATION 1292+00 TO STA. 1302+00 LOWER CHANNEL BOTTOM TO ELEVATION SHOWN ON PROFILE. SEE SECTION (K) DETAIL SHEET 44

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.

FOR CONTINUATION OF FLOODPLAIN SEE DENVER SOUTH PLATTE FHAD

SCALE OF FEET



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16,1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 SO. FEDERAL BLVD. SUITE 195 DENVER, COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL 2 FEET

WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave. Suite 55-A Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.

DESIGNED WWC, RRHG DATE 5/85
DRAWN RRM, CMC DATE 5/85
CHECKED WWC, DRH DATE 5/85
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE STA 1292+00 TO STA. 1347+00

SHEET 19 OF 45

COMMENTARY
SHEET 20 OF 45
STATIONS 1232+00 TO STATION 1292+00
REACHES 5 AND 6

This reach includes rail yards and industrial properties. Flood problems in this reach are confined mainly to the right overbank area between Interstate 25 and Speer Boulevard, an area of approximately 200 acres, which receives flooding from direct overflow from the South Platte River and from water which flows underneath Interstate 25 starting at 13th Avenue. This reach also includes Confluence Park and Shoemaker Plaza, a popular location for outdoor events.

The recommended plan for this reach is limited structural improvements. Between 16th Street and 15th Street on the right bank a bench area should be removed. The Farmers and Gardners diversion structure should be relocated upstream 800 feet and the existing dam replaced with a low dam 3 feet high and a modified boat chute. Both dams should be designed to provide the sound of falling water to muffle the sounds of traffic on Speer Boulevard during events at Confluence Park. Upstream of the lowered confluence dam the channel bottom would be lowered 5 feet underneath Speer Boulevard and the right bank underneath Speer Boulevard placed on a steeper landscaped slope. The relocated Farmers and Garnder's diversion dam will be at Station 1262 with a crest length of 820 feet including the boat chute. This boat chute will tie into the modified boat chute at the lowered confluence dam providing a total boat chute length of nearly 1,000 feet. From Station 1262 to Station 1292 the left bank should remain undisturbed. The right bank should be benched 150 feet from the existing bank. The bench elevation on the right bank should be 2 feet above the crest of the relocated dam to provide direct access to the river. A low area of 18 acres will remain below the 100-year flood elevation with the implementation of this plan which would have to be filled to two feet above the 100-year flood elevation before development should occur. Fill material may not be taken from the improved river channel. In those areas where the recommended plan calls for the channel to be lowered, the toes of the slopes should be protected with riprap. In order to accommodate the lowered channel a 16-inch water line at Station 1274 would be relocated or lowered.

The first priority in this reach is to relocate the Farmers and Gardner's diversion dam. Following that it would be necessary to lower the existing dam and remove the material from the channel between the existing dam and the relocated dam. The next priority is to remove the bench area between 15th Street and 16th Street. The recommended improvements on this sheet will, however, be of limited value until the improvements on Sheet 19 from Station 1292 to 13th Avenue are completed.

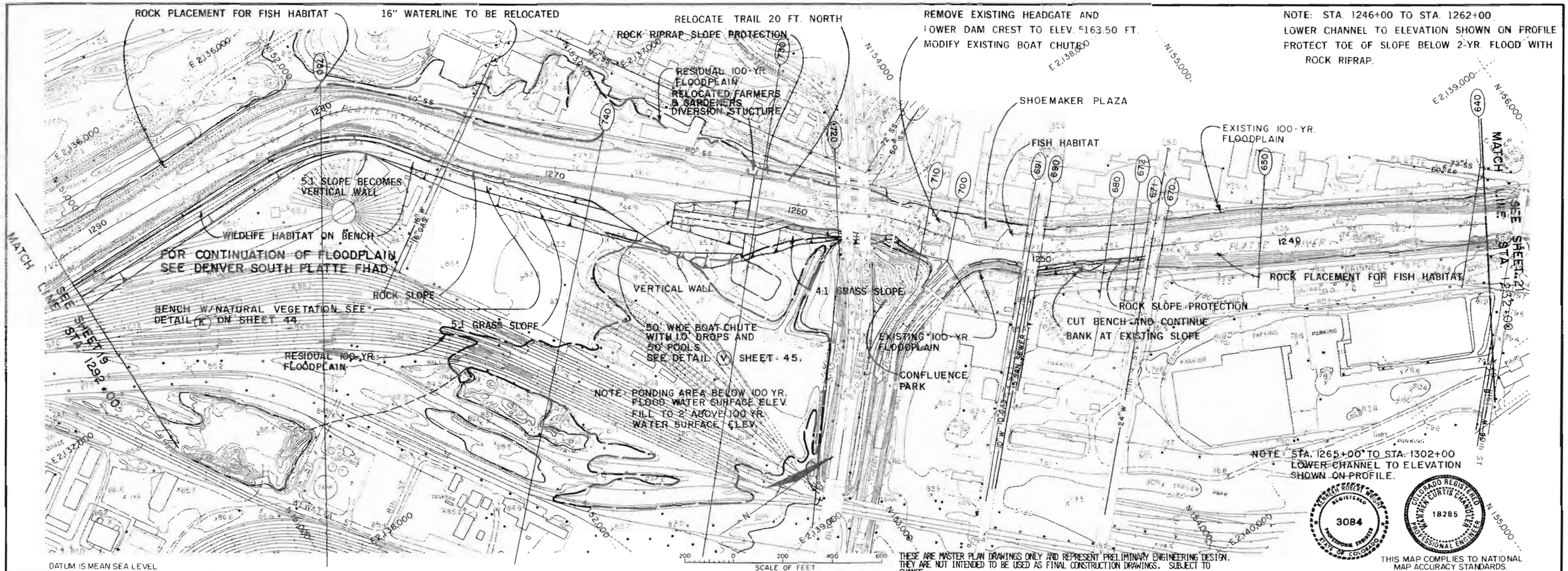
The dam lowering and construction of the new dam upstream of Speer Boulevard has significant ramifications for both flood control and recreational activities. Design is a major undertaking which will require adequate public review and comment. Landscape design is of great significance of the final project suitability. Hydraulic modelling is recommended for the dam and boat chute. A scale model should be constructed and approved by the Greenway Foundation and the Denver Parks Department.

The floodplain management strategy for this reach is to require enforcement of floodplain management regulations.

COST ESTIMATE
SHEET 20 OF 45
SOUTH PLATTE RIVER
STATION 1232+00 TO STATION 1292+00

CONSTRUCTION

Drainage improvement costs	$2,517,444
Street crossing costs	35,000
Utility relocation costs	350,667
Total construction costs	2,903,111
Engineering and contingencies (30% of total construction costs)	870,933
Property acquisition	750,000
TOTAL IMPROVEMENT COSTS	$4,524,044
Operation and Maintenance	$35,282



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, TEAG DATE 5/85
DRAWN PEM, EAG DATE 5/85
CHECKED WCC, REW DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1232+00 TO STA. 1292+00

SHEET 20 OF 45

COMMENTARY
SHEET 21 OF 45
STATION 1175+00 TO 1232+00
REACH 6

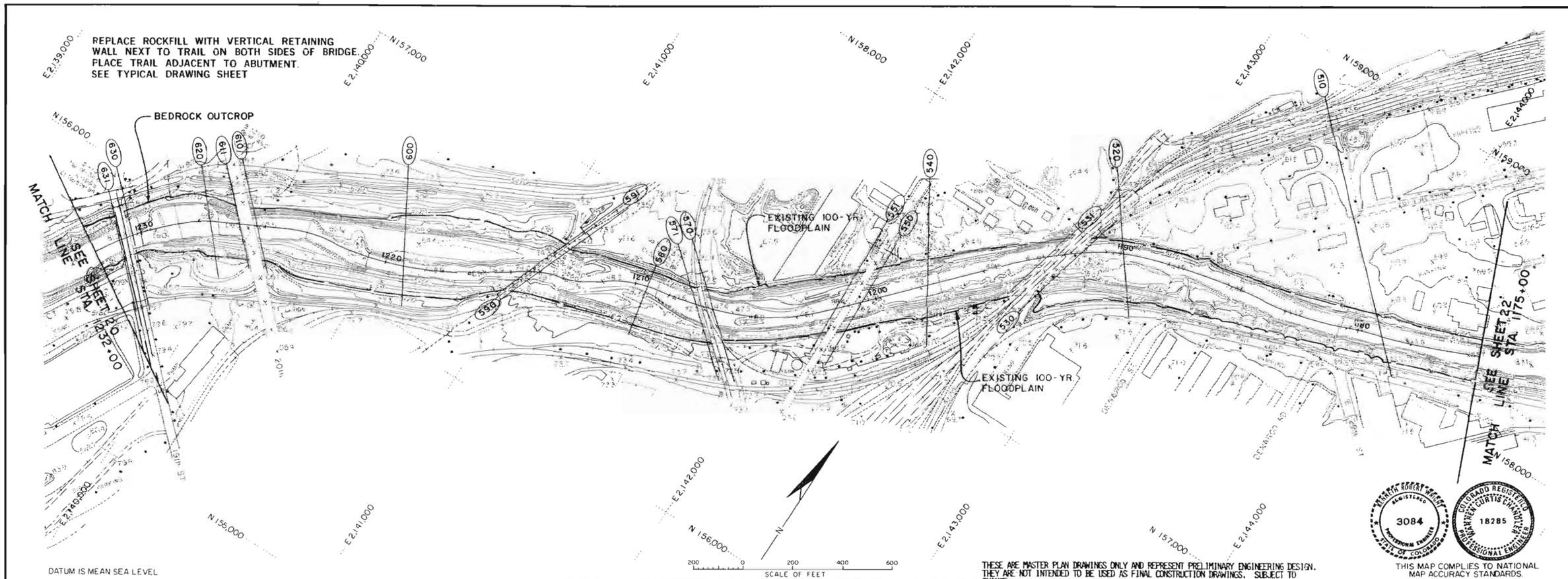
This reach of river is primarily industrial and there are no areas where the 100-year flood is outside the existing banks.

The recommended plan in this reach is limited structural improvements, primarily to provide lower backwater elevations for the Confluence Park area. The recommended improvement is to remove the material on the left bank underneath the 19th Street bridge and replace it with a vertical abutment.

COST ESTIMATE
SHEET 21 OF 45
SOUTH PLATTE RIVER
STATION 1175+00 TO STATION 1232+00

CONSTRUCTION

Drainage improvement costs	$ ---
Street crossing costs	67,185
Utility relocation costs	---
Total construction costs	67,185
Engineering and contingencies (30% of total construction costs)	20,155
Property acquisition	
TOTAL IMPROVEMENT COSTS	$87,341
Operation and Maintenance	$8,800



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MKW DATE 5/85
DRAWN PEM, CAR DATE 5/85
CHECKED WCC, MKW DATE 5/85
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1175+00 TO STA. 1232+00

SHEET 21 OF 45

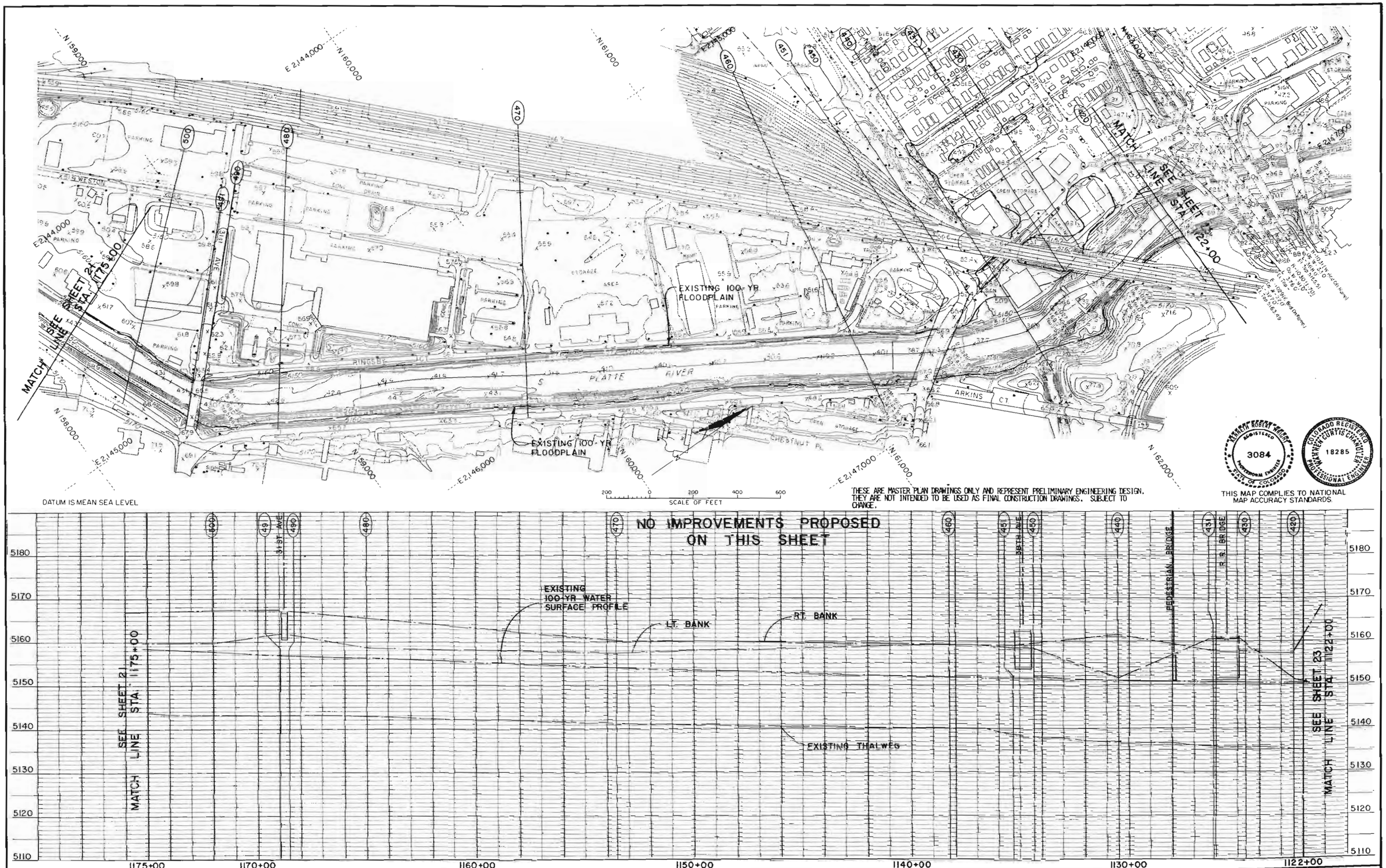
COMMENTARY
SHEET 22 OF 45
STATIONS 1122+00 TO 1175+00
REACH 6

There are no identified flood problems in this reach.

COST ESTIMATE
SHEET 22 OF 45
SOUTH PLATTE RIVER
STATION 1122+00 TO STATION 1175+00

CONSTRUCTION

Drainage improvement costs	---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	
TOTAL IMPROVEMENT COSTS	No Improvements
Operation and Maintenance	$8,030



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, WWG DATE 5/85
DRAWN PEM, PAL DATE 5/85
CHECKED WCC, WRW DATE 5/85
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1122+00 TO STA. 1175+00

SHEET 22 OF 45

COMMENTARY
SHEET 23 OF 45
STATION 1064+00 TO 1122+00
REACH 6

This reach includes residential and industrial development. There are 150 acres of floodplain on the left bank.

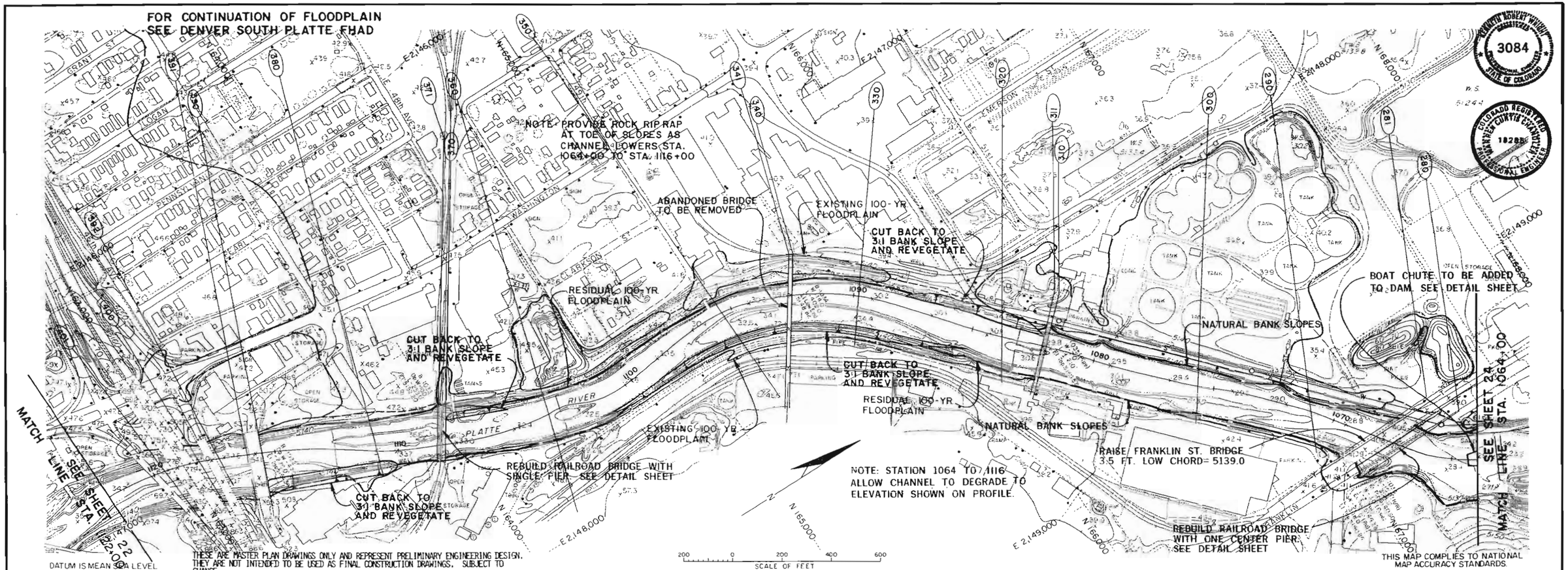
The Franklin Street bridge is overtopped by the 100-year flood. The recommended plan is limited structural improvements including raising the low chord of the Franklin Street bridge by 3.5 feet and rebuilding the railroad bridge using one center pier instead of a trestle. The railroad bridge top elevation would not be changed. Raising the Franklin Street bridge will require the approaches to be regraded for 60 feet. Other recommended bridge improvements in this reach include removal of the abandoned cattle bridge at Station 1092 and rebuilding the trestle railroad bridge at Station 1108 with a single pier bridge. The channel should be lowered in this reach by an average of 3 feet. Some of this lowering will occur as the result of the recommended modifications to the Burlington Dam on Sheet 24 including the construction of sand flushing gates, but from Station 1074 to 1116 the channel should be excavated. As the channel is excavated or lowered, the toes of all slopes should be protected with rock riprap. The channel should be widened on the left bank between Stations 1082 and 1088 and on the right bank between Station 1085 and 1101, and 1110 and 1115. Lowering the 100-year floodplain in this reach by approximately 4 feet would remove the flood potential from the left overbank and provide adequate freeboard below the natural levees.

The floodplain management strategy for this reach is to encourage purchase of flood insurance and enfocement of floodplain management regulations.

COST ESTIMATE
SHEET 23 OF 45
SOUTH PLATTE RIVER
STATION 1064+00 TO STATION 1122+00

CONSTRUCTION

Drainage improvement costs	$254,670
Street crossing costs	2,550,062
Utility relocation costs	---
Total construction costs	2,804,732
Engineering and contingencies (30% of total construction costs)	841,420
Property acquisition	17,000
TOTAL IMPROVEMENT COSTS	$3,663,152
Operation and Maintenance	$11,220



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave, Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN CC, MB, CAR DATE 5/85
CHECKED WCC, MRW DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1064+00 TO STA. 1122+00

SHEET 23 OF 45

COMMENTARY
SHEET 24 OF 45
STATIONS 1005+00 TO STATION 1064+00
REACH 7

This reach is primarily industrial with large parcels of undeveloped land. An area of 200 acres on the left bank is in the existing floodplain, and is lower than the natural levees.

The recommended plan for this reach is limited structural improvements including rebuilding the railroad bridge located 400 feet downstream of York Street to eliminate the trestles, lowering the drop structure 100 feet upstream of York Street by 5 feet, and installing a boat chute. Lowering of this structure is limited by the 60-inch Denver Water Board line which crosses 200 feet upstream. This drop also serves as a diversion for the Gardners Ditch which would be relocated to Station 1057. A diversion structure should be built which will also protect a sewer line crossing at Station 1057. The new structure should be 2 feet high. A boat chute should be added to the Burlington Diversion Dam at Station 1063 which would be 150 feet long. The boat chute would be 90 feet wide at its narrowest point. Between Station 1014 and the York street drop structure at Station 1022, the channel bottom should be lowered 3 feet requiring the York Street bridge to be modified and rock riprap provided at the toes of all slopes. Lowering the York Street drop structure by 5 feet will result in a general lowering of the channel between Station 1022 and the new Gardners diversion structure at Station 1057. As the channel bottom degrades, riprap would be required at the toes of the slopes. Between Station 1005 and 1012, the channel should be lowered approximately 2 feet as the result of removal of the dam downstream on Sheet 25. The channel should be widened between Station 1005 and 1006, Stations 1018 and 1028, 1040 and 1052, and 1053 and 1064 where slopes should be reduced and planted with grass or natural vegetation.

COMMENTARY
SHEET 24 OF 45
STATIONS 1005+00 TO STATION 1064+00
REACH 7
(Continued)

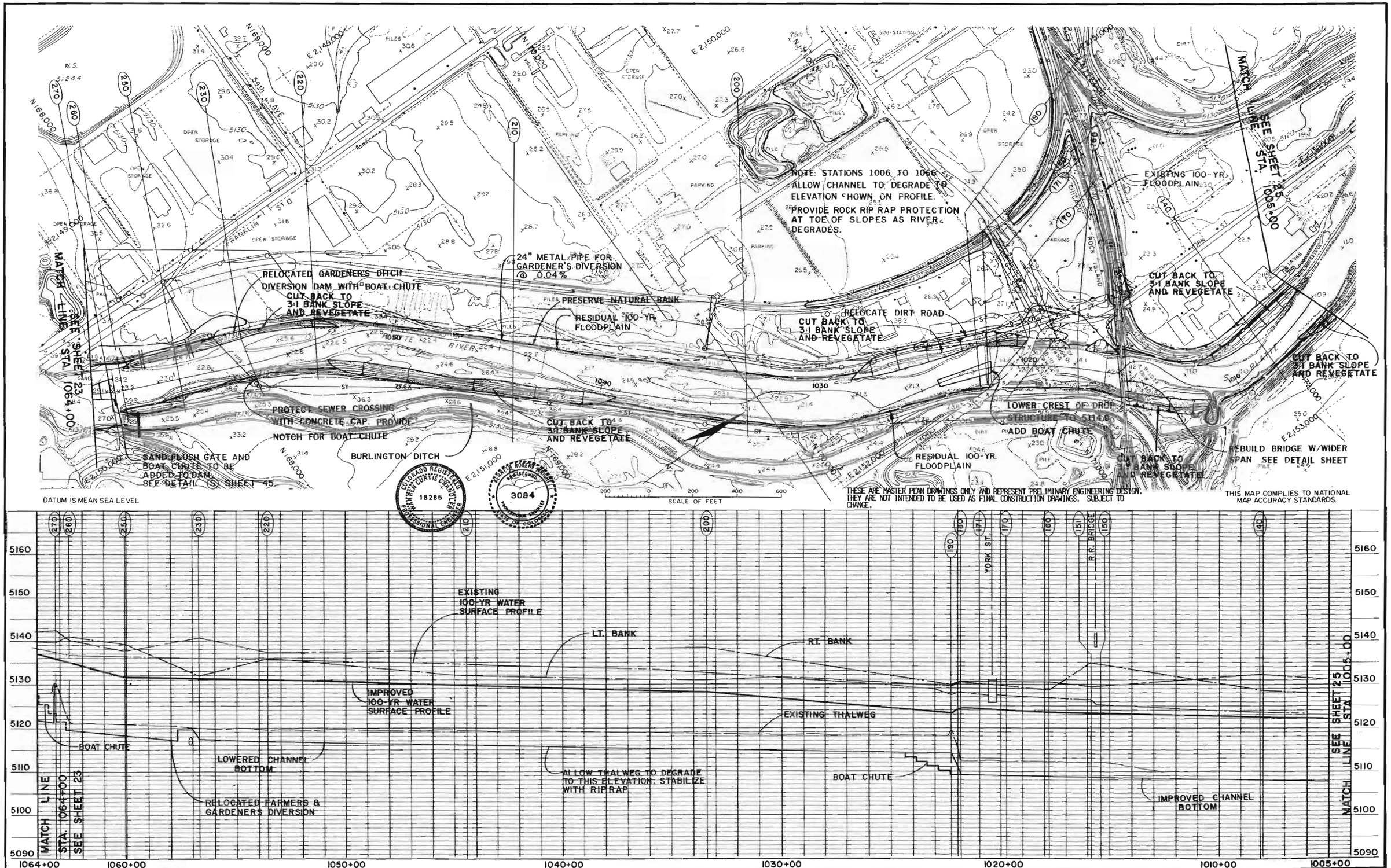
The first priority on this reach is the improvement to the Burlington Dam including addition of a boat chute. This will work in conjunction with the improvements to the Franklin Street bridge and adjacent railroad bridge on Sheet 23 to eliminate flooding upstream. The next priority is to lower the York Street drop structure and the relocate the Gardners diversion. Following that the channel widening and the rebuilding of the railroad bridge downstream of York Street should be implemented.

The floodplain management strategy for this reach is to encourage purchase of flood insurance and to enforce floodplain management regulations on the large areas where there is currently no development.

COST ESTIMATE
SHEET 24 OF 45
SOUTH PLATTE RIVER
STATION 1005+00 TO STATION 1064+00

CONSTRUCTION

Drainage improvement costs	$1,254,090
Street crossing costs	1,000,000
Utility relocation costs	859,500
Total construction costs	2,254,090
Engineering and contingencies (30% of total construction costs)	676,227
Property acquisition	45,000
TOTAL IMPROVEMENT COSTS	$2,975,317
Operation and Maintenance	$22,145



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY: APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN PEM, EDK DATE 5/85
CHECKED WCC, MEW DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 1005+00 TO STA. 1064+00

SHEET 24 OF 45

COMMENTARY
SHEET 25 OF 45
STATIONS 960+00 TO 1005+00
REACH 7

This reach is primarily industrial consisting of a Public Service Company generating plant on the left bank and the Metro Sewage Treatment plant on the right bank. The floodplain in this reach is confined to the channel, however, many areas on both banks are behind berms and are lower than the 100-year flood elevation.

The recommended plan for this reach is limited structural improvements including removal of an unused dam at Station 996 which would allow the channel to naturally erode about 2 feet between Station 996 and 1005. As the channel erodes it would be necessary to place riprap at the toes of the slope for erosion protection. In addition, the channel should be widened from Station 999 to 1005 by cutting back the right bank.

COST ESTIMATE
SHEET 25 OF 45
SOUTH PLATTE RIVER
STATION 960+00 TO STATION 1005+00

CONSTRUCTION

Drainage improvement costs	$157,840
Street crossing costs	---
Utility relocation costs	---
Total construction costs	157,840
Engineering and contingencies (30% of total construction costs)	47,352
Property acquisition	17,000
TOTAL IMPROVEMENT COSTS	$222,192
Operation and Maintenance	$7,820

EXISTING & RESIDUAL 100-YR. FLOODPLAIN

NATURAL BANK SLOPES

RESIDUAL 100-YR. FLOODPLAIN

DAM TO BE REMOVED

CUT BACK TO 3:1 BANK SLOPE AND REVEGETATE

PROVIDE ROCK RIPRAP AT TOE OF SLOPE

NATURAL BANK SLOPES

NOTE: STATIONS 980+00 TO 1005+00 LOWER CHANNEL BOTTOM TO ELEV SHOWN ON PROFILE

10" WATER LINE
90" SEWER LINE
TWIN 8" SLUDGE LINE
24" GAS LINE

CUT BACK TO 3:1 BANK SLOPE AND REVEGETATE

EXISTING 100-YR. FLOODPLAIN

EXISTING 100-YR. FLOODPLAIN

PLATTE RIVER

SAND CREEK

MATCH LINE SEE SHEET 24 STA. 1005+00

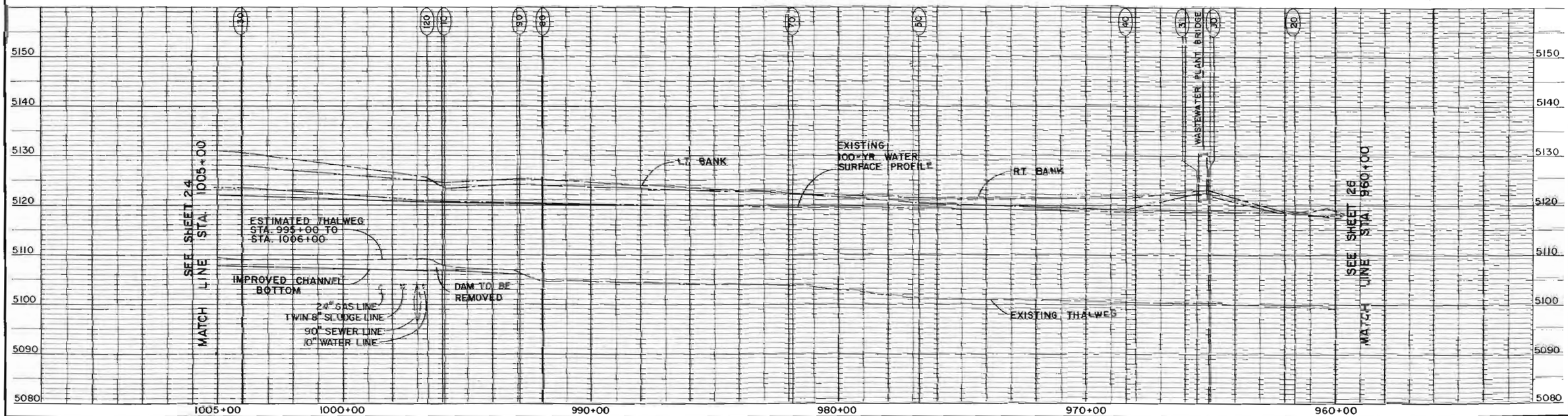
MATCH LINE SEE SHEET 26 STA. 960+00

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

DATUM IS MEAN SEA LEVEL

SCALE OF FEET

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc.
CONTOUR INTERVAL: 2 FEET
2345 SO. FEDERAL BLVD. SUITE 195 DENVER, COLORADO 80219 (303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WWE DATE 5/85
DRAWN RLM, RDL DATE 5/85
CHECKED WWE, MRM DATE 5/86
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 960+00 TO STA. 1005+00

SHEET 25 OF 45

COMMENTARY
STATIONS 822+00 TO 862+70
SHEET 26 OF 45
REACH 8

The channel in this reach is confined by levees on both the east and west side. Flow is contained within the levee banks. The low flow channel meanders and is braided. Interstate 270 is the upstream limit of Reach 8. The entire 100-year flood passes through the I-270 bridge.

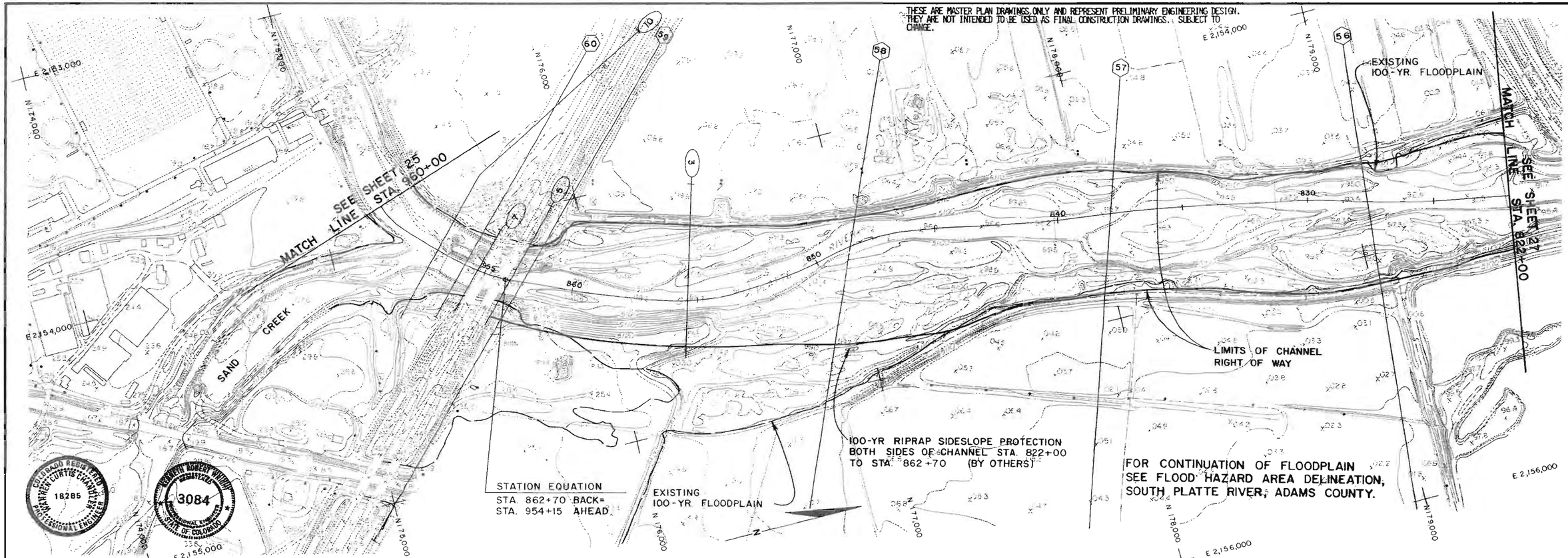
The proposed improvements to this reach consist of the stabilization of both channel banks. This work is necessary to protect overbank facilities. It is assumed that the work will be accmplished by the overbank owners outside the scope of this work. No changes are proposed in the channel invert elevation.

The 100-year floodplain for the existing condition as well as the proposed condition is contained within the channel banks, as such, no additional floodplain regulations are required beyond prohibiting encroachment into the channel itself.

COST ESTIMATE
SHEET 26 OF 45
SOUTH PLATTE RIVER
STATION 822+00 TO STATION 862+70

CONSTRUCTION

Drainage improvement costs	---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	
TOTAL IMPROVEMENT COSTS	---
Operation and Maintenance	$14,240



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 SO FEDERAL BLVD. SUITE 195 DENVER, COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL: 2 FEET

WRIGHT WATER ENGINEERS, INC. 2490 W 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN FCM, EAD DATE 5/85
CHECKED MWG, KRW DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 822+00 TO STA. 960+00

SHEET 26 OF 45

COMMENTARY
SHEET 27 OF 45
STATIONS 765+00 TO 822+70
REACH 8

The channel passes under Interstate 76, Colorado Highway 224, and a Union Pacific Railroad track. The channel banks are well defined and in some cases constitute levees which prevent flow from leaving the channel. Because of the inconsistent construction of the channel levees, much flow during the 100-year event overtops them or passes around them and floods some of the adjacent lands. The low flow channel is very well defined with minor braiding occurring upstream of the Union Pacific Railroad track crossing. Engineers Lake is in the east overbank between I-76 and Colorado Highway 224. Clear Creek enters the South Platte River in this reach. Structural damages associated with flooding are minor in this area because of the limited number of structures in the floodplain. The majority of the overbank areas consist of gravel pit operations and gravel pit lakes.

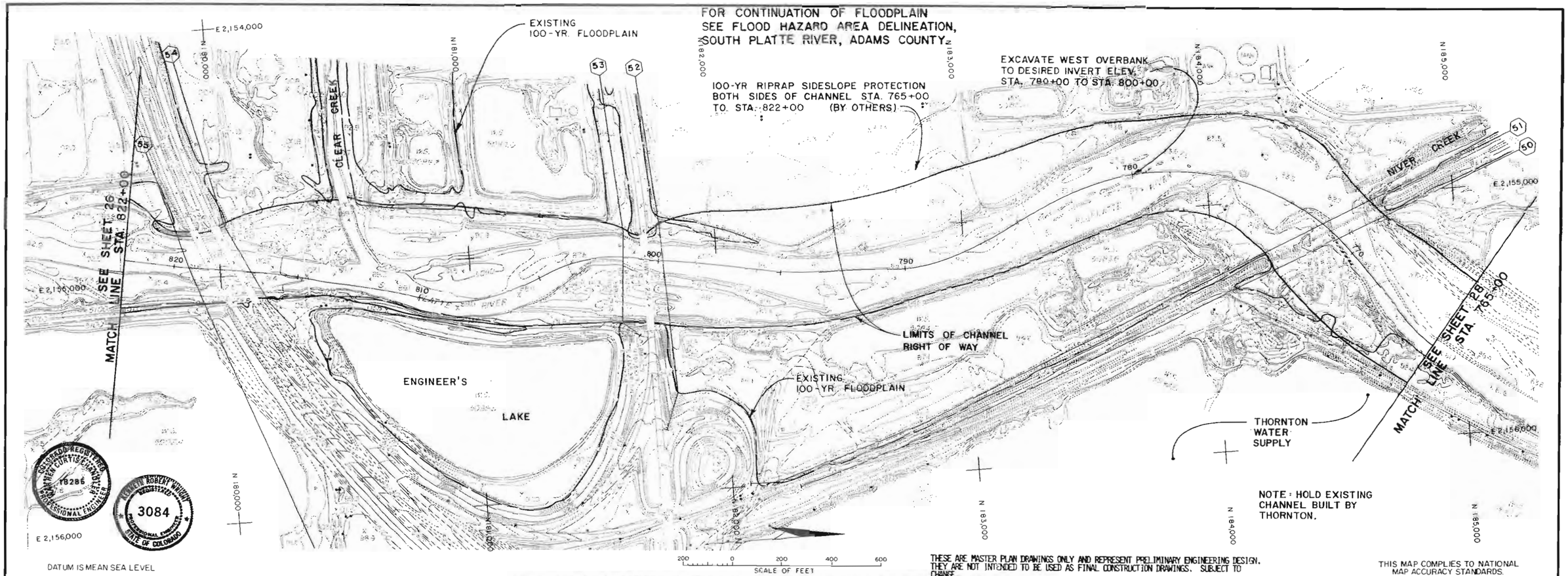
Improvements proposed consist of the stabilization of both channel banks in order to allow the conveyance of the 100-year event. Much of this work has already been accomplished. New work will be the responsibility of the overbank owners as much as has already been planned. Minor excavation on the west overbank downstream of Colorado Highway 224 is required in order to achieve sufficient capacity to convey the 100-year event. No improvements to the highway bridges or the railroad bridge are anticipated. With the exception of the widening of the channel, no changes to the South Platte River invert elevation are proposed through this area.

In areas where there is no reduction in the floodplain limits, floodplain regulations should be enforced. This will insure that no imprudent development occurs in the 100-year floodplain. In areas where the floodplain will be reduced significantly, floodplain regulations should be superimposed on the recommended improvements, floodplain management practices should be in accord with the flood hazard identified for the existing channel conditions.

COST ESTIMATE
SHEET 27 OF 45
SOUTH PLATTE RIVER
STATION 765+00 TO STATION 822+00

CONSTRUCTION

Drainage improvement costs	---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	
TOTAL IMPROVEMENT COSTS	---
Operation and Maintenance	$19,210



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
23-45 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED [illegible] DATE 5/85
DRAWN [illegible] DATE 5/85
CHECKED [illegible] DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 765+00 TO STA. 822+00

SHEET 27 OF 45

COMMENTARY
SHEET 28 OF 45
STATIONS 710+00 TO 765+00
REACH 8

The channel banks on the east side of the river are very well defined as a result of the water storage facilities constructed by the City of Thornton. The west channel banks are less well defined, however, they do serve to prevent significant overbank flooding. Minor flooding occurs to overbank gravel pits west of the channel. The low channel is well defined with some braiding and meandering.

Improvements proposed include the stabilization of both channel banks using riprap to the 100-year level. Much of the east side is complete and the west side is being designed. The costs are not included in this estimate. It is the intent of the improvements proposed to stabilize the channel banks and not construct levees along the channel banks. Therefore, the channel banks on the west side of the South Platte River should be stabilized with riprap protection to the elevation available along their proposed alignment. No levees will be constructed. No improvements are proposed to the invert of the river.

In areas where there is no reduction of floodplain limits, floodplain regulations should be enforced. This will insure that no imprudent development occurs in the 100-year floodplain. In areas where the floodplain will be reduced, floodplain regulations should be superimposed on the recommended improvements. Prior to the construction of the recommended improvements, floodplain management practices should be in accord with the flood hazard identified for the existing channel conditions.

COST ESTIMATE
SHEET 28 OF 45
SOUTH PLATTE RIVER
STATION 710+00 TO STATION 765+00

CONSTRUCTION

Drainage improvement costs	---
Street crossing costs	---
Utility relocation costs	---
Total construction costs	---
Engineering and contingencies (30% of total construction costs)	---
Property acquisition	
TOTAL IMPROVEMENT COSTS	---
Operation and Maintenance	$17,380

FOR CONTINUATION OF FLOODPLAIN
SEE FLOOD HAZARD AREA DELINEATION,
SOUTH PLATTE RIVER, ADAMS COUNTY.

100-YR RIPRAP SIDESLOPE PROTECTION
BOTH SIDES OF CHANNEL STA. 710+00
TO STA. 765+00 (BY OTHERS)

EXISTING
100-YR. FLOODPLAIN

MATCH LINE STA. 765+00
SEE SHEET 27

MATCH LINE STA. 710+00
SEE SHEET 29

THORNTON WATER
SUPPLY RESERVOIR

EXISTING
100-YR. FLOODPLAIN

LIMITS OF CHANNEL
RIGHT OF WAY

EAST BANK OF RIVER
TO BE PROTECTED BY
FLATTENING SLOPE
AND VEGETATED RIPRAP
CONSISTENT WITH RISK
TO WATER SUPPLY

KENNETH ROBERT HOLLY
REGISTERED
3084
PROFESSIONAL ENGINEER
STATE OF COLORADO

COLORADO REGISTERED
PROFESSIONAL ENGINEER
18285
PARKER CURTIS CHANEY

DATUM IS MEAN SEA LEVEL

SCALE OF FEET

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.

EXISTING
100-YR WATER
SURFACE PROFILE

IMPROVED
100-YR WATER
SURFACE PROFILE

IMPROVED
10-YR WATER
SURFACE PROFILE

EXISTING THALWEG

RESERVOIR WATER SURFACE

RESERVOIR WATER SURFACE

MATCH LINE STA. 765+00
SEE SHEET 27

MATCH LINE STA. 710+00
SEE SHEET 29

765+00 760+00 750+00 740+00 730+00 720+00 710+00

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL = 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED JCC, TWE DATE 5/84
DRAWN KCM, KDL DATE 5/84
CHECKED JCC, TWE DATE 5/84
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 710+00 TO STA. 765+00

SHEET 28 OF 45

COMMENTARY
SHEET 29 OF 45
STATIONS 657+00 TO 710+00
REACH 8

The channel upstream of 88th Avenue is well defined along its eastern channel bank and poorly defined along the western banks. Downstream of 88th the channel is well defined, however, meanders are severe. Encroachment into the overbanks downstream of 88th has resulted in a channel which is approximately 100 to 150 feet wide. The crossing at 88th Avenue is small and restricts flow through the bridge. A drop structure downstream of 88th exists to protect utilities and the bridge foundation. The majority of the property adjacent to the channel downstream of 88th is owned by gravel operators and experiencing gravel mining or has gravel mine operations proposed in the near future.

Improvements proposed include the construction of 100-year riprap protection upstream of 88th. This is already being planned by the owners and is therefore not included in the cost estimate. The 88th Avenue bridge is to be replaced with a 450 foot span bridge.

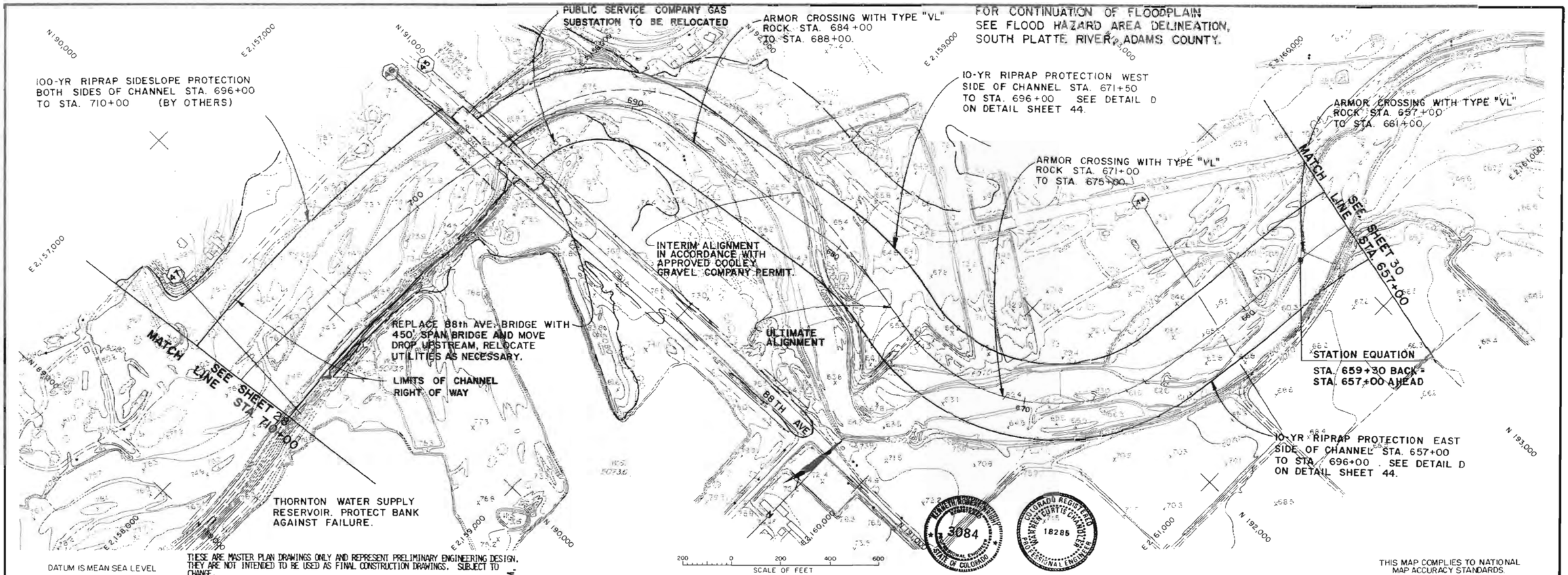
The channel downstream of 88th Avenue is planned as a two phase project. The interim phase follows the proposals of Cooley's gravel pit application with the river being directed through the excavation.

The ultimate configuration will include moving the drop structure and utilities upstream of 88th Avenue to increase the hydraulic efficiency of the bridge. The channel alignment will more closely follow the requirements of a minimum maintenance alignment as defined by Stevens until it enters the gravel pit at which point the ultimate alignment is achieved. Channel bank protection is to be provided which will be capable of conveying the 10-year event. Protection should be constructed of riprap.

COST ESTIMATE
SHEET 29 OF 45
SOUTH PLATTE RIVER
STATION 657+00 TO STATION 710+00

CONSTRUCTION

Drainage improvement costs	$841,000
Street crossing costs	2,835,000
Utility relocation costs	160,000
Total construction costs	3,836,000
Engineering and contingencies (30% of total construction costs)	1,150,800
Property acquisition	---
TOTAL IMPROVEMENT COSTS	$4,986,800
Operation and Maintenance	$15,850



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 SO. FEDERAL BLVD. SUITE 195 DENVER, COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL = 2 FEET

WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED DATE 5/85
DRAWN DATE 5/85
CHECKED DATE 5/85
REVISED DATE 11/85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 657+00 TO STA. 710+00

SHEET 29 OF 45

COMMENTARY
SHEET 30 OF 45
STATION 613+00 TO 657+00
REACH 8

The floodplain in this area is characterized by its broad, flat nature. The main channel meanders slightly and is well defined with minor braiding. Levees have been constructed along the downstream portions, however, are ineffective in preventing the spread of floods. The overbanks are developed with gravel pits or agricultural land.

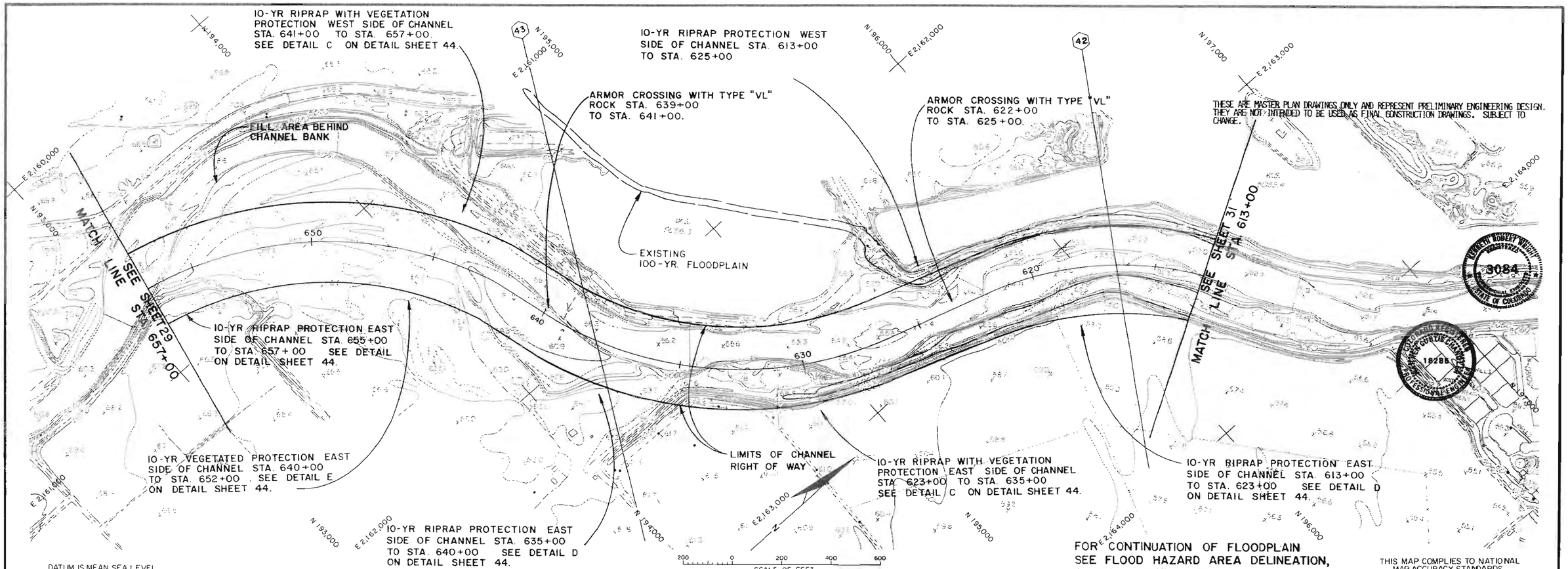
Improvements proposed in this reach include the stabilization of the banks using riprap with vegetation along portions of the west channel bank which are currently unprotected. The east side of the channel will be protected with riprap or vegetation, or a combination of both. The channel invert will be lowered between 2 and 3 feet and protected with armoring at two of the crossings. The channel will convey the 10-year event and be stabilized with the lining material to at least the 5,000 cfs level.

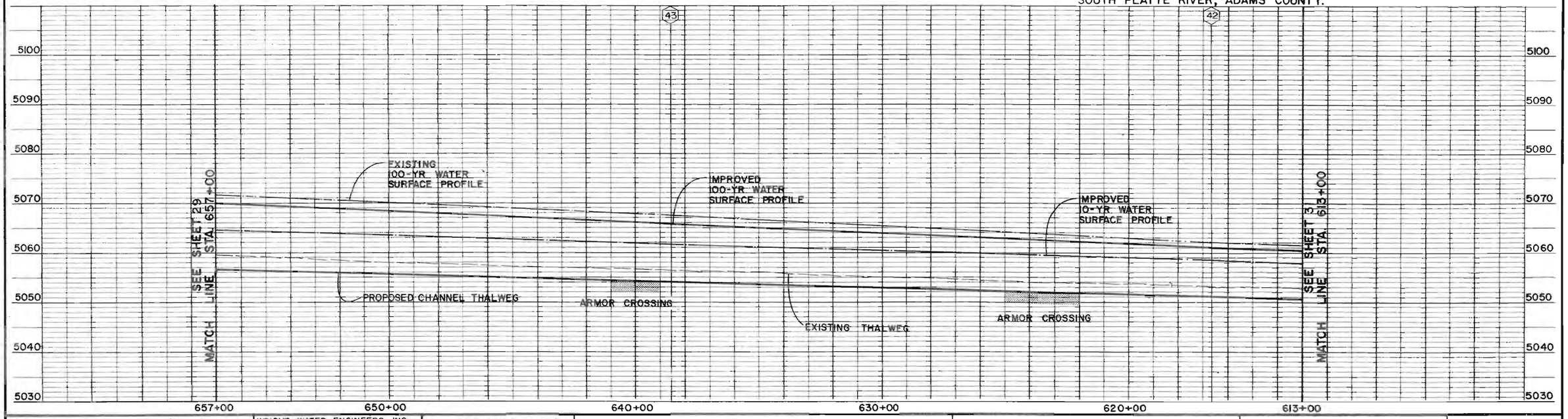
Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 30 OF 45
SOUTH PLATTE RIVER
STATION 8613+00 TO STATION 657+00

CONSTRUCTION

Drainage improvement costs	$1,587,000
Street crossing costs	---
Utility relocation costs	---
Total construction costs	1,587,000
Engineering and contingencies (30% of total construction costs)	476,000
Property acquisition	180,000
TOTAL IMPROVEMENT COSTS	2,063,000
Operation and Maintenance	$21,340





GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983 TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL: 2 FEET	Delta Aerial Surveys, Inc. 2345 SO. FEDERAL BLVD. SUITE 195 DENVER, COLORADO 80219 (303) 934-5500	WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700 URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.	DESIGNED MCC, MWG DATE 5/85 DRAWN PEM, COL DATE 5/85 CHECKED MWG, MEH DATE 5/85 REVISED DATE	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 613+00 TO STA. 657+00

SHEET 30 OF 45

COMMENTARY
SHEET 31 TO 45
STATIONS 560+00 TO 613+00
REACH 8

The floodplain through this reach is broad and unconfined. Levees have been constructed along the river banks, however, they are ineffective in preventing flow from leaving the channel into the overbank. The river has been in its present alignment for some time and appears stable. A wastewater treatment plant has been constructed adjacent to Monaco Street and the South Platte River. The overbanks are developed with agricultural lands or gravel mines. The Fulton Ditch diversion dam is located 3,000 feet downstream of the Monaco Street crossing. The dam is between 5 and 6 feet high and provides a control for upstream degradation.

Improvements proposed for this sheet include the stabilization of the banks with riprap. This level of protection would be able to convey the 10-year event using a combination of riprap slope protection and channel invert lowering. The Fulton Ditch is to be relocated upstream approximately 2,300 feet. A new boat chute is proposed to provide boating access through the structure. Upstream of the relocated Fulton Ditch diversion structure, the river should be lowered between 1 and 2 feet. Downstream, the river is lowered approximately 5 feet between the existing location of the diversion and the proposed location. Channel widening and the removal of existing levees on the west side of the channel are required to provide sufficient conveyance and the proposed top width. The Monaco Street bridge is to be removed and replaced with a 450 foot span bridge.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 31 OF 45
SOUTH PLATTE RIVER
STATION 560+00 TO STATION 613+00

CONSTRUCTION

Drainage improvement costs	$2,462,400
Street crossing costs	1,755,000
Utility relocation costs	69,600
Total construction costs	4,287,000
Engineering and contingencies (30% of total construction costs)	1,286,000
Property acquisition	111,000
TOTAL IMPROVEMENT COSTS	5,684,000
Operation and Maintenance	$31,510

ARMOR CROSSING WITH TYPE "VL" ROCK STA. 601+00 TO STA. 605+00

SEE SHEET 30 MATCH LINE STA. 613+00

REPLACE MONACO ST. BRIDGE WITH 450' SPAN

10-YR RIPRAP PROTECTION WEST SIDE OF CHANNEL STA. 585+00 TO STA. 613+00. SEE DETAIL D ON DETAIL SHEET 44.

STA. 585+00 NEW LOCATION OF FULTON DITCH DIVERSION.

EXISTING 100-YR FLOODPLAIN

10-YR RIPRAP PROTECTION EAST SIDE OF CHANNEL STA. 580+00 TO STA. 613+00. SEE DETAIL D ON DETAIL SHEET 44.

FOR CONTINUATION OF FLOODPLAIN SEE FLOOD HAZARD AREA DELINEATION, SOUTH PLATTE RIVER, ADAMS COUNTY.

10-YR RIPRAP PROTECTION WEST SIDE OF CHANNEL STA. 560+00 TO STA. 561+00. SEE DETAIL D ON DETAIL SHEET 44.

LIMITS OF CHANNEL RIGHT OF WAY

ARMOR CROSSING WITH TYPE "VL" ROCK STA. 560+00 TO STA. 562+00

MATCH LINE SEE SHEET 32 STA. 560+00

STA. 562+00 REMOVE EXISTING FULTON DITCH DIVERSION DAM AND RELOCATE TO STA. 585+00

EXTEND FULTON DITCH UPSTREAM TO LOCATION OF NEW DIVERSION

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

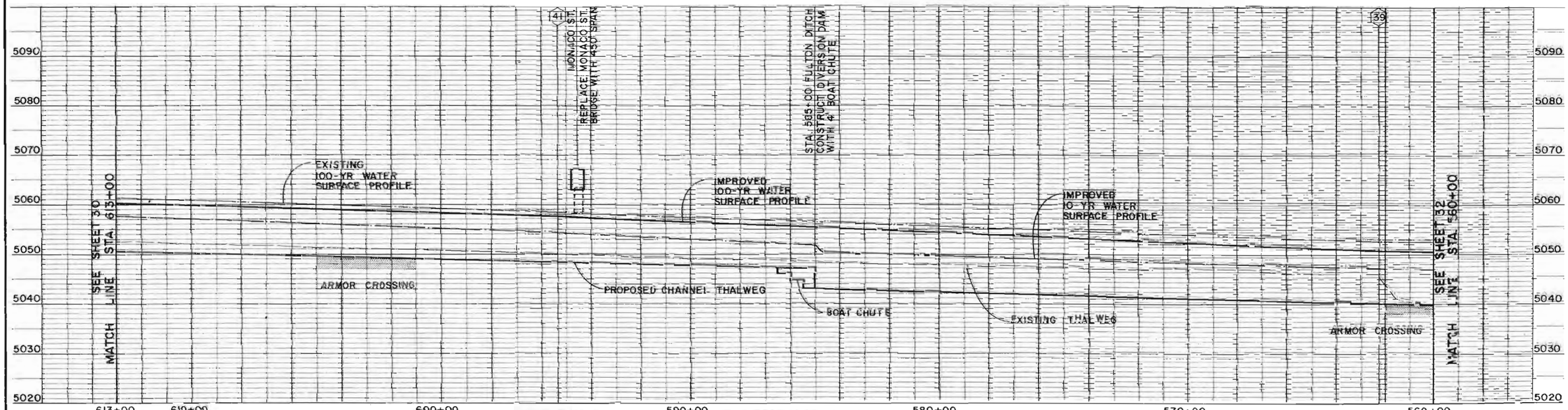
COLORADO REGISTERED PROFESSIONAL ENGINEER 18285 WARREN CURTIS CHANTLAND

REGISTERED PROFESSIONAL ENGINEER 3084 STATE OF COLORADO

DATUM IS MEAN SEA LEVEL

200 0 200 400 600 SCALE OF FEET

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.



GROUND CONTROL SURVEY.
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WWG DATE 5/85
DRAWN PCH/ERA DATE 5/85
CHECKED WWG/MM DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 560+00 TO STA. 613+00

SHEET 31 OF 45

COMMENTARY
SHEET 32 OF 45
STATIONS 507+00 TO 560+00
REACH 8

The channel and floodplain are unconfined and uncontrolled. The channel is braided with many bars and bends. Levees have been constructed along both sides of the channel in the vicinity of 104th Avenue, however, they provide little protection or control for the flooding outside the channel. Gravel pit stock piles to the west of the channel and downstream of 104th Avenue are out of the floodplain. The floodplain land is undeveloped or agricultural. One-hundred and fourth Avenue crosses the river and presents an additional obstruction to flow.

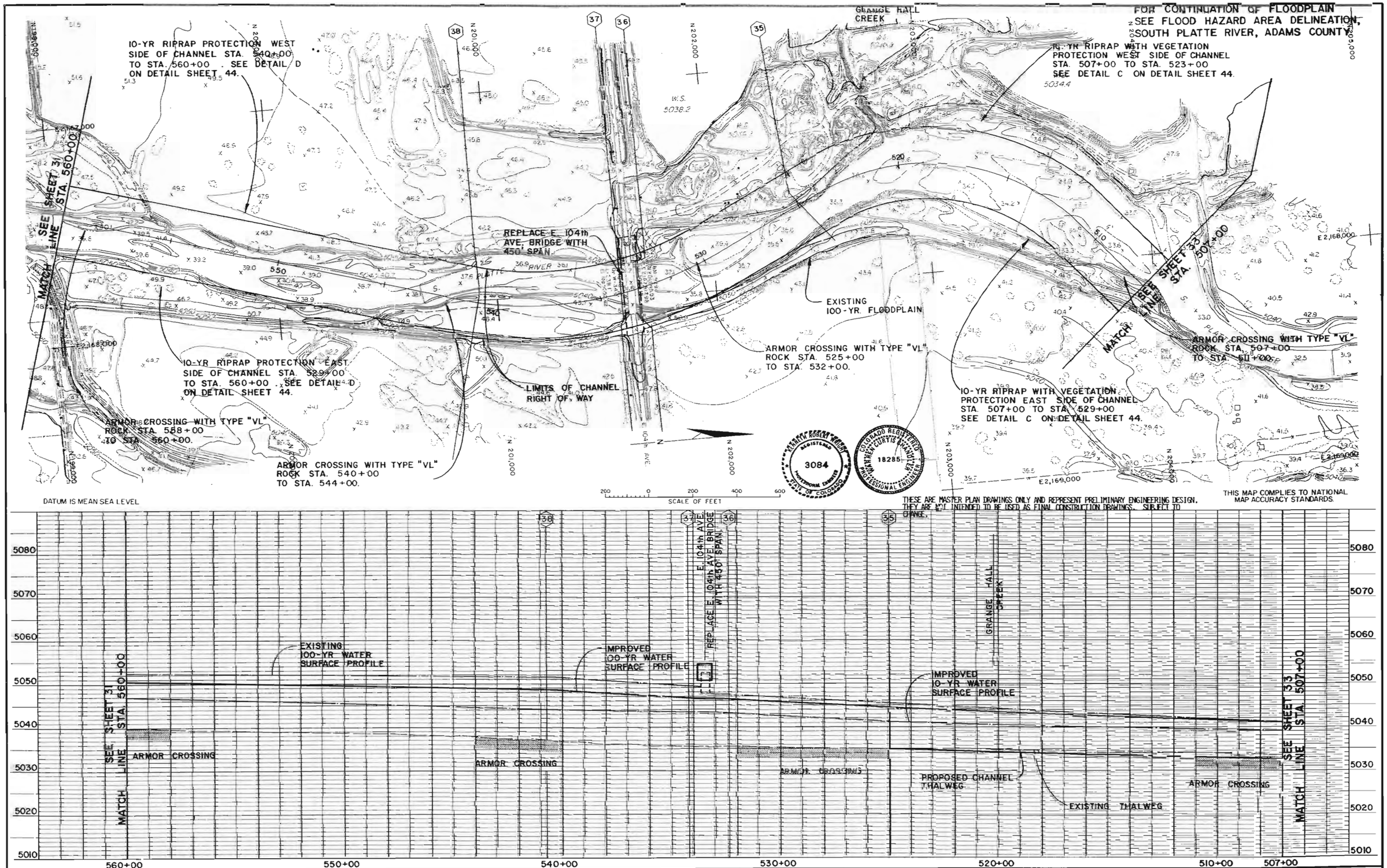
The recommended improvements consist of the stabilizing of the river banks using riprap or a combination of riprap and vegetation to provide a 10-year conveyance capacity. Crossings are to armored throughout this reach. The existing 104th Avenue bridge is to be replaced with a 450 foot span bridge. The proposed channel invert should be maintained at the existing invert elevation. Channel widening will be accomplished by regular river movement. When the river reaches the desired bank location, the bank should be stabilized.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 32 OF 45
SOUTH PLATTE RIVER
STATION 507+00 TO STATION 560+00

CONSTRUCTION

Drainage improvement costs	$1,329,000
Street crossing costs	2,210,000
Utility relocation costs	---
Total construction costs	3,539,000
Engineering and contingencies (30% of total construction costs)	1,062,000
Property acquisition	183,000
TOTAL IMPROVEMENT COSTS	4,784,000
Operation and Maintenance	$20,020



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL = 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, WNG DATE 5/85
DRAWN LEM, COH DATE 5/85
CHECKED WNG, WCH DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 507+00 TO STA. 560+00

SHEET 32 OF 45

COMMENTARY
SHEET 33 OF 45
STATIONS 458+00 TO 507+00
REACH 8

The floodplain is very close to the channel bank on the west side, and extends out approximately 2,000 feet to the east. The channel overbanks consist of undeveloped or agricultural properties. No levees exist to confine the flow. The channel meanders, with bars forming on the inside of bonds.

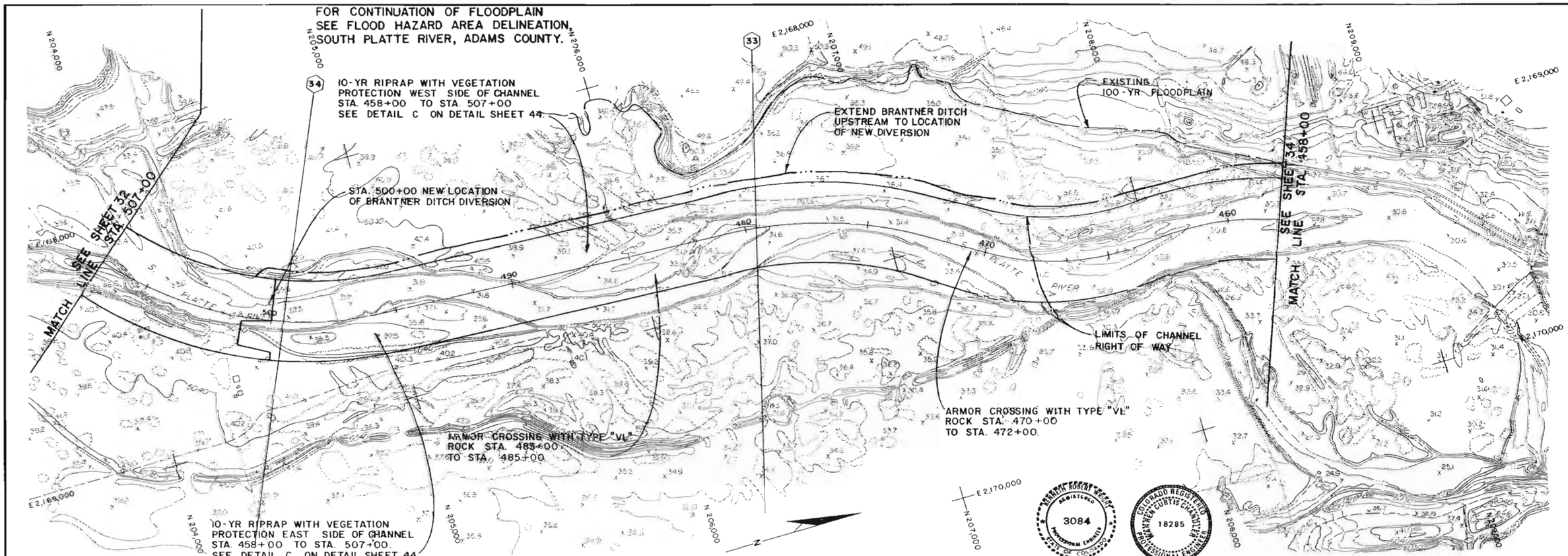
Improvements proposed include the stabilization of the channel banks with a combination of riprap and vegetation to convey the 10-year event. Crossings are to be be armored. The proposed location of the Brantner Ditch diversion dam is near the upstream portion of this sheet. The ditch is to be extended to provide sufficient capacity to convey the 10-year event across it without exceeding the existing channel banks. Upstream of the relocated Brantner Ditch diversion dam no channel lowering is anticipated. Downstream the proposed channel invert should be 3 to 7 feet lowe than existing. A boat chute will be provided across the dam in order to allow boating access.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

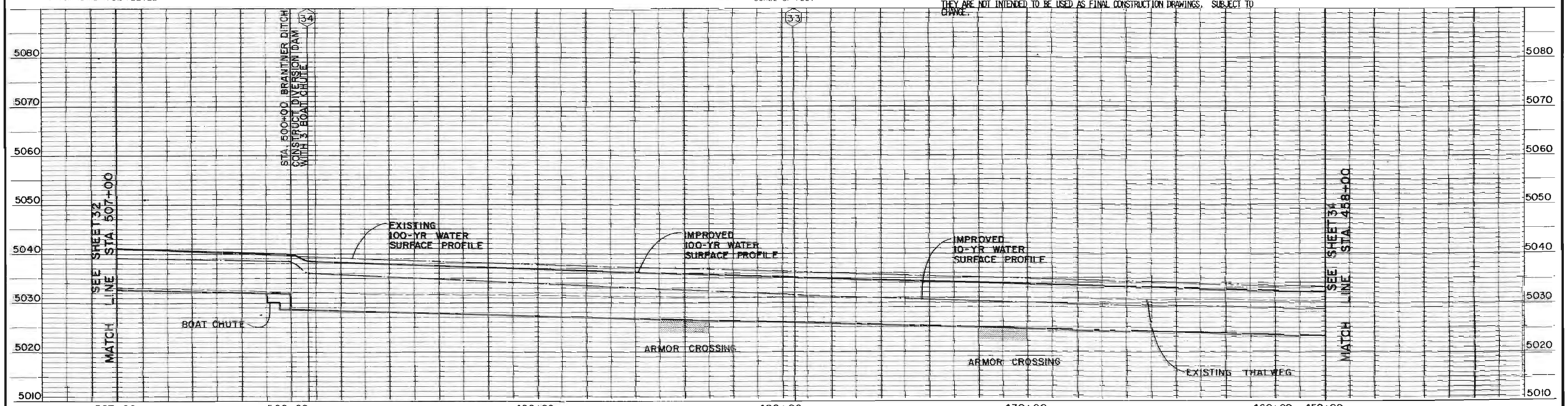
COST ESTIMATE
SHEET 33 OF 45
SOUTH PLATTE RIVER
STATION 458+00 TO STATION 507+00

CONSTRUCTION

Drainage improvement costs	$1,448,500
Street crossing costs	---
Utility relocation costs	78,500
Total construction costs	1,527,000
Engineering and contingencies (30% of total construction costs)	458,000
Property acquisition	294,000
TOTAL IMPROVEMENT COSTS	2,279,000
Operation and Maintenance	$20,920



THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS, SUBJECT TO CHANGE.



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN PEM, EAJ DATE 5/85
CHECKED MWG, MRW DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 458+00 TO STA. 507+00

SHEET 33 OF 45

COMMENTARY
SHEET 34 OF 45
STATIONS 430+00 TO 458+00
REACH 8

The floodplain is br_ad to the east and very close to the channel bank on the west side. The existing Brantner Ditch diversion dam is shown on this sheet. Overbank development consists of gravel mining operations and agricultural lands. Some bank protection has been provided downstream of the Brantner Ditch diversion dam along the east channel bank.

The improvements proposed include the stabilization of the channel banks with a combination of riprap and vegetation to convey the 10-year event. A drop structure is proposed upstream of the location of the existing Brantner Ditch diversion dam. The removal of the Brantner Ditch is required and the headgate is to be relocated upstream approximately 5,000 feet. The Brantner Ditch must be extended from the existing headgate location upstream to meet the relocated diversion dam location. The existing bank stabilization should be utilized where possible.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 34 OF 45
SOUTH PLATTE RIVER
STATION 430+00 TO STATION 458+00

CONSTRUCTION

Drainage improvement costs	$855,000
Street crossing costs	---
Utility relocation costs	23,000
Total construction costs	878,000
Engineering and contingencies (30% of total construction costs)	263,000
Property acquisition	152,000
TOTAL IMPROVEMENT COSTS	1,293,000
Operation and Maintenance	$12,130

FOR CONTINUATION OF FLOODPLAIN SEE FLOOD HAZARD AREA DELINEATION, SOUTH PLATTE RIVER, ADAMS COUNTY.

EXISTING 100-YR. FLOODPLAIN

EXTEND BRANTNER DITCH UPSTREAM TO LOCATION OF NEW DIVERSION

REMOVE EXISTING BRANTNER DITCH AND RELOCATE TO STA. 500+00

10-YR RIPRAP WITH VEGETATION PROTECTION WEST SIDE OF CHANNEL STA. 441+00 TO STA. 458+00 SEE DETAIL C ON DETAIL SHEET 44.

MATCH LINE SEE SHEET 35 STA. 430+00

ARMOR CROSSING WITH TYPE "VL" ROCK STA. 430+00 TO STA. 432+00.

EXISTING 10-YR RIPRAP WITH VEGETATION PROTECTION EAST SIDE OF CHANNEL STA. 430+00 TO STA. 441+00.

LIMITS OF CHANNEL RIGHT OF WAY

ARMOR CROSSING WITH TYPE "VL" ROCK STA. 440+00 TO STA. 443+00.

STA. 450+00 TO STA. 450+35 CONSTRUCT 3.5' DROP WITH 10:1 FACE SLOPE

MATCH LINE SEE SHEET 33 STA. 458+00

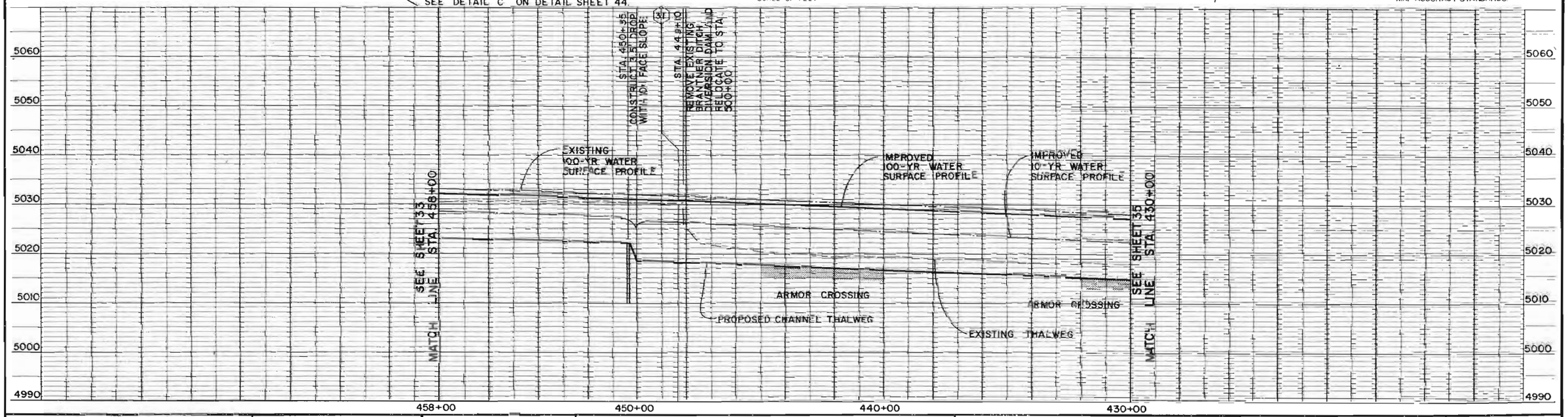
10-YR RIPRAP WITH VEGETATION PROTECTION EAST SIDE OF CHANNEL STA. 457+00 TO STA. 458+00. SEE DETAIL C ON DETAIL SHEET 44.

DATUM IS MEAN SEA LEVEL

SCALE OF FEET 200 0 200 400 600

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED _____ DATE _____
DRAWN _____ DATE _____
CHECKED _____ DATE _____
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 430+00 TO STA. 458+00

SHEET 34 OF 45

SHEET 35 OF 45
STATIONS 338+00 TO 430+00
REACH 8

The channel meanders from one edge of the floodplain to the other. The floodplain is approximately 4,000 feet wide and the river is meandering and displays some instability. Major meanders are evident as is a large degree of braiding and bar formation. Agricultural and open space land uses dominate the overbank.

The proposed channel improvements include the stabilization of the river banks using riprap or a combination of riprap and vegetation to the 10-year level. A drop structure is proposed to limit the required lowering of the channel invert. Downstream of the drop structure, the channel is to be lowered between 1 and 2 feet and upstream the lowering will be approximately 3 feet. Crossings will be armored throughout. The major meander at Station 420 should be bypassed and the channel excavated through the bar created by the meander.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 35 OF 45
SOUTH PLATTE RIVER
STATION 388+00 TO STATION 430+00

CONSTRUCTION

Drainage improvement costs	$1,821,000
Street crossing costs	---
Utility relocation costs	---
Total construction costs	1,821,000
Engineering and contingencies (30% of total construction costs)	546,000
Property acquisition	274,000
TOTAL IMPROVEMENT COSTS	2,367,000
Operation and Maintenance	$23,410

FOR CONTINUATION OF FLOODPLAIN
SEE FLOOD HAZARD AREA DELINEATION,
SOUTH PLATTE RIVER, ADAMS COUNTY

10-YR RIPRAP WITH VEGETATION PROTECTION WEST SIDE OF CHANNEL STA. 395+00 TO STA. 430+00 SEE DETAIL C ON DETAIL SHEET 44

EXISTING 100-YR FLOODPLAIN

PLATTE RIVER

10-YR RIPRAP PROTECTION WEST SIDE OF CHANNEL STA. 388+00 TO STA. 395+00 . SEE DETAIL D ON DETAIL SHEET 44.

STA. 409+85 TO STA. 410+10 CONSTRUCT 2.5' DROP WITH 10:1 FACE SLOPE

MATCH LINE SEE SHEET 34 STA. 430+00

LIMITS OF CHANNEL RIGHT OF WAY

10-YR RIPRAP PROTECTION EAST SIDE OF CHANNEL STA. 408+00 TO STA. 430+00 . SEE DETAIL D ON DETAIL SHEET 44.

ARMOR CROSSING WITH TYPE "VL" ROCK STA. 428+00 TO STA. 430+00.

10-YR RIPRAP WITH VEGETATION PROTECTION EAST SIDE OF CHANNEL STA. 388+00 TO STA. 408+00. SEE DETAIL C ON DETAIL SHEET 44.

ARMOR CROSSING WITH TYPE "VL" ROCK STA. 391+00 TO STA. 395+00

MATCH LINE SEE SHEET 36 STA. 388+00

SCALE OF FEET 200 0 200 400 600

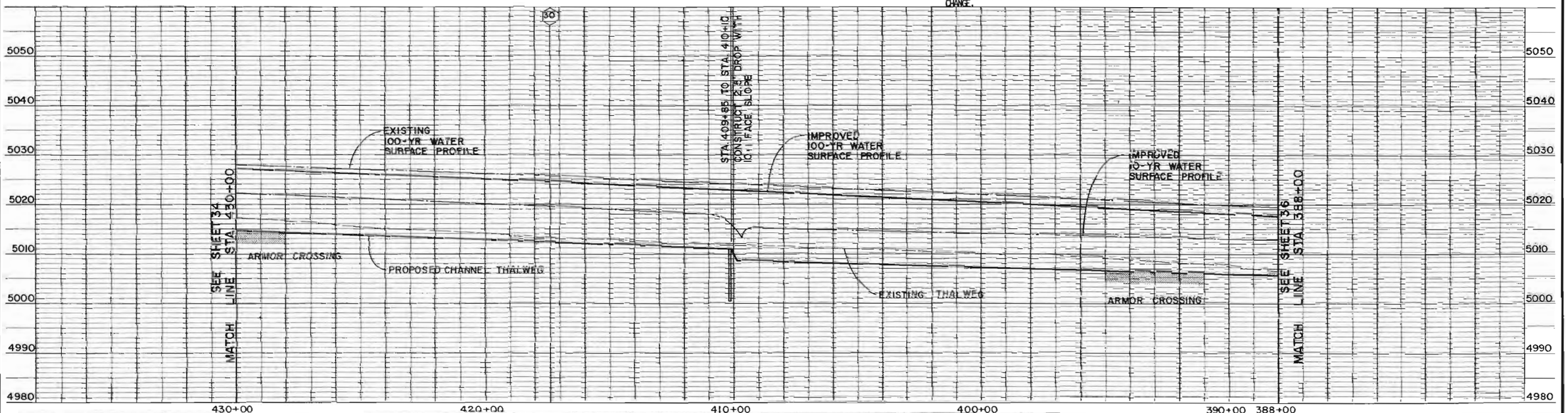
DATUM IS MEAN SEA LEVEL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

COLORADO REGISTERED PROFESSIONAL ENGINEER 18285 BRENT CURTIS CHANDLER

REGISTERED 3084 PROFESSIONAL ENGINEER STATE OF COLORADO

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED MC MRG DATE 3/85
DRAWN BCM COL DATE 4/85
CHECKED MRG MRG DATE 5/85
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 388+00 TO STA. 430+00

SHEET 35 OF 45

COMMENTARY
SHEET 36 OF 45
STATIONS 332+00 TO 388+00
REACH 8

The floodplain east of the channel is dominated by agricultural farms. West of the channel the ground is undeveloped. The river meanders and exhibits some instabilities with its bars, braiding and islands. Henderson Road crosses the river. Low levees have been constructed along the river banks, however, they do not provide any protection against flooding of the overbanks. In the vicinity of the Henderson Road bridge, the river has been stabilized with riprap along both banks.

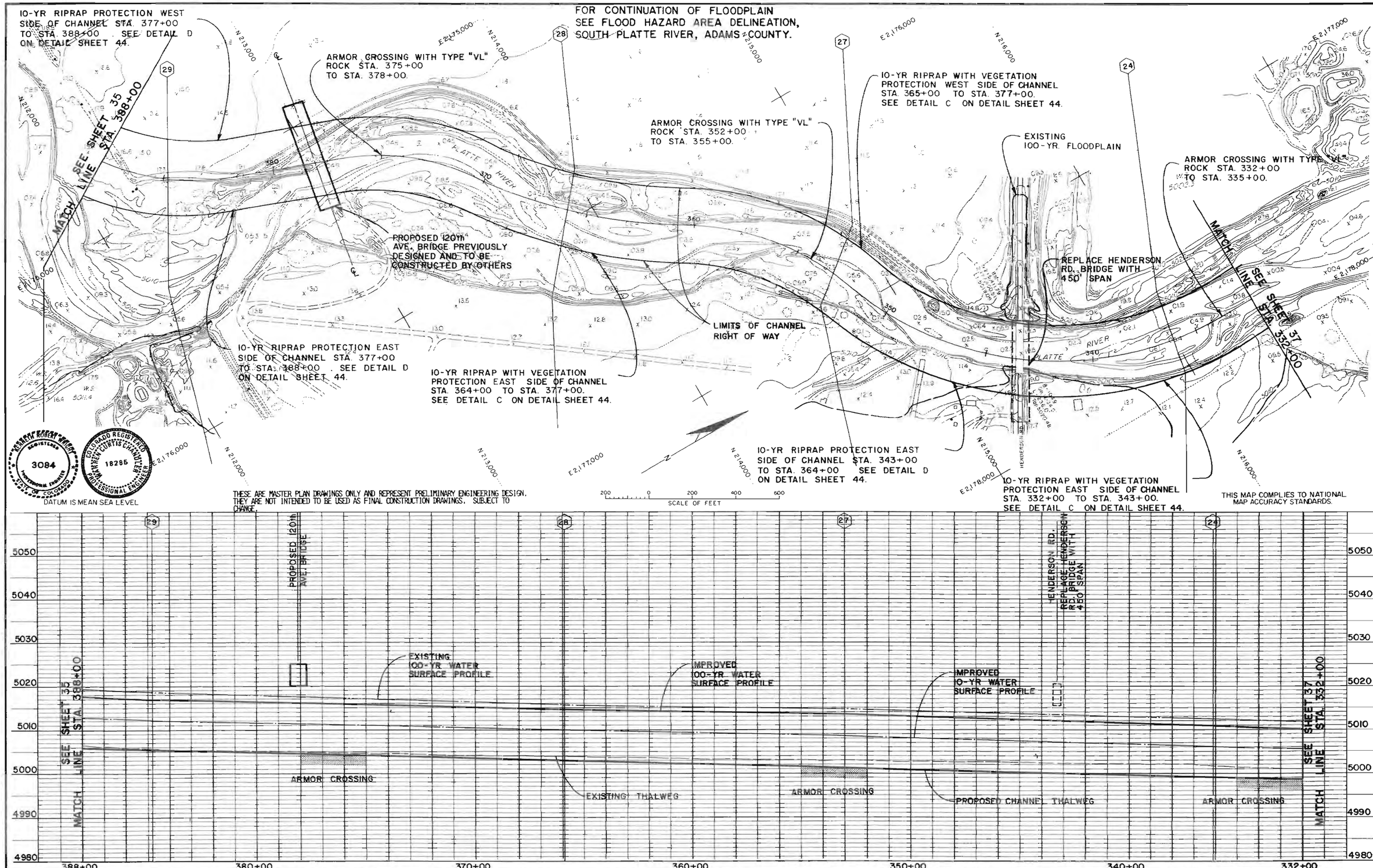
Proposed improvements include the realignment of the river to eliminate a major meander. The Henderson Road bridge is to be replaced with a 450 foot bridge and 120th Avenue is proposed to cross the channel in this reach. The new bridge at 120th will be a 500 foot span and has been designed. Its cost is not included in the cost estimate. The channel banks should be stabilized with riprap or a combination of riprap and vegetation to the 10-year level. Where existing riprap is in place, it will be maintained if possible. The proposed channel invert will be within 2 feet of the existing channel invert.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 36 OF 45
SOUTH PLATTE RIVER
STATION 332+00 TO STATION 388+00

CONSTRUCTION

Drainage improvement costs	$1,460,000
Street crossing costs	2,048,000
Utility relocation costs	---
Total construction costs	3,508,000
Engineering and contingencies (30% of total construction costs)	1,052,000
Property acquisition	43,000
TOTAL IMPROVEMENT COSTS	4,603,000
Operation and Maintenance	$22,170



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983 TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL: 2 FEET Delta Aerial Surveys, Inc. 2345 SO. FEDERAL BLVD. SUITE 195 DENVER, COLORADO 80219 (303) 934-5500	WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700 URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.	DESIGNED WCC, MWG DATE 5/85 DRAWN CCM, RDJ DATE 5/85 CHECKED MWG, KRW DATE 5/85 REVISED DATE	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	PLAN AND PROFILE STA. 332+00 TO STA. 388+00

SHEET 36 OF 45

COMMENTARY
SHEET 37 OF 45
STATIONS 277+00 TO 332+00
REACH 8

The west side of the channel consists of the Adams County Regional Park complex. The east side is agricultural or gravel mining operations. The floodplain is narrow on the east side of the channel and broad on the west. Much of the regional park complex is within the 100-year floodplain of the South Platte River. The river is experiencing extensive instability. The gravel pit lake at Station 312 was breached in the summer of 1983 and has been repaired. The river is actively eroding banks along both sides and is meandering extensively. The bank along the gravel pit which was breached has been stabilized with rock riprap.

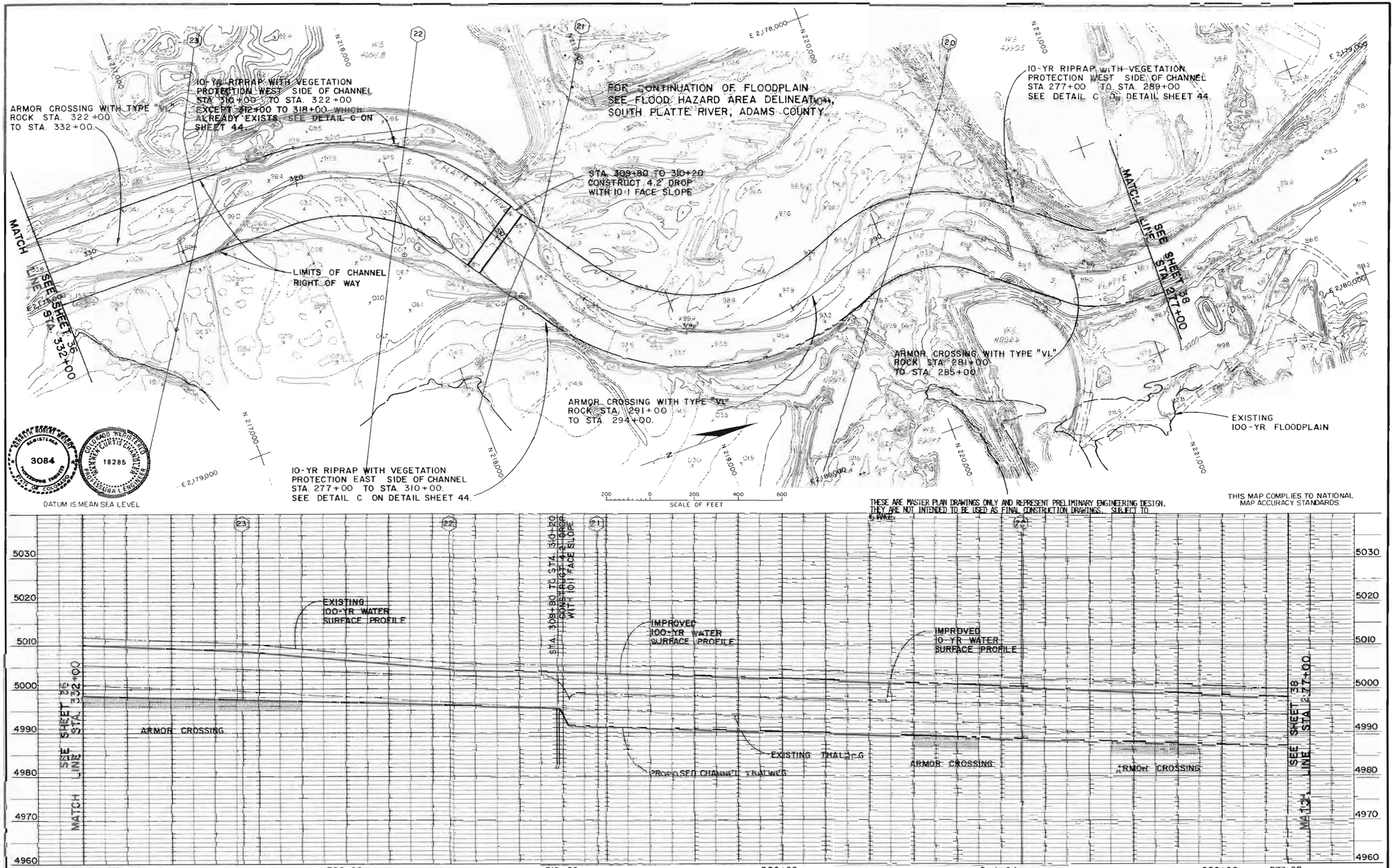
The proposed improvements include stabilizing the alignment using a combination of riprap and vegetation to convey the 10-year flood. Crossing are to be armored in order to control the downstream degradation of the channel. A drop structure is proposed at Station 310.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 37 OF 45
SOUTH PLATTE RIVER
STATION 277+00 TO STATION 332+00

CONSTRUCTION

Drainage improvement costs	$1,282,000
Street crossing costs	---
Utility relocation costs	---
Total construction costs	1,282,000
Engineering and contingencies (30% of total construction costs)	385,000
Property acquisition	---
TOTAL IMPROVEMENT COSTS	1,667,000
Operation and Maintenance	$19,500



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY: APRIL 16, 1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 SO FEDERAL BLVD SUITE 195 DENVER, COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL: 2 FEET

WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED [illegible] DATE [illegible]
DRAWN [illegible] DATE [illegible]
CHECKED [illegible] DATE [illegible]
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 277+00 TO STA. 332+00

SHEET 37 OF 45

COMMENTARY
SHEET 38 OF 45
STATIONS 220+00 TO 277+00
REACH 8

The floodplain is highly irregular varying from very broad widths of 4,000 feet down to less than 1,000 feet. The overbanks are gravel operations and agricultural lands. The river is eroding its banks in several locations and meanders extensively. Riprap erosion protection has been placed along gravel pit banks on the east side of the river.

The proposed improvements include the protection of the banks with a mixture of riprap and vegetation to convey the 10-year event. Crossing are to be armored to limit the vertical degradation of the channel bottom and a drop structure is to be constructed in order to control the total degradation necessary. The channel should be routed through some of the point bars in order to smooth out its alignment. Some filling will be necessary outside the channel banks in order to fill in the existing river channel.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 38 OF 45
SOUTH PLATTE RIVER
STATION 220+00 TO STATION 277+00

CONSTRUCTION

Drainage improvement costs	$1,569,000
Street crossing costs	---
Utility relocation costs	---
Total construction costs	1,569,000
Engineering and contingencies (30% of total construction costs)	471,000
Property acquisition	108,000
TOTAL IMPROVEMENT COSTS	2,148,000
Operation and Maintenance	$22,930

FOR CONTINUATION OF FLOODPLAIN
SEE FLOOD HAZARD AREA DELINEATION,
SOUTH PLATTE RIVER, ADAMS COUNTY.

10-YR RIPRAP WITH VEGETATION
PROTECTION WEST SIDE OF CHANNEL
STA. 249+00 TO STA. 277+00
SEE DETAIL C ON DETAIL SHEET 44.

STA. 254+80 TO STA. 255+20
CONSTRUCT 3.5' DROP WITH
10:1 FACE SLOPE

LIMITS OF CHANNEL
RIGHT OF WAY

MATCH LINE SEE SHEET 37 STA. 277+00

10-YR RIPRAP WITH VEGETATION
PROTECTION EAST SIDE OF CHANNEL
STA. 239+00 TO STA. 277+00.
SEE DETAIL C ON DETAIL SHEET 44.

ARMOR CROSSING WITH TYPE "VL"
ROCK STA. 237+00
TO STA. 241+00.

EXISTING
100-YR. FLOODPLAIN

10-YR RIPRAP WITH VEGETATION
PROTECTION WEST SIDE OF CHANNEL
STA. 220+00 TO STA. 236+00
SEE DETAIL C ON DETAIL SHEET 44.

MATCH LINE SEE SHEET 39 STA. 220+00

EXISTING
10-YR RIPRAP WITH VEGETATION
PROTECTION EAST SIDE OF CHANNEL
STA. 220+00 TO STA. 239+00.

ARMOR CROSSING WITH TYPE "VL"
ROCK STA. 220+00
TO STA. 224+00.

KENNETH ROBERT WRIGHT 3084 REGISTERED PROFESSIONAL ENGINEER STATE OF COLORADO

COLORADO REGISTERED WILLIAM CURTIS CHAMBERLAIN 18285 PROFESSIONAL ENGINEER

DATUM IS MEAN SEA LEVEL

SCALE OF FEET

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS, SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.

EXISTING
100-YR WATER
SURFACE PROFILE

STA. 255+20
CONSTRUCT 3.5' DROP
WITH (0:1 FACE SLOPE

IMPROVED
100-YR WATER
SURFACE PROFILE

IMPROVED
10-YR WATER
SURFACE PROFILE

PROPOSED CHANNEL THALWEG

ARMOR CROSSING

EXISTING THALWEG

ARMOR CROSSING

MATCH LINE SEE SHEET 37 STA. 277+00

MATCH LINE SEE SHEET 39 STA. 220+00

277+00 270+00 260+00 250+00 240+00 230+00 220+00

5020 5010 5000 4990 4980 4970 4960 4950

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16,1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5800

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED KCC DATE 5/85
DRAWN [illegible] DATE 5/85
CHECKED [illegible] DATE 5/85
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 220+00 TO STA. 277+00

SHEET 38 OF 45

COMMENTARY
SHEET 39 OF 45
STATION 165+00 TO 220+00
REACH 8

The channel and the overbanks are undeveloped and stable. The floodplain is very wide, approximately 4,000 feet. Few problems exist with the existing river bends in this area.

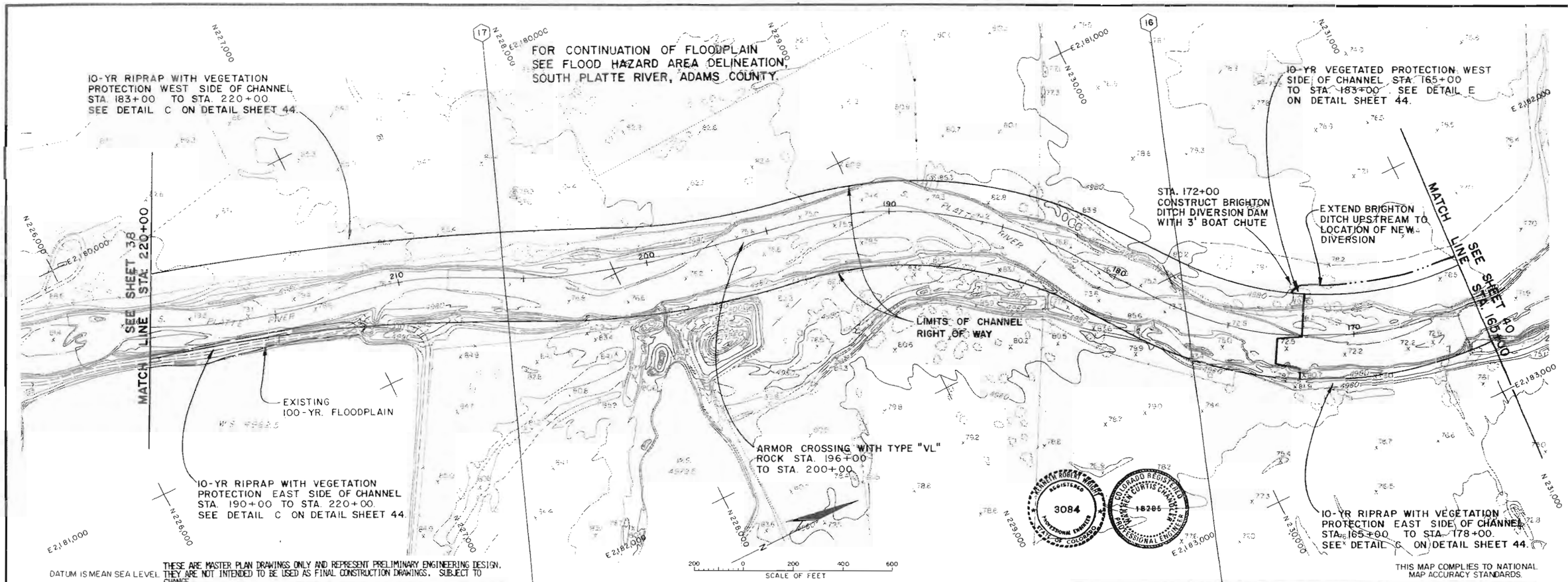
The proposed channel alignment follows the existing channel. Banks stabilization will be either vegetation or a combination of riprap with vegetation. Because of the apparent stability of the river in this area, the alignment does not rigorously adhere to the recommendations in the Stevens study. The Brighton Ditch diversion dam is to be relocated to Station 172. The Brighton Ditch must be extended in order to allow water to flow from the new diversion dam through the existing ditch distribution system. One crossing should be stabilized to limit the amount of total degradation in the channel. The channel will degrade approximately 3 feet upstream of the Brighton Ditch headgate to allow for the conveyance of the 10-year event. Downstream of the Brighton Ditch diversion dam, the proposed channel will be approximately 3 1/2 feet below the existing channel invert.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 39 OF 45
SOUTH PLATTE RIVER
STATION 165+00 TO STATION 220+00

CONSTRUCTION

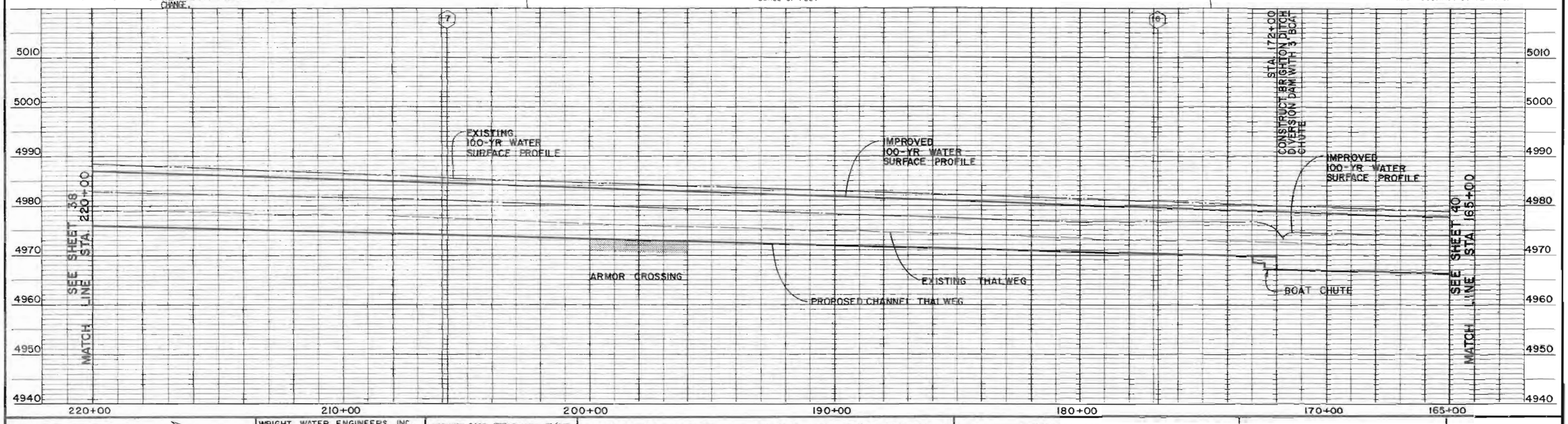
Drainage improvement costs	$1,306,500
Street crossing costs	---
Utility relocation costs	15,500
Total construction costs	1,322,000
Engineering and contingencies (30% of total construction costs)	397,000
Property acquisition	222,000
TOTAL IMPROVEMENT COSTS	1,941,000
Operation and Maintenance	$20,240



DATUM IS MEAN SEA LEVEL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD SUITE 195
DENVER COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED DATE 5/85
DRAWN DATE 5/85
CHECKED DATE 5/85
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 165+00 TO STA. 220+00

SHEET 39 OF 45

COMMENTARY
SHEET 40 OF 45
STATION 125+00 TO 165+00
REACH 8

The channel approaches the western floodplain limit and the floodplain is very broad to the east. Meanders exist along the existing west bank of the channel. Some instability of the river is evident and has resulted in riprap stabilization being placed along the outside bank. The overbank area is undeveloped or agricultural property.

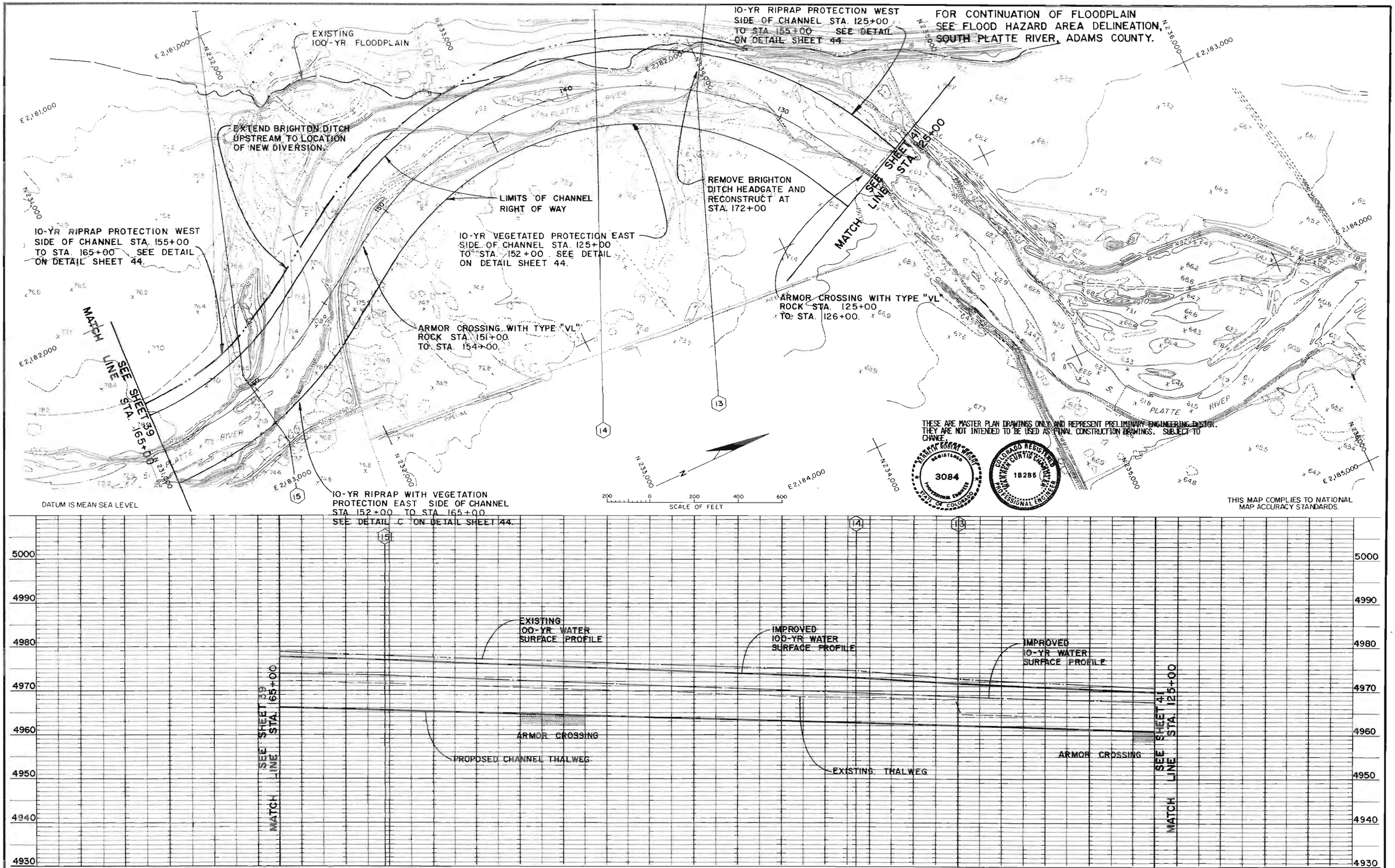
The recommendations proposed include the stabilization of the channel banks with riprap and vegetation to the level necessary to convey the 10-year flood. The existing Brighton Ditch diversion dam must be removed and the Brighton Ditch extended upstream to tie into the newly relocated location.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 40 OF 45
SOUTH PLATTE RIVER
STATION 125+00 TO STATION 165+00

CONSTRUCTION

Drainage improvement costs	$647,000
Street crossing costs	---
Utility relocation costs	68,000
Total construction costs	715,000
Engineering and contingencies (30% of total construction costs)	214,000
Property acquisition	174,000
TOTAL IMPROVEMENT COSTS	1,103,000
Operation and Maintenance	$11,480



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL = 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC, MWG DATE 5/85
DRAWN RCM, EDW DATE 5/85
CHECKED MWG, MEN DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 125+00 TO STA. 165+00

SHEET 40 OF 45

COMMENTARY
SHEET 41 OF 45
STATION 71+00 TO 125+00
REACH 8

The floodplain is approximately 4,000 feet wide. The river is actively eroding its banks and meandering. Channel protection has been installed along portions of the more significant meanders in order to control the lateral movement of the river. The overbank lands are undeveloped or agricultural properties.

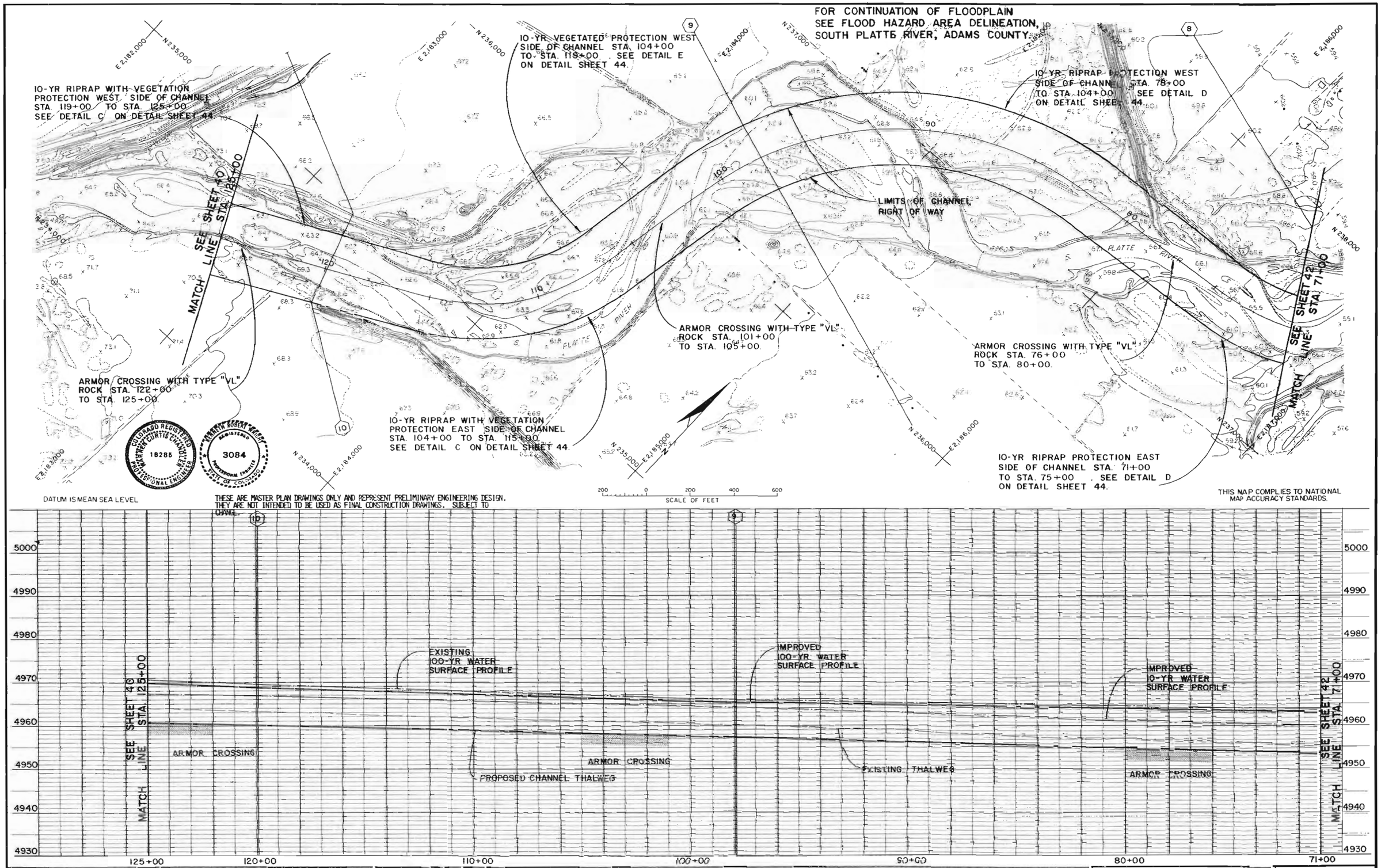
The proposed improvements include the realignment of the river to conform to the recommendations as described in the Stevens study. The realignment proposed involves the excavation of the channel through three point bars. Backfilling is required to fill in the existing channel. The banks must be protected with vegetation or a combination of riprap with vegetation or riprap alone to a level which coneys the 10-year storm. Riprap with vegetation should be installed in areas where the banks are subject to severe erosion and aesthetics are an important consideration. Crossings should be armored to limit the amount of channel bottom degradation to 3 feet.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 41 OF 45
SOUTH PLATTE RIVER
STATION 71+00 TO STATION 125+00

CONSTRUCTION

Drainage improvement costs	$2,280,000
Street crossing costs	---
Utility relocation costs	---
Total construction costs	2,280,000
Engineering and contingencies (30% of total construction costs)	684,000
Property acquisition	300,000
TOTAL IMPROVEMENT COSTS	3,264,000
Operation and Maintenance	$29,420



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO FEDERAL BLVD SUITE 195
DENVER COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED DATE
DRAWN DATE
CHECKED DATE
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 71+00 TO STA. 125+00

SHEET 41 OF 45

COMMENTARY
SHEET 42 TO 45
STATIONS 52+00 TO 71+00
REACH 8

The existing floodplain is wide and is enlarged further by the 160th Avenue crossing. The west overbank is dominated by agricultural lands while the east overbank is largely undeveloped. The river has been stabilized by riprap in areas experiencing erosion and is, for the most part, stable.

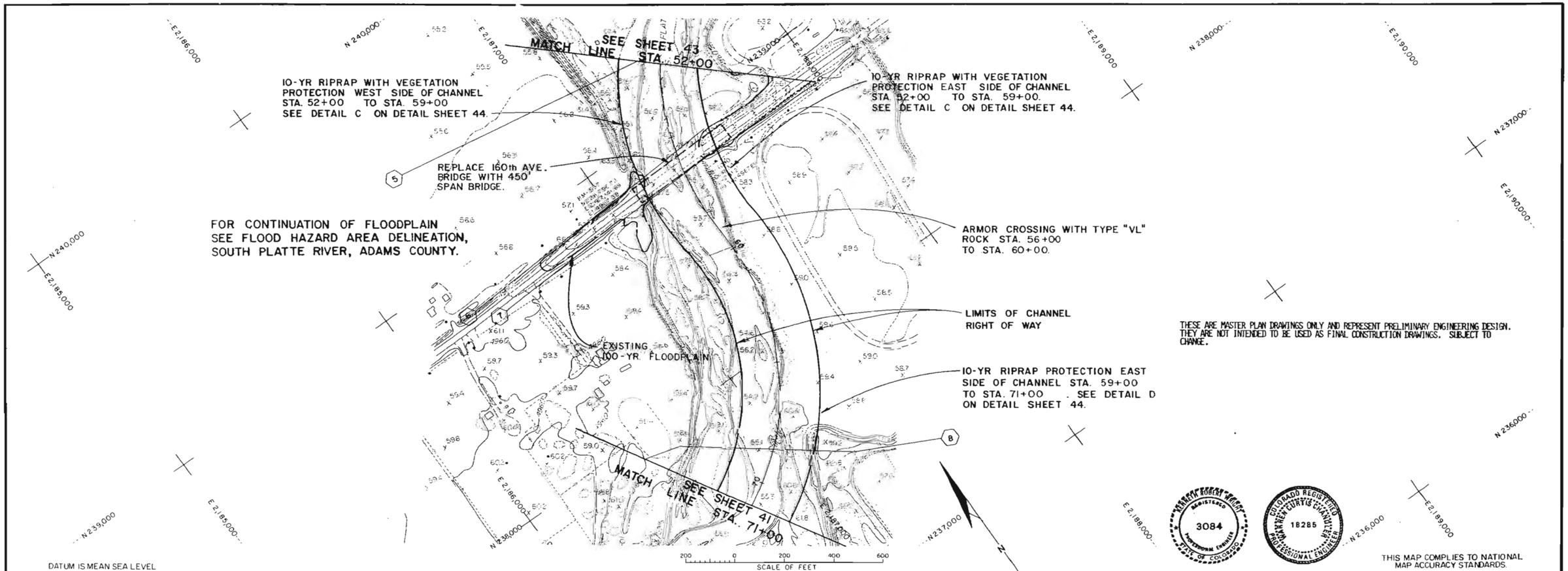
Improvements proposed include the stabilization of both banks of the river with riprap or a combination of riprap and vegetation to the 10-year level. Crossings are to be armored and the 160th Avenue bridge is to be reconstructed with a 450 foot span bridge. The armoring of the crossings will limit the degradation in this reach to approximately 2 feet. The selection of the river alignment was such that no manpower is required to achieve it, rather the river will accomplish this by its own means.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions.

COST ESTIMATE
SHEET 42 OF 45
SOUTH PLATTE RIVER
STATION 52+00 TO STATION 71+00

CONSTRUCTION

Drainage improvement costs	$354,000
Street crossing costs	2,340,000
Utility relocation costs	---
Total construction costs	2,694,000
Engineering and contingencies (30% of total construction costs)	808,000
Property acquisition	90,000
TOTAL IMPROVEMENT COSTS	3,592,000
Operation and Maintenance	$6,190



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED WCC DATE 5/85
DRAWN DATE 5/85
CHECKED DATE 5/85
REVISED DATE

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 52+00 TO STA. 71+00

SHEET 42 OF 45

COMMENTARY
SHEET 43 OF 45
STATIONS 0+00 TO 52+00
REACH 8

The floodplain is approximately 4,500 feet wide. The western overbank consists of agricultural fields. The eastern overbank is undeveloped with the floodplain encroaching on residential and commercial properties along Highway 85. The channel is fairly stable, not exhibiting much evidence of movement. Portions of the banks have been stabilized with riprap in order to prevent failure of levees adjacent to the river.

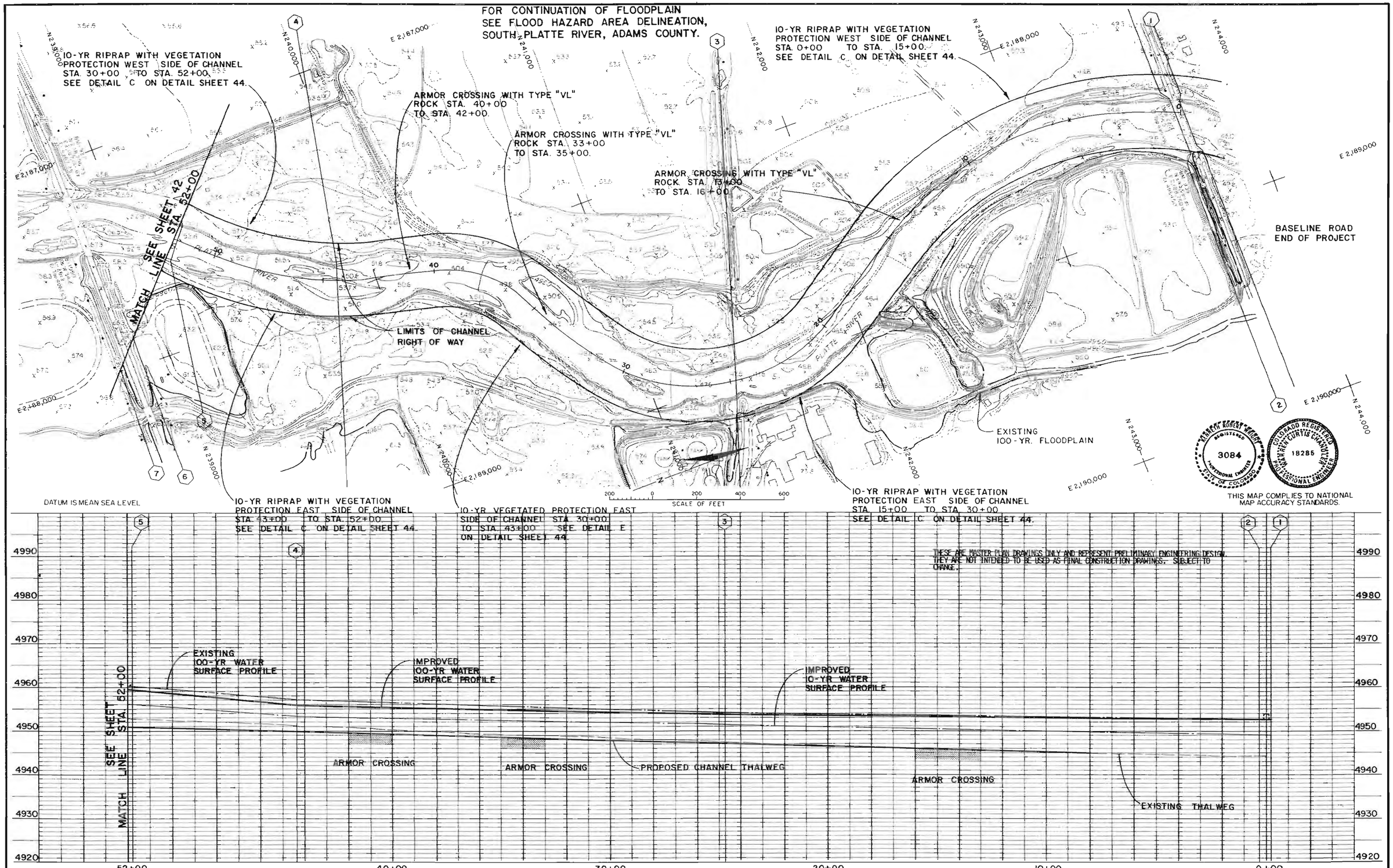
Improvements proposed include the stabilization of the river banks using vegetation or a combination of riprap with vegetation to the 10-year level. The alignment is close to its existing alignment with some widening required. The channel invert is to conform reasonably closely to that of the existing river bottom. Crossings must be armored in order to assure that no unreasonable degradation occurs.

Floodplain regulations are to be superimposed on the recommended improvements. This will insure that no imprudent development occurs in the residual 100-year floodplain. Prior to the construction of recommended improvements, floodplain management practices should be in accord with the flood hazards identified for the existing channel conditions

COST ESTIMATE
SHEET 43 OF 45
SOUTH PLATTE RIVER
STATION 0+00 TO STATION 52+00

CONSTRUCTION

Drainage improvement costs	$670,000
Street crossing costs	---
Utility relocation costs	---
Total construction costs	670,000
Engineering and contingencies (30% of total construction costs)	201,000
Property acquisition	252,000
TOTAL IMPROVEMENT COSTS	1,123,000
Operation and Maintenance	$13,160



GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave, Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

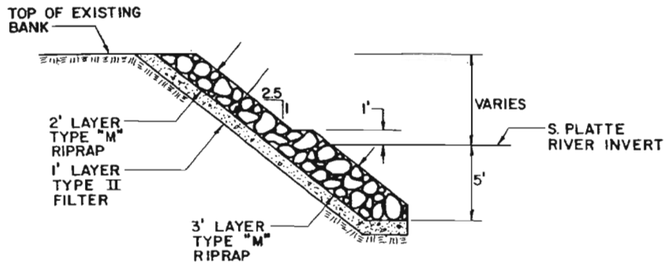
DESIGNED WCC, MWG DATE 5/85
DRAWN AFM, PQZ DATE 5/85
CHECKED MWG, BRW DATE 5/85
REVISED _____ DATE _____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

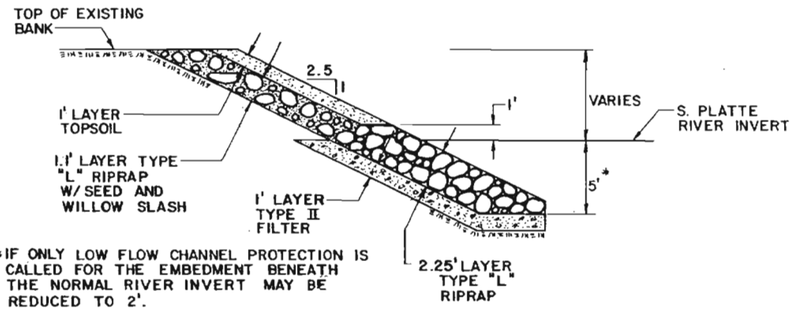
MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PLAN AND PROFILE
STA. 0+00 TO STA. 52+00

SHEET 43 OF 45

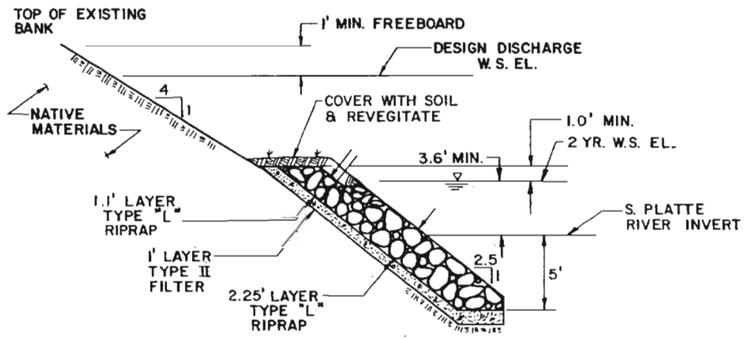


A REACH I — RIPRAP SLOPE PROTECTION DETAIL
1" = 5'

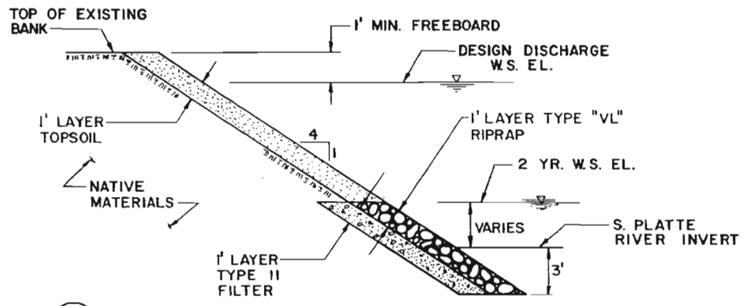


B REACH I — RIPRAP W/ VEGETATION SLOPE PROTECTION DETAIL
1" = 5'

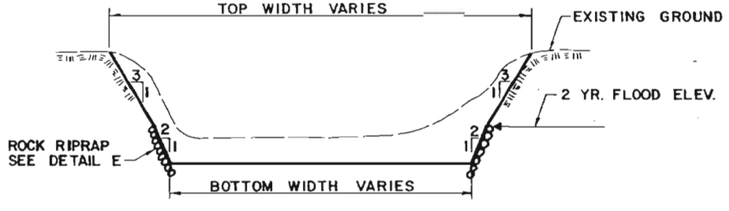
C TYPICAL RIPRAP WITH VEGETATION SLOPE PROTECTION DETAIL
1" = 5'



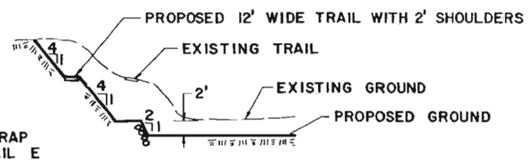
D TYPICAL RIPRAP SLOPE PROTECTION DETAIL
1" = 5'



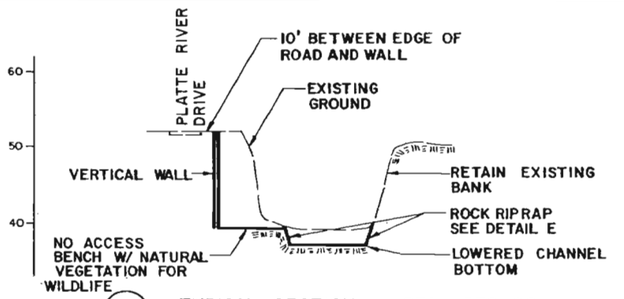
E TYPICAL CHANNEL WIDENING
1" = 5'



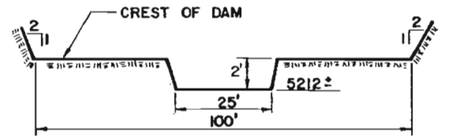
F TYPICAL CHANNEL DEEPENING
1" = 50' HORIZ. 1" = 10' VERT.



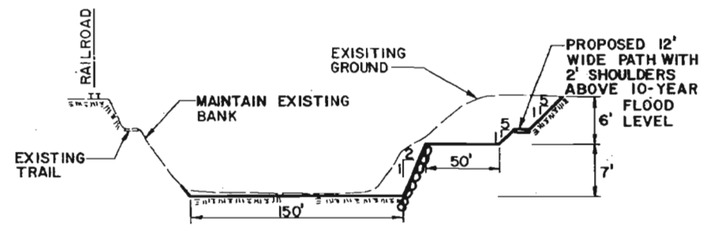
G TYPICAL SECTION AT STA. 1355+00 TO STA. 1358+00 1" = 50' HORIZ. 1" = 10' VERT.



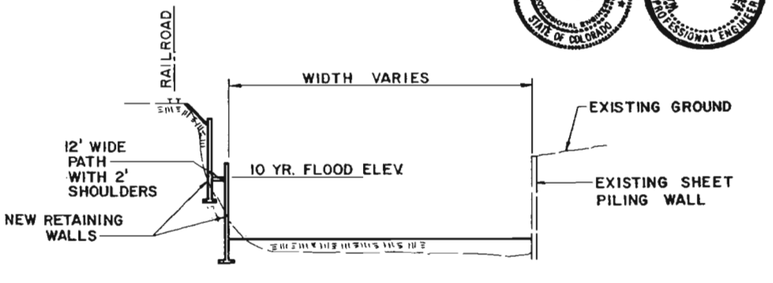
H TYPICAL SECTION STA. 1570+00
1" = 100' HORIZ. 1" = 10' VERT.



J DAM AT STA. 1479+00



K SPEER BLVD. TO I-25
1" = 50' HORIZ. 1" = 10' VERT.



L TYPICAL SECTION UPSTREAM OF 13th AVE.
1" = 50' HORIZ. 1" = 10' VERT.

0 1 2 3
ORIGINAL SCALE IN INCHES

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS, SUBJECT TO CHANGE.

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

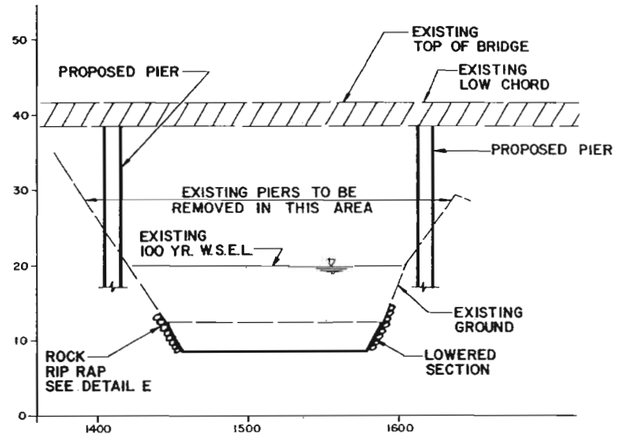
DESIGNED WCC, MWG DATE 5/85
DRAWN RTM DATE 5/85
CHECKED WCC, MWG DATE 5/85
REVISED ——— DATE ———

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

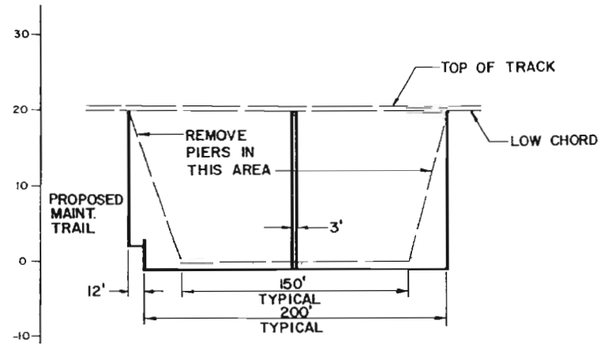
MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

TYPICAL DETAILS

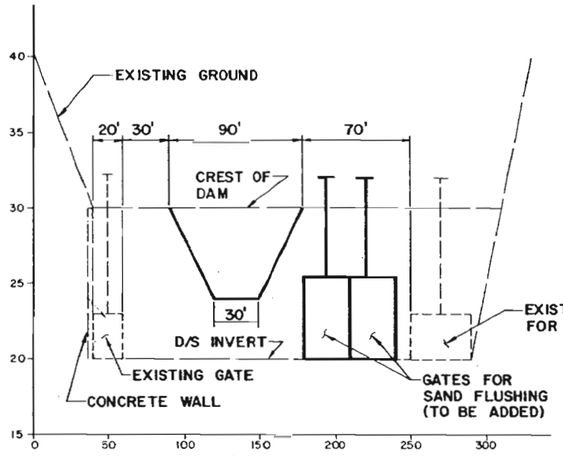
THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY ENGINEERING DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.



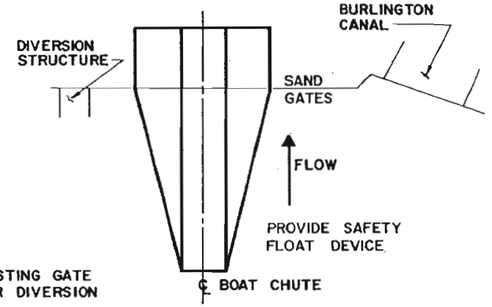
M RAILROAD BRIDGE NORTH OF YORK STREET
1" = 50' HORIZ. 1" = 10' VERT.



Q TYPICAL RAILROAD BRIDGE IMPROVEMENT
STA. 1108+50 TO STA. 1067+00
1" = 50' HORIZ. 1" = 10' VERT.

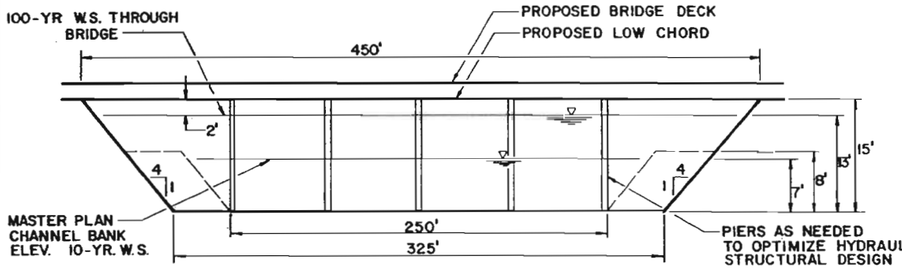


PROFILE



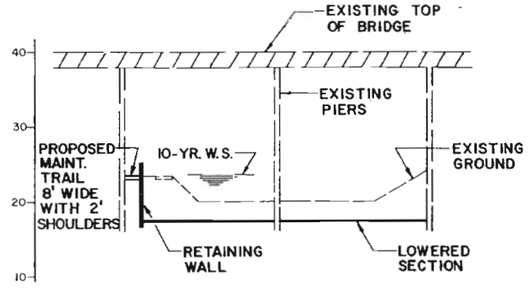
PLAN

S BURLINGTON DAM BOAT CHUTE
1" = 10' HORIZ. 1" = 5' VERT.

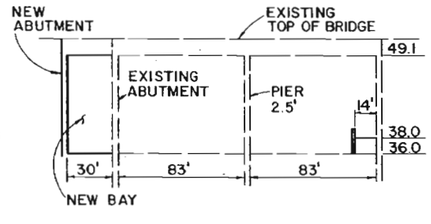


PROVIDE TRAIL IN ACCORDANCE WITH REQUIREMENTS IN VOLUME II.

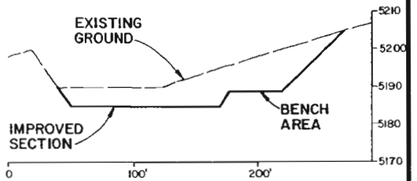
N TYPICAL ADAMS COUNTY BRIDGE DETAIL
1" = 50' HORIZ. 1" = 10' VERT.



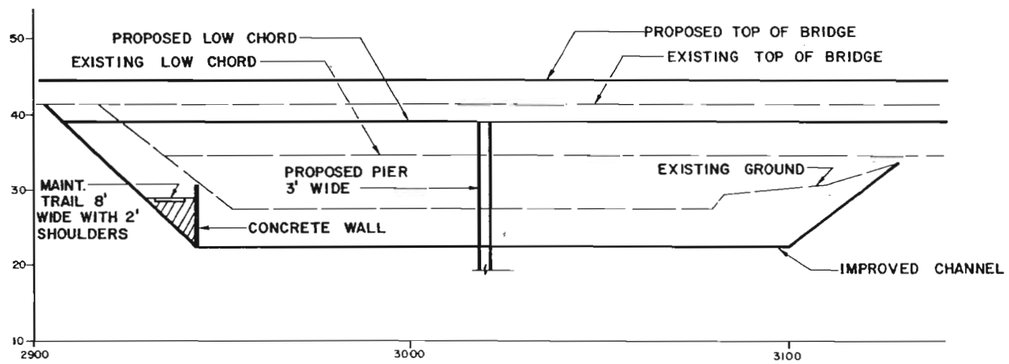
R TYPICAL BRIDGE MODIFICATION WITH TRAIL RELOCATION AND CHANNEL LOWERING



T EVANS AVE. BRIDGE
1"=50' HORIZ. 1"=10' VERT.

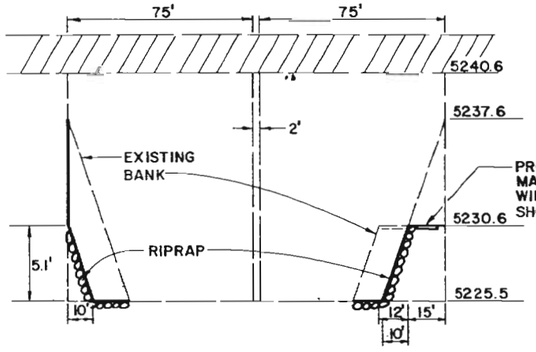


W BENCH AREA U/S OF SIXTH AVE.
STA. 1372+00 TO 1376+00

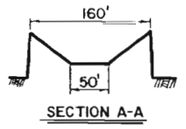


P FRANKLIN STREET BRIDGE
1" = 20' HORIZ. 1" = 10' VERT.

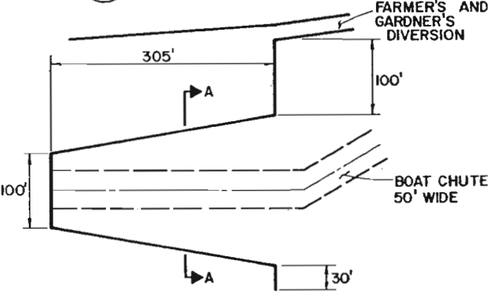
0 1 2 3
ORIGINAL SCALE IN INCHES

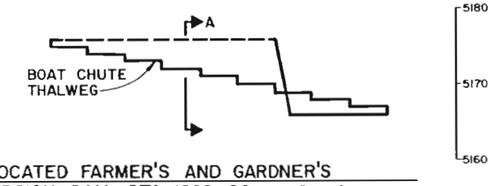


U FLORIDA AVE. BRIDGE
1" = 30' HORIZ. 1" = 5' VERT.



SECTION A-A





V RELOCATED FARMER'S AND GARDNER'S DIVERSION DAM STA. 1262+00 1"=100'

WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700 URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.	DESIGNED WCC, MVG DATE 5/85 DRAWN PF, JM DATE 5/85 CHECKED WCC, MVG DATE 5/85 REVISED DATE	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	TYPICAL DETAILS	SHEET 45 OF 45

MAJOR DRAINAGEWAY PLANNING

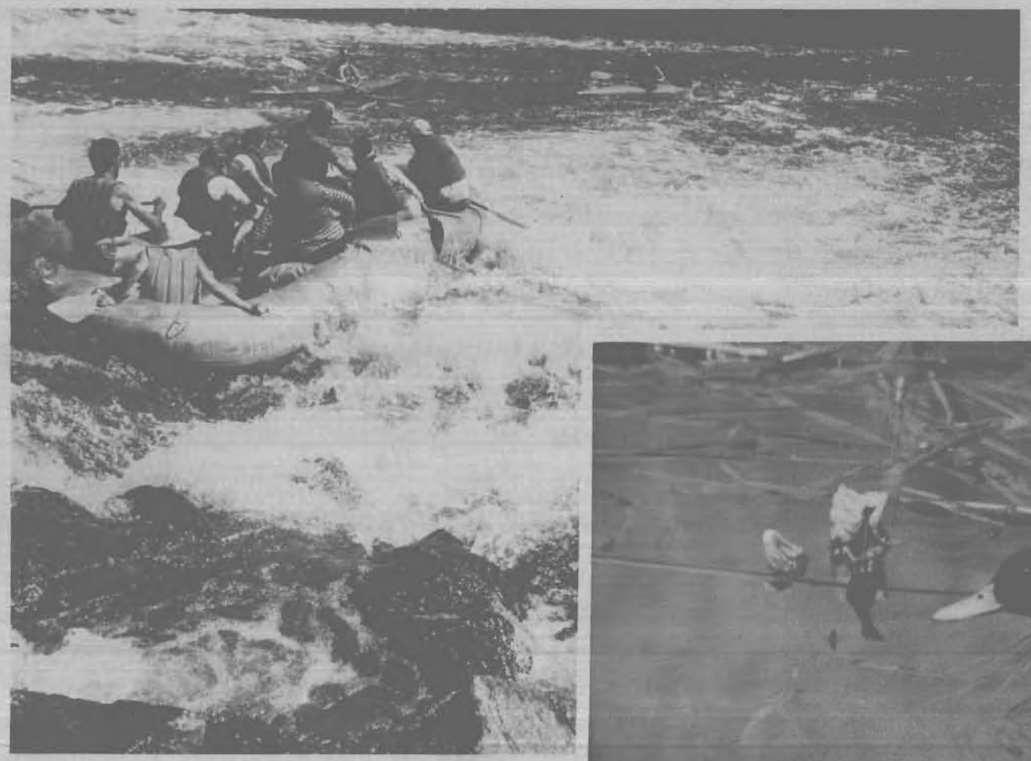
SOUTH PLATTE RIVER

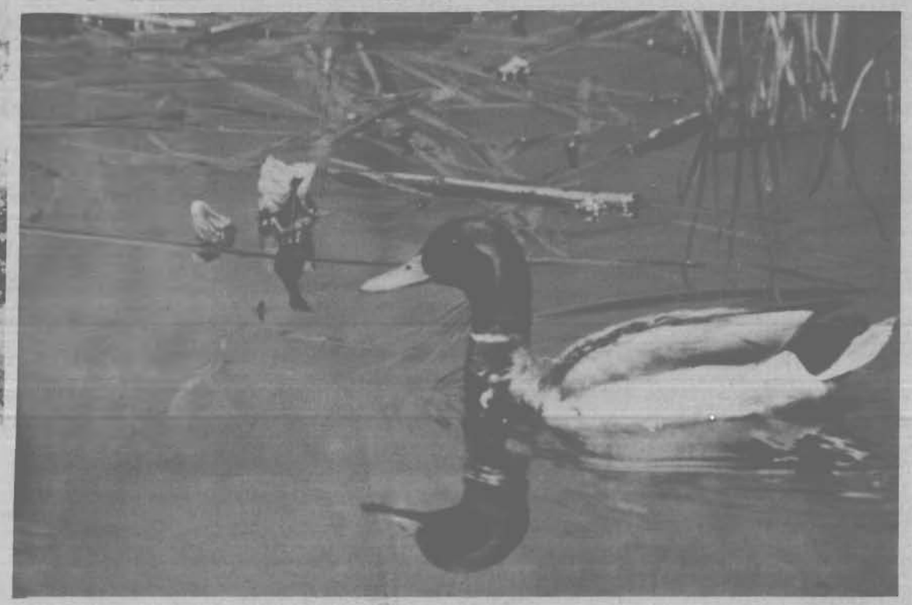
CHATFIELD DAM TO BASELINE ROAD

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B - VOLUME II

RECREATION PLAN





PROJECT SPONSORS

- ADAMS COUNTY
- ARAPAHOE COUNTY
- DOUGLAS COUNTY
- JEFFERSON COUNTY
- CITY AND COUNTY OF DENVER
- TOWN OF COLUMBINE VALLEY
- CITY OF BRIGHTON
- COMMERCE CITY
- CITY OF ENGLEWOOD
- CITY OF LITTLETON
- CITY OF SHERIDAN
- CITY OF THORNTON
- GREENWAY FOUNDATION

PROJECT ADVISORS

- DENVER REGIONAL COUNCIL OF GOVERNMENTS
- COLORADO WATER CONSERVATION BOARD
- SOUTH SUBURBAN PARKS AND RECREATION DISTRICT
- COLORADO DIVISION OF WILDLIFE
- U.S. ARMY CORPS OF ENGINEERS
- COLORADO DIVISION OF PARKS AND OUTDOOR RECREATION

WRIGHT WATER ENGINEERS, INC.

URBAN ENVIRONMENTS, LTD.

DENTON HARPER MARSHALL, INC.

NOVEMBER 1985

WWE
Wright Water Engineers, Inc.

DENVER OFFICE
2490 West 26th Ave., Suite 55A
Denver, Colorado 80211
(303) 480-1700

TULSA OFFICE
707 South Houston, Suite 302
Tulsa, Oklahoma 74127
(918) 584-7136

GLENWOOD SPRINGS OFFICE
818 Colorado Avenue
P.O. Box 219
Glenwood Springs, Colorado 81602
(303) 945-7755
Denver Direct Line: 893-1608

November 11, 1985

Mr. L. Scott Tucker, Executive Director
Urban Drainage & Flood Control District
2480 West 26th Avenue, Suite 156-B
Denver, Colorado 80211

Re. South Platte River Corridor Recreation Plan

Dear Mr. Tucker:

Volume I of the South Platte River Corridor Phase B Report presented the preliminary design and master plan for the 40-mile reach of the South Platte River from Chatfield Reservoir to Brighton. Volume II of this report, which assumes that all improvements recommended in Volume I are in place, presents the recreation plan for this same 40-mile reach of the South Platte River.

The recreation plan of our Phase B work is published in a separate volume to provide wider distribution, coupled with economy of publication.

As Contractors with the District for the South Platte River Corridor assignment, we wish to take this opportunity to mention the outstanding work of Mr. Robert Smith of Denton Harper Marshall, Landscape Architects, and Mr. Rick Lamoreaux of Urban Environments, Limited.

Mr. Smith handled his assignment on this project in a thorough and professional manner. He contributed effort over and above what is expected to ensure a quality work product.

Mr. Lamoreaux provided valuable insight and innovative handling of the water-based wildlife and recreational aspects of the assignment. His descriptions and recommended solutions are clear and practical. Mr. Lamoreaux worked numerous hours over and above our expectations to ensure a result of which the sponsors can be proud. We are very pleased with the final work of these two consultants.

We would like to note the contribution of William A. Godby, of the Wright Water Engineers' technical staff. Mr. Godby is the former Chief Engineer of the U.S. Fish and Wildlife Service. He provided input to help ensure compatibility with the everyday needs of the fish and wildlife aspects of the project.

Direct support and assistance was provided by the American and Colorado Wildlife Federations, the National Audubon Society, and the Colorado Whitewater Association. Mr. Holliday, of the Colorado Division of Parks and Outdoor Recreation, provided excellent reviews and recommendations for the wildlife aspects of the project.

The preliminary design and master plan for the South Platte River was performed under Agreement No. 83-04.01 for the Urban Drainage and Flood Control District.

This recreation volume was undertaken and completed with the assistance and cooperation of the 13 Project Sponsors listed on the cover. The six Project Advisors provided invaluable contributions.

The purpose of this preliminary design is to provide guidance for the solution of flood problems while maintaining a balance with respect to the uses of the river. While the foremost and primary use of the South Platte River is for drainage and flood control, the development of this use must be coordinated with water supply, sewerage, land use, building development, recreation, transportation, wildlife, and open space.

The completed reports for this assignment include the following:

1. Phase A: Development of Alternative Plans
2. Phase B: Preliminary Engineering Design, Volumes I and II
3. Flood Hazard Area Delineation
4. Gravel Mining Criteria Report

The Phase B Report includes technical and planning information of the South Platte River, including:

- River flow
- Water rights
- Water quality
- Geomorphology
- Sedimentation
- Groundwater
- Open space
- Boating needs
- Inventories
- Mineral resources
- Parks and recreation
- Wildlife
- Trails and access roads

The South Platte River preliminary design is practical and achievable. It will result in a unified approach to control of the flooding problem within the framework of a valuable regional linear amenity. The South Platte River Corridor is an asset for all local governments and their citizens and can be made to serve them better.

This Volume II of the Phase B Report on the South Platte River Corridor represents a road map for recreational and ecological development and restoration of the 40-mile-long corridor. Following this master plan will provide a connected and systematic development of the corridor.

WRIGHT WATER ENGINEERS, INC.

KENNETH ROBERT WRIGHT REGISTERED 3084 PROFESSIONAL ENGINEER STATE OF COLORADO

Kenneth R. Wright,
Project Manager

William A. Godby,
Fish and Wildlife Specialist

DENTON HARPER MARSHALL

Robert Smith,
Chief Landscape Architect

URBAN ENVIRONMENTS, LTD.

Rick Lamoreaux
Chief Recreational Planner

VOLUME II
RECREATION PLAN
SOUTH PLATTE RIVER MAJOR DRAINAGEWAY PLAN
PHASE B REPORT

TABLE OF CONTENTS

	PAGE
SECTION I - PARKS, RECREATION AND OPEN SPACE OVERVIEW	
Introduction	I-1
General	I-1
SECTION II - PLANNING PROCESS	
General	II-1
Alternative Descriptions	II-1
SECTION III - CRITERIA	
General	III-1
Parks	III-1
Trails	III-2
Water Recreation	III-4
Wildlife/Fish/Aquatic Life	III-6
River Access	III-8
Landscaping	III-9
Views	III-9
Operation and Maintenance	III-9
SECTION IV - COMMENTARY, COST ESTIMATE AND PRELIMINARY DESIGN DRAWINGS	
General	IV-1
Reach 1	
Commentary	IV-2
Cost Estimate	IV-2
Reach 2	
Commentary	IV-3
Cost Estimate	IV-3
Reach 3	
Commentary	IV-4
Cost Estimate	IV-4
Reach 4	
Commentary	IV-5
Cost Estimate	IV-5
SECTION IV (continued)	
Reach 5	
Commentary	IV-6
Cost Estimate	IV-6
Reach 6	
Commentary	IV-7
Cost Estimate	IV-7
Reach 7	
Commentary	IV-8
Cost Estimate	IV-8
Reach 8	
Commentary	IV-9
Sub-Reach A - Cost Estimate	IV-10
Sub-Reach B - Cost Estimate	IV-10
Sub-Reach C - Cost Estimate	IV-11
Sub-Reach D - Cost Estimate	IV-11
Sub-Reach E - Cost Estimate	IV-12
Sub-Reach F - Cost Estimate	IV-12
CONCLUSION	IV-13
COST ESTIMATE SUMMARY	IV-13
PRELIMINARY DESIGN DRAWINGS	IV-14
FOOTNOTES	IV-57
APPENDIX A - VEGETATION AND WILDLIFE INVENTORY	A-1
APPENDIX B - EXISTING AND PROPOSED PARK TABLE	B-1
APPENDIX C - RIVER OBSTRUCTIONS TABLE	C-1
APPENDIX D - ACKNOWLEDGEMENTS	D-1

SECTION I
PARKS, RECREATION AND OPEN SPACE OVERVIEW

INTRODUCTION

The South Platte River and its tributaries are very important natural resources in the Denver metropolitan area. Most of the region's population lives within walking distance of these waterways, making them key links from neighborhoods to a metro-wide recreation and transportation system. Increasing urban pressures require that we preserve and enhance the river corridor's recreational, wildlife and aesthetic benefits and that we continue the realization of its potential.

Even though the recreational resources of the Rocky Mountains lie just to the west of the urban region, access is almost exclusively dependent upon the automobile. The use of the automobile to reach the mountains further compounds the already critical air pollution problems of the metro area. The low-to-middle income areas of Denver lack sufficient recreational space, as does the region in general (page IV-57). A centrally located regional recreation resource is needed to help alleviate this deficiency and to serve as an alternative to the weekly, mountain-bound exodus of Denver residents.

The South Platte's potential as such a resource for metropolitan Denver is unparalleled. Since it forms the area's backbone not only in terms of physical location, but also with respect to transportation, drainage and employment concentration, it is readily accessible by most of the urban population. Tributaries to the South Platte and major highways offer direct connections from the river to surrounding business areas and residential communities.

Like most rivers around which an urban area has grown, the South Platte has been overlooked and neglected. In many areas, encroachment has resulted in flood problems, blight and pollution (page IV-57). It is time to utilize this valuable resource for better purposes.

The river valley still hosts a tremendous variety of native plant and animal life (see Appendix A). Descending into this riparian environment, one can escape the city bustle and rediscover the sights, sounds and scents of nature. If creatively restored and enhanced, the river can be a place to play, a wildlife refuge, an education facility and floodway, as well as a unique feature and focal point in the heart of the Denver metropolitan region.

GENERAL

The South Platte River is also a valuable resource as a home and refuge for a wide array of fish and wildlife. Though riparian ecosystems occupy less than two percent of Colorado's total land area, some 43 percent of the state's wildlife and over 50 percent of its bird species require a riparian ecosystem to exist and thrive. The river's continuous riparian habitat, anchored by South Platte Park and the Smith Natural Area at either end of the 40-mile corridor, is critical to the survival of hundreds of mammals, reptiles, birds and fish that inhabit or migrate through the area.

Urban wildlife is receiving increased attention across the nation. The city developed using the South Platte as its primary life-giving resource. In the same way, the river is essential to the wildlife along the river which was here long before man settled in the Denver area. Its role in maintaining the balance between man and nature is important.

The fish and wildlife resources which are dependent on the river and its associated riparian habitat must not be subordinated to the perceived uses of the river by man. Cottonwoods, willows and other native plant species provide food, shelter and breeding habitat for the wildlife that share our urban environment. It is important that much of the river be maintained and improved in a natural state, although introduced species such as Russian Olive in areas of beaver depredation may have value. The preservation and management of wildlife snags is critical, as the number of species that prefer dead wood, in fact need it for survival, is vastly underestimated by the general public.

When development in the river valley is authorized by local government, land areas adjacent to the river need to be deeded or reserved by easement to provide both life-sustaining habitat for wildlife, and for the enjoyment of those people using the river corridor. With appropriate bank stabilization for safety and vegetation development, the ponds remaining after gravel mining operations are complete should be reclaimed as a wildlife and aquatic resource where possible. The deep bottoms found in most gravel ponds provide improved fish habitat and often help to prevent eutrophication. A native riparian land buffer should be provided between the river and the gravel ponds to encourage greater diversity in the riparian ecosystem.

An ongoing, vigorous water quality improvement program, including both biological and thermal aspects, will greatly enhance the environment for the fish and wildlife that inhabit and frequent the river valley. The habitat in the river channel and gravel ponds can be further enhanced through creating depressions in the river bottom where possible, selective boulder placement and boat chutes to create plunge pools, riffles and resting areas, and by providing overhanging vegetation for wildlife protection. Fish stocking should be accomplished as appropriate by the Colorado Division of Wildlife.

In addition to water quality improvement, the preservation of minimum stream flows is essential for fish and wildlife along the river. Additional wetland areas and native plantings adjacent to the water's edge are critical if we are to maintain and increase the number and variety of fish and wildlife species which require this habitat for life. Ideally, a wetland "bank" should be created in available areas along the river so that in the future, as existing wetlands need to be eliminated for justifiable reasons, mitigating wetland resources will already be established.

Where possible and necessary, artificial nesting boxes or structures can be provided as a supplement to the natural environment. Creation and preservation of nesting islands, protected from the influence of man, should be considered in the development of the riparian ecosystem. In order to provide for the enjoyment and education of the public, interpretive trails, special public facilities, and appreciation areas dedicated to wildlife observation and peaceful interaction with the natural environment should be provided wherever possible.

Although beaver co-inhabiting our urban environment is a somewhat amazing reality along the river, the location of their colonies and their population needs to be controlled by an agency such as the Colorado Division of Wildlife. This is essential to preserve and protect the natural habitat so critical to other species which inhabit and depend upon the river's riparian ecosystem for survival. Key trees should be identified and protected from beaver felling with wire mesh collars.

As specific plans for river improvement are formulated, it is hoped that reference will be made to, amongst others, Managing Forested Land for Wildlife, edited by Hoover-Wills, published by and available at the Colorado Division of Wildlife (page IV-57). Both the Division of Wildlife and the Colorado Wildlife Federation have been very helpful to the consultant during the course of the master planning effort and are prepared to continue providing assistance as the river improvement program continues.

RIVERFRONT IMPROVEMENTS AT HABITAT PARK IN DENVER, COLORADO

SECTION II
PLANNING PROCESS

GENERAL

As reflected in the Phase A portion of the master planning effort, the consultant has conducted an exhaustive inventory of existing and desired recreation improvements throughout the 40 miles of river being studied and has outlined a realistic, achievable improvement program for each reach of the river which, with minor adjustments, has been enthusiastically endorsed by each local sponsor. These sponsors include:

Adams County
Arapahoe County
Douglas County
Jefferson County
City and County of Denver
Town of Columbine Valley
City of Brighton
Commerce City
City of Englewood
City of Littleton
City of Sheridan
City of Thornton
Greenway Foundation

The process used by the consultant to arrive at the alternatives and criteria presented in this volume were vitally important elements of the work. Through the course of many months, complete previews of the inventory data and mapping were presented to the local sponsors at regular meetings, as well as to the public and interested groups. This continuous process of input and review by all interested and affected parties up and down the river helped to insure a complete data base on which later planning decisions could be made.

First, a matrix comparing engineering alternatives to recreation forms was developed to evaluate the impact of one upon the other. The recreation forms (parks, trails, boating, fishing/aquatic, swimming, access points, views/landscape and wildlife) were compared to the following engineering alternatives:

maintain existing configuration
natural type waterway
lined channels
limited structural improvements
acquisition of floodplain land
non-structural
relocation of channel
other
combinations

A second matrix was then prepared to determine which recreation form needed further study under each preliminary recreation alternative.

Using this data base, preliminary lists of alternatives and design criteria were prepared for each reach of the river. Local sponsors were again invited to review this material to insure a meaningful, realistic recreation program.

The Phase A conclusions and recommendations were carefully studied by each local sponsor and reviewed by the public in three separate forums. Through this continuous process of input and evaluation, the information and options were pared down into a publicly accepted and achievable improvement program for the South Platte River from Chatfield to Brighton.

ALTERNATIVE DESCRIPTIONS

The alternatives were developed in response to the environmental characteristics of each individual river reach and the desires of the local sponsors. Each reach of the South Platte River offers differing features. The alternatives are designed to describe the general nature of the recreation program that eventually may be implemented, but are still flexible to allow for the inclusion of such features as locally desired focal points and pocket parks. The alternatives can also be combined to create a special description for a unique reach of the river. The alternatives are as follows:

Develop a Regional Park Reserve

The Regional Park Reserve alternative is utilized in locations where the river corridor has not been channelized and the 100-year floodplain extends

beyond the banks. Its main purpose is to preserve the natural river corridor by offering an undisturbed area for wildlife habitat and passive recreation uses. This alternative captures the essence of the natural river valley.

Develop a Regional Park

This alternative utilizes the development of a regional park which dominates the river reach due to is size and scale. The park can be active and/or passive in nature.

Develop a Linear Park

The Linear Park alternative is used to describe a greenbelt system of trails and park spaces, while also providing a connection to other park facilities.

Develop a Focal Point Park

This alternative is the development of a park that emphasizes a natural or man-made feature.

Develop Limited Improvements

The Limited Improvements alternative builds upon an existing greenbelt trail system with the addition of such facilities as rest areas, boat landings, boat chutes, trails, landscaping, picnic shelters and parking lots. The specialized improvements complete the development of an existing linear park system.

Enhance Riverine Riparian Habitat

Whenever feasible and as a part of channel improvements (particularly those in Adams County), this alternative is used to stabilize banks and revegetate with native riparian vegetation for bank erosion protection. This alternate will also provide wildlife habitat for a wide variety of terrestrial and bird species.

THE UNCHANNELIZED RIVER FLOWS THROUGH SOUTH PLATTE PARK WHERE THE NATURAL ENVIRONMENT IS PRESERVED AND OFFERS AN UNDISTURBED AREA FOR WILDLIFE AND PASSIVE RECREATION.

SECTION III
CRITERIA

GENERAL

The recreation design criteria has been formulated to provide a sound basis for the construction of the river improvement program. The existing greenbelt establishes a time-tested set of design parameters which the consultant proposes to utilize and expand upon. The criteria is also a programming tool in the master planning process for determining the magnitude and type of recreational development along the river. In the future, local sponsors will be able to utilize this criteria for implementation of a unified and cost effective river corridor development.

PARKS

The five major classification of parks for this study are as outlined below:

Regional Park: Typically greater than 50 acres and/or incorporates regional appeal and is a destination point. The park can be active, passive, formal or natural.

Linear Park: Strip character oriented around a linear resouce that usually incorporates trail development and passive uses.

Pocket Park: Typically less than 20 acres in size and having a localized appeal. Often will serve as a trail access point and node along a linear park system.

Focal Point Park: Generally a park that emphasizes a unique natural or man-made feature such as a waterfall, fountain, monument or historical marker.

Reserve Park: Characterized by a river corridor that has not been channelized and is generally within the 100-year floodplain. The park preserves the natural environment and offers an undisturbed area for wildlife habitat and passive recreation uses.

General Park Uses

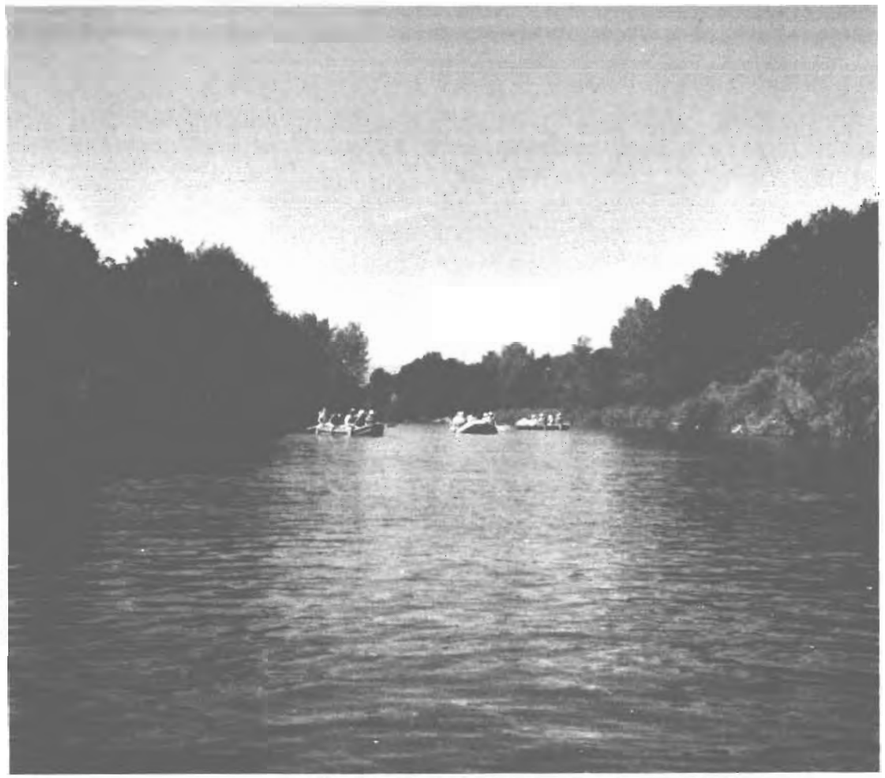
1. Active Recreation

Baseball	Playing Fields	Hockey
Softball	Play Structures	Tennis
Basketball	Multi-Use Courts	Fishing
Ice Skating	Cross-Country Skiing	Water Sports

2. Passive

Trails	Shelters	Ponds
Benches	Restrooms	Parking
Picnic Areas	Landscape Areas	Wildlife Observation

3. Natural
   - Wildlife Preserves
   - Vegetation Preserves



RAFTING ON THE SOUTH PLATTE RIVER IN METROPOLITAN DENVER

TRAILS (MAINTENANCE ACCESS)

Hard Surfaced: Common uses are hiking, biking, alternative transportation commuting, maintenance access, jogging, ski touring, walking and nature observation. No motorized vehicles should be permitted on the trail system except for maintenance purposes. National guidelines for handicapped accessibility should be strictly adhered to in the design of trails

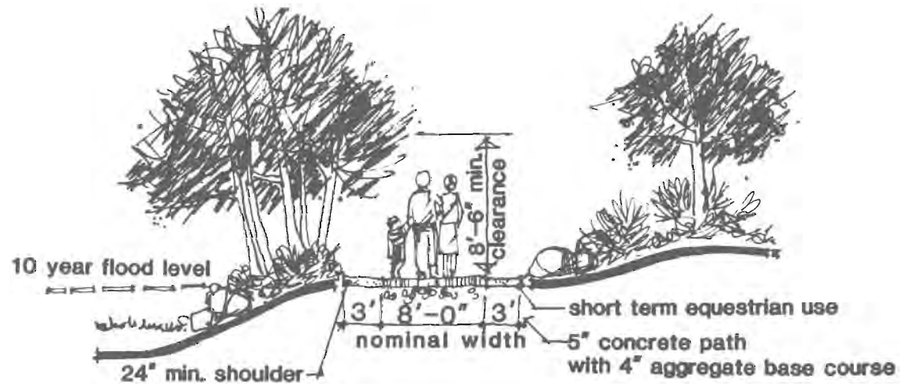
A five-inch thick concrete surface with strength of 4000 psi, eight to ten feet wide, should be placed over a four inch compacted aggregate base course. Asphalt surfacing is not recommended due to flooding and maintenance problems. Concrete is far more economical over the long term. The Denver Greenway trail system along the South Platte River is constructed with a color additive to enhance its appearance in the natural river environment. Other local sponsors are encouraged to continue its use to help create a unified river corridor.

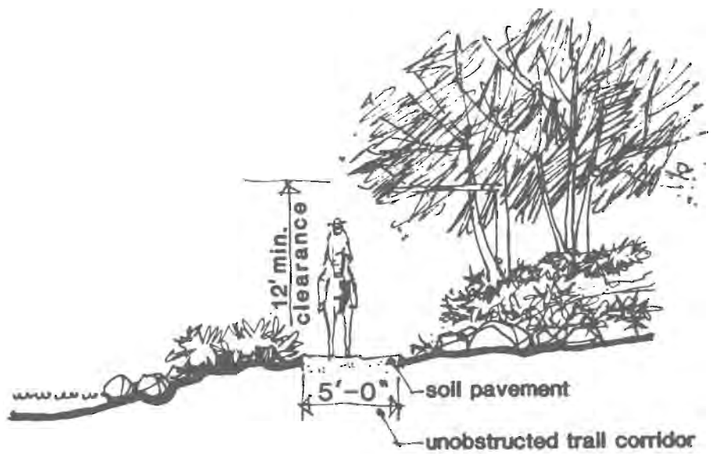
The trail, continuous throughout the 40-mile corridor, should be built on a relatively flat bench, 12'-14' wide, at or above the 5- to 10-year flood level wherever reasonable. Street/trail conflicts should be minimized to the fullest extent by constructing underpasses at automobile bridges. The underpasses should have a minimum vertical clearance of 8'6" and be placed at or above the two-year flood surface whenever possible. Trail connections to the cross-street above should be provided where existing clearance is insufficient and to offer access and continuous passage during periods of higher flows.

Convenient trail connections from tributary streams, consistent with the Colorado Division of Parks and Outdoor Recreation's "Colorado Greenway" loop-trail plan, as well as from local on-street bike routes should also be provided. A signage system throughout the corridor is recommended which locates and describes special features and identifies potential safety hazards for the benefit of recreationists, wildlife observers, bicycle commuters and others using the trail system.

Soft Surfaced: Common uses are equestrian, nature observation, walking, jogging, hiking, ski touring and maintenance access. These trails vary in width from five to twelve feet, depending upon the use anticipated, and are normally surfaced with gravel, soil or woodchips.

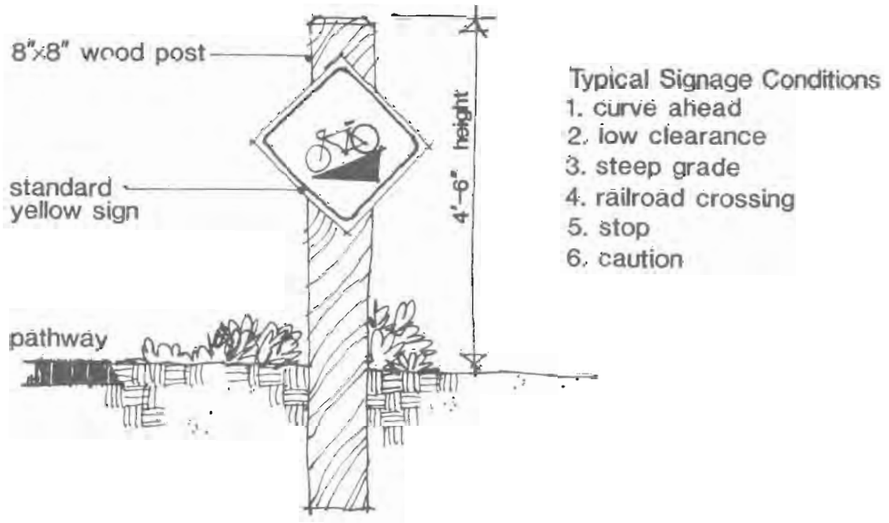
Typical preliminary design solutions for trails and signage are shown below.



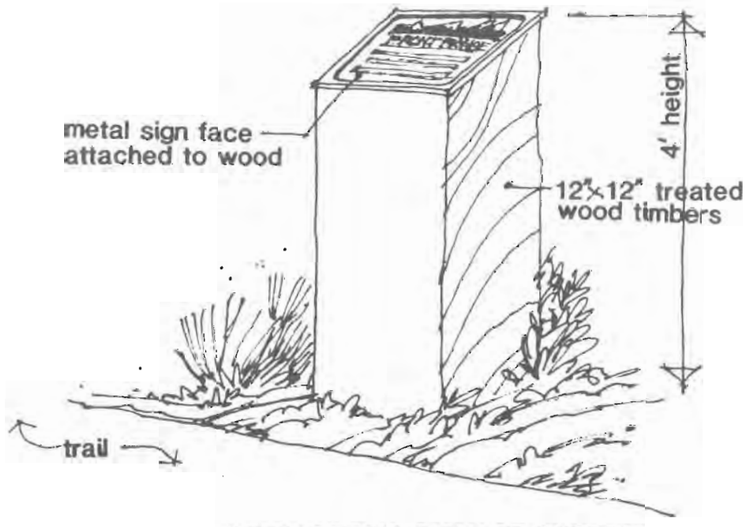


SOFT SURFACE TRAIL SKETCH

INFORMATIONAL SIGNAGE SYSTEM



SAFETY SIGNAGE SYSTEM



INTERPRETIVE SIGNAGE SYSTEM

TYPICAL REST AREA WITH BENCH, BIKE RACKS AND WATER FOUNTAIN

WATER RECREATION

Boating

The South Platte River through the metropolitan area is a valuable boating resource. The river can be navigated by rafts, canoes, kayaks and tubes. Row boats are basically restricted to the adjacent gravel lakes. Motorized boats are not used on the river.

Currently, river boating is hampered by man-made in-channel obstructions Such as concrete dams, weirs and rubble dams. The best method for achieving safe boating on the river is to construct a boat chute through the impediments and to build portage facilities that enable the boater to carry around the obstruction. Providing boat chutes (whitewater channels) is the preferred method from the standpoints of safety, flooding and fish habitat improvement.

Safety: Chutes allow the boater to negotiate the drop safely if the portage area is inadvertantly bypassed. However, it should be noted that whitewater boating presents inherent dangers. As such, particularly during higher flows, boat chutes should be negotiated only by experienced boaters.

Fun and Excitement: Chutes form whitewater drops that create a sense of excitement similar to running natural rapids.

Flooding: Chutes provide added flow carrying capacity for the river without harming the integrity or purpose of the structure.

Recreational Amenity: Chutes create pleasing whitewater and enhance the great recreational opportunities of the river.

Fish Habitat: Chutes create pools, eddies and riffles in the river which enhance its fishery potential and contribute to healthy, abundant aquatic life.

Warning signage and portages should be provided at each obstruction even if a chute or modification is constructed. The design of portages (boat landings) should be of a stepped configuration to allow for water level fluctuations.

Signage that identifies life vest requirements for water sports should be developed and displayed at access points, boat landings, and other appropriate locations.

Obstructions are classified into three general types:

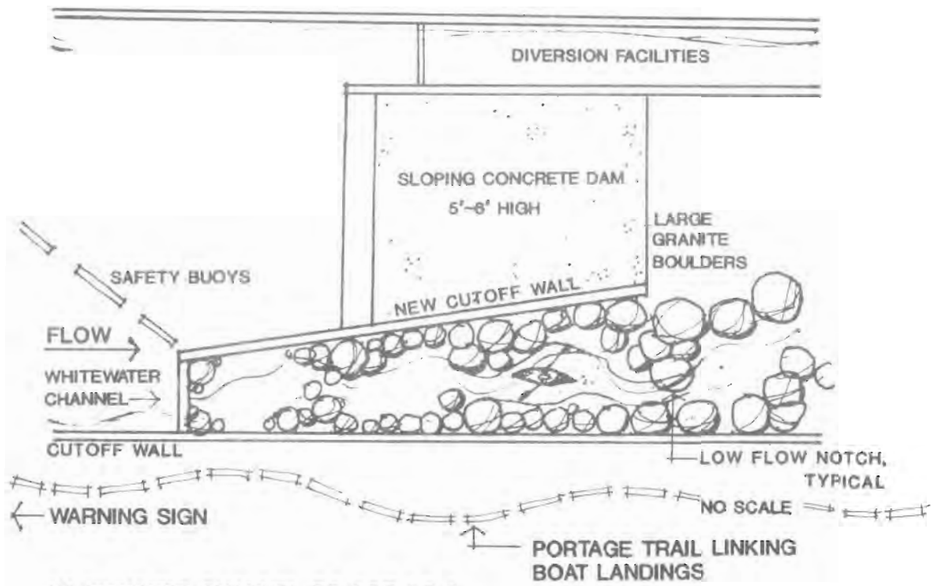
Large Concrete Structure: 6' to 12' high and normally used to divert irrigation or municipal water.

Medium Sized Dams: Generally constructed of rubble or sheet piles, 3' to 6' in height and used to divert water or to prevent upstream erosion.

Small Check Dams and Utility Crossings: 1' to 3' high and normally used to prevent erosion or to protect utility crossings.

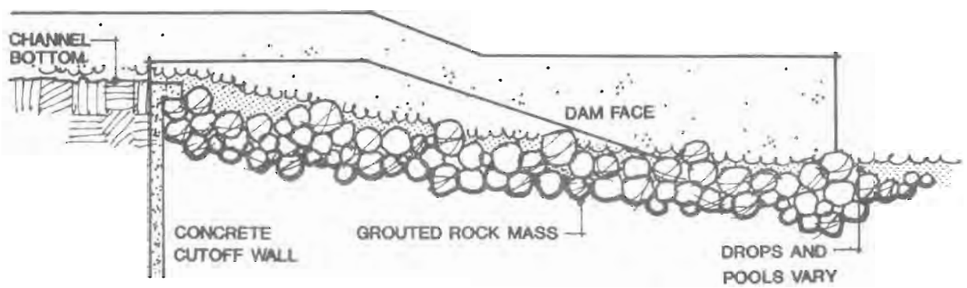
Each impediment or dam has characteristics unique in its structure and location. A detailed field investigation of each drop structure should be conducted before final design is undertaken. Typical preliminary design solutions for each type of obstruction are shown below.

WHITE-WATER RAFTING IN THE HEART OF DENVER, COLORADO



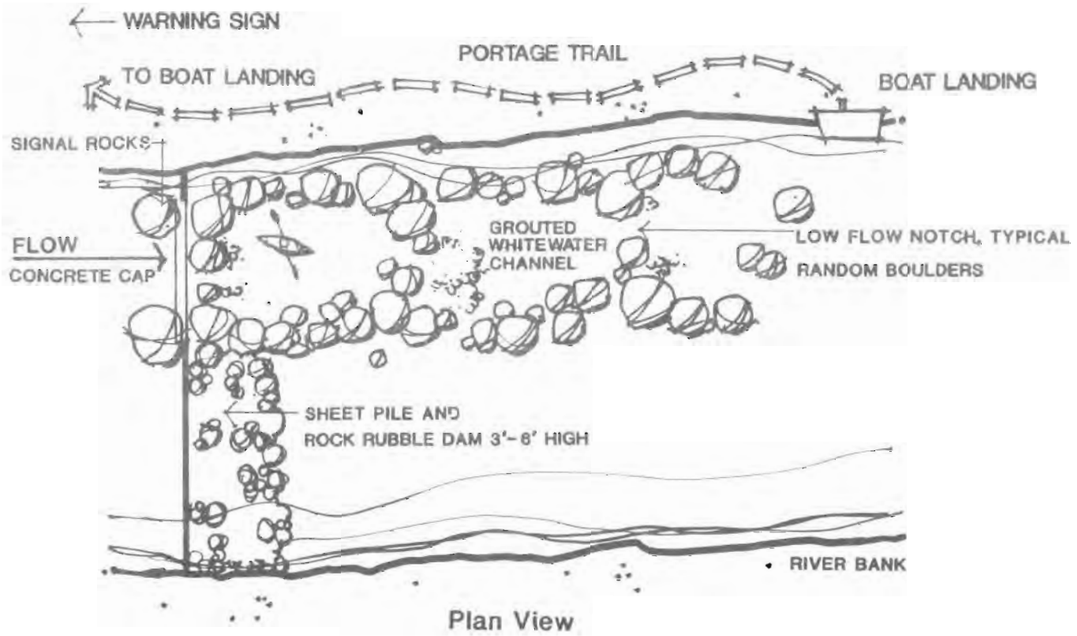
WHITEWATER CHANNEL TO ACT AS A
SIDE CHANNEL SPILLWAY DURING FLOOD PERIODS.

Plan View

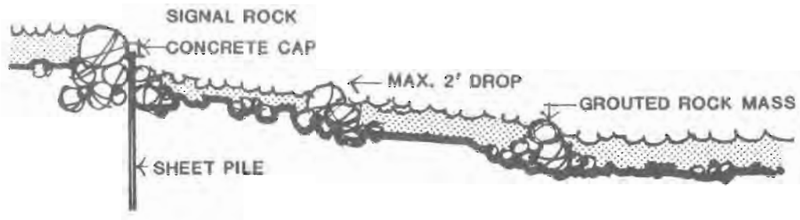


Section Through Whitewater Channel

LARGE CONCRETE DIVERSION DAMS

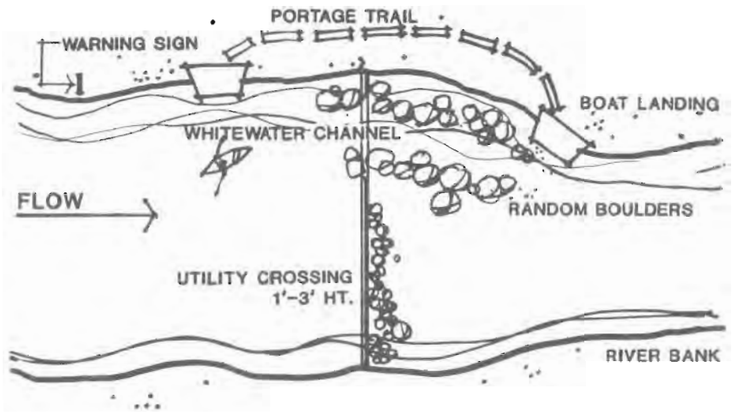


Plan View

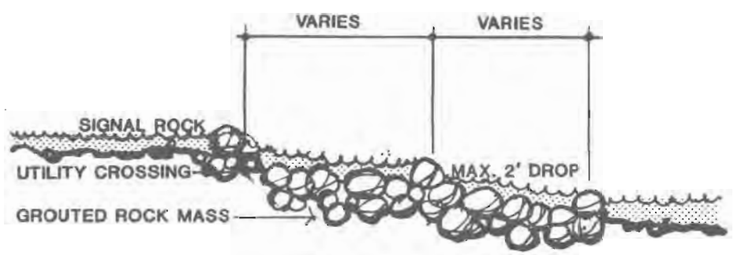


Section Through Whitewater Channel

MEDIUM SHEET PILE AND RUBBLE DAMS



Plan View



Section Through Whitewater Channel

UTILITY CROSSINGS AND SMALL CHECK DAMS

Wading/Swimming

The river provides ample opportunity for both supervised and spontaneous swimming and wading. Confluence Park is frequently host to many unsupervised South Platte bathers.

To enhance the river quality for swimming, wading, and boating, the water quality in the river should be monitored and improved. Where supervised swimming areas are developed, lifeguards and marked boundaries should be provided. Gentle side slopes on the river and gravel ponds are needed for easy wading entrance to a smooth, sandy bottom, and water quality should be frequently tested to meet adequate health standards.

WILDLIFE/FISH/AQUATIC LIFE

The South Platte River is currently home to a tremendous variety of wildlife. The river corridor has the potential to host an even greater abundance of waterfowl and aquatic life if properly managed to preserve and enhance important habitat for each species.

Once developed, the wildlife of the South Platte River will provide many fantastic opportunities for urban residents to enjoy and learn from the natural environment. In addition, as a healthy, productive river corridor, the South Platte can continue to play its historical and critical role in the survival of Colorado's wildlife population.

A variety of techniques for developing the wildlife resources of the river corridor are presented below.

Habitat Protection

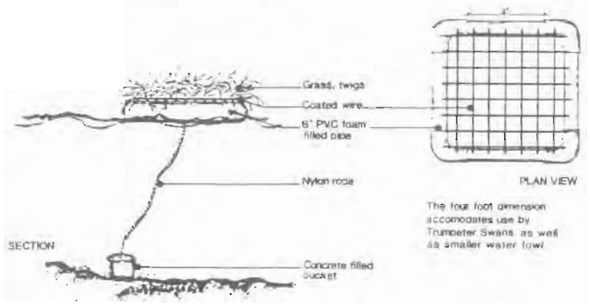
Human activities have taken their toll on the river as prime habitat is developed for other uses and water resources are polluted or depleted. Thus, protection of remaining habitat from further encroachment by development is an important strategy for protecting wildlife. Similarly, continued efforts to improve water quality and ensure proper water levels are critical to survival of wildlife and aquatic species. The potential of the river to support healthy and diverse fish and waterfowl populations is directly related to water quality and quantity.

Human activities are not the only threat to the river habitat. Surprisingly, the beaver, a native species, often destroys tree cover needed by other species. The Colorado Division of Wildlife or other appropriate agency should manage beaver colonies as needed. Key trees should be identified and protected from beaver felling with wire mesh collars.

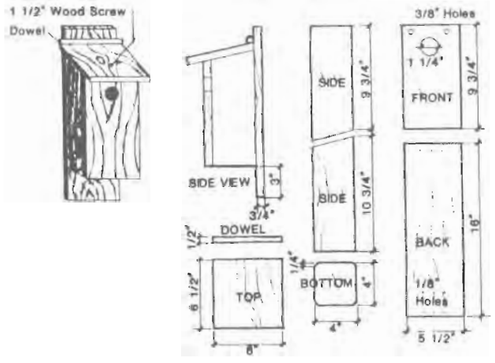
Habitat Enhancement

Nesting habitat for waterfowl can be improved with groundcover and artificial nesting boxes. A good, dense nesting groundcover can be created by using a mix of 1/2 lbs. sweet clover, 2-3 lbs. alfalfa, 6 lbs. intermediate wheat, and 4 lbs. tall wheat per acre.

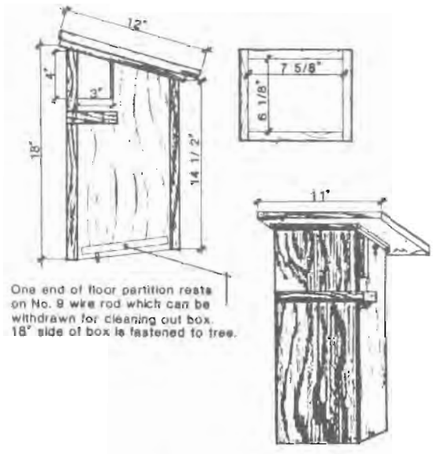
Both floating and ground based nests as shown in the sketches should be provided in appropriate locations. Bluebird and squirrel nest boxes are also shown.



ARTIFICIAL FLOATING NESTING BOX

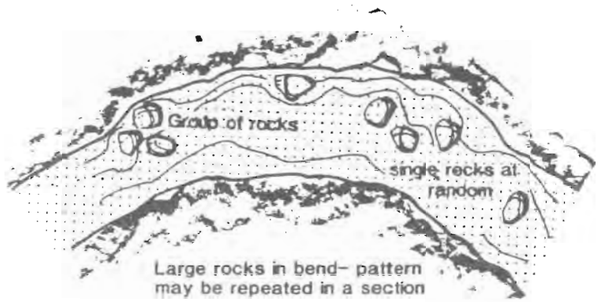


BLUEBIRD NESTING BOX

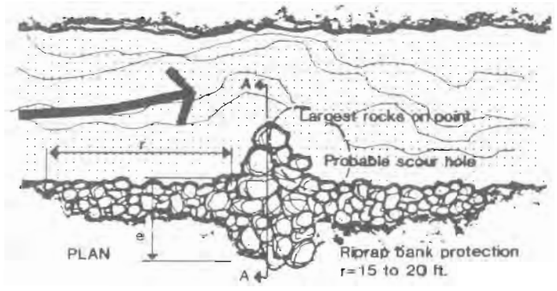


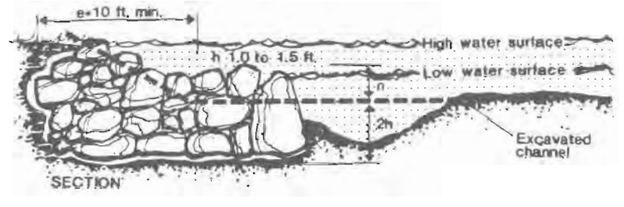
SQUIRREL NESTING BOX

The ponds remaining after gravel mining operations often provide excellent habitat for fish. By developing areas around selected ponds, the gravel ponds can become excellent fishing spots. In the river itself, fish benefit from plunge pools, riffles, and resting areas created by varying the depth of the river bottoms and the placement of rocks and other obstacles. In fact, the boat chutes recommended for the dams along the river also enhance fish habitat. Proper rock placement for fish habitat enhancement along the river is shown in the following sketches.

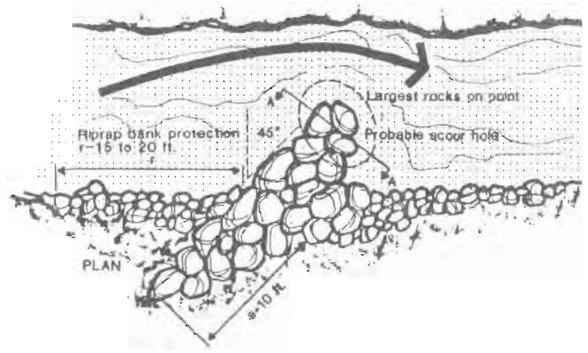


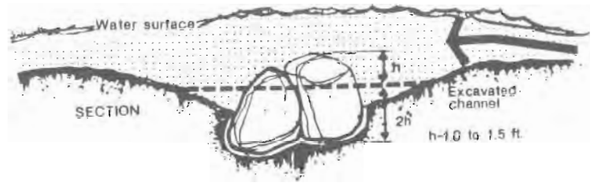
RANDOM INDIVIDUAL ROCK PLACEMENT





DUMPED ROCK DEFLECTOR

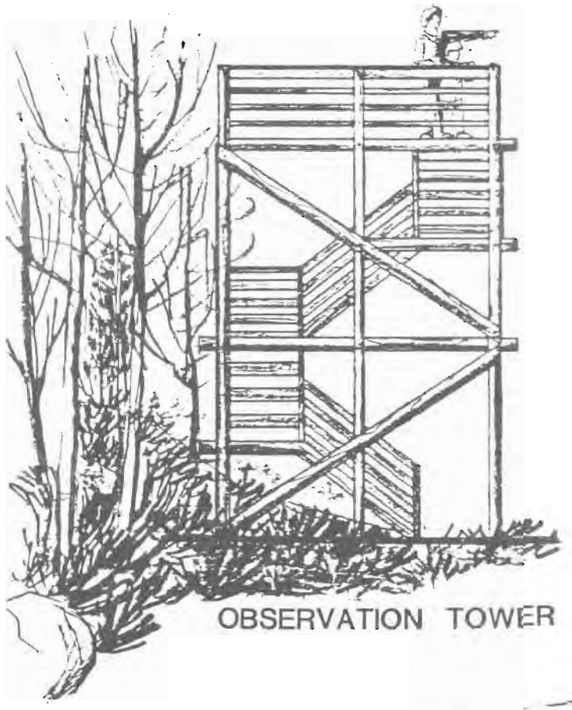




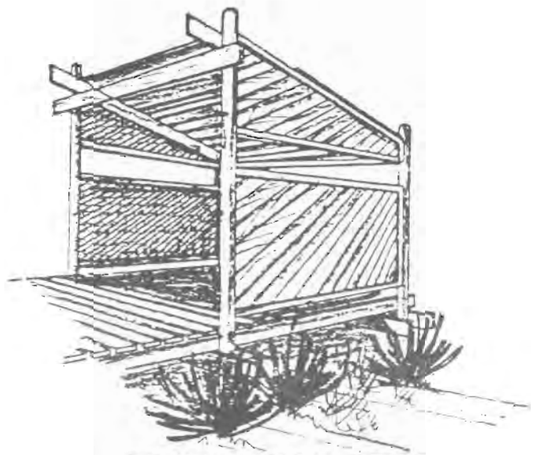
PLACED ROCK DEFLECTOR

Education

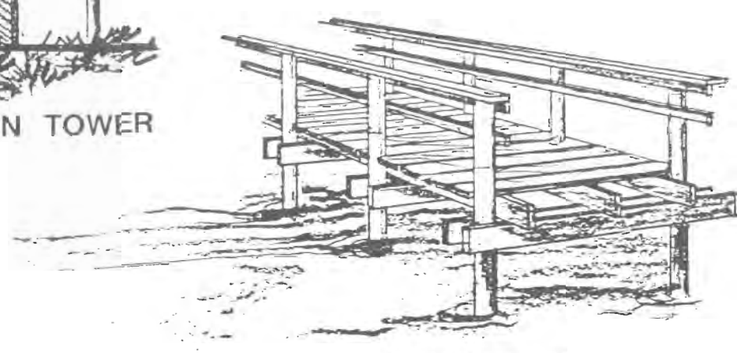
Increased contact between people and the wildlife resources of the South Platte River is a potentially valuable educational experience. However, wildlife must be protected from detrimental contact that would threaten their existence. A variety of structures as shown in the sketches can be used to allow contact while protecting wildlife and the land.



OBSERVATION TOWER



OBSERVATION DECK



BOARDWALK

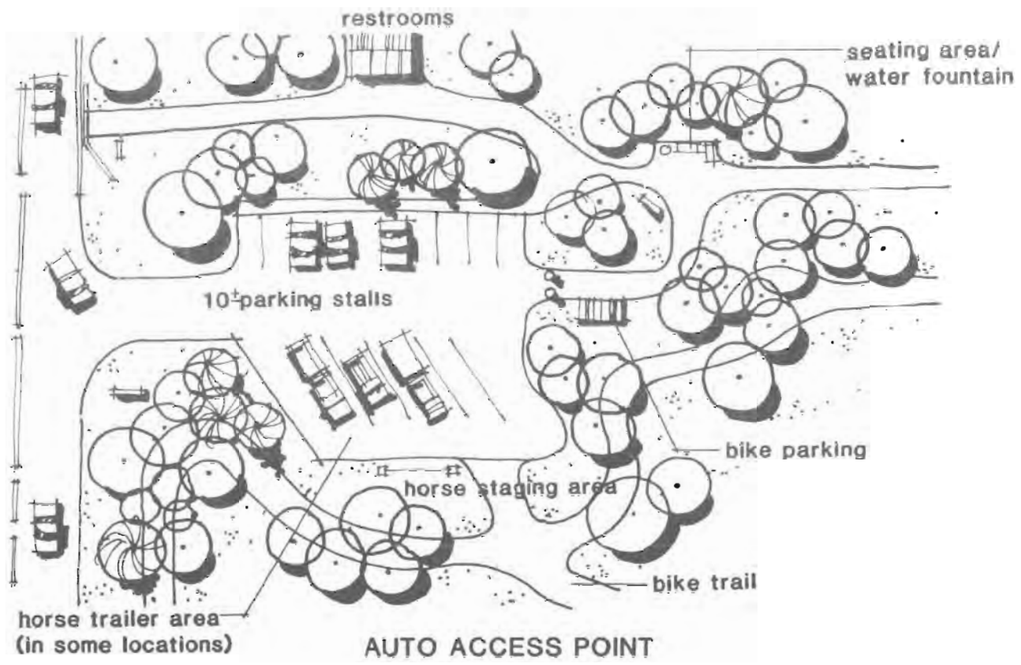
RIVER ACCESS

Boat Landings: The design of landings should be of a stepped configuation to allow for various flow levels. The steps should be 6" to 8" in height to accomodate easy boat access. The landings need to be within boat carrying distance of parking lots and trail systems.

Trail Access Points: Appropriate locations are at major street crossings, commercial/residential developments, tributaries, parking lots and boat landings. Access points should be clearly identified and signed.

Auto Access Points: Parking should generally be provided at boat landings, trail access points and major street crossings.

Typical designs for river access are depicted below.



AUTO ACCESS POINT

AUTO ACCESS POINT CHARACTER SKETCH

LANDSCAPING

Non-irrigated: This type of landscape approach utilizes native grasses, trees and shrubs. Turf areas should be species that are drought tolerant such as Buffalograss, Blue Grama, Side-Oats Grama and Little Blue Stem. Trees well adapted to the river environment include Cottonwood, Willow, Russian Olive, Green Ash and Hawthorn. The use of native plant materials along the river is encouraged.

Irrigated: This type of landscaping should be utilized for active park areas and irrigated with an underground automatic system. Typically the turf grasses are a bluegrass seed mixture. Trees and shrubs should be the more ornamental nursery grown varieties that are adapted to irrigated turf conditions.

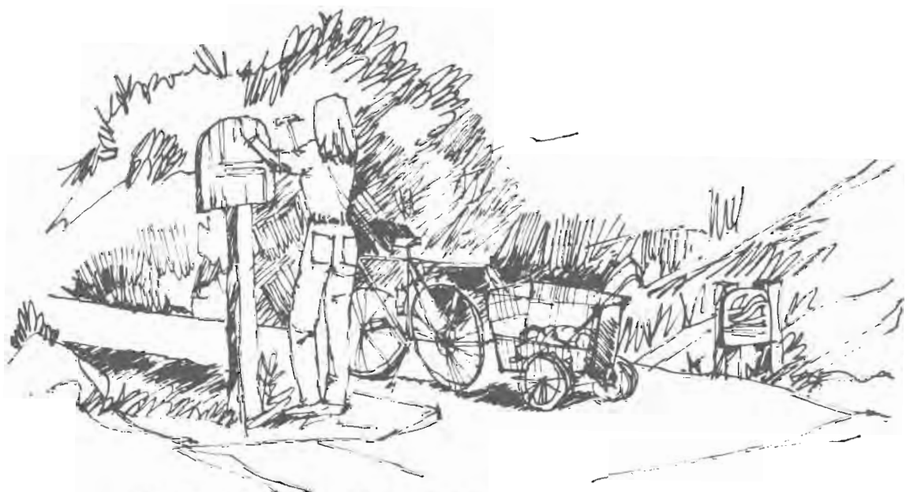
VIEWS

Existing good views from the river to the mountains and the city should be preserved and enhanced. Objectionable views can be screened by vegetation, fencing and/or zoning ordinances. Views to the river from the banks often require selective thinning of the vegetation to maximize sight lines.

OPERATION AND MAINTENANCE

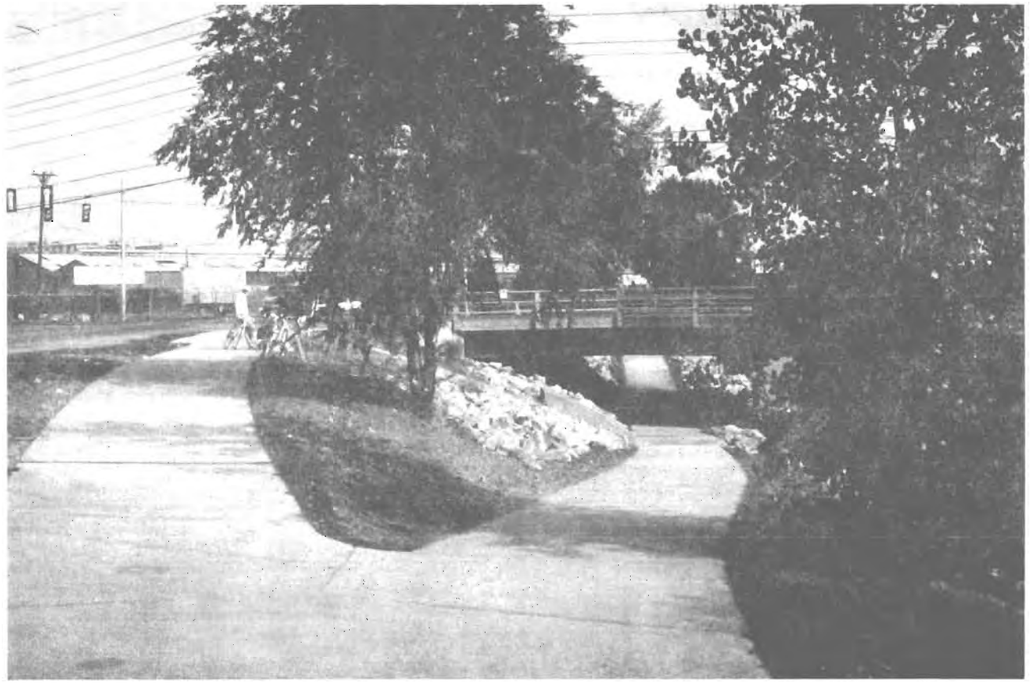
For the benefit of recreationsists and bicycle commuters using the river corridor and its tributary connections, as well as to preserve maximum flood carrying capacity in the channel, on-going maintenance of the improvements should be a high priority in each jurisdiction. Routine maintenance which should be carried out on a regular basis includes keeping the channel free of trash and debris, mowing the riverbanks (particularly the area adjacent to the trail system), litter pickup, weekly trail sweeping, weed control and general upkeep of the river improvements. In many jurisdictions, this work would be accomplished by the local parks and public works agencies or under contract to a private organization.

In Denver, the Greenway Foundation has found it necessary and desirable to supplement the city's maintenance efforts with a "Trail Ranger" program. During the summer months when use is the highest, the rangers regularly patrol the system to provide assistance to trail users while routinely picking up litter, sweeping glass and dirt off the trail in particular spots as needed, and generally keeping up the improvements such as by repairing handrail. This very successful program can serve as a model for other jurisdictions finding supplementary maintenance necessary.



TRAIL RANGER MAINTENANCE PROGRAM

DARTMOUTH AVENUE UNDERPASS BEFORE CONSTRUCTION



DARTMOUTH AVENUE UNDERPASS AFTER CONSTRUCTION

SECTION IV

COMMENTARY, COST ESTIMATE AND PRELIMINARY DESIGN DRAWINGS

GENERAL

It is now understood that improvements for recreation and wildlife enhancement should accompany any work accomplished along the river for flood control or other purposes. The South Platte is a valuable resource for the metropolitan area, and its revitalization is important if we are to continue and improve our quality of life.

The preliminary design drawings and cost estimates which follow offer specific design recommendations for desired recreational improvements along the river. In general, a continuous hike/bike/maintenance trail for non-motorized transportation and wildlife observation should be built throughout the entire 40-mile corridor. For protection against flooding and maintenance economy over time, it should be built of concrete. Street/trail conflicts should be minimized to the full extent possible, and convenient trail connections from tributary streams and local on-street bike routes should be provided.

Parks and wildlife areas of varying types should be created adjacent to the river wherever the opportunity exists or presents itself in the future. Adequate auto parking areas should be incorporated at each park area and at major street crossings. The existing riparian vegetation along the river should be preserved and expanded for reasons of improved habitat for wildlife and general aesthetics. Plantings of cottonwood, willow and other indigenous riparian species should be systematically done in conjunction with other improvements throughout the entire corridor.

Safe passage for boats using the river should be provided through river obstructions wherever possible and economically feasible. Boat landings both up and downstream of every obstruction, whether or not it contains a boat chute, should also be provided. Frequent use of large boulders to create plunge pools, riffles and eddies is encouraged both to improve the acquatic environment in the channel for fishlife and to enhance the boating experience. Efforts to improve water quality and minimum stream flows should be vigorously pursued for both recreational and wildlife reasons.

On the following pages is a brief descriptive summary of the recommended recreation and wildlife improvements for each reach of the river. The accompanying preliminary design drawings and cost estimates provide a detailed account of the consultant's recommendations.

JOGGING IS ONE OF THE MANY USES FOR THE HIKE, BIKE AND MAINTENANCE TRAIL.

REACH COMMENTARY

Sheets 4 and 5 of 23

Station 2074+00 to 1940+00

Reach One -- Chatfield to Columbine

Flood Control Alternative: Natural Type Channel with Erosion Protection and Floodplain Management

Recreation Alternative: Regional Park Reserve.

A major, regional park resource is currently under development in the form of South Platte Park (Littleton Floodplain Park). Much of the park should be developed for passive uses, such as wildlife observation, hiking and nature study. Two focal points (visitor center and historical marker) with more active uses are planned. The major spine trail should be constructed on the river's east side, but numerous nature trails throughout the balance of the park also need to be provided.

The two boating obstructions within Chatfield State Recreation Area are not to be improved due to restrictions by the Corps of Engineers. Both fish and wildlife habitat can be enhanced by selective rock placement in the channel and native plantings throughout the park. Access by car should be provided to the visitors center within the park. It is recommended that the local sponsor work with the state to provide a safe and convenient auto access and parking area where the same currently exists on an informal basis along C-470.

Wetlands should be created and enhanced within the park wherever there is adequate water and level land. The excellent wildlife habitat which currently exists in the area should be preserved and enhanced by leaving downed trees and wildlife snags in place, installing artificial nesting areas as appropriate, and providing wildlife observation facilities for the public throughout the park.

Tributary trail connections are recommended at or near Dutch Creek and Dad Clark Gulch. All of the land for the park has already been acquired, and it is open to the public for primarily passive use at the present time.

COST ESTIMATE

REACH 1: Chatfield Reservoir to Columbine Valley

Item	Quantity	Unit Cost	Total
A. PARKS			
1. South Platte Park Visitor Center	LS	$250,000	$250,000.00
2. Wolhurst Historical Marker	LS	10,000	10,000.00
		Subtotal:	$260,000.00
B. Trails			
1. Hard Surface Trail Construction			
a) South of C-470	2.2 MI	200,000	440,000.00
b) North of C-470	2.5 MI	200,000	500,000.00
c) West bank trial	1.3 MI	200,000	260,000.00
2. Tributary Trails	---	---	n/a
3. Pedestrian Bridge			
a) Unchannelized Type	LS	250,000	250,000.00
b) Drainage Crossing	LS	50,000	50,000.00
4. Nature Trails	---	---	n/a
		Subtotal:	$1,500,000.00
C. Boating			
1. Medium Boat Chutes	1	60,000	60,000.00
2. Boat Landings	6	6,000	36,000.00
3. Informal Boat Landing at South Platte Park	---	---	n/a
		Subtotal:	$96,000.00
D. Fishing			
1. Create additional fish habitat (20 CY of rock per spot)	160 CY	50	8,000.00
2. Stocking of lakes (state)	---	---	n/a
		Subtotal:	$8,000.00
E. Access Points			
1. Auto Access to South Platte Park	LS	60,000	60,000.00
2. Parking Lot North of C-470	LS	70,000	70,000.00
		Subtotal:	$130,000.00
F. Views/Landscaping			
1. Landscape Reclamation in South Platte Park (materials only)	LS	50,000	50,000.00
2. Linear Landscape Planting	6 MI	21,000	126,000.00
		Subtotal:	$176,000.00
		Total:	$2,170,000.00
		30% Contingency:	651,000.00
		TOTAL REACH 1:	$2,821,000.00

Reach 1: Annual O & M Cost:

Routine Maintenance			
1. Trail Mowing	31,680 LF	.36	11,405.00
2. Weed Control	31,680 LF	.09	2,851.00
3. Debris & Trash Removal	31,680 LF	.50	15,840.00
4. Trail Sweeping	31,680 LF	.58	18,374.00
			$48,470.00

REACH COMMENTARY

Sheets 5, 6, and 7 of 23

Station 2074+00 to 1738+00

Reach Two -- Columbine to Oxford

Flood Control Alternative: U.S. Army Corps of Engineers Channel Improvement Project

Recreation Alternative: Linear Park.

Several pocket parks are recommended in this section, including Watson Lake, and at focal points such as Lee Gulch, the Riverfront Development and the Riverwalk Development. The entire reach is planned to be developed as a linear park with a continuous trail running on the river's east side until crossing via a new pedestrian bridge near Bowles to the west side. Tributary trail connections are suggested along Lee Gulch and Big Dry Creek.

The Corps of Engineers is currently channelizing this section of the river, and existing vegetation is being stripped. In order to provide for a continuous riparian wildlife corridor with an aesthetic character, attention should be given to revegetating both riverbanks with indigenous species at the earliest possible opportunity. In focal point parks which are natural in character, opportunities may exist for developing additional wetland areas as native wildlife habitats.

After the Corps completes its work, any remaining obstructions to continuous boating should be fitted with boat chutes and landings. The acquatic environment of the river can also be improved with selective rock placement as needed.

COST ESTIMATE

REACH 2: Columbine Valley to Oxford Avenue

Item	Quantity	Unit Cost	Total
A. Parks			
1. Watson Lake	17.2 AC	$ 30,000	$516,000.00
2. Focal Pt. Riverfront Development	1 AC	60,000	60,000.00
3. Focal Pt. Riverwalk Development	1 AC	60,000	60,000.00
4. Pocket Park (Waterfall) at Confluence of Lee Gulch	4 AC	40,000	160,000.00
5. Land Acquisition:			
a. Lee Gulch Park	4 AC	35,000	140,000.00
b. Watson Lake	17.2 AC	35,000	602,000.00
		Subtotal:	$1,538,000.00
B. Trails			
1. Hard Surface Trail Construction (trail only, grading by others)	4.9 MI	125,000	612,500.00
2. Tributary Trails	---	---	n/a
3. Pedestrian Bridge			
a) Unchannelized type	2	250,000	500,000.00
b) Drainage Crossing Type	3	50,000	150,000.00
		Subtotal:	$1,262,500.00
C. Boating			
1. Large Boat Chutes	2	250,000	500,000.00
2. Boat Landings	10	6,000	60,000.00
		Subtotal:	$560,000.00
D. Fishing			
1. Fish habitat (20 CY per spot)	160 CY	50	8,000.00
2. Watson Lake (State)	---	---	n/a
		Subtotal:	$8,000.00
E. Access Points			
1. Rest Areas and Special Features	4	10,000	40,000.00
2. River Plaza at Theatre Complex	LS	50,000	50,000.00
		Subtotal:	$90,000.00
F. Views/Landscaping			
1. Linear Planting/Thinning	4.9 MI	21,000	102,900.00
		Subtotal:	$102,900.00
G. Wildlife			
1. Landscape Plantings	4.9 MI	13,000	63,700.00
		Subtotal:	$63,700.00
		Total:	$3,625,100.00
		30% Contingency:	1,087,530.00
		TOTAL REACH 2:	$4,712,630.00

Reach 2: Annual O & M Cost

Routine Maintenance			
1. Trail Mowing	25,872 LF	.36	9,314.00
2. Weed Control	25,872 LF	.09	2,328.00
3. Debris & Trash Removal	25,872 LF	.50	12,936.00
4. Trail Sweeping	25,872 LF	.58	15,006.00
5. Park Mowing	23.2 AC	480.00	11,136.00
			$50,720.00

REACH COMMMENTARY

Sheets 7 and 8 of 23

Station 1738+00 to 1642+00

Reach Three -- Oxford to Bates

Flood Control Alternative: Natural Type Channel with Erosion Protection and Floodplain Management

Recreation Alternative: Linear Park

Skirting the Englewood Golf Course for much of this reach, the existing spine trail follows the river's east bank from the Oxford pedestian bridge to a point south of Hampden near Bear Creek confluence. There, it crosses on a pedestrian bridge to join the west-bank trail which was built in 1984 by the Greenway Foundation, Colorado Division of Parks and Outdoor Recreation, and the South Suburban Parks Foundation.

Under the Colorado Greenway program, 17 miles of tributary trail were linked together along the South Platte, Bear Creek, Kipling Parkway and Sanderson Gulch to form a loop trail connecting to the major Platte River Greenway trail and providing access to the system for thousands of people near the corridors. This is a model which the consultants recommend be followed along most of the tributaries to the river. Corridor preservation should begin immediately.

The Englewood Wildlife Preserve at the mouth of Bear Creek should be maintained and enhanced in a native state. Home to Heron and other wildlife species which depend on the habitat, additional wetland areas should be created in the preserve if at all possible. Access and auto parking could be provided on the river's west bank near Oxford. Additional access areas are recommended at several locations convenient to the trail system and linear park through this reach.

A pocket park is proposed for now-vacant property at the mouth of Little Dry Creek near Dartmouth. Since the Corps of Engineers is channelizing the river and stripping all vegetation along the Golf Course area, attention

COST ESTIMATE

REACH 3: Oxford Avenue to Bates Avenue

Item	Quantity	Unit Cost	Total
A. Parks			
1. Little Dry Creek Pocket Park	4.5 AC	$40,000	$180,000.00
2. Informal Picnic Area	.25 AC	40,000	10,000.00
		Subtotal:	190,000.00
B. Trails			
1. Soft Surface Trail	.5 MI	50,000	25,000.00
2. Hard Surface Trail	.2 MI	200,000	40,000.00
		Subtotal:	$65,000.00
C. Access			
1. Parking Lot at Little Dry Creek and Dartmouth	LS	40,000	40,000.00
2. Parking Lot at Oxford	LS	40,000	40,000.00
3. Boat Landings	4	6,000	24,000.00
		Subtotal:	$104,000.00
D. Views/Landscaping			
1. Tree Thinning	1 AC	2,000.00	2,000.00
2. Tree & Shrub Plantings	1.8 MI	21,000.00	37,800.00
		Subtotal:	$39,800.00
		Total:	$398,800.00
		30% Contingency:	119,640.00
		TOTAL REACH 3:	$518,440.00

Reach 3: Annual O & M Cost

Routine Maintenance			
1. Trail Mowing	9504 LF	.36	3,421.00
2. Weed Control	9504 LF	.09	855.00
3. Debris & Trash Removal	9504 LF	.50	4,752.00
4. Trail Sweeping	9504 LF	.58	5,512.00
5. Park Mowing	4.75 AC	480.00	2,280.00
			$16,820.00

REACH COMMENTARY

Sheets 8, 9, 10, and 11 of 23

Station 1642+00 to 1314+00

Reach Four -- Bates to Colfax

Flood Control Alternative: Limited Structural Improvements and Floodplain Management

Recreation Alternative: Limited Recreation Improvements

This area has already been developed by the Greenway Foundation and the City of Denver. Most of what remains to be done is relatively small in comparison to the $13 million expended to date in the successful ten-mile, 400-acre rehabilitation of the South Platte through Denver. However, several small park areas and parts of the existing trail are in need of additional improvement.

Since Denver forms the heart of the metropolitan region and will receive the heaviest trail use, an opposite-bank trail system is proposed. Boat chutes and landings are required at several locations to provide for continuous and safer passage, although most obstructions through the city have already been notched.

The excellent existing wildlife habitat along the river should be maintained and improved wherever possible. For example, dense ground cover should be planted along the riverbanks and at Overland Pond Park, where artificial floating nests and fish stocking can be employed to vastly improve the wildlife resources of the area.

Reach 4: Annual O & M Cost

Routine Maintenance				
1.	Trail Mowing	54,000 LF	.36	19,440.00
2.	Weed Control	54,000 LF	.09	4,860.00
3.	Debris & Trash Removal	54,000 LF	.50	27,000.00
4.	Trail Sweeping	54,000 LF	.58	31,320.00
5.	Park Mowing	90 AC	480.00	43,200.00
				$125,820.00

COST ESTIMATE

REACH 4: Bates Avenue to Colfax Avenue

	Item	Quantity	Unit Cost	Total
A.	Parks			
1.	Landscaping (turf and irrigation) opposite Valverde Park	.25 AC	$40,000	$ 10,000.00
2.	Picnic Area opposite Frog Hollow Park	.50 AC	40,000	20,000.00
3.	Overlook Park Picnic Shelter	LS	30,000	30,000.00
4.	Landscaping of Open Area south of 6th Avenue Pocket Park	8.8 AC	40,000	352,000.00
5.	Expand Frog Hollow Park	4.0 AC	40,000	160,000.00
			Subtotal:	$572,000.00
B.	Trails			
1.	Hard Surface Trail Construction - opposite bank	4.1 MI	200,000	820,000.00
2.	Right-of-way Acquisition (opposite bank trail)	19.4 AC	15,000	291,000.00
3.	New Concrete Trail from 8th Ave. to 13th Ave.	2,900 LF	175.00	507,500.00
4.	Retaining Walls to alleviate trail flooding	4 locations	30,000	120,000.00
5.	Pedestrian Bridge at Lakewood Gulch	LS	150,000	150,000.00
6.	Improved 13th Ave. Crossing	LS	15,000	15,000.00
7.	Tributary Trails	---	---	n/a
8.	Underpass Construction (opposite bank trail)	7	60,000	420,000.00
			Subtotal:	$2,323,500.00
C.	Boating			
1.	Medium Boat Chute	LS	60,000	60,000.00
2.	Safety Barrier at 13th Ave. Boat Chute	LS	5,000	5,000.00
3.	Low-Flow Channel downstream of Alameda Ave.	LS	2,250	2,250.00
4.	Boat Landings	14	6,000	84,000.00
			Subtotal:	$151,250.00
D.	Access			
1.	Guard Rail	2750 LF	18.00	49,500.00
2.	Pedestrian Crossings at Grant-Frontier Park, Florida Ave. Pedestrian Bridge and Vanderbilt Park	3	5,000	15,000.00
3.	Habitat Park Parking Lot	LS	40,000	40,000.00
			Subtotal:	$104,500.00
E.	Views/Landscaping			
1.	Tree Thinning	6.0 AC	2,000	12,000.00
2.	Overland Park Landscaping			
	a) Native Grass Seeding	12 AC	3,000	36,000.00
	b) Automatic Irrigation	12 AC	15,000	180,000.00
	c) Native Landscaping	12 AC	9,000	108,000.00
3.	Habitat Park Native Landscaping (trees & shrubs)	5 AC	9,000	45,000.00
4.	Landscape Screening at Public Works Yards	300 LF	16.00	4,800.00
5.	Linear Landscape Planting between 8th Ave. and 13th Ave.	.6 MI	21,000	12,600.00
6.	Linear Landscape Planting adjacent to I-25	2.1 MI	21,000	44,100.00
			Subtotal:	$442,500.00
			Total:	$3,593,750.00
			30% Contingency:	$1,078,125.00
			TOTAL REACH 4:	$4,671,875.00

REACH COMMENTARY

Sheets 11 and 12 of 23

Station 1314+00 to 1258+00

Reach Five -- Colfax to Cherry Creek

Flood Control Alternative: Limited Structrual Improvements and Floodplain Management

Recreation Alternative: Limited Recreation Improvements.

An excellent opportunity exists in this reach on both sides of the river to significantly expand the recreation, open space and wildlife habitat of the riparian ecosystem. Massive redevelopment projects are slated for this reach, which lies adjacent to downtown Denver, providing people-oriented improvements aimed at enhancing the visual attractiveness and recreational potential of the area should be a high priority. For significant wildlife enhancement, wetlands should be created both along the river and within development areas to receive and naturally cleanse storm runoff from the projects prior to reaching the river.

An opposite-bank trail system, preferrably 10' wide, is needed in this reach to provide adequate capacity for the expected heavy use. Miscellaneous boating improvements are recommended, together with improved access and parking facilities. Major relandscaping, as well as access trails through the new developments, should be included in the developers' and city's plans for the area. The existing tributary trail connection along Cherry Creek, built under the auspices of the Urban Drainage and Flood Control District and the City of Denver, provides an excellent link to downtown and the neighborhoods of southeast Denver.

An objective in this reach, proposed for intensive residential and office use, should be to permit one to take an elevator down to ground level, walk out the front door, and enter onto a running trail leading either upstream or downstream. Kayaking in the river before and after work would also be a resonable expectation.

COST ESTIMATE

REACH 5: Colfax Avenue to Cherry Creek

Item	Quantity	Unit Cost	Total
A. Parks			
1. West Bank Development	---	---	n/a
2. Central Platte Valley Development Park Land	---	---	n/a
3. Centennial Park	6.5 AC	$40,000	$260,000.00
4. Maintenance Warehouse Removal (turns into park land): Gates-Crescent Park (includes demolition only, not relocation)	2.0 AC	50,000	100,000.00
		Subtotal:	$360,000.00
B. Trails			
1. Hard Surface Trail Construction - opposite bank (east)	1.4 MI	200,000	280,000.00
2. Right-of-way Acquisition (opposite bank trail)	3.0 AC	15,000	45,000.00
3. Spur Trails through private development	---	---	n/a
4. Bank Stabilization rock riprap	175 CY	35.00	6,125.00
5. Pedestrian Bridges	2	250,000	500,000.00
		Subtotal:	$831,125.00
C. Boating			
1. Small Boat Chute	2	30,000	60,000.00
2. Low Flow Channel	LS	2,250	2,250.00
3. Boat Landings	6	6,000	36,000.00
4. Confluence Kayak Boater Return	LS	10,000	10,000.00
		Subtotal	$108,250.00
		Total:	$1,299,375.00
		30% Contingency:	389,813.00
		TOTAL REACH 5:	$1,689,188.00

Reach 5: Annual O & M Cost

Routine Maintenance			
1. Trail Mowing	14,784 LF	.36	5,322.00
2. Weed Control	14,784 LF	.09	1,331.00
3. Debris & Trash Removal	14,784 LF	.50	7,392.00
4. Trail Sweeping	14,784 LF	.58	8,575.00
5. Park Mowing	31 AC	480.00	14,880.00
			$37,500.00

REACH COMMENTARY

Sheets 12 and 13 of 23

Station 1258+00 to 1068+00

Reach Six -- Cherry Creek to Franklin

Flood Control Alternative: Limited Structural Improvements and Floodplain Management

Recreation Alternative: Limited Recreation Improvements

The major park opportunities in this section exist along the river's west bank, and they should be developed. An opposite-bank trail should be established through Riverfront Park north of 19th Street on the west bank with a pedestrian bridge connection to the east bank main trail. Riverfront Park itself should be developed for passive recreation use and improved wildlife habitat. As vacant land areas become available between Washington Street and the river, it is recommended they be obtained and converted to pocket park use.

Generally, river access needs to be improved throughout this reach. The trail connection to northwest Denver should be completed through the Rockmont Drive area and its landscape character improved. A short section of new trail between 50th Avenue and Franklin Street, together with a new pedestrian bridge crossing to the east, are also needed. Boating improvement recommendations for this area are relatively minor, but include a low-flow channel for continuous passage through the reach. Major relandscaping, native plantings and dense ground cover are suggested throughout this entire section for wildlife and aesthetic improvement.

COST ESTIMATE

REACH 6: Cherry Creek to Franklin Street

Item	Quantity	Unit Cost	Total
A. Parks			
1. Washington St. Pocket Park	4.0 AC	$40,000	$160,000.00
2. Land Acquisition (Washington St. Pocket Park)	4.0 AC	35,000	140,000.00
		Subtotal:	$300,000.00
B. Trails			
1. Hard Surface Trail Construction - opposite bank	3.5 MI	200,000	700,000.00
2. Northwest Trail Connection (19th St. to I-25)	0.6 MI	200,000	120,000.00
3. Right-of-way acquisition (opposite bank trail)	10.3 AC	15,000	154,500.00
4. Hard Surface Trail Construction (50th Ave. to Franklin St.)	0.4 MI	200,000	80,000.00
5. Pedestrian Bridges	2	250,000	500,000.00
		Subtotal:	$1,554,500.00
C. Boating			
1. Boat Landings	2	6,000	12,000.00
2. Improve Boater Access at existing Docks	3	8,000	24,000.00
		Subtotal:	$36,000.00
D. Views/Landscaping			
1. Riverfront Park and Rockmont Park Landscaping West Bank (trees, shrubs, turf, and irrigation)	22.4 AC	36,000	806,400.00
2. Linear Landscape Planting from Riverfront Park to Burlington-Northern Bridge (east bank)	.25 MI	21,000	5,250.00
3. Linear Landscape Planting from Burlington-Northern Bridge (38th St. to Franklin Street)	.50 MI	21,000	10,500.00
		Subtotal:	$822,150.00
		Total:	$2,712,650.00
		30% Contingency:	813,795.00
		TOTAL REACH 6:	$3,526,445.00

Reach 6: Annual O & M Cost

Routine Maintenance			
1. Trail Mowing	38,400	.36	13,824.00
2. Weed Control	38,400	.09	3,456.00
3. Debris & Trash Removal	38,400	.50	19,200.00
4. Trail Sweeping	38,400	.58	22,272.00
5. Park Mowing	37 AC	480.00	17,760.00
			$76,512.00

REACH COMMENTARY

Sheets 13, 14, and 15 of 23

Station 1068+00 to 960+00

Reach Seven -- Franklin to Sand Creek

Flood Control Alternative: Limited Structural Improvements and Floodplain Management

Recreation Alternative: Linear Park

Several pocket parks are proposed in this section, including those at Franklin Street, York Street, 64th Avenue and Highway 270 frontage road. The trail runs on the east bank to a point just south of the Metro Sewer Plant where it crosses on a new pedestrian bridge and continues on the west bank to Sand Creek. The roads and open area of the Riverside Cemetary could be incorporated into the trail corridor in this reach.

Seven river obstructions need to be improved with boat chutes and landings for continuous passage and improved safety. An opportunity exists for a Reserve Park for wildlife and passive recreation at the confluence with Sand Creek where additional wetlands might also be created. Native plantings of cottonwood, willow and dense ground cover should be accomplished to enhance the wildlife habitat, together with selective rock placement in the channel for improvement of the acquatic environment. The tributary connection along Sand Creek to the Highline Canal, which serves Aurora and other east-side metropolitan areas, should also be developed before the opportunity is lost. A new pedestrian bridge will be required to connect the Sand Creek trail to the Greenway trail.

COST ESTIMATE

REACH 7: Franklin to Sand Creek

	Item	Quantity	Unit Cost	Total
A.	Parks			
	1. 64th Ave. Pocket Park	1 AC	$40,000	$ 40,000.00
	2. York Street Pocket Park	1 AC	40,000	40,000.00
	3. Franklin St. Pocket Park	1 AC	40,000	40,000.00
	4. Land Acquisition	3 AC	35,000	105,000.00
			Subtotal:	$225,000.00
B.	Trails			
	1. Hard Surface Trail Construction	2.3 MI	200,000	460,000.00
	2. Burlington Canal Pedestrian Bridge - creek type	LS	50,000	50,000.00
	3. Hard Surface Trail Construction from Sank Creek Confluence to Brighton Blvd.	.9 MI	200,000	180,000.00
	4. Underpass Construction	2	60,000	120,000.00
	5. Pedestrian Bridge	2	250,000	500,000.00
			Subtotal:	$1,310,000.00
C.	Boating			
	1. Large Boat Chutes	2	250,000	500,000.00
	2. Medium Boat Chutes	2	60,000	120,000.00
	3. Small Boat Chutes	2	30,000	60,000.00
	4. Boat Landings	11	6,000	48,000.00
			Subtotal:	$728,000.00
D.	Views/Landscaping			
	1. Soil Cover for unsightly riprap, seeding & mulching	6 AC	3,000	18,000.00
			Subtotal:	18,000.00
E.	Wildlife			
	1. Wildlife Plantings (also serves a visual landscape purpose)	2.1 MI	21,000	44,100.00
			Subtotal:	$44,100.00
			Total:	$2,325,100.00
			30% Contingency:	697,530.00
			TOTAL REACH 7:	$3,022,630.00

Reach 7: Annual O & M Costs

Routine Maintenance				
1.	Trail Mowing	12,144 LF	.36	4,372.00
2.	Weed Control	12,144 LF	.09	1,093.00
3.	Debris & Trash Removal	12,144 LF	.50	6,072.00
4.	Trail Sweeping	12,144 LF	.58	7,044.00
5.	Park Mowing	17 AC	480.00	6,720.00
				$25,301.00

REACH COMMENTARY

Sheets 15, 16, 17, 18, 19, 20, 21, 22, and 23 of 23

Station 960+00 to 0+00

Reach Eight -- Sand Creek to Baseline Road

Flood Control Alternative: 10-year Engineered Stable Channel and Floodplain Management

Recreation Alternative: Linear Park, Regional/Focal Point Parks

The existing improvements in this reach are a great beginning to the Adams County Greenway system. They include a section of trail from Rendesvous Park near the confluence with Clear Creek to Steele Street Park, a graceful pedestrian bridge from Rendezvous Park to Engineer's Lake on the river's east bank, and substantial improvements within the major regional parks in the county.

The trail system is planned for the west side throughout this reach until it crosses to the east bank via a new pedestrian bridge to access the Smith Natural Area near Brighton. With appropriate advance planning, the trail can leave the riverbank entirely and meander through native wildlife habitats which can be acquired as the opportunity arises. Corridor preservation and land acquisition for park and wildlife habitat expansion should continue to be a high priority throughout this reach.

A tributary connection along Clear Creek, portions of which are existing, has the potential to link Golden and the northwest metropolitan area into the system. Other potentials exist along Niver Creek, Grange Hall Creek and several canals in the area. The connections should be taken advantage of before the opportunities are lost.

Significant expansion of the riparian and natural environment of the Colorado plains is possible throughout this reach, and it should be vigorously pursued. Snags and downed trees should be left in place as they create excellent wilfife nesting areas. Artificial nesting boxes should be provided in open water areas where ground cover is sparse.

The proposed channel realignment and bank stabilzation in this reach provide an excellent opportunity to reestablish an extensive riparian habitat within the river's flood plain, an opportunity which to date has been lost due to river erosion and dumping of debris on the banks to try and contain erosion. The planting of dense ground cover throughout this reach will help prevent erosion and greatly supplement the natural wildlife habitat along the river in Adams County. Observation and interpretive facilities should be provided at frequent intervals.

The lakes left over from gravel mining operations provide excellent habitat for fish and other wildlife, and they should be reclaimed for that purpose as well as for recreation use whenever possible. Breaching the dikes between these lakes and the river is not recommended as such action would diminish wildlife values, contribute to river instability and be contrary to the fish stocking objectives of the Colorado Division of Wildlife.

Development of pocket parks is proposed at 88th, 104th, and 160th Avenues. Four boating obstructions need to be modified and landings built in order to provide continuous passage and improved safety.

The development of major regional parks by Thornton and Adams County should be continued, and significant areas of wetland wildlife habitat are recommended for the specific designs for these facilities. Additional wetlands should be created, if the land is available, on lands adjacent to the river, particularly in the old oxbows which remain when the channel is realigned.

Extensive revegetation of both the riverbanks and adjacent property should be a priority throughout this reach. There is already an abundance of high quality wildlife habitat in this area. It should be maintained and expanded for the benfit of the riparian species which frequent and inhabit the river corridor, as well as for the enjoyment and education of all those who use it for peaceful contemplation, nature study, bird watching and other similar passive activities.

COST ESTIMATE

SUB-REACH A:

	Item	Quantity	Unit Cost	Total
A.	Parks			
	1. Rendezvous Park (focal point park) - completion only	37 AC	$25,000	$925,000.00
	2. Improve the Safety of Engineers Lake	25,000 CY	6.00	150,000.00
	3. C-270 to Frontage Pocket Park	1 AC	40,000	40,000.00
			Subtotal:	$1,115,000.00
B.	Trails			
	1. Hard Surface Trail Construction (west bank)	1.0 MI	200,000	200,000.00
	2. Soft Surface Trail Construction	2.2 MI	50,000	110,000.00
	3. Hard Surface Trail Construction (east bank)	1.2 MI	200,000	240,000.00
			Subtotal:	$550,000.00
C.	Fishing/Aquatic Life			
	1. Stock Lakes (by others)	---	---	n/a
D.	Boating			
	1. Boat Landings	1	6,000	6,000.00
			Subtotal:	$6,000.00
E.	Views/Landscaping			
	1. Linear Plantings	2.2 MI	21,000	46,200.00
			Subtotal:	$46,200.00
			Total:	$1,717,200.00
			30% Contingency:	515,160.00
			TOTAL SUB-REACH E:	$2,232,360.00

Sub-Reach A: Annual O & M Costs

Routine Maintenance				
1.	Trail Mowing	11,616 LF	.36	4,182.00
2.	Weed Control	11,616 LF	.09	1,045.00
3.	Debris & Trash Removal	11,616 LF	.50	5,808.00
4.	Trail Sweeping	11,616 LF	.58	6,737.00
5.	Park Mowing	44 AC	480.00	21,120.00
				$38,892.00

COST ESTIMATE

REACH B: Steele Street to 88th Avenue

	Item	Quantity	Unit Cost	Total
A.	Parks			
	1. Improve Thornton Regional Park (passive uses)	142 AC	$ 5,000	$710,000.00
	2. Improve Steele Street Park	5 AC	40,000	200,000.00
			Subtotal:	$910,000.00
B.	Trails			
	1. Hard surface Trail Construction (west bank)	1.4 MI	200,000	280,000.00
	2. Soft Surface Trail Construction	5.4 MI	50,000	270,000.00
	3. Hard Surface Trail Construction (east bank)	4.0 MI	200,000	800,000.00
	4. Pedestrian Bridge - drainage crossing	LS	50,000	50,000.00
			Subtotal:	$1,400,000.00
C.	Views/Landscaping			
	1. Linear Planting	2.8 MI	21,000	58,800.00
			Subtotal:	$58,800.00
D.	Wildlife			
	1. Wildlife Planting	2.8 MI	13,000	36,400.00
			Subtotal:	$36,400.00
			Total:	$2,405,200.00
			30% Contingency:	721,560.00
			TOTAL SUB-REACH B:	$3,126,760.00

Sub-Reach B: Annual O & M Costs

Routine Maintenance				
1.	Trail Maintenance	7,392 LF	.36	2,661.00
2.	Weed Control	7,392 LF	.09	665.00
3.	Debris & Trash Removal	7,392 LF	.50	3,696.00
4.	Trail Sweeping	7,392 LF	.58	4,287.00
5.	Park Mowing			
	a. Passive Area	142 AC	200.00	28,400.00
	b. Active Area	5 AC	480.00	2,400.00
				$42,109.00

COST ESTIMATE

SUB-REACH C:

	Item	Quantity	Unit Cost	Total
A.	Parks			
	1. 88th Ave. Pocket Park	2 AC	$40,000	$80,000.00
	2. 104th Ave. Pocket Park	4 AC	40,000	160,000.00
	3. Land Acquisition	6 AC	35,000	210,000.00
			Subtotal:	$450,000.00
B.	Trails			
	1. Hard Surface Trail Construction	3.0 MI	200,000	600,000.00
	2. Soft Surface Trail Construction	3.0 MI	50,000	150,000.00
	3. Pedestrian Bridge	LS	250,000	250,000.00
			Subtotal:	$1,000,000.00
C.	Boating			
	1. Large Boat Chute	LS	250,000	250,000.00
	2. Boat Landing	3	6,000	18,000.00
			Subtotal:	$268,000.00
D.	Fishing/Aquatic Life			
	1. Stock Lakes (by others)	---	---	n/a
E.	Wading/Swimming			
	1. Improve the Safety of the Gravel Lakes (by gravel company)	---	---	n/a
F.	Views/Landscaping			
	1. Linear Plantings	6.0 MI	21,000	126,000.00
			Subtotal:	$126,000.00
G.	Wildlife			
	1. Wildlife Plantings	6.0 MI	13,000	78,000.00
			Subtotal:	$78,000.00
			Total:	$1,922,000.00
			30% Contingency:	576,600.00
			TOTAL SUB-REACH C:	$2,498,600.00

Sub-Reach E: Annual O & M Costs

Routine Maintenance				
1.	Trail Mowing	15,840 LF	.36	5,702.00
2.	Weed Control	15,840 LF	.09	1,426.00
3.	Debris & Trash Removal	15,840 LF	.50	7,920.00
4.	Trail Sweeping	15,840 LF	.58	8,978.00
5.	Park Mowing	5.0 AC	480.00	2,400.00
				$26,426.00

COST ESTIMATE

SUB-REACH D: 104th Avenue to 120th Avenue

	Item	Quantity	Unit Cost	Total
A.	Trails			
	1. Hard Surface Trail Construction	3.9 MI	$200,000	$780,000.00
	2. Soft Surface Trail Construction	3.9 MI	50,000	195,000.00
	3. Small Pedestrian Bridge	LS	50,000	50,000.00
			Subtotal:	$1,025,000.00
B.	Boating			
	1. Large Boat Chutes	3	250,000	750,000.00
	2. Portages	8	6,000	48,000.00
			Subtotal:	$798,000.00
C.	Fishing/Aquatic Life			
	1. Stock Lakes (by others)	---	---	n/a
D.	Wading/Swimming			
	1. Improve the Safety of the Gravel Lakes (by gravel company)	---	---	n/a
E.	Views/Landscaping			
	1. Linear Plantings	3.9 MI	21,000	81,900.00
			Subtotal:	$81,900.00
F.	Wildlife			
	1. Wildlife Plantings	3.9 MI	13,000	50,700.00
			Subtotal:	$50,700.00
			Total:	$1,955,600.00
			30% Contingency:	586,680.00
			TOTAL SUB-REACH D:	$2,542,280.00

Sub-Reach D: Annual O & M Costs

Routine Maintenance				
1.	Trail Mowing	20,592 LF	.36	7,413.00
2.	Weed Control	20,592 LF	.09	1,853.00
3.	Debris & Trash Removal	20,592 LF	.50	10,296.00
4.	Trail Sweeping	20,592 LF	.58	11,943.00
				$31,505.00

COST ESTIMATE

SUB-REACH E:

Item	Quantity	Unit Cost	Total
A. Parks			
1. Continue Development of the Adams County Regional Park (to be determined by the County)	---	---	n/a
B. Trails			
1. Hard Surface Trail Construction	2.3 MI	200,000	460,000.00
2. Soft Surface Trail Construction	2.3 MI	50,000	115,000.00
3. Small Pedestrian Bridge	LS	50,000	50,000.00
		Subtotal:	$625,000.00
C. Fishing/Aquatic Life			
1. Stock Lakes (by others)	---	---	n/a
D. Wading/Swimming			
1. Improve the Safety of the Gravel Lakes (by gravel company)	---	---	n/a
E. Boating			
1. Boat Landings	5	6,000	30,000.00
2. Large Boat Chutes	3	250,000	750,000.00
		Subtotal:	$780,000.00
F. Views/Landscaping			
1. Linear Plantings	2.3 MI	21,000	48,300.00
		Subtotal:	$48,300.00
G. Wildlife			
1. Wildlife Plantings	2.3 MI	13,000	29,900.00
		Subtotal:	$29,900.00
		Total:	$1,483,200.00
		30% Contingency:	444,960.00
		TOTAL SUB-REACH E:	$1,928,160.00

Sub-Reach E: Annual O & M Costs

Routine Maintenance			
1. Trail Mowing	12,144 LF	.36	4,372.00
2. Weed Control	12,144 LF	.09	1,093.00
3. Debris & Trash Removal	12,144 LF	.50	6,072.00
4. Trail Sweeping	12,144 LF	.58	7,044.00
			$18,581.00

COST ESTIMATE

SUB-REACH F: 136TH Avenue to Baseline Road

Item	Quantity	Unit Cost	Total
A. Parks			
1. 160th Ave. Pocket Park	1.0 AC	$40,000	$ 40,000.00
2. Brighton Wildlife Preserve	---	---	n/a
3. Smith Natural Area	---	---	n/a
4. Land Acquisition	1.0 AC	35,000	35,000.00
		Subtotal:	$75,000.00
B. Trails			
1. Hard Surface Trail Construction	4.3 MI	200,000	860,000.00
2. Pedestrian Bridge - unchannelized	LS	250,000	250,000.00
3. Soft Surface Trail Construction	4.2 MI	50,000	210,000.00
4. Pedestrian Bridge - drainage crossing	LS	50,000	50,000.00
		Subtotal:	$1,370,000.00
C. Boating			
1. Large Boat Chute	2	250,000	500,000.00
2. Portages	4	6,000	24,000.00
		Subtotal:	$524,000.00
D. Fishing/Acquatic Life			
1. Stock Lakes	---	---	n/a
E. Wading/Swimming			
1. Improve Safety of Gravel Lakes	---	---	n/a
F. Access Points			
1. Parking Lot	1	40,000	40,000.00
		Subtotal:	$40,000.00
		Total:	$2,009,000.00
		30% Contingency:	602,700.00
		TOTAL SUB-REACH F:	$2,611,700.00

Sub-Reach F: Annual O & M Cost

Routine Maintenance			
1. Trail Mowing	22,704 LF	.36	8,173.00
2. Weed Control	22,704 LF	.09	2,043.00
3. Debris & Trash Removal	22,704 LF	.50	11,352.00
4. Trail Sweeping	22,704 LF	.58	13,168.00
5. Park Mowing	14.0 AC	480.00	6,720.00
			$41,456.00

COST ESTIMATE SUMMARY

VOLUME II - RECREATION PLAN

REACH	ALTERNATE	LAND ACQUISITION	CONSTRUCTION COST	TOTAL DEV. COST	ANNUAL O&M COST
I: Chatfield Reservoir to Columbine Valley	Develop a Regional Park Reserve	N/A	$ 2,821,000	$ 2,821,000	$ 48,470
II: Columbine Valley to Oxford Avenue	Develop a Linear Park	$ 742,000	$ 3,970,630	$ 4,712,630	$ 50,720
III: Oxford Avenue to Bates Avenue	Develop a Linear Park	N/A	$ 518,440	$ 518,440	$ 16,820
IV: Bates Avenue to Colfax Avenue	Develop Limited Improvements	$ 291,000	$ 4,380,875	$ 4,671,875	$125,820
V: Colfax Avenue to Cherry Creek	Develop Limited Improvements	$ 45,000	$ 1,644,188	$ 1,689,188	$ 37,500
VI: Cherry Creek to Franklin Street	Develop Limited Improvements	$ 294,500	$ 3,231,945	$ 3,526,445	$ 76,512
VII: Franklin Street to Sand Creek	Develop a Linear Park	$ 105,000	$ 2,917,630	$ 3,022,630	$ 25,301
VIII: Sand Creek to Baseline Road	Varies				
Subreach A - Sand Creek to Steele Street	Develop a Linear Park and Focal Point Park	N/A	$ 2,232,360	$ 2,232,360	$ 38,892
B - Steele Street to 88th Avenue	Develop a Linear Park and Major Park	N/A	$ 3,126,760	$ 3,126,760	$ 42,109
C - 88th Avenue to 104th Avenue	Develop a Linear Park	$ 210,000	$ 2,288,600	$ 2,498,600	$ 26,426
D - 104th Avenue to 120th Avenue	Develop a Linear ark	N/A	$ 2,542,280	$ 2,542,280	$ 31,505
E - 120th Avenue to 136th Avenue	Develop a Linear Park and a Major Park*	N/A	$ 1,928,160	$ 1,928,160	$ 18,581
F - 136th Avenue to Baseline Road	Develop a Linear Park	$ 35,000	$ 2,576,700	$ 2,611,700	$ 41,456
	TOTAL	$1,722,500	$33,809,068	$35,531,568	$580,112

NOTES: 1. Annual O & M costs are calculated only for local sponsor projects.
2. Annual O & M costs are for existing and proposed facilities.
*3. The cost to implement the master plan being prepared by the County for the Adams County Regional park is not included.

CONCLUSION

An incredible opportunity for river recreation, open space and wildlife is available now in the South Platte River corridor. It can be seized only if action is taken soon to insure that open lands adjacent and nearby are maintained in the public interest. From such action throughout the metropolitan Greenway system, significant benefits can accrue to the community at large by improving our quality of life, increasing our land values, and stimulating our tax base by attracting distinctive commercial and residential development into a unique park environment.

The River's time has come . . .

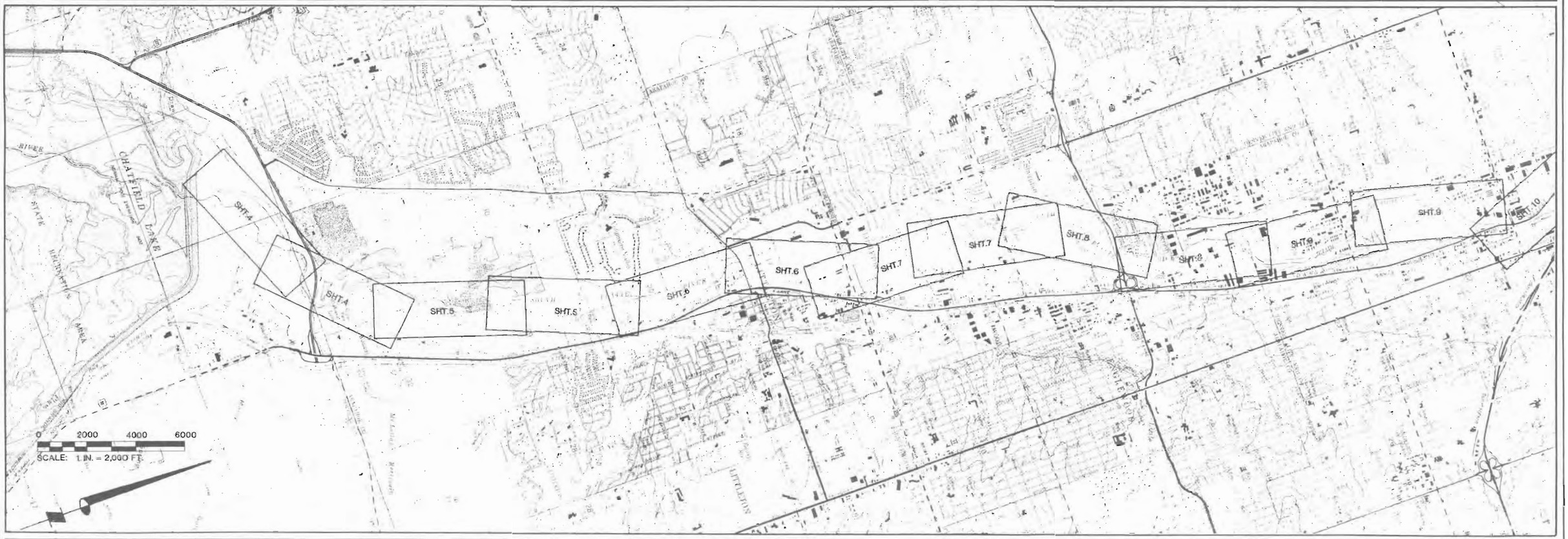
"We travel together, passengers on a little spaceship, preserved from annihilation only by the care, the work, and the love we give our fragile craft."

Adlai Stevenson

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

CHATFIELD DAM TO BASELINE ROAD

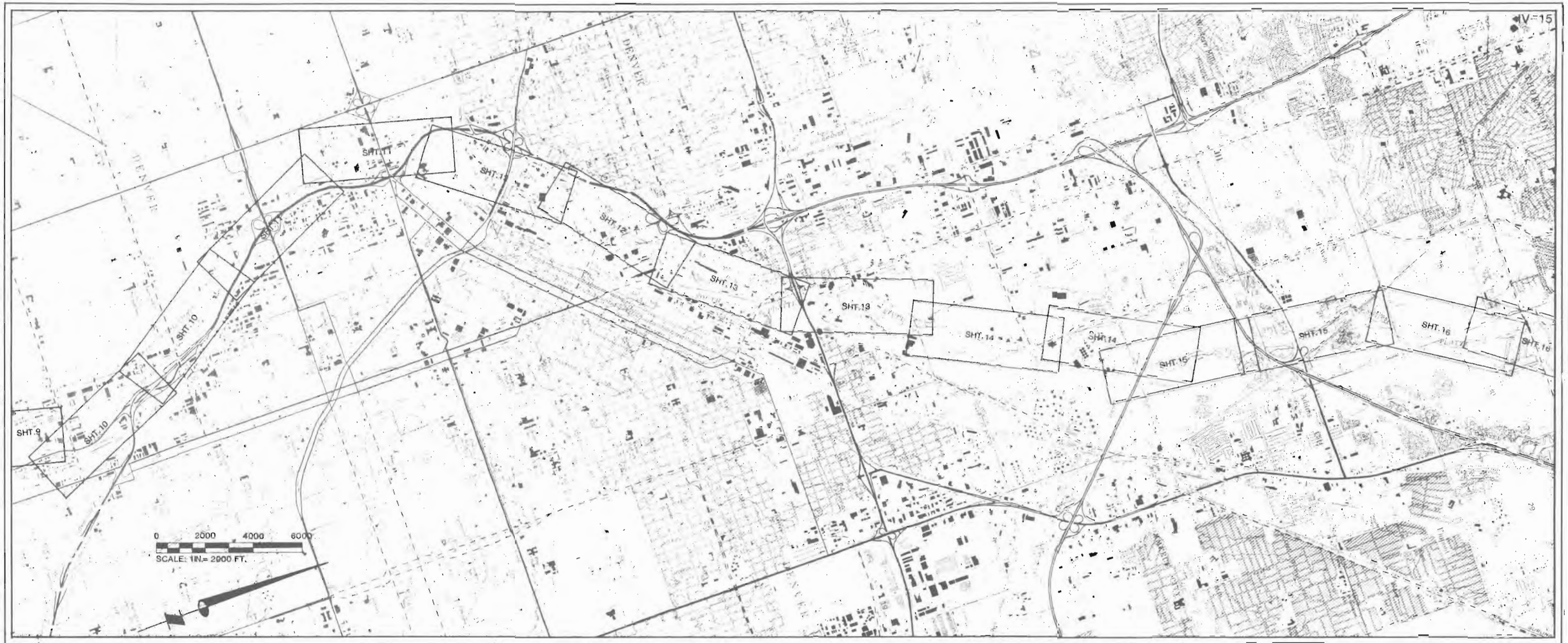


RECREATION PLAN
INDEX OF DRAWINGS

1.	TITLE SHEET & SHEET INDEX		8.	RECREATION PLAN	STA. 1686+00 TO STA. 1730+00	13.	RECREATION PLAN	STA. 1064+00 TO STA. 1122+00	19.	RECREATION PLAN	STA. 430+00 TO STA. 548+00
2.	SHEET INDEX, LEGEND & GENERAL NOTES		8.	RECREATION PLAN	STA. 1632+00 TO STA. 1686+00	14.	RECREATION PLAN	STA. 1005+00 TO STA. 1064+00	19.	RECREATION PLAN	STA. 385+00 TO STA. 430+00
3.	SHEET INDEX		9.	RECREATION PLAN	STA. 1572+00 TO STA. 1632+00	14.	RECREATION PLAN	STA. 960+00 TO STA. 1005+00	20.	RECREATION PLAN	STA. 332+00 TO STA. 385+00
4.	RECREATION PLAN	STA. 2074+00 TO STA. 2130+00	9.	RECREATION PLAN	STA. 1512+00 TO STA. 1572+00	15.	RECREATION PLAN	STA. 822+00 TO STA. 960+00	20.	RECREATION PLAN	STA. 277+00 TO STA. 332+00
4.	RECREATION PLAN	STA. 2014+00 TO STA. 2074+00	10.	RECREATION PLAN	STA. 1456+00 TO STA. 1512+00	15.	RECREATION PLAN	STA. 866+00 TO STA. 822+00	21.	RECREATION PLAN	STA. 220+00 TO STA. 277+00
5.	RECREATION PLAN	STA. 1972+00 TO STA. 2014+00	10.	RECREATION PLAN	STA. 1402+00 TO STA. 1456+00	16.	RECREATION PLAN	STA. 719+00 TO STA. 765+00	21.	RECREATION PLAN	STA. 165+00 TO STA. 220+00
5.	RECREATION PLAN	STA. 2014+00 TO STA. 1916+00	11.	RECREATION PLAN	STA. 1347+00 TO STA. 1402+00	16.	RECREATION PLAN	STA. 657+00 TO STA. 719+00	22.	RECREATION PLAN	STA. 125+00 TO STA. 165+00
6.	RECREATION PLAN	STA. 1860+00 TO STA. 1916+00	11.	RECREATION PLAN	STA. 1292+00 TO STA. 1347+00	17.	RECREATION PLAN	STA. 613+00 TO STA. 657+00	22.	RECREATION PLAN	STA. 71+00 TO STA. 125+00
6.	RECREATION PLAN	STA. 1804+00 TO STA. 1860+00	12.	RECREATION PLAN	STA. 1232+00 TO STA. 1292+00	17.	RECREATION PLAN	STA. 560+00 TO STA. 613+00	23.	RECREATION PLAN	STA. 32+00 TO STA. 71+00
7.	RECREATION PLAN	STA. 1760+00 TO STA. 1804+00	12.	RECREATION PLAN	STA. 1175+00 TO STA. 1232+00	18.	RECREATION PLAN	STA. 507+00 TO STA. 560+00	23.	RECREATION PLAN	STA. 0+00 TO STA. 32+00
7.	RECREATION PLAN	STA. 1730+00 TO STA. 1760+00	13.	RECREATION PLAN	STA. 1122+00 TO STA. 1175+00	18.	RECREATION PLAN	STA. 456+00 TO STA. 507+00			

NOTE: SEE VOLUME I FOR PRELIMINARY ENGINEERING DESIGN

MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN – VOLUME II	PLAN SHEET INDEX	DENTON HARPER MARSHALL, INC. URBAN ENVIRONMENTS, LTD. WRIGHT WATER ENGINEERS, INC.	DESIGN RLS DATE: 9/12/85 DETAIL RJB CHECK RLS REV. 11/6/85	PROJECT NUMBER 831-036.00W	DRAWING NUMBER 1 OF 23



GENERAL NOTES:

The following maps present the Recreation and Plan described in the preceding text. The maps show where additional hike, bike and maintenance trail should be built, where boating improvements are needed, and where wildlife habitat can be enhanced or protected. The maps also show where parks, parking lots and other special features should be provided. The plan is based on the engineering design presented in Volume I of the Phase B Report.

LEGEND

- POCKET PARK — DEVELOPED AREAS WITH PROVISION FOR PICNICING OR VARIOUS OTHER RECREATION ACTIVITIES
- LINEAR PARK — CONTINUOUS TRAIL FOR HIKING AND BIKING ALONG SOUTH PLATTE RIVER WITH LINKS TO VARIOUS SPECIAL FEATURES AND ACCESSABLE TO ALL METRO-DENVER COMMUNITIES.
- SPECIAL WILDLIFE HABITAT — UNIQUE AREAS WITH OPPORTUNITIES TO ENJOY AND LEARN ABOUT NATURAL SYSTEMS ALONG THE SOUTH PLATTE RIVER.
- WATER BODY
- BOAT LANDING
- FISH HABITAT IMPROVEMENTS BY ROCK PLACEMENT
- EXISTING TRAIL
- PROPOSED TRAIL
- BOAT CHUTE IN DAM
- SPECIAL FEATURES

MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN - VOLUME II	PLAN SHEET INDEX	DENTON HARPER MARSHALL, INC. URBAN ENVIRONMENT S, LTD. WRIGHT WATER ENGINEERS, INC.	DESIGN RWS DETAIL EP CHECK RWS DATE: 11/2/82	PROJECT NUMBER 83-056.06	DRAWING NUMBER 2 OF 3

MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN – VOLUME II	PLAN SHEET INDEX	DENTON HARPER MARSHALL,INC. URBAN ENVIRONMENTS, LTD. WRIGHT WATER ENGINEERS, INC.	DESIGN R.W.S DETAIL R.B. CHECK R.W.S DATE: 9/12/85	PROJECT NUMBER 831-036.00B	DRAWING NUMBER 3 OF 23

SHEET COMMENTARY
SHEET 4 OF 23
STATION 2014+00 TO STATION 2130+00
REACH ONE

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

This segment is the southernmost portion of the study corridor. The land on both banks of the river is designated for regional recreation facilities: Chatfield State Recreation Area and South Platte Park. Chatfield State Recreation Area begins at the southern tip of the segment and continues north to Highway C-470. Three existing picnic areas on the east bank provide parking and auto access.

The plan proposes construction of an east-bank trail with trail heads at each picnic area. The trail loops around several lakes and continues along the east bank, crossing C-470 into South Platte Park. The trail also provides access to boat landings.

South Platte Park (Littleton Floodplain Park) begins north of Highway C-470, and is currently under development as a Regional Park for wildlife observation, nature study, hiking and other passive uses. The plan proposes continued development for these purposes. The plan also proposes construction of a 30-car parking lot with a boat loading and unloading area on the west bank with access from Highway C-470. A guardrail is proposed for Highway C-470 to limit left turn movements from the parking lot. The plan also proposes construction of a west-bank trail which begins at the parking lot and joins the east-bank trail via a pedestrian bridge in the next segment.

To improve boating along this segment, the plan proposes the addition of boat chutes to the dam north of Highway C-470 and construction of boat landings as portage facilities. No boating improvements are recommended for the two dams in the southern portion of this segment due to concerns raised by the U.S. Army Corps of Engineers.

Selective rock placement is proposed to enhance fish habitat, further developing the wildlife interest in this segment.

NO BOATING IMPROVEMENTS TO RUBBLE DAM

PROPOSED BOAT LANDINGS

CONSIDER ROCK PLACEMENT TO ENHANCE FISH HABITAT

SOUTH PLATTE RIVER

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

PROPOSED BOAT LANDING

NO BOATING IMPROVEMENTS TO CONCRETE DAM

CHATFIELD DAM UPSTREAM LIMITS OF STUDY

MATCH LINE-STA. 2074+00

EXISTING COTTONWOOD GROVE PICNIC AREA

EXISTING STEVENS GROVE PICNIC AREA

CHATFIELD STATE PARK RECREATION AREA

EXISTING OWL GLEN PICNIC AREA

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

DATUM IS MEAN SEA LEVEL

SCALE OF FEET

CONTROL VEHICULAR ACCESS WITH GUARDRAIL

MATCH LINE-2074+00

STOCK EXISTING GRAVEL POND

WEST BANK TRAIL

SOUTH PLATTE RIVER

CONSIDER ROCK PLACEMENT TO ENHANCE FISH HABITAT

MATCH LINE-2014+00

SOUTH PLATTE PARK

REGIONAL PARK PRESERVE UNDER DEVELOPMENT

- DEVELOP FOR WILDLIFE OBSERVATION, NATURE STUDY, HIKING AND PASSIVE USES
- ENHANCE WETLANDS AND WILDLIFE HABITAT

REGIONAL PARK PRESERVE

- NATURAL TYPE CHANNEL WITH EROSION PROTECTION AND FLOODPLAIN MANAGEMENT
- RIVER NOT CHANNELIZED AND THE 100-YEAR FLOODPLAIN EXTENDS BEYOND BANKS

PROPOSED PEDESTRIAN BRIDGE

PROVIDE PARKING AND RIVER ACCESS

APPROX. 30 PARKING SPACES
BOAT LOADING AND UNLOADING AREA
ENHANCE LANDSCAPE CHARACTER

PROPOSED BOAT LANDINGS

PROPOSED WOLHURST HISTORICAL MARKER

ADD BOAT CHUTE TO 3 FT. CONCRETE AND RUBBLE DAM

SEWER CROSSING

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 6, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED RWE DATE 7-15-85
DRAWN PEM DATE 8-14-85
CHECKED RWE DATE 9-9-85
REVISED RLB/PEM DATE 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 2014+00 TO STA. 2130+00

SHEET COMMENTARY

SHEET 5 OF 23

STATION 1916+00 TO STATION 2014+00

REACHES ONE AND TWO

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The majority of the land on both banks in this segment is under development as a Regional Park called South Platte Park (Littleton Floodplain Park). The park extends north encompassing 75% of this sheet. The park provides opportunities to preserve and enhance the natural systems of the South Platte River. On the east bank of the park's southern end, a nature center is planned to concentrate active uses and provide auto access. The plan proposes development of the nature center to provide auto access from South Santa Fe Drive and boater access to the river.

The plan proposes construction of the main spine trail on the east bank, continuing the trail that began in the previous segment. The west-bank trail joins the east bank trail via a pedestrian bridge located north of Dad Clark Gulch. The bridge creates a pedestrian connection between the parking area off Highway C-470 and the nature center. A tributary trail connection to the east is recommended at or near Dad Clark Gulch. If construction of Ken Caryl Road at the southern portion of the segment proceeds as anticipated, the plan should provide for a landscape buffer to protect the visual integrity of the park experience.

The proposed east-bank trail crossses the northern boundary of South Platte Park several hundred feet south of the Columbine Dam, then crosses a small pedestrian bridge over Lee Gulch. The plan also proposes a tributary trail along Lee Gulch and construction of Lee Gulch Pocket Park where Lee Gulch joins the river. Possible special features for the park include a water fall and rest area with benches and bike rack.

The boating improvements proposed on this sheet are the addition of a boat chute and two boat landings as portage facilities for the Columbine Dam.

PROPOSED VISITORS CENTER AND NATURE TRAIL
RIVER ACCESS
INFORMAL BOAT LANDING
EDUCATIONAL EXHIBITS

ADD LANDSCAPE BUFFER BETWEEN ROAD AND PARK

PROPOSED KEN CARYL ROAD

MATCH LINE-STA. 2014+00

PROPOSED PEDESTRIAN BRIDGE

CONSIDER ROCK PLACEMENT TO ENHANCE FISH HABITAT

MATCH LINE-STA. 1872+00

SOUTH PLATTE PARK
REGIONAL PARK UNDER DEVELOPMENT
DEVELOP FOR WILDLIFE OBSERVATION, NATURE STUDY, HIKING AND PASSIVE USES
ENHANCE WETLANDS AND WILDLIFE HABITAT

SOUTH PLATTE RIVER

N 98,000
N 97,000
N 96,000
N 95,000
N 94,000
N 93,000
E 2,132,000
E 2,133,000
E 2,134,000
E 2,135,000
E 2,136,000

CONNECT ROAD ENTRY TO SANTE FE DRIVE
DATUM IS MEAN SEA LEVEL

DAD CLARK GULCH TRAIL

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

SCALE OF FEET

REGIONAL PARK PRESERVE

- NATURAL TYPE CHANNEL WITH EROSION PROTECTION AND FLOODPLAIN MANAGEMENT
- RIVER NOT CHANNELIZED AND THE 100-YEAR FLOODPLAIN EXTENDS BEYOND BANKS

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

ADD BOAT CHUTE TO 8 FT. COLUMBINE DAM

POSSIBLE LOCATION FOR NEW WETLANDS AND WILDLIFE HABITAT IN ABANDONED OXBOW IF R.O.W. IS AVAILABLE

PROPOSED BOAT LANDINGS

LINEAR PARK

- U.S. ARMY CORPS OF ENGINEERS CHANNEL IMPROVEMENT PROJECT
- TYPICAL 400 FT. CORRIDOR
- REVEGETATE TO ENHANCE WILDLIFE

WS 5339.1

SOUTH PLATTE RIVER

MATCH LINE-STA. 1916+00

MATCH LINE-STA. 1872+00

MATCH LINE-REACH TWO
MATCH LINE-REACH ONE

SOUTH PLATTE PARK
REGIONAL PARK UNDER DEVELOPMENT

PROPOSED LEE GULCH FOCAL POINT PARK
WATERFALL FEATURE AND REST AREA

LEE GULCH

PROPOSED PEDESTRIAN BRIDGE

LEE GULCH TRAIL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY:
AERIAL PHOTOGRAPHY APRIL 6, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET

Delta Aerial Surveys, Inc.
2345 SO FEDERAL BLVD SUITE 195
DENVER COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED	RLB	DATE 7-15-85
DRAWN	PEM	DATE 8-14-85
CHECKED	RLB	DATE 9-9-85
REVISED	RLB/PEM	DATE 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 1916+00 TO STA. 2014+00

SHEET COMMENTARY
SHEET 6 OF 23
STATION 1805+00 TO STATION 1916+00
REACH TWO

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

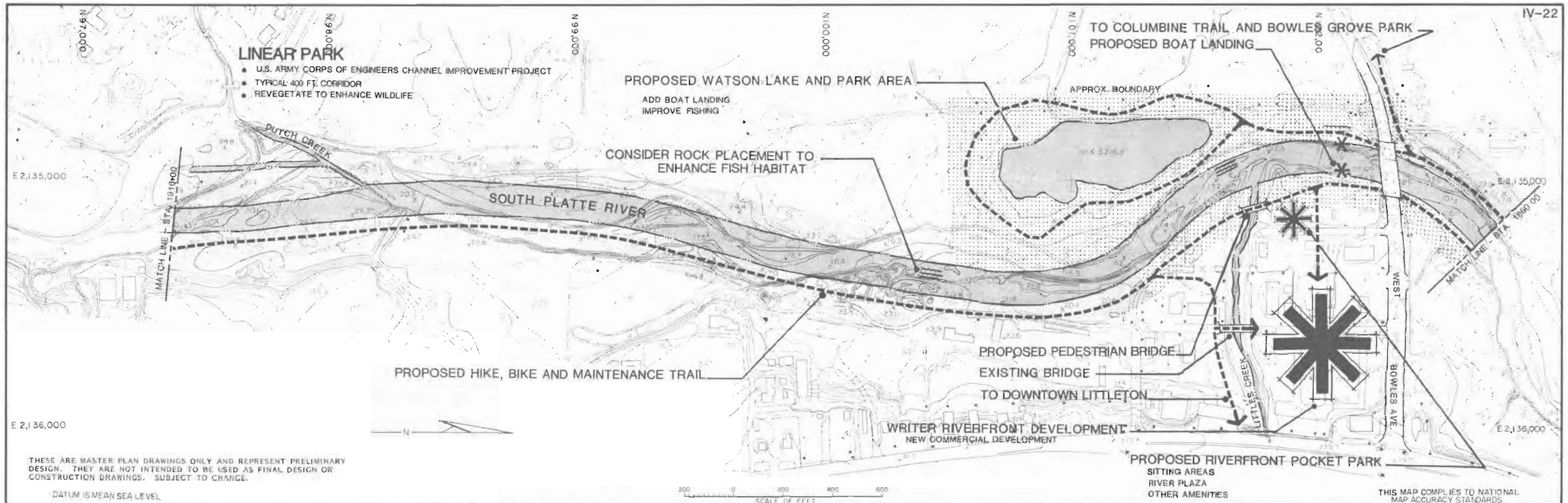
Land uses along the river in this segment are mixed. Substantial new residential, commercial, office, and mixed-use developments have been completed recently or are under development between West Bowles Avenue and West Belleview Avenue in Littleton.

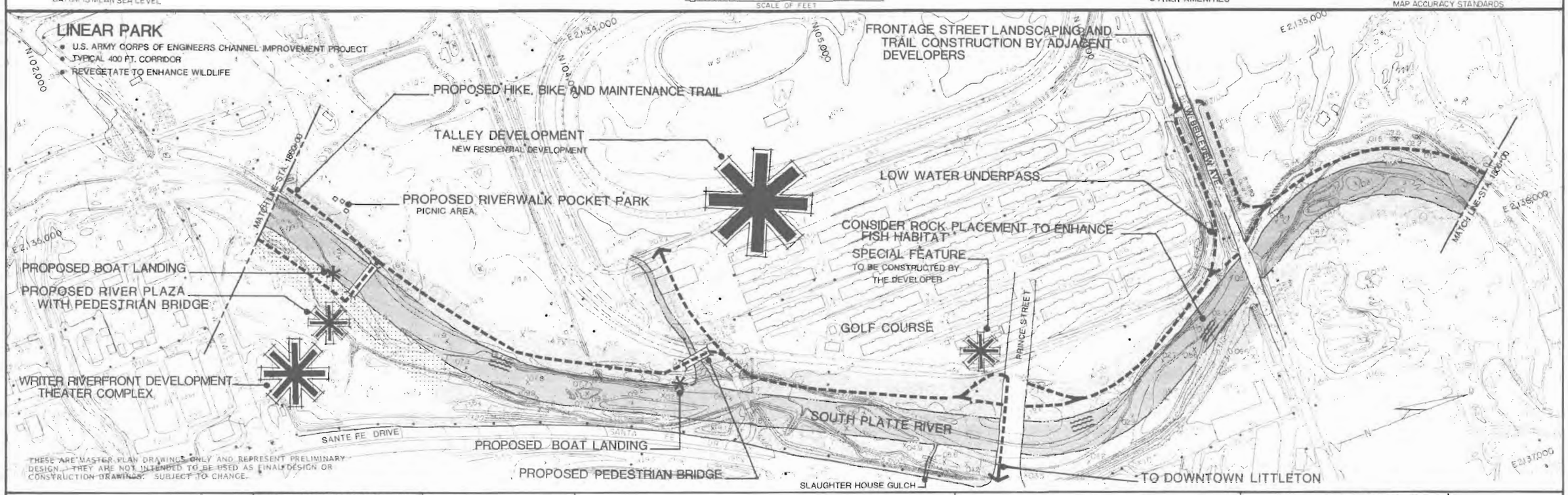
The plan proposes development of a linear park with spur trails connecting adjacent developments and a special park called Watson Lake Park. The plan calls for construction of the major spine trail along the east bank with a connecting trail east to Downtown Littleton along Little's Creek. The major spine trail continues north along the east bank, crossing underneath West Bowles Avenue. Approximately 3500 feet north of W. Bowles Avenue, the trail crosses the river via a pedestrian bridge to the west bank. At this point, the main trail continues north along the west bank, crossing underneath Prince Street and West Belleview Avneue with ramps to street grade in both cases. The West Belleview ramp continues along West Belleview until the first stop light which would provide a safe crossing. A Spur trail is proposed to the west along the golf course drainage to connect to nearby residential developments. The plan also proposes construction of a west-bank trail that continues south from the pedestrian bridge to Watson Lake Park, and a spur trail to the Columbine trail and Bowles Grove Park along Bowles Avenue.

The plan also calls for creation of Watson Lake Park. The park would provide trails and boater access. A loop trail around the lake would offer nature walks and fishing opportunities.

Several special amenities are proposed within this segment. An informal picnic area south of the major pedestrian bridge and a special feature near Prince Street are planned by private entities. The plan proposes development of a special plaza associated with the proposed Writer Riverfront Theater Complex. In addition, the plan recommends development of a pocket park or plaza area that relates the Riverfront Festival Center to the river.

There are no major boating obstructions. The addition of four boat landings along this segment will increase river access, boating safety and enjoyment.





GROUND CONTROL SURVEY AERIAL PHOTOGRAPHY APRIL 16, 1983 TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL - 2 FEET	Delta Aerial Surveys, Inc. 2345 SO FEDERAL BLVD SUITE 195 DENVER COLORADO 80219 (303) 934-5500	WRIGHT WATER ENGINEERS, INC. 2490 W. 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700 URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.	DESIGNED RHS DATE 7-15-85 DRAWN PKM DATE 8-14-85 CHECKED RHS DATE 9-9-85 REVISED MDV DATE 9-15-85 11-6-85	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	PARKS RECREATION & OPEN SPACE PLAN STA. 1805+00 TO STA. 1916+00

SHEET COMMENTARY
SHEET 7 OF 23
STATION 1730+00 TO STATION 1805+00
REACHES TWO AND THREE

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land uses along the river in this segment include various industrial activities and a portion of the Englewood Golf Course north of Oxford. The study corridor is typically 400 feet wide in this segment.

The plan proposes development of a linear park complimented by a small rest area and scenic overlook approximately 700 feet north of Union Avenue. The plan calls for continuation of the major spine trail along the east bank crossing underneath Union Avenue and West Oxford Avenue with a ramp to the street at Union. As the trail crosses West Oxford, it enters the Englewood Golf Course. Approximately 350 feet north of West Oxford, the trail crosses to the east bank via an existing bridge within the golf course used by golfers. At this point the trail joins an existing trail and continues north.

The plan also proposes a west-bank spur trail from the golf cart bridge north to the Englewood Wildlife Preserve. This trail would be for hiking only.

The plan also proposes providing a parking lot for approximately 20 cars accessible from West Oxford on the west bank. A nearby boat landing would also improve boater access.

To increase boating safety and access, several improvements to the river are proposed. The plan proposes adding a boat chute or white water bypass to the Union Dam. Two other dams in this segment have boat chutes, but construction of boat landings are proposed for each and for Union Dam to allow portage around the dams.

LINEAR PARK

- U.S. ARMY CORPS OF ENGINEERS CHANNEL IMPROVEMENT PROJECT
- TYPICAL 400 FT. CORRIDOR
- REVEGETATE TO ENHANCE WILDLIFE

N 106,000 N 107,000 N 108,000 N 109,000 N 110,000

E 2,136,000 E 2,137,000

CENTENNIAL PARK AND LAKE

TO CENTENNIAL PARK

OVERFLOW CENTENNIAL

PROPOSED PEDESTRIAN BRIDGE

REST AREA AND SCENIC OVERLOOK

MATCH LINE-STA. 1858+00

MATCH LINE-STA. 1765+00

PROPOSED BOAT LANDINGS

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

SOUTH PLATTE RIVER

JASON AVENUE

ADD BOAT CHUTE OR BY-PASS TO UNION DAM

BIG DRY CREEK

U.S. ARMY CORPS OF ENGINEERS EROSION CONTROL STRUCTURES

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

DATUM IS MEAN SEA LEVEL

SCALE OF FEET 200 0 200 400 600

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

LINEAR PARK

- U.S. ARMY CORPS OF ENGINEERS CHANNEL IMPROVEMENT PROJECT
- TYPICAL 400 FT. CORRIDOR
- REVEGETATE TO ENHANCE WILDLIFE

E 2,135,000 E 2,136,000

N 109,000 N 110,000 N 111,000 N 112,000 N 113,000

TO ENGLEWOOD WILDLIFE PRESERVE (HIKING TRAIL ONLY)

PROPOSED PARKING LOT WITH 20 SPACES

MATCH LINE-BEACH TRACT (BEACH TWO)

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

PROPOSED BOAT LANDINGS

MATCH LINE-STA. 1760+00

EXISTING PEDESTRIAN BRIDGE

EXISTING HIKE, BIKE, AND MAINTENANCE TRAIL

SOUTH PLATTE RIVER

EXISTING ROCK DAM AND BOAT CHUTE

EXISTING ROCK DAM AND BOAT CHUTE

PROPOSED BOAT LANDING

ENGLEWOOD GOLF COURSE

ADD LANDSCAPE BUFFER BETWEEN GOLF COURSE AND TRAIL

GRIDLEY AVENUE

MATCH LINE-STA. 1730+00

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL 2 FEET
Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DIENTON HARPER MARSHALL, INC.

DESIGNED	RWS	DATE 7-15-85
DRAWN	PRM	DATE 8-14-85
CHECKED	RWS	DATE 9-9-85
REVISED	RLB/PRM	DATE 12-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 1730+00 TO STA. 1805+00

SHEET 7 OF 20

SHEET COMMENTARY

SHEET 8 OF 23

STATION 1632+00 TO STATION 1730+00

REACHES THREE AND FOUR

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land uses along this segment of river include a golf course, a wildlife preserve and various industrial uses. A linear park currently exists in this segment. The main spine trail is on the east bank until it crosses to the west bank via an existing pedestrian bridge just north of Oxford Avenue. At this point, the main trail continues to the north while a spur trail to the south connects to the Bear Creek Trail.

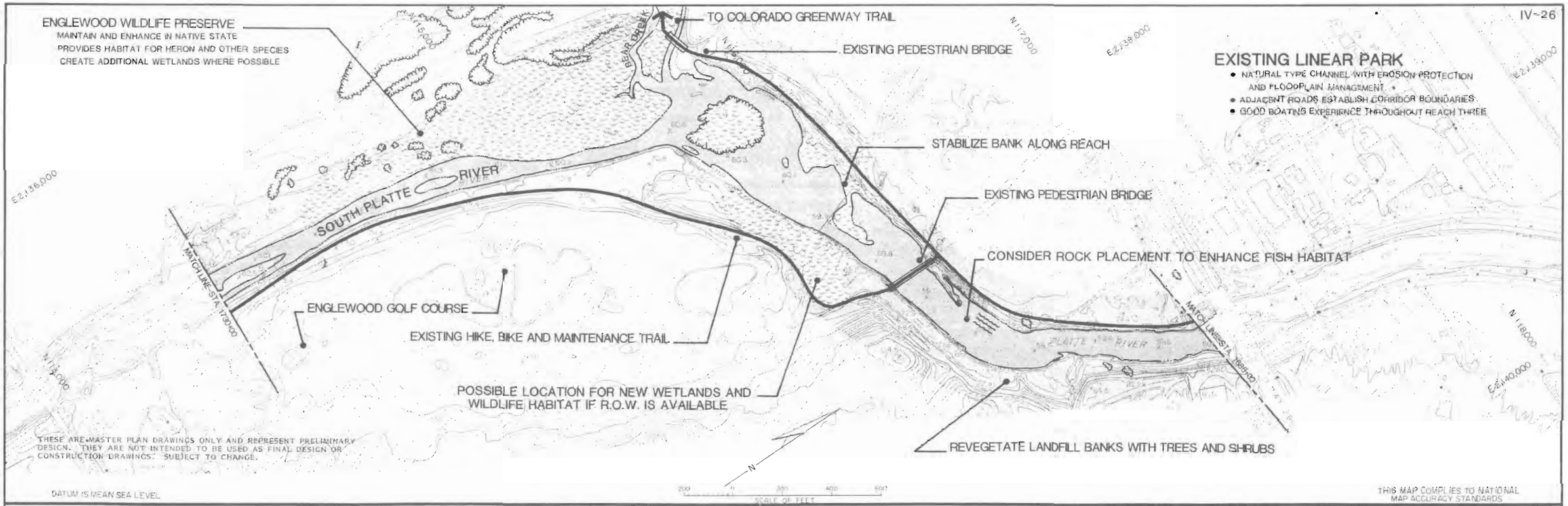
In this segment, the plan proposes addition of an opposite-bank trail system to the north and relatively minor improvements to the existing linear trail system. An opposite-bank trail system is needed to accommodate the heavy use expected in this segment. Construction of the opposite-bank trail system begins at Little Dry Creek and continues north with a spur trail east to Cinderella City along Little Dry Creek. The proposed trail goes under Dartmouth Avenue and also ramps up to street grade which allows access to the west-bank trail. The plan also proposes crosswalk improvements at Dartmouth Avenue to facilitate crossing.

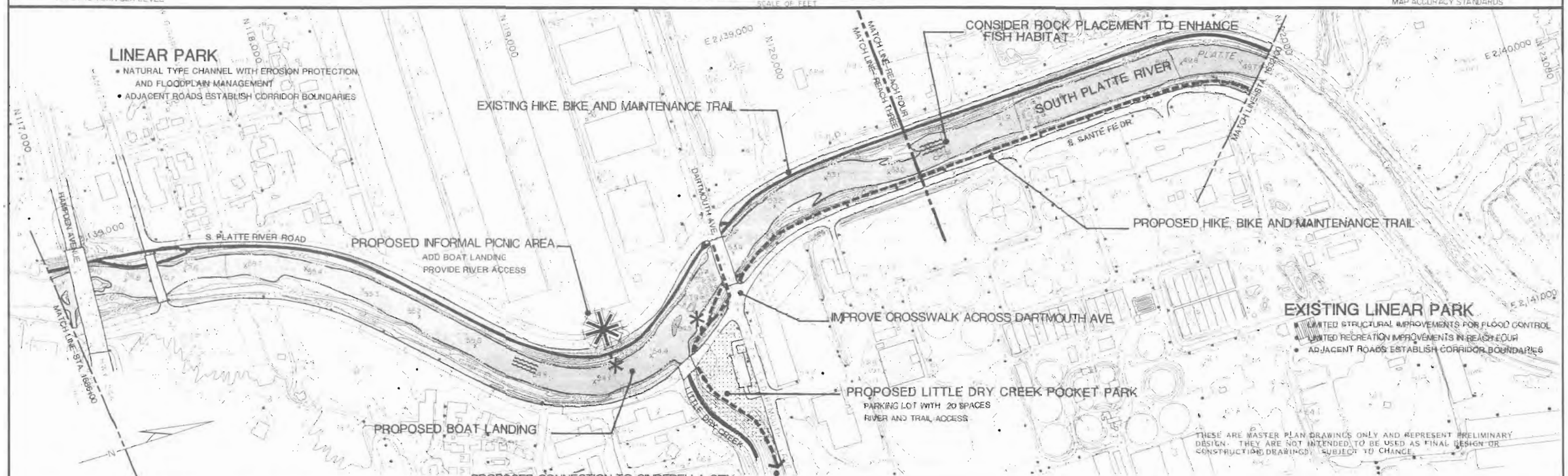
A pocket park is proposed on the east bank along Little Dry Creek with auto access from Dartmouth Avenue and parking for approximately 20 cars. Addition of a boat landing in the park improves boater access to the river.

To provide rest areas for trail users and boaters, the plan proposes construction of an informal picnic area with a boat landing approximately 300 feet upstream of Dartmouth Avenue.

The plan also proposes landscape plantings between the trail and the Englewood Golf Course. As the plantings mature, they will enhance the trail experience while augmenting existing safety measures that separate trail users from the golf course. Landscaping along both banks north of the golf course is proposed to stabilize the river banks while increasing the aesthetics of the trail experience.

Boating is excellent throughout Reach Three. No improvements are proposed other than construction of the boat landings previously mentioned.





GROUND CONTROL SURVEY AERIAL PHOTOGRAPHY APRIL 16, 1983 TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL 2 FEET	Delta Aerial Surveys, Inc. 2345 SO. FEDERAL BLVD SUITE 195 DENVER, COLORADO 80219 (303) 934-5500	WRIGHT WATER ENGINEERS, INC. 2490 W 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700 URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.	DESIGNED RWS DATE 7-15-85 DRAWN PRM DATE 8-14-85 CHECKED RWS DATE 9-9-85 REVISED RLB/PRM DATE 11-6-85	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	PARKS RECREATION & OPEN SPACE PLAN STA. 1632+00 TO STA. 1730+00

SHEET COMMENTARY
SHEET 9 OF 23
STATION 1512+00 TO STATION 1632+00
REACH FOUR

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land uses in this segment include commercial, industrial and residential developments as well as a Public Service Company generating plant and Overland Golf Course. For the most part, corridor boundaries are established by existing roads. A linear park and several special parks have already been developed in this segment by the Greenway Foundation and the City of Denver. The linear park consists of a west-bank trail that crosses the river south of Evans Avenue and continues along the east bank until a point north of Florida Avenue, where it again crosses the river to the east bank.

The plan proposes construction of an opposite-bank trail system in this segment as well as improvements to existing special parks. The opposite-bank trail is needed to accommodate the heavy use expected through Denver, the heart of the metropolitan region. The proposed trail continues along the east bank from the previous segment to the existing trail at the pedestrian bridge. On the other side of the bridge, the trail continues north along the west bank crossing underneath Evans Avenue and Florida Avenue with ramps to street grade at both crossings. The proposed trail again connects to an existing trail and pedestrian bridge then continues on the east bank, crossing underneath South Santa Fe Drive. The plan also proposes a connecting trail to Lakewood along Sanderson Gulch and an on-street connection to the Harvard Gulch Trail that provides access to neighborhoods on the east. Addition of a pedestrian crosswalk and signal at Huron Street is proposed to further improve pedestrian access to the trail.

The five major parks associated with the linear trail system are Ruby Hill Park, Grant Park, Frontier Park, Pasquinel's Landing Park and Overland Park. The plan recommends adding boat landings in Grant Park and Pasquinel's Landing Park to improve river access. The plan also proposes developing the Montana City Historical Cabin within Frontier Park. A variety of improvements are proposed for Overland Park located on the east bank north of Florida. The plan calls for addition of a picnic shelter and construction of a guard rail on the east side to prevent vehicles from randomly crossing grass areas. Moreover, the park site provides an excellent opportunity to improve wildlife habitat and create fishing areas. The plan proposes planting dense ground cover, building artificial nesting boxes, and stocking the pond with fish. Retaining walls recommended in the Volume I Phase B Report to improve flood carrying capacity provide the opportunity to create new wetlands south of Sanderson Gulch and north of Evans Avenue.

Although many impediments to boating have already been removed by the City of Denver, a five-foot rubble dam at the south end of the segment should be notched. Both dams further north in the segment have boat chutes. However, boat landings are proposed for each side of all three dams to allow boaters to portage.

W. HARVARD GULCH

MATCH LINE-STA. 1632+00

ADD BOAT CHUTE TO 5 FT. RUBBLE DAM

PROPOSED BOAT LANDINGS

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

SPECIAL FEATURE
MONTANA CITY HISTORICAL CABIN
EARLY DENVER SETTLEMENT

EVANS AVE.

PROPOSED RETAINING WALL

MATCH LINE-STA. 1572+00

IMPROVE GRANT PARK
ADD BOAT LANDING
EXISTING PARKING LOT AND PICNIC AREA

CONSIDER ROCK PLACEMENT TO ENHANCE FISH HABITAT

S. PLATTE RIVER DRIVE

SOUTH PLATTE RIVER

IMPROVE PASQUINEL'S LANDING PARK
ADD BOAT LANDING
EXISTING PLAY AREA, PARKING LOT AND REST AREA

EXISTING LINEAR PARK

- LIMITED STRUCTURAL IMPROVEMENTS AND FLOODPLAIN MANAGEMENT
- LIMITED RECREATION IMPROVEMENTS
- ADJACENT ROADS ESTABLISH TRAIL CORRIDOR BOUNDARIES

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

DATUM IS MEAN SEA LEVEL

FRONTIER PARK

EXISTING PEDESTRIAN BRIDGE

ON-STREET CONNECTION TO HARVARD GULCH TRAIL

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

SCALE OF FEET

RUBY HILL PARK

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

PROPOSED RETAINING WALL

MATCH LINE-STA. 1572+00

S. PLATTE RIVER DRIVE

SOUTH PLATTE RIVER

REMOVAL OF DAM RECOMMENDED IN VOL. I

EXISTING BOAT LANDINGS

POSSIBLE LOCATION FOR NEW WETLANDS AND WILDLIFE HABITAT IF R.O.W. IS AVAILABLE

EXISTING HIKE, BIKE AND MAINTENANCE TRAIL

OVERLAND PARK GOLF COURSE

SANDERSON GULCH

TO LAKEWOOD

FLORIDA AVE.

EXISTING PEDESTRIAN BRIDGE

EXISTING BOAT CHUTE IN 2 FT. SHEET PILE DAM

HURON ST.

IMPROVE OVERLAND PARK
ADD PICNIC SHELTER
STOCK EXISTING POND
IMPROVE LANDSCAPE CHARACTER

PROVIDE PEDESTRIAN CROSSWALK AND ADD SIGNAL

PROPOSED BOAT LANDINGS

CONTROL VECHICULAR ACCESS WITH GUARD RAIL

S. SANTE FE DR.

MATCH LINE-STA. 1512+00

BUILD HIGH-WATER RETAINING WALLS UNDER SANTE FE DR.

EXISTING LINEAR PARK

- LIMITED STRUCTURAL IMPROVEMENTS AND FLOOD PLAIN MANAGEMENT
- LIMITED RECREATION IMPROVEMENTS
- ADJACENT ROADS ESTABLISH TRAIL CORRIDOR BOUNDARIES

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 6, 1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 SO FEDERAL BLVD SUITE 195 DENVER, COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL = 2 FEET

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED RLW DATE 7-15-85
DRAWN PRM DATE 8-1-85
CHECKED RLW DATE 8-9-85
REVISED RLW/PRM DATE 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 1512+00 TO STA. 1632+00

SHEET COMMENTARY
SHEET 10 OF 23
STATION 1402+00 TO STATION 1512+00
REACH FOUR

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

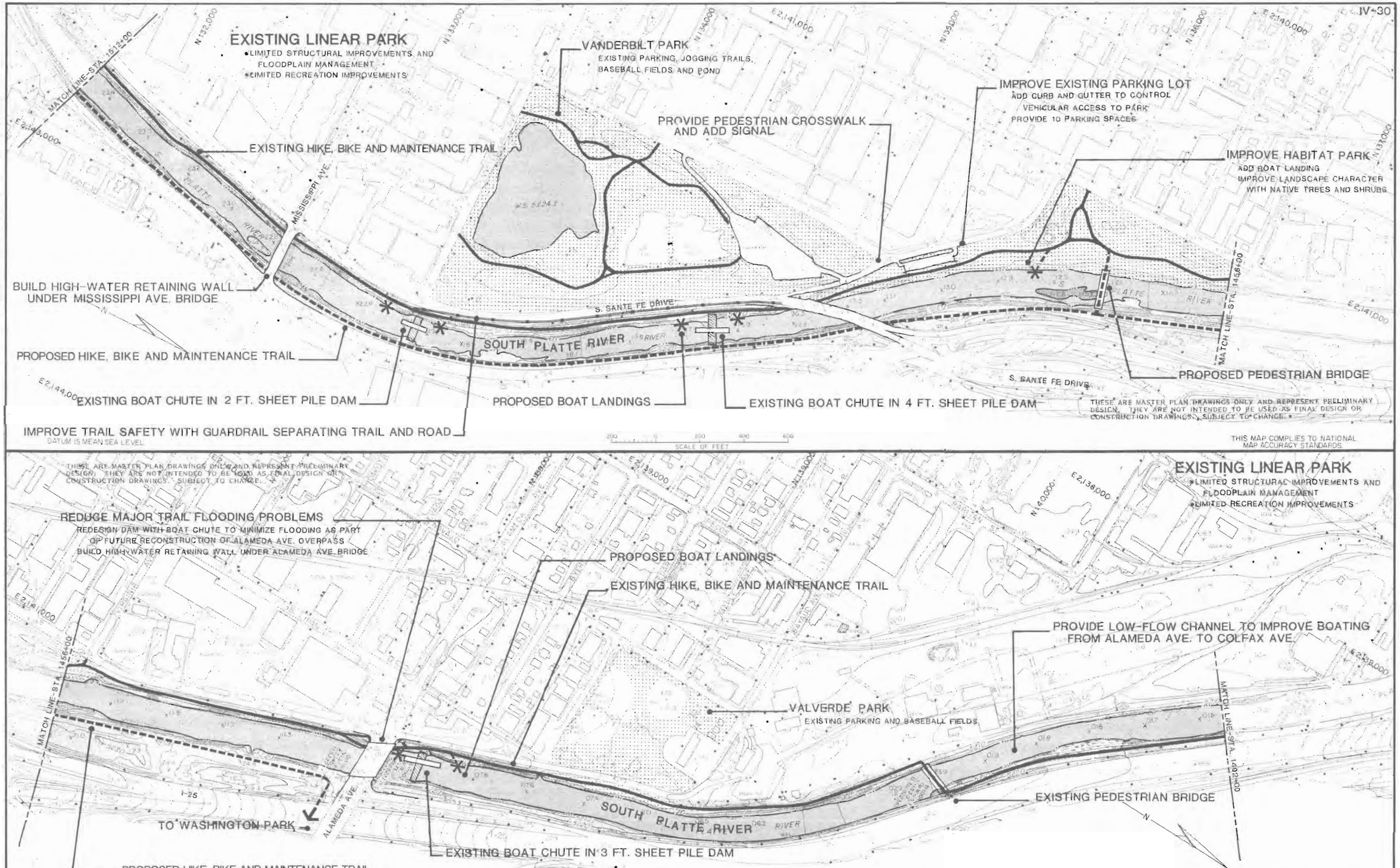
The land use in this segment is primarily industrial with residential uses towards the north. Existing roads establish the corridor boundaries. A linear park and several special parks have already been constructed in this segment by the Greenway Foundation and the City of Denver. The linear park consists of a west-bank trail which crosses underneath Mississippi Avenue, South Santa Fe Drive, and Alameda Avenue with a ramp to street grade at Alameda. Near the end of the segment the trail crosses the river to the east bank then continues north. The existing linear park is complimented by three parks: Vanderbilt park, Habitat Park, and Valverde Park, each of which currently provide parking and trail access.

The plan calls for construction of an opposite-bank trail system along the east bank to Alameda Avenue, with a connection east along Alameda to the Washington Park area. The opposite-bank trail is needed to accomodate the heavy use expected through Denver, the heart of the metropolitan region.

The plan also calls for various miscellaneous improvements to the existing trail. First, at the Alameda underpass, the trail is frequently impassable due to flooding. The reconstruction of the Alameda overpass and dam proposed in Volume I provides an opportunity to correct the flooding problem. Consequently, the plan proposes that necessary measures be taken, and a high water retaining wall built. Similarly, the plan proposes construction of a high water retaining wall under the Mississippi Avenue overpass. In addition, the plan proposes construction of a guardrail between a portion of Santa Fe Drive and the trail to improve trail safety.

The plan proposes limited improvements to Habitat Park and adjacent streets. Addition of a boat landing is proposed to improve river access for boaters and a pedestrian bridge is proposed to connect west and east bank trails within the park. By adding curb and gutter to the existing parking area, vehicular movement across lawn areas would be controlled. Adding a signal and crosswalk near the parking area would facilitate pedestrian movement between Habitat and Vanderbilt Parks. In addition, landscape improvements are proposed to enhance the quality of the park and trail experience.

All three dams in this segment have boat chutes. However, the plan proposes construction of two boat landings per dam to provide portage facilities. Construction of the low-flow channel from Alameda north as called for in Volume I of the Phase B Report will also improve boating and fish habitat during periods of low flow in the river.



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983 TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL 2 FEET	Delta Aerial Surveys, Inc. 2345 SO FEDERAL BLVD SUITE 195 DENVER COLORADO 80219 (303) 934-5500	WRIGHT WATER ENGINEERS, INC. 2490 W 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700 URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.	DESIGNED RWS DATE 7-15-85 DRAWN PRM DATE 8-14-85 CHECKED RWS DATE 9-9-85 REVISED RLB/PRM DATE 11-6-85	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 1402+00 TO STA. 1512+00

SHEET COMMENTARY
SHEET 11 OF 23
STATION 1292+00 TO STATION 1402+00
REACHES FOUR AND FIVE

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

Land use in this segment is primarily industrial although residential and commercial developments are found along the northern banks. A linear park currently exists, complimented by three major parks: 6th Avenue Park, Frog Hollow Park, and the southern portion of Gates-Crescent Park. The park system was developed by the Greenway Foundation and the City of Denver. The existing linear park consists of an east-bank trail that continues north to a pedestrian bridge south of 8th Avenue, at which point it crosses to the west bank and continues north.

The plan proposes a variety of improvements to the existing trail. High-water retaining walls are proposed for the 6th and 8th Avenue underpasses to reduce trail flooding. The existing boardwalk trail from 8th Avenue to 13th Street needs repairs and should be widened. A landscape buffer is proposed between the trail and nearby development for the dual purposes of providing privacy to residents and improving the recreation experience of the trail-user. Directly south of 13th Street, a guardrail is proposed to separate trail users from the railroad tracks. A signal and crosswalk are proposed for the 13th Street and trail intersection to improve pedestrian safety. If the Public Service Company Dam is relocated an underpass could be constructed at 13th Street to avoid a street grade crossing. Although most of the year flows through Lakewood Gulch are low, a small pedestrian bridge is proposed to allow trail use during spring flooding.

The plan also proposes construction of an opposite-bank trail system beginning at 14th Avenue and continuing north along the east bank. The opposite-bank trail cannot be constructed south of 14th Avenue along Public Service Company land due to safety conflicts. The trail should be 10 feet wide to provide capacity for expected heavy use.

In addition the plan proposes development of a turf picnic area on the west bank north of 8th Avenue as well as improvements to the existing boat landing in Frog Hollow Park and significant expansion of the park itself.

To improve boating in this segment, boat landings are proposed adjacent to the dam north of I-25 to allow portage. The dam currently has a boat chute. Rock drops are proposed in two locations along the river to provide riffles according to Volume I of the Phase B Report.

PROPOSED PICNIC AREA WITH TURF

WEIR GULCH PARK AND TRAIL

REPAIR AND WIDEN BOARDWALK TRAIL
8TH AVENUE TO 13TH ST

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

SOUTH PLATTE RIVER

6TH AVENUE

8TH AVENUE

MATCH LINE STA. 1347+00

EXISTING HIKE, BIKE AND MAINTENANCE TRAIL

ROCK DROP TO PROVIDE RIFFLES

ROCK DROP TO PROVIDE RIFFLES

IMPROVE FROG HOLLOW PARK
IMPROVE BOAT LANDING
EXISTING PICNIC AREA AND PARKING AREA REMAIN

EXPAND FROG HOLLOW PARK

EXISTING BOAT CHUTE IN THIRD AVENUE DAM

BUILD HIGH-WATER RETAINING WALLS UNDER 6TH AVE. AND 8TH AVE. BRIDGES

EXISTING BOAT LANDINGS

IMPROVE 6TH AVENUE PARK AND PICNIC AREA
PROVIDE SHADE FOR PICNIC AREA
ENHANCE LANDSCAPE CHARACTER

EXISTING LINEAR PARK
- LIMITED STRUCTURAL IMPROVEMENTS AND FLOODPLAIN MANAGEMENT
- LIMITED RECREATION IMPROVEMENTS

MATCH LINE STA. 1402+00

DATUM IS MEAN SEA LEVEL

IMPROVE AESTHETIC CHARACTER ALONG I-25

SCALE OF FEET

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

TO RUDE PARK VIA LAKEWOOD GULCH TRAIL

EXISTING LINEAR PARK
- LIMITED STRUCTURAL IMPROVEMENTS AND FLOODPLAIN MANAGEMENT
- LIMITED RECREATION IMPROVEMENTS
- EXCELLENT OPPORTUNITY TO EXPAND RECREATION, OPEN SPACE AND WILDLIFE HABITAT ON BOTH SIDES OF RIVER IN REACH FIVE

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

EXISTING "BRONCO" BRIDGE
PEDESTRIAN LINK BETWEEN AURARIA PARKING LOTS AND MILE HIGH STADIUM USED DURING FOOTBALL GAMES

GATES-CRESCENT PARK
(SEE FOLLOWING MAP)

PROPOSED PEDESTRIAN BRIDGE ACCOMODATES SPRING FLOODS

PROVIDE PEDESTRIAN CROSSWALK AND ADD SIGNAL

IMPROVE TRAIL SAFETY WITH GUARDRAIL SEPARATING TRAIL AND RAILROAD TRACKS

ADD LANDSCAPE BUFFER BETWEEN TRAIL AND DEVELOPMENT

REPAIR AND WIDEN BOARDWALK TRAIL
8TH AVENUE TO 13TH STREET

LAKEWOOD GULCH

W. COLFAX AVE.

14TH AVENUE

13TH STREET

SOUTH PLATTE RIVER

MATCH LINE - REACH FIVE

MATCH LINE - REACH FOUR

MATCH LINE STA. 1292+00

MATCH LINE STA. 1347+00

PROPOSED BOAT LANDINGS

EXISTING BOAT CHUTE IN 11/2 FT. SHEET PILE DAM

PROPOSED HIKE, BIKE, AND MAINTENANCE TRAIL

EXISTING HIKE, BIKE AND MAINTENANCE TRAIL

EXPAND FROG HOLLOW PARK

EXISTING BOAT CHUTE IN 8 FT. INFLATABLE DAM

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 SO. FEDERAL BLVD SUITE 195 DENVER COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL = 2 FEET

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED	RWS	DATE 7-18-86
DRAWN	PRM	DATE 8-14-86
CHECKED	RWS	DATE 9-9-86
REVISED	RWS/PRM	DATE 11-6-86

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 1292+00 TO STA. 1402+00

SHEET COMMENTARY

SHEET 12 OF 23

STATION 1175+00 TO STATION 1292+00

REACHES FIVE AND SIX

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land uses on both banks include railroad yards and industrial properties. A linear park currently exists along the west bank, complimented by Gates-Crescent Park, Fishback Landing Park, Confluence Park, Rockmont Park and Riverfront Pak. The existing linear park consists of a west-bank trail that continues north to 19th Street, crossing to the east bank over the 19th Street Viaduct and continuing north.

The plan proposes construction of an opposite-bank trail system to accommodate the anticipated heavy use through Denver as well as further development of the existing parks. The proposed trail would begin on the east bank continuing north to the existing pedestrian bridge below Speer Boulevard in Confluence Park. The proposed trail would continue along the east bank, extending the existing trail north of Cherry Creek, including an opposite-bank spur along the creek itself. On the west bank, the new trail would tie to the existing trail at 19th Street and continue north to the end of the segment with a spur trail to the Rockmont Neighborhood through Rockmont Park. Two pedestrian bridges are proposed to connect the east and west-bank trails: one in Gates-Crescent Park and the other below 20th Street in Rockmont Park. A critical plan concept is to develop trail connections to downtown, Auraria, and the proposed new developments in the Central Platte Valley. Because the nature of the developments in the Central Platte Valley is unknown, the exact location and alignment of these connections cannot be determined at this time. The plan also proposes development of open spaces and parks within the Central Platte Valley.

The land owned by the City of Denver and currently designated as Centennial Park should be developed as a park or traded for a more appropriate location.

The plan proposes improvements to several parks. Proposed improvements to Confluence Park include rebuilding the Kayak Course with stairs for return boater access and maintaining a three foot water cascade through the channel as part of upstream dam reconstruction. Proposed improvements to Rockmont Park include expansion of the park, addition of boat landings and multipurpose play fields, and landscaping to improve park character. The plan also proposes development of Riverfront Park on the east bank north of 20th by adding a boat landing and improving the existing parking lots. Improvements to Gates-Crescent Park, home of the Denver Children's Museum, include relocation of the maintenance warehouses, addition of a boat landing, and development of a trail connection to Mile High Stadium.

The plan proposes inclusion of boat landings and a boat chute in the dam that may be constructed south of Speer Boulevard. (See Volume I of the Phase B Report.)

DENVER CHILDREN'S MUSEUM

PROPOSED CONNECTIONS TO FUTURE DEVELOPMENT IN CENTRAL PLATTE VALLEY

FISHBACK LANDING PARK
EXISTING PARKING LOT, PICNIC AREA AND RESTROOMS REMAIN

IMPROVE CONFLUENCE PARK
REBUILD KAYAK COURSE WITH STAIRS FOR RETURN BOATER ACCESS AND MAINTAIN 3 FT. WATER CASCADE THROUGH CHANNEL AS PART OF DAM RECONSTRUCTION AND CHANNEL IMPROVEMENTS
EXISTING GRASS AMPHITHEATER AND PLAZA REMAIN
EXISTING RAPIDS AND KAYAK CHUTE

N 152,000
N 150,000
E 2,139,000
E 2,137,000
N 156,000

SOUTH PLATTE RIVER

EXISTING ROUND HOUSE

STABILIZE WEST BANK OF RIVER

IMPROVE GATES-CRESCENT PARK
ADD BOAT LANDING
RELOCATE MAINTENANCE WAREHOUSE
CONNECT TRAIL TO MILE-HIGH STADIUM
EXISTING PLAY AREA AND PARKING LOT REMAIN

INCLUDE BOAT CHUTE IN PROPOSED DAM AND ADD BOAT LANDINGS

MATCH LINE-STA. 1292+00

PROPOSED CONNECTIONS TO FUTURE DEVELOPMENT IN CENTRAL PLATTE VALLEY

NOTE: CITY OF DENVER CURRENTLY OWNS 6.5 ACRES OF LAND IN THIS LOCATION CURRENTLY DESIGNATED AS CENTENNIAL PARK. LAND SHOULD BE DEVELOPED AS PARK OR USED IN TRADE TO OBTAIN PARKLAND IN MORE DESIREABLE LOCATIONS BASED ON NATURE OF FUTURE ADJACENT DEVELOPMENT.

PROPOSED CONNECTION TO DOWNTOWN AND AURARIA CAMPUS

PROPOSED PEDESTRIAN BRIDGE

CHERRY CREEK TRAIL

PROPOSED PEDESTRIAN BRIDGE ACROSS I-25 TO MILE HIGH STADIUM

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

PROPOSED CHERRY CREEK OPPOSITE-BANK TRAIL

SPEER BLVD
CHERRY CREEK
MATCH LINE-REACH FIVE
MATCH LINE-REACH SIX
15TH STREET
16TH STREET

EXISTING BOAT LANDINGS

PROPOSED CONNECTION TO DOWNTOWN

EXISTING HIKE, BIKE AND MAINTENANCE TRAIL

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

MATCH LINE-STA. 1232+00

NOTE: PARKS AND OPEN SPACE SHOULD BE INCLUDED IN FUTURE DEVELOPMENT ON BOTH SIDES OF RIVER
SPECIFIC ALIGNMENTS AND LOCATIONS FOR CONNECTIONS COULD VARY

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

DATUM IS MEAN SEA LEVEL

SCALE OF FEET
200 0 200 400 600

E 2,139,000
N 156,000
MATCH LINE-STA. 1282+00

CONNECTION TO ROCKMONT AREA

PROPOSED PARK AREA

EXISTING PARK WITH 10 CAR PARKING LOT

IMPROVE AND EXPAND ROCKMONT PARK
ADD BOAT LANDINGS AND IMPROVE BOATER ACCESS
ADD MULTI-PURPOSE PLAY FIELDS
INCREASE PARK ACREAGE SIGNIFICANTLY
ENHANCE LANDSCAPE CHARACTER
PROTECT AND ENHANCE WILDLIFE HABITAT

E 2,142,000
E 2,143,000
N 159,000
E 2,144,000

EXISTING LINEAR PARK
LIMITED STRUCTURAL IMPROVEMENTS AND FLOODPLAIN MANAGEMENT

N 158,000

19TH STREET
20TH STREET

PROPOSED PEDESTRIAN BRIDGE

RAILROAD CROSSING

SOUTH PLATTE RIVER

EXISTING BOAT LANDING

PROPOSED BOAT LANDING

EXISTING MAN-MADE RAPIDS

IMPROVE RIVERFRONT PARK
ADD BOAT LANDINGS
ADD CURB AND GUTTER AND PAVE EXISTING 35-CAR PARKING LOTS
ENHANCE LANDSCAPE CHARACTER

PROPOSED BOAT LANDING

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

EXISTING HIKE, BIKE AND MAINTENANCE TRAIL

IMPROVE LANDSCAPE CHARACTER ALONG RIVER

OPPORTUNITY TO PRESERVE EXISTING WILDLIFE HABITAT

LOWER RIVER CHANNEL FROM CONFLUENCE PARK TO 19TH STREET TO IMPROVE BOATING

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

MATCH LINE-STA. 1175+00
N 158,000

GROUND CONTROL SURVEY
AERIAL PHOTOGRAPHY APRIL 15, 1983
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 50 FEDERAL BLVD SUITE 195 DENVER COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL: 2 FEET

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave, Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED RLB DATE 7-15-86
DRAWN PBM DATE 8-14-86
CHECKED RLB DATE 9-9-86
REVISED RLB/PBM DATE 11-6-86

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT
PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING
SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 1175+00 TO STA. 1292+00

SHEET 12 OF 23

SHEET COMMENTARY

SHEET 13 OF 23

STATION 1064+00 TO STATION 1175+00

REACHES SIX AND SEVEN

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land uses along this segment include residential and industrial development. Corridor boundaries are typically established by existing roads. A linear park already exists, complimented by Globeville Landing and Washington Street Pocket Park. The existing linear park consists of an east-bank trail which continues north to Globeville Landing where it crosses a pedestrian bridge to the west bank and continues north, ending abruptly approximately 1000 feet south of Franklin Street.

The plan suggests construction of an opposite-bank trail system through this segment and improvements to existing parks. From the south end of the segment, the proposed trail continues north along the west bank, crossing underneath East 31st Avenue and East 38th Street with ramps to street grade at each crossing. The trail joins the existing trail north of 38th Street. The plan also recommends continuing the existing east-bank trail north from Globeville Landing Park, crossing underneath I-70 and Franklin Street with a ramp to street grade at Franklin. The plan proposes two options for creating a new pedestrian bridge to connect the east and west-bank trails. The first option is to use the abandoned cattle bridge and the second option is to construct a new bridge south of Franklin.

The recommended improvement to Globeville Landing is to add stairs to the existing boardwalk to provide boater access to the river.

The plan proposes significant expansion of Washington Street Pocket Park. The plan calls for development of a new Pocket Park north of Franklin Street with boat landings and a parking lot for approximately 14 cars.

Boating improvements are expected to result from construction of the low flow channel proposed in Volume I of the Phase B Report.

EXISTING LINEAR PARK

- LIMITED STRUCTURAL IMPROVEMENTS AND FLOODPLAIN MANAGEMENT
- LIMITED RECREATION IMPROVEMENTS

IMPROVE GLOBEVILLE LANDING PARK
EXISTING BOAT LANDING
IMPROVE BOARDWALK WITH STEPS FOR BOATER ACCESS
EXISTING PARKING, PICNIC AREA AND SHELTER REMAIN

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

EXISTING HIKE, BIKE AND MAINTENANCE MAINTENANCE TRAIL

EXISTING PEDESTRIAN BRIDGE

PROPOSED EXPANSION OF WASHINGTON ST. POCKET PARK

WASHINGTON ST.

MATCH LINE - STA. 1122+00

MATCH LINE - STA. 1175+00

E 31ST AVE

SOUTH PLATTE RIVER

38TH AVE.

N

DATUM IS MEAN SEA LEVEL

SCALE OF FEET

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

EXISTING LINEAR PARK

- LIMITED STRUCTURAL IMPROVEMENTS AND FLOODPLAIN MANAGEMENT
- LIMITED RECREATION IMPROVEMENTS

USE ABANDONED CATTLE BRIDGE AS PEDESTRIAN BRIDGE - ALTERNATIVE ONE

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS, SUBJECT TO CHANGE.

PROVIDE LOW-FLOW CHANNEL TO IMPROVE BOATING FROM RIVERFRONT PARK TO FRANKLIN ST.

IMPROVE LANDSCAPE CHARACTER ALONG RIVER

PROPOSED PEDESTRIAN BRIDGE - ALTERNATIVE TWO

SOUTH PLATTE RIVER

PROPOSED EXPANSION OF WASHINGTON ST. POCKET PARK

EXISTING WASHINGTON ST. POCKET PARK

I-70

MATCH LINE - STA. 1122+00

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

N

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

EXISTING HIKE, BIKE AND MAINTENANCE TRAIL

MATCH LINE - REACH SIX

MATCH LINE - REACH SEVEN

FRANKLIN ST.

MATCH LINE - STA. 1064+00

PROPOSED POCKET PARK
BOAT LANDING
PARKING LOT WITH 14 SPACES

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL - 2 FEET

Delta Aerial Surveys, Inc.
2345 50 FEDERAL BLVD SUITE 195
DENVER, COLORADO 80211
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave , Suite 55-A
Denver , Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS , LTD.
DENTON HARPER MARSHALL , INC.

DESIGNED RWB DATE 7-15-86
DRAWN PRM DATE 8-14-86
CHECKED RWB DATE 9-9-86
REVISED RWB/PRM DATE 11-26-86

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 1064+00 TO STA. 1175+00

SHEET 13 OF 23

SHEET COMMENTARY
SHEET 14 OF 23
STATION 960+00 TO STATION 1064+00
REACH SEVEN

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land use in this segment is primarily industrial with large parcels of undeveloped land. The typical corridor width is 400 feet. No recreation improvements currently exist in this segment.

The plan proposes construction of an east-bank trail system and two pocket parks. Beginning at the south end of the segment, the trail crosses the Burlington Canal via a pedestrian bridge and continues north, crossing underneath York Street with a ramp to street grade. The trail continues north along the east bank, then crosses to the west bank via a pedestrian bridge. The trail continues along the west bank through a proposed pocket park and underneath the metro-sewage district bridge with ramps to street grade. A landscape buffer is proposed between the trail and adjacent development north of York Street to create a quality trail experience.

The plan includes development of the York Street Pocket Park with informal picnic and rest areas in the land between the Burlington Canal and the South Platte River. A pocket park is also proposed at 64th Avenue which would provide parking, picnic tables, and adjacent boat landings.

The addition of a boat chute to each of the six dams is suggested in this segment, as well as construction of two boat landings adjacent to each as portage facilities.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to experience the river in its natural state.

ADD BOAT CHUTE TO 8 FT. CONCRETE DAM

PROPOSED BOAT LANDINGS

PROPOSED PEDESTRIAN BRIDGE

ADD BOAT CHUTE TO 2 FT. SHEET PILE DAM

PROPOSED BOAT LANDINGS

SOUTH PLATTE RIVER

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

ADD BOAT CHUTE TO 6 FT. WOOD AND RUBBLE DAM

PROPOSED BOAT LANDINGS

PROPOSED BOAT LANDINGS

ADD BOAT CHUTE TO 8 FT. SHEET PILE DAM

LINEAR PARK

- LIMITED STRUCTURAL IMPROVEMENTS AND FLOOD PLAIN MANAGEMENT
- TYPICAL 400 FT. CORRIDOR

MATCH LINE-STA. 1005+00

MATCH LINE STA. 1064+00

BURLINGTON CANAL HEADGATE

BURLINGTON DITCH

YORK ST.

PROPOSED YORK ST. POCKET PARK
INFORMAL PICNIC AND REST AREAS

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

SCALE OF FEET

DATUM IS MEAN SEA LEVEL

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

PROPOSED 64TH AVE. POCKET PARK

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

PROPOSED BOAT LANDINGS

SOUTH PLATTE RIVER

ADD BOAT CHUTE TO SHEET PILE SEWER LINE CROSSING

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL

PROPOSED PEDESTRIAN BRIDGE

ADD LANDSCAPE BUFFER BETWEEN TRAIL AND DEVELOPMENT

REMOVAL OF EXISTING DAM RECOMMENDED IN VOL. I ENGINEERING REPORT

PROPOSED BOAT LANDINGS

ADD BOAT CHUTE TO 3 FT. RUBBLE DAM

PROPOSED BOAT LANDINGS

PROPOSED PEDESTRIAN BRIDGE

LINEAR PARK

- LIMITED STRUCTURAL IMPROVEMENTS AND FLOOD PLAIN MANAGEMENT
- TYPICAL 400 FT. CORRIDOR

MATCH LINE-STA. 960+00

MATCH LINE-STA. 1005+00

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY.
AERIAL PHOTOGRAPHY APRIL 16, 1985
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL = 2 FEET

Delta Aerial Surveys, Inc.
2345 50 FEDERAL BLVD SUITE 195
DENVER COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED	RLW	DATE 7-15-85
DRAWN	PRM	DATE 8-14-85
CHECKED	RLW	DATE 9-9-85
REVISED	RLB, PRM	DATE 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 960+00 TO STA. 1064+00

SHEET 14 OF 23

SHEET COMMENTARY
SHEET 15 OF 23
STATION 765+00 TO STATION 960+00
REACH EIGHT

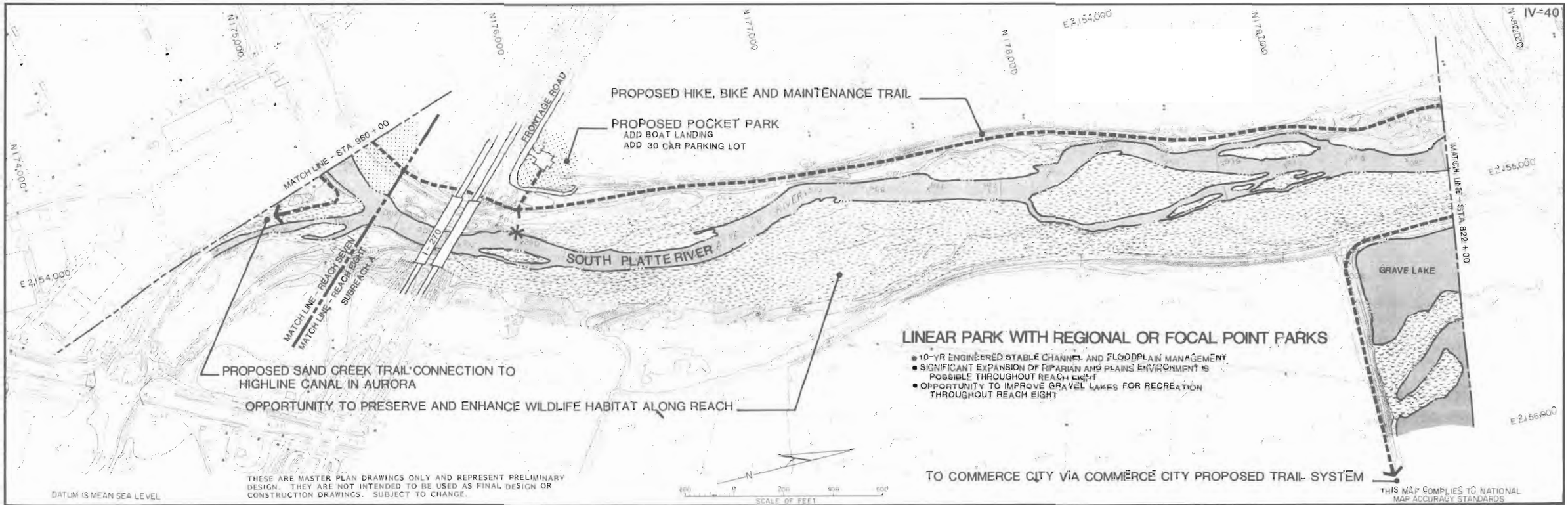
The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land use in this segment is industrial with large parcels of undeveloped land. Several recreation-related improvements have been constructed as part of the Adams County Greenway. Specifically, a trail begins below I-76 in Rendezvous Park, where it crosses first the river itself then Clear Creek via pedestrian bridges. After crossing Clear Creek, the existing trail continues north along the west bank to Niver Creek Canal where it ends. In addition to the hike and bike trail, from Clear Creek north the trail has an adjacent horse path.

The plan proposes development of a linear park, improvement and expansion of Rendezvous Park, and development of auto access points and other special facilities. The overall emphasis of the plan in this segment and Reach Eight in general is to preserve and enhance the riparian environment to the extent possible.

The proposed trail and adjacent horse path begin on the east bank, continuing north to join the existing trail at the existing picnic area on Clear Creek's west bank. Although the trail crosses underneath I-270 and I-76 no ramps to street grade are provided due to the high speed traffic. The plan also proposes development of connecting trails along Clear Creek to the City of Golden and the entire northwest metropolitan area and along Niver Creek Canal to the City of Thornton. On the east bank, the plan proposes development of a loop trail around Engineer's Lake with a connection to Barr Lake via the O'Brian Canal.

In addition to trail construction, a variety of improvements are proposed for Rendezvous Park. The plan proposes constructing a parking lot with access from Highway 224 and increasing Rendezvous Park's acreage. Improvements to Engineer's Lake include improving bank safety and fishing. Landscaping for visual purposes and additional habitat as well as to improve park character is also recommended. Where possible, riparian vegetation should be used to enhance the natural character of the park. The plan also proposes addition of camping and picnic facilities in the northern portion of Rendezvous Park.



GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1983 TOPOGRAPHIC MAPPING BY CONTOUR INTERVAL: 2 FEET Delta Aerial Surveys, Inc. 2345 SO FEDERAL BLVD SUITE 195 DENVER COLORADO 80219 (303) 934-5500	WRIGHT WATER ENGINEERS, INC. 2490 W 26th Ave., Suite 55-A Denver, Colorado 80211 (303) 480-1700 URBAN ENVIRONMENTS, LTD. DENTON HARPER MARSHALL, INC.	DESIGNED RWS DATE 7-15-85 DRAWN PRM DATE 8-14-85 CHECKED RWS DATE 9-9-85 REVISED RLB/PRM DATE 11-6-85	URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PHASE B PLAN	MAJOR DRAINAGEWAY PLANNING SOUTH PLATTE RIVER	PARKS RECREATION & OPEN SPACE PLAN STA. 765+00 TO STA. 960+00

SHEET COMMENTARY
SHEET 16 OF 23
STATION 657+00 TO STATION 765+00
REACH EIGHT

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

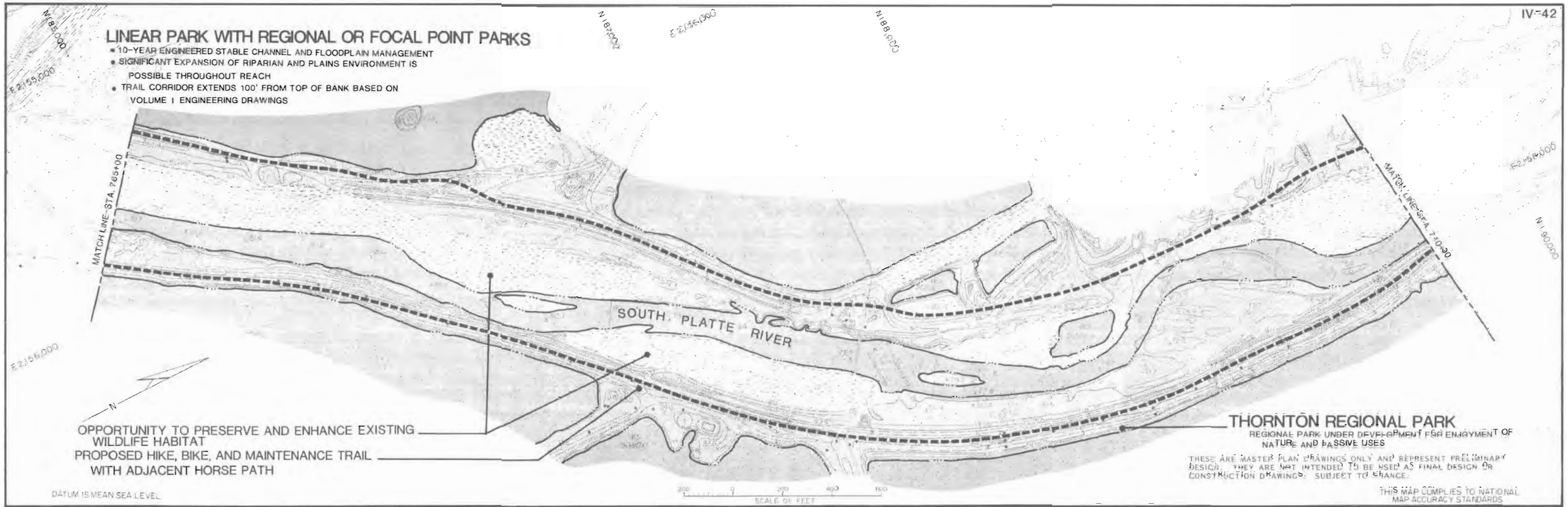
The land use in this segment is primarily industrial with large expanses of undeveloped land. No recreation-related improvements currently exist. The trail corridor typically extends 100 feet from the top of the bank as determined in Volume I Engineering Drawings.

In this segment, the plan proposes a linear park with the major spine trail continuing north along the west bank with an adjacent horse path. On the east bank, the trail continues north, crossing underneath 88th Avenue and joining the west bank trail via a pedestrian bridge. The plan proposes development of a pocket park along the east side of 88th Avenue with parking for approximately 18 cars and a boat landing to increase trail and river access. If the 88th Avenue bridge is replaced and the associated drop structure relocated as recommended in Volume I of the Phase B Report, a boat chute should be included in the drop structure. Adjacent boat landings would be needed as portage facilities.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to enjoy the river in a natural state.

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS



THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

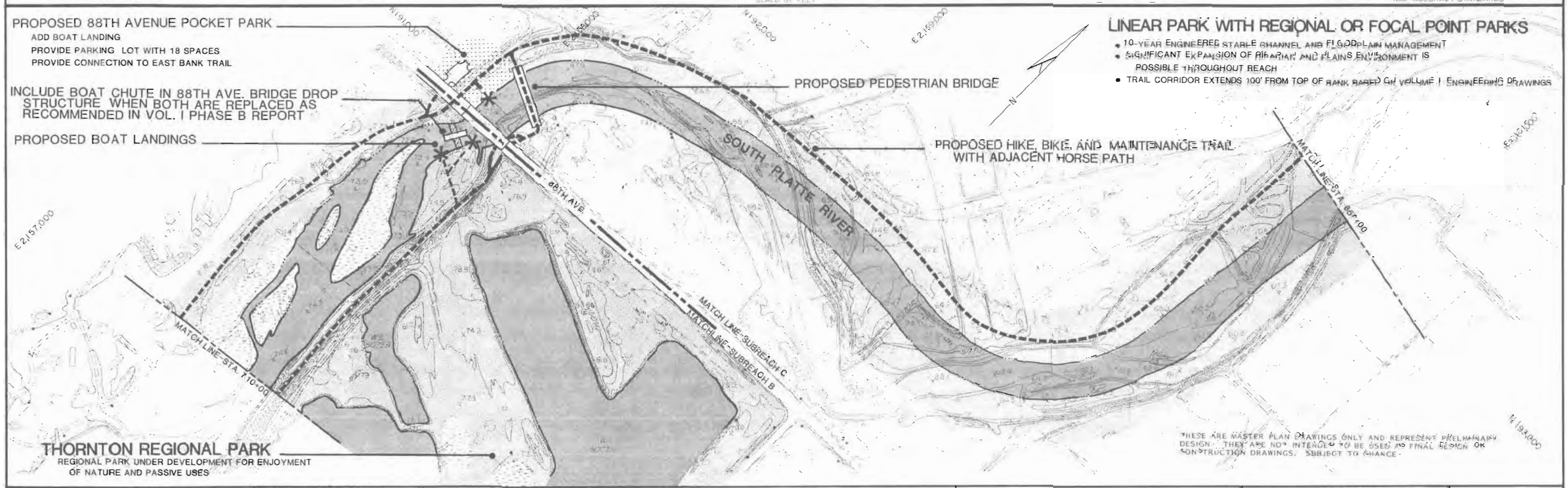
PROPOSED 88TH AVENUE POCKET PARK
- ADD BOAT LANDING
- PROVIDE PARKING LOT WITH 18 SPACES
- PROVIDE CONNECTION TO EAST BANK TRAIL

INCLUDE BOAT CHUTE IN 88TH AVE. BRIDGE DROP STRUCTURE WHEN BOTH ARE REPLACED AS RECOMMENDED IN VOL. I PHASE B REPORT

PROPOSED BOAT LANDINGS

PROPOSED PEDESTRIAN BRIDGE

PROPOSED HIKE, BIKE, AND MAINTENANCE TRAIL WITH ADJACENT HORSE PATH



LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16,1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL: 2 FEET
Dalta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED RWS DATE 7-15-83
DRAWN PRM DATE 8-14-83
CHECKED RWS DATE 9-9-83
REVISED RLB/PRM DATE 11-6-83

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 657+00 TO STA. 765+50

SHEET 16 OF 23

SHEET COMMENTARY
SHEET 17 OF 23
STATION 560+00 TO STATION 657+00
REACH EIGHT

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land use in this segment is primarily industrial with large expanses of undeveloped land. No recreation-related improvements currently exist. The trail corridor typically extends 100 feet from the top of bank based on Volume I Engineering Drawings.

The plan proposes continued development of a west-bank trail system with an adjacent horse path. Opportunities to protect and enhance existing wildlife habitat or to create additional habitat should be further explored. In addition, opportunities to develop gravel lakes for recreational use should also be explored. Boating opportunities will be excellent in this segment if a boat chute is included in the relocated Fulton Ditch Diversion Dam which is to be built during channel reconstruction. (See Volume I Engineering Drawings.) The plan also proposes construction of two boat landings adjacent to the dam as portage facilities.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to enjoy the river in a natural state.

POSSIBLE LOCATION FOR NEW WETLANDS AND WILDLIFE HABITAT IN ABANDONED OXBOW IF R.O.W. IS AVAILABLE

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL WITH ADJACENT HORSE PATH

E 2,150,000 N 194,000 E 2,160,000 N 193,000 E 2,161,000 E 2,164,000 N 192,000

SOUTH PLATTE RIVER

MATCH LINE-STA. 657+00

MATCH LINE-STA. 613+00

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

DATUM IS MEAN SEA LEVEL

0 100 200 400 600 SCALE OF FEET

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS.

PROPOSED HIKE, BIKE, AND MAINTENANCE TRAIL WITH ADJACENT HORSE PATH

REMOVAL AND RELOCATION OF EXISTING FULTON DITCH DIVERSION DAM RECOMMENDED IN VOL. I ENGINEERING REPORT

E 2,163,000 N 197,000 E 2,164,000 N 196,000 E 2,165,000 E 2,166,000 N 193,000

MONACO

SOUTH PLATTE RIVER

MATCH LINE-STA. 613+00

MATCH LINE-STA. 560+00

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

INCLUDE BOAT CHUTE IN FULTON DIVERSION DAM BUILT DURING CHANNEL RECONSTRUCTION

PROPOSED BOAT LANDINGS

FULTON DITCH

IMPROVE BOATING THROUGHOUT SUBREACH C

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY Data Aerial Surveys, Inc. 2345 50 FEDERAL BLVD SUITE 155 DENVER COLORADO 80219 (303) 934-5500
CONTOUR INTERVALS: 2 FEET

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED	RWB	DATE 1-85
DRAWN	PRM	DATE 8-14-85
CHECKED	RWB	DATE 9-9-85
REVISED	RWB/PRM	DATE 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 560+00 TO STA. 657+00

SHEET COMMENTARY
SHEET 18 OF 23
STATION 458+00 TO STATION 560+00
REACH EIGHT

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land use in this segment is primarily industrial with large expanses of undeveloped land. No recreation-related improvements currently exist. The trail corridor is typically 100 feet from top of bank as shown in Volume I Engineering Drawings.

The plan proposes construction of a west-bank trail with an adjacent horse path, as well as a pocket park on the west side of 104th Avenue. The trail crosses both Grange Hall Creek and the Brantner Ditch via small pedestrian bridges. The plan proposes development of a boat landing and parking for approximately 18 cars in the pocket park.

To ensure continuous boating in this segment, the plan proposes addition of a boat chute to the relocated Brantner Diversion Dam and construction of two adjacent boat landings as portage facilities. Boat landings are also proposed at the 104th Avenue pocket park and the confluence of the river and Grange Hall Creek.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to enjoy the river in a natural state.

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

PROPOSED TRAIL CONNECTION ALONG GRANGE CREEK

PROPOSED PEDESTRIAN BRIDGE

PROPOSED 104TH AVENUE POCKET PARK
- ADD BOAT LANDING
- PROVIDE PARKING LOT WITH 18 SPACES
- PROVIDE TRAIL ACCESS

MATCH LINE-STA. 560+00

MATCH LINE-STA. 507+00

SOUTH PLATTE RIVER

PROPOSED BOAT LANDING

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL WITH ADJACENT HORSE PATH

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

DATUM IS MEAN SEA LEVEL

SCALE OF FEET

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH EIGHT
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

ADD BOAT CHUTE TO BRANTNER DIVERSION DAM

PROPOSED BOAT LANDINGS

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL WITH ADJACENT HORSE PATH

BRANTNER DITCH

MATCH LINE-STA. 507+00

MATCH LINE-STA. 458+00

SOUTH PLATTE RIVER

PROPOSED PEDESTRIAN BRIDGE

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH EIGHT
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16,1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL = 2 FEET

Data Aerial Surveys, Inc.
2345 SO FEDERAL BLVD SUITE 155
DENVER COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED RLB DATE 7-12-85
DRAWN PRM DATE 8-14-85
CHECKED RLB DATE 9-9-85
REVISED RLB/PRM DATE 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 458+00 TO STA. 560+00

SHEET COMMENTARY
SHEET 19 OF 23
STATION 458+00 TO STATION 388+00
REACH EIGHT

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

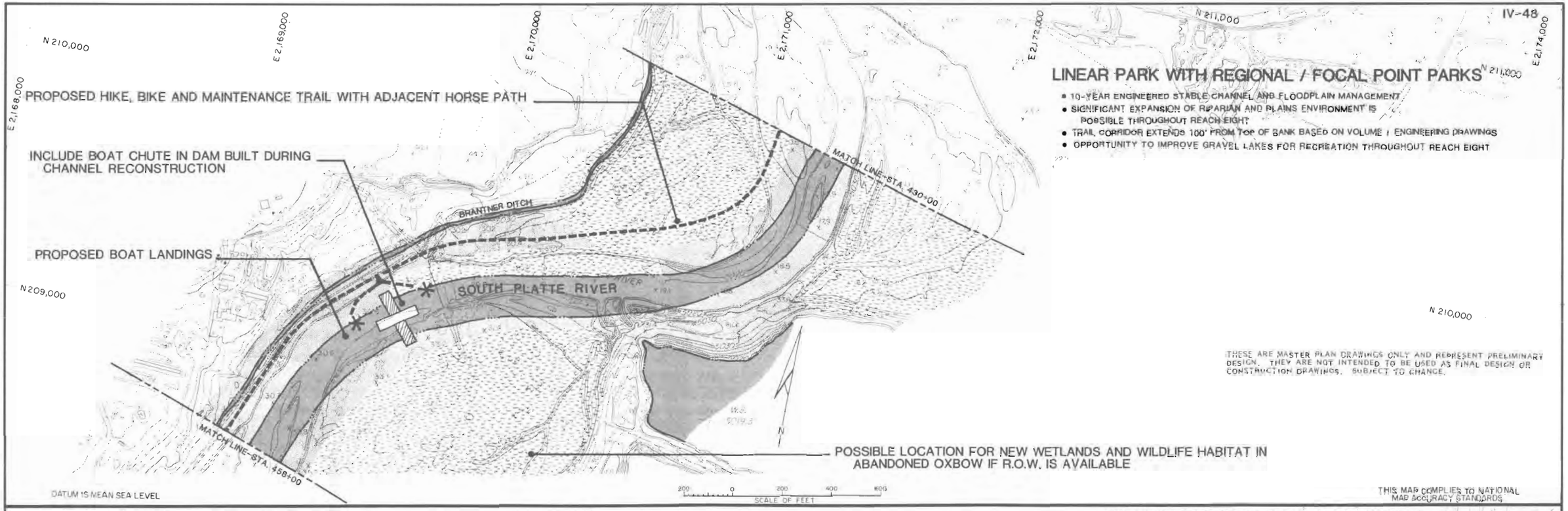
The land use in this segment is primarily industrial with large expanses of undeveloped land. No recreation-related improvements currently exist. The trail corridor typically extends 100 feet from the top of bank based on Volume I Engineering Drawings.

The plan proposes development of a west-bank trail system with an adjacent horse path. Opportunities to protect and enhance existing wildlife habitat or to create additional habitat should be further explored. In addition, opportunities to develop gravel lakes for recreational use should be explored. Boating opportunities will be excellent in this segment if the boat chutes are included in both erosion control structures which will be built during channel reconstruction. The plan also proposes construction of boat landings on either side of each dam as portage facilities.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to enjoy the river in a natural state.

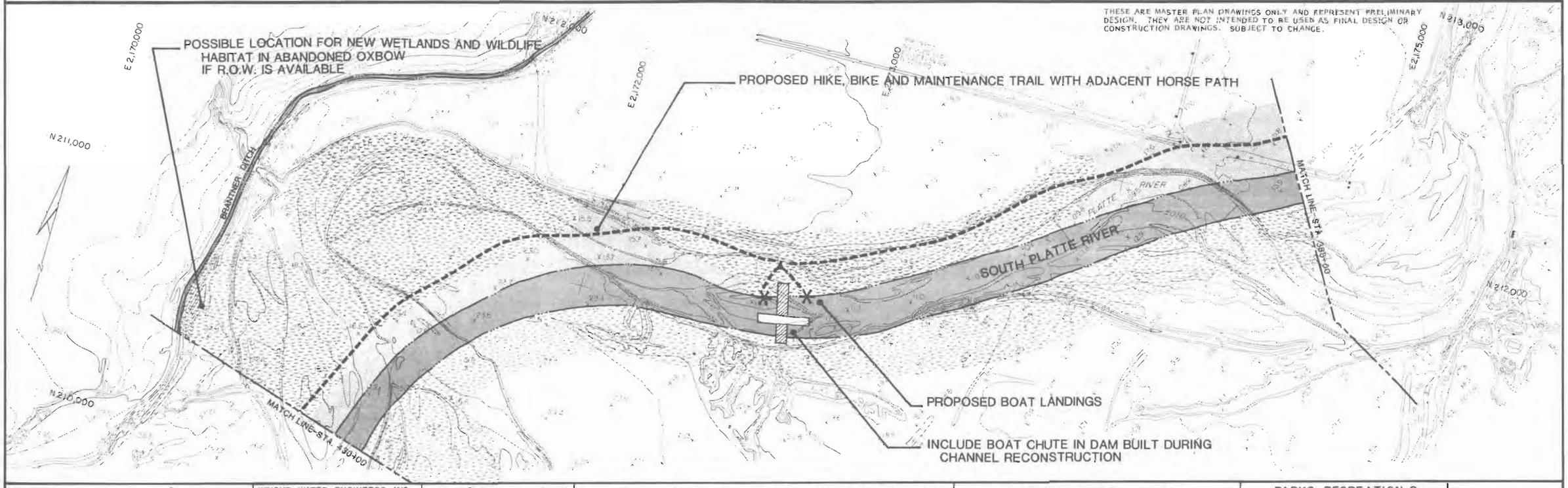
LINEAR PARK WITH REGIONAL / FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH EIGHT
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT



THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS



GROUND CONTROL SURVEY.
AERIAL PHOTOGRAPHY APRIL 15, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVALS 2 FEET

Daltz Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD. SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED	RWS	DATE 7-1985
DRAWN	PRH	DATE 8-1985
CHECKED	RWS	DATE 9-9-85
REVISED	RLB/PRH	DATE 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 458+00 TO STA. 388+00

SHEET COMMENTARY
SHEET 20 OF 23
STATION 227+00 TO STATION 388+00
REACH EIGHT

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land use in this segment is primarily industrial with large expanses of undeveloped land. No recreation-related improvements currently exist. The trail corridor typically extends 100 feet from the top of bank based on Volume I Engineering Drawings.

The plan proposes development of a west-bank trail system with an adjacent horse path. Toward the northern half of this segment, Adams County plans to develop a nature center with associated hiking-only nature trails. The spine trail skirts the west side of the center, away from the river. Opportunities to protect and enhance existing wildlife habitat or to create additional habitat should be further explored. In addition, opportunities to develop gravel lakes for recreational use should also be explored. The future Adams County Regional Park Master Plan will identify areas for river access in this segment. Boating opportunities will be excellent in this segment if a boat chute is included in the erosion control structure which will be built north of 124th Avenue during channel reconstruction. The plan also proposes construction of boat landings on either side of the dam to serve as portage facilities.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to enjoy the river in a natural state.

PROPOSED TRAIL CONNECTION ALONG 120TH AVENUE

FUTURE ADAMS COUNTY REGIONAL PARK MASTER PLAN WILL PROVIDE FOR RIVER ACCESS AS APPROPRIATE

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

N 213,000 · E 2,175,000 · E 2,176,000 · N 216,000 · N 217,000 · E 2,177,000 · N 212,000 · E 2,175,000 · N 217,000 · E 2,178,000

MATCH LINE-STA. 388+00

FUTURE 120TH AVE

MATCH LINE-SUBREACH E

MATCH LINE-SUBREACH D

SOUTH PLATTE RIVER

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL WITH ADJACENT HORSE PATH

124TH AVE.

MATCH LINE-STA. 332+00

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

DATUM IS MEAN SEA LEVEL

200 0 200 400 600
SCALE OF FEET

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

ADAMS COUNTY CAMPGROUND

FUTURE ADAMS COUNTY REGIONAL PARK MASTER PLAN WILL PROVIDE FOR RIVER ACCESS AS APPROPRIATE

ADAMS COUNTY NATURE PRESERVE AND TRAIL LOOP

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

N 227,000 · E 2,179,000 · N 222,000 · E 2,180,000 · N 222,000

MATCH LINE-STA. 232+00

MATCH LINE-STA. 277+00

PROPOSED BOAT LANDINGS

INCLUDE BOAT CHUTE IN DAM BUILT DURING CHANNEL RECONSTRUCTION

SOUTH PLATTE RIVER

WS 4395.5

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL WITH ADJACENT HORSE PATH

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY
AERIAL PHOTOGRAPHY APRIL 10, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL = 2 FEET

Delta Aerial Surveys, Inc.
2345 SO. FEDERAL BLVD SUITE 195
DENVER, COLORADO 80219
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED	PHS	DATE 7-16-85
DRAWN	FRM	DATE 8-10-85
CHECKED	PHS	DATE 9-10-85
REVISED	MDV	DATE 9-19-85 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 227+00 TO STA. 388+00

SHEET COMMENTARY
SHEET 21 OF 23
STATION 165+00 TO STATION 277+00
REACH EIGHT

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land use in this segment is primarily industrial with large expanses of undeveloped land. No recreation-related improvements currently exist. The trail corridor typically extends 100 feet from the top of bank based on Volume I Engineering Drawings.

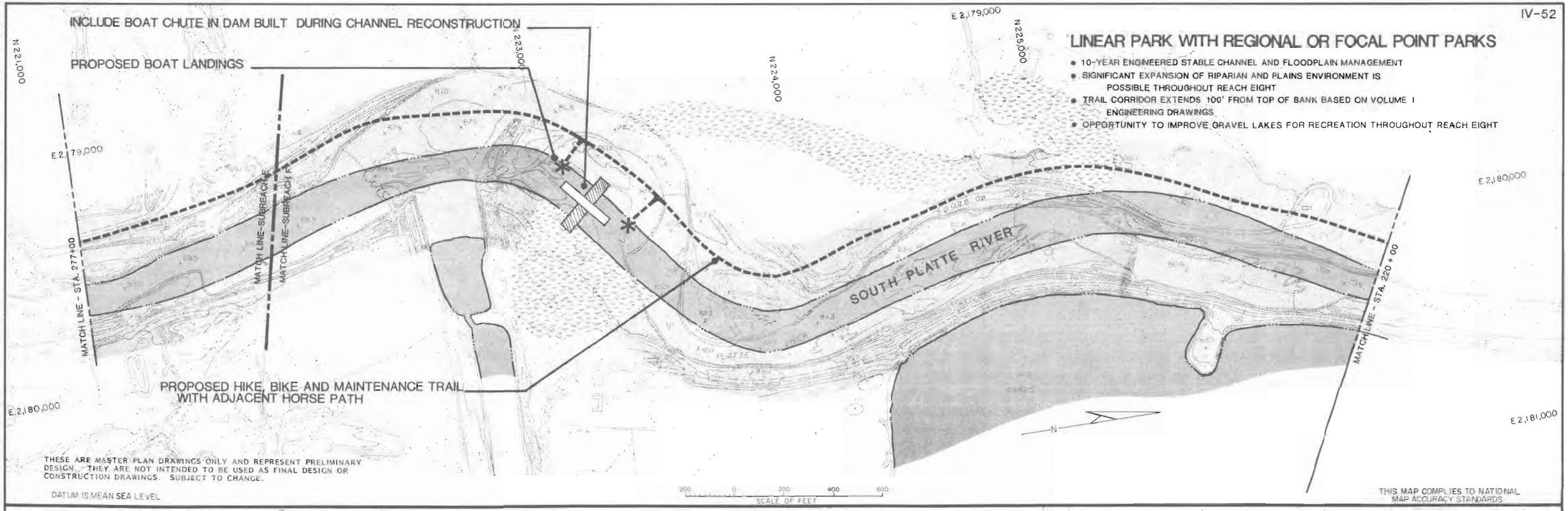
The plan proposes development of a west-bank trail system with an adjacent horse path. Opportunities to protect and enhance existing wildlife habitat or to create additional habitat should be further explored. In addition, opportunities to develop gravel lakes for recreational use should also be explored.

Boating opportunities will be excellent in this segment if a boat chute is included in the relocated Brighton Ditch Diversion Dam and the new erosion control structure at the southern end of the segment which will be built during channel reconstruction. The plan also proposes construction of boat landings on each side of the dams to serve as portage facilities.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to enjoy the river in a natural state.

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH EIGHT
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

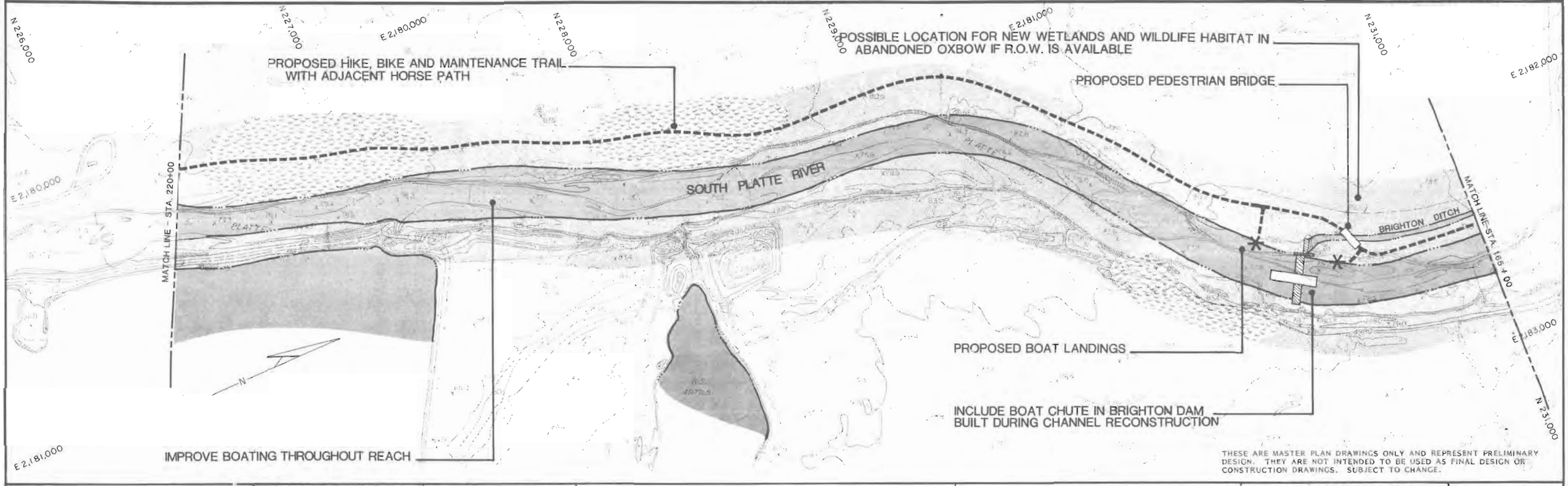


THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

DATUM IS MEAN SEA LEVEL

200 0 200 400 600
SCALE OF FEET

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS



THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1985
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc.
2345 S0 FEDERAL BLVD SUITE 195 DENVER, COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL 2 FEET

WRIGHT WATER ENGINEERS, INC.
2490 W 26th Ave, Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED	RHG	DATE 7-19-85
DRAWN	PEM	DATE 8-14-85
CHECKED	RHG	DATE 9-9-85
REVISED	MDV	DATE 9-15-85, 11-6-85

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 165+00 TO STA. 277+00

SHEET COMMENTARY

SHEET 22 OF 23

STATION 71+00 TO STATION 165+00

REACH EIGHT

The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land use in this segment is primarily industrial with large expanses of undeveloped land. No recreation-related improvements currently exist. The trail corridor typically extends 100 feet from the top of bank based on Volume I Engineering Drawings.

The plan proposes development of a west-bank trail system with an adjacent horse path. Opportunities to protect and enhance existing wildlife habitat or to create additional habitat should be further explored. In addition, opportunities to develop gravel lakes for recreational use should also be explored.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to enjoy the river in a natural state.

PROPOSED HIKE,BIKE AND MAINTENANCE TRAIL
WITH ADJACENT HORSE PATH

E 2,181,000
N 233,000
E 2,182,000
N 235,000
E 2,183,000
N 236,000
N 231,000
E 2,181,000
E 2,182,000
E 2,184,000
N 235,000

SOUTH PLATTE RIVER
BRIGHTON DITCH
MATCH LINE-STA. 125+00
MATCH LINE-STA. 185+00

REMOVAL AND RELOCATION OF BRIGHTON DITCH DIVERSION DAM RECOMMENDED IN VOL. I ENGINEERING DRAWINGS

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH EIGHT
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME 1 ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

DATUM IS MEAN SEA LEVEL

SCALE OF FEET

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS

E 2,182,000
N 235,000
N 234,000
E 2,184,000
N 231,000
E 2,185,000
N 238,000
E 2,186,000
N E 238,000

PROPOSED HIKE, BIKE AND MAINTENANCE TRAIL WITH ADJACENT HORSE PATH

OPPORTUNITY TO PRESERVE AND ENHANCE EXISTING WILDLIFE HABITAT

MATCH LINE-STA. 125+00

SOUTH PLATTE RIVER

MATCH LINE-STA. 71+00

POSSIBLE LOCATION FOR NEW WETLAND AND WILDLIFE HABITAT IN ABANDONED OXBOWS IF R.O.W. IS AVAILABLE

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-YEAR ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH EIGHT
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY,
AERIAL PHOTOGRAPHY APRIL 16, 1983
TOPOGRAPHIC MAPPING BY
CONTOUR INTERVAL = 2 FEET

Delta Aerial Surveys, Inc.
2345 50 FEDERAL BLVD SUITE 115
DENVER, COLORADO 80211
(303) 934-5500

WRIGHT WATER ENGINEERS, INC.
2490 W. 26 N Ave., Suite 53-a
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED ____ DATE ____
DRAWN ____ DATE ____
CHECKED ____ DATE ____
REVISED ____ DATE ____

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 71+00 TO STA. 165+00

SHEET 22 OF 23

SHEET COMMENTARY

SHEET 23 OF 23

STATION 560+00 TO STATION 657+00

REACH EIGHT

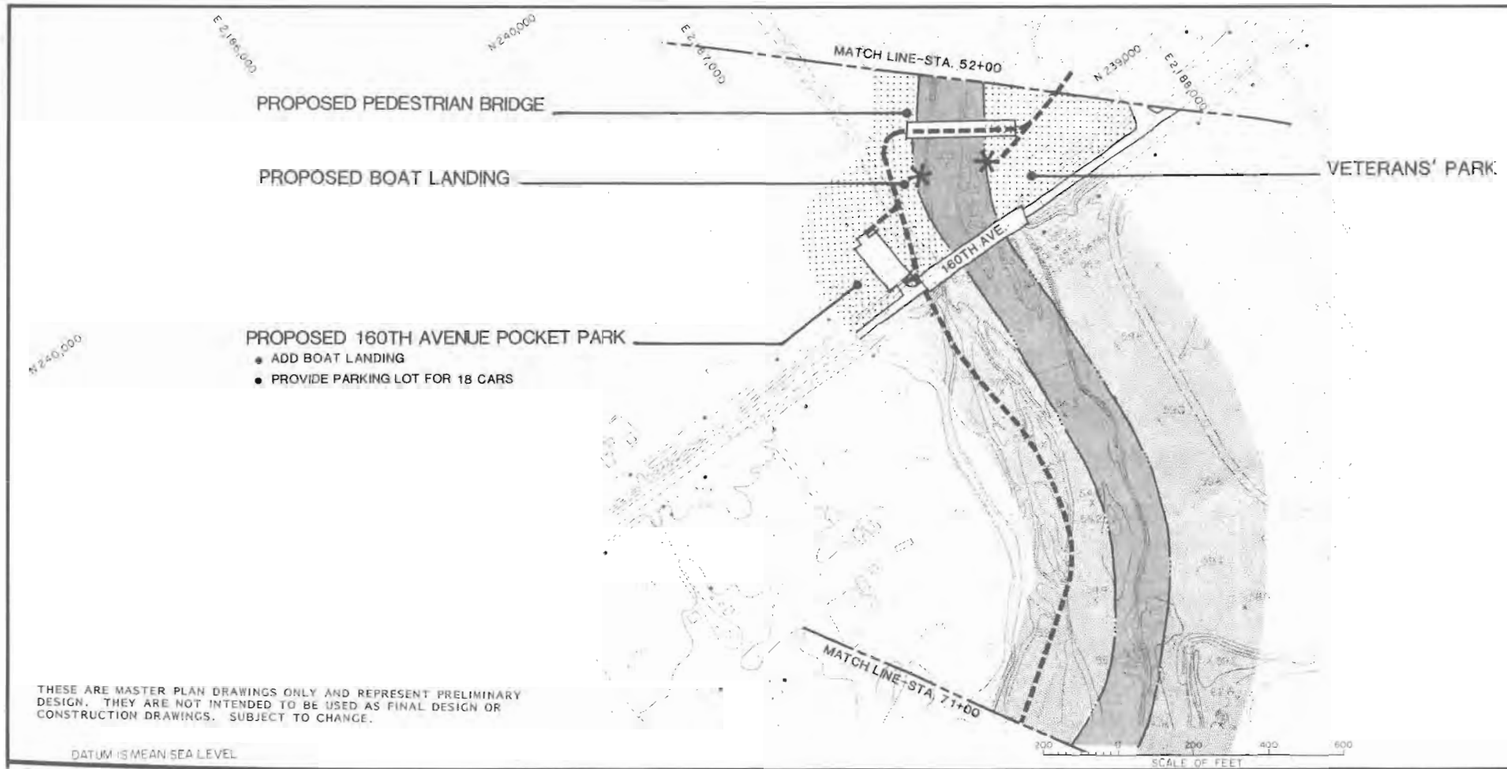
The Recreation Plan proposed for this segment of the South Platte River is based on the engineering drawings in Vol. I of the Phase B Report. As the engineering drawings are revised and refined, the plan proposed here will need to be reevaluated and modified if necessary to accommodate flood control measures.

The land use in this segment is primarily industrial with large expanses of undeveloped land. Two special parks currently exist in this segment: Smith Natural Area and Veteran's Park. The trail corridor typically extends 100 feet from the top of bank based on Volume I Engineering Drawings.

The plan proposes development of a west-bank trail system with an adjacent horse path. The trail crosses underneath 160th Avenue through a proposed pocket park, then it crosses a pedestrian bridge to the west bank into Veteran's Park. A connection to the Town of Brighton is proposed from Veteran's Park. Opportunities to protect and enhance existing wildlife habitat or to create additional habitat should be further explored.

The plan proposes development of a pocket park with access from 160th Avenue and parking for approximately 16 cars. Two boat landings are proposed, one within the park and the other on the opposte bank in Veteran's Park.

The underlying concept for the plan is to preserve and enhance the riparian system to the extent possible, providing opportunities for people to enjoy the river in a natural state.



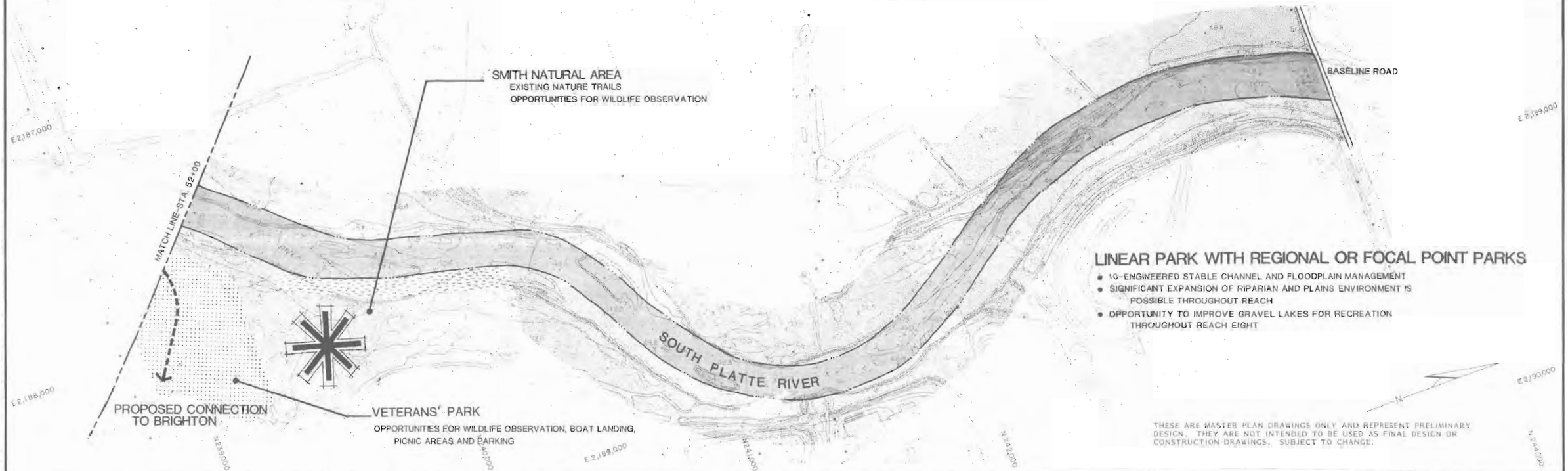
THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

DATUM IS MEAN SEA LEVEL

LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH
- TRAIL CORRIDOR EXTENDS 100' FROM TOP OF BANK BASED ON VOLUME I ENGINEERING DRAWINGS
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

THIS MAP COMPLIES TO NATIONAL MAP ACCURACY STANDARDS



LINEAR PARK WITH REGIONAL OR FOCAL POINT PARKS

- 10-ENGINEERED STABLE CHANNEL AND FLOODPLAIN MANAGEMENT
- SIGNIFICANT EXPANSION OF RIPARIAN AND PLAINS ENVIRONMENT IS POSSIBLE THROUGHOUT REACH
- OPPORTUNITY TO IMPROVE GRAVEL LAKES FOR RECREATION THROUGHOUT REACH EIGHT

THESE ARE MASTER PLAN DRAWINGS ONLY AND REPRESENT PRELIMINARY DESIGN. THEY ARE NOT INTENDED TO BE USED AS FINAL DESIGN OR CONSTRUCTION DRAWINGS. SUBJECT TO CHANGE.

GROUND CONTROL SURVEY, AERIAL PHOTOGRAPHY APRIL 16, 1981
TOPOGRAPHIC MAPPING BY Delta Aerial Surveys, Inc. 2345 SO. FEDERAL BLVD SUITE 195 DENVER COLORADO 80219 (303) 934-5500
CONTOUR INTERVAL: 2 FEET

WRIGHT WATER ENGINEERS, INC.
2490 W. 26th Ave., Suite 55-A
Denver, Colorado 80211 (303) 480-1700
URBAN ENVIRONMENTS, LTD.
DENTON HARPER MARSHALL, INC.

DESIGNED	KWB	DATE 7-16-80
DRAWN	KMM	DATE 8-14-80
CHECKED	BWB	DATE 9-1-80
REVISED	MDV	DATE 9-15-80
		1-6-81

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

PHASE B PLAN

MAJOR DRAINAGEWAY PLANNING

SOUTH PLATTE RIVER

PARKS RECREATION & OPEN SPACE PLAN
STA. 0+00 TO STA. 52+00

SHEET 23 OF 23

FOOTNOTES

1. A mid-1970 comparison of Denver's population-to-open-space ratio indicated approximately 147 persons/acre, as opposed to the National Recreation and Parks Association standard of 100 persons/acre. Construction of the Platte River Greenway during the ensuing ten years has reduced Denver's ratio to approximately 137 persons/acre. See Environmental Impact Assessment, South Platte River Improvement Project, January, 1975. Efforts to update these figures through the Denver Department of Parks and Recreation and the Denver Regional Council of Governments were unsuccessful, but generally confirmed the statistics noted above.

2. See Environmental Impact Assessment, South Platte River Improvement Project, January, 1975; Returning the Platte to the People, by Joe Shoemaker with Leonard Stevens, 1981; South Platte River Master Plan, Phase A Report, August 1984, specifically Section X and XIII.

3. See Managing Forested Land for Wildlife, Hoover-Wills, editors, 1984, published by and available at the Colorado Division of Wildlife, 6060 Broadway, Denver, CO 80216. Other references, available from the Colorado Division of Wildlife and the Colorado Wildlife Federation and Denver Audubon Society, both at 1720 Race Street, Denver, CO 80206, include: Audubon's Focus -- The South Platte Watershed, September, 1983, Warbler; Wild in the Streets, Colorado Division of Wildlife, date unknown; Managing Snag Habitats in Southwestern National Forests, Symposium, June 7-9, 1983, Flagstaff, Arizona; Cavity Nesting Birds of North American Forests, Forest Service USDA publication #511; and The Community Rivers Concept, by Christopher N. Brown, June, 1984 issue of American Forests.

REST AREA AND SHELTER IN GLOBEVILLE LANDING PARK LOOKING TOWARDS DOWNTOWN DENVER, COLORADO

APPENDIX A

VEGETATION AND WILDLIFE INVENTORY

INTRODUCTION

In order to fully understand and appreciate the vast array of recreation and wildlife benefits found along the South Platte River through metropolitan Denver, the following inventory from the Phase A portion of the master plan study is reproduced below.

VEGETATION INVENTORY

General

A survey of the plant communities on the South Platte River floodplain reveals a diverse mixture of vegetation that offers excellent wildlife habitat. The study site extends from Chatfield Reservoir to Brighton. Information from other past vegetation surveys were incorporated in the vegetation inventory. Species that have been introduced into city parks along the river were not classified into communities but are included in the plant species list.

Plant Communities

Ten general plant communities were identified along the South Platte River from Chatfield Reservoir to the City of Brighton.

1. Open-Mixed Cottonwood Community

   Includes mixed species of Peachleaf Willow, Narrowleaf Willow, Box Elder, Narrowleaf Cottonwood, Lanceleaf Cottonwood and is dominated by Plains Cottonwood. Cultivars such as American Elm, Chinese Elm, Russian Olive, Green Ash, and Hawthorns are occasionally found in mixed cottonwood communities. This community is very important for wildlife habitat because of the diverse vegetation, food and shelter offered.

   Location: Reach 1, 2, 3, 7 and 8

2. Closed Cottonwood Community

Similar to the open-mixed cottonwood community, except that it is totally dominated by cottonwood species in pure stands. The understory is typically less disturbed in older cottonwood stands because the density of these communities prohibit cattle grazing and disturbance by man. An excellent habitat for high, protected nesting sites and perches for birds. Cottonwoods are also an important food source for beaver.

Location: Reach 1, 2, 7 and 8.

3. Narrowleaf Willow Community

Usually found in dense colonies along river banks in moist, sandy soil. They provide a high quality food source for birds and mammals. Narrowleaf Willow communities are also extensively used for protective cover during the winter by migratory water fowl.

Location: Reach 1 through 8.

4. Strip Cottonwood Community

Strip Cottonwood communities generally occur in elongated belts on the river banks. This is caused by the removal and thinning of trees for agricultural and industrial land uses. These communities provide an important buffer zone between river wildlife species and industry, highways and housing developments.

Location: Reach 1 through 8.

5. Strip Elm Community

Strip elm communities are similar to strip cottonwood communities but are dominated by American, Chinese and Siberian Elms. Elms lack the wildlife value that cottonwood trees offer.

Location: Reach 3, 4, 5 and 6.

6. Disturbed Open Park Community

The disturbed open park community is a treeless area within the riparian zone often created by cattle over-grazing and abandoned crop fields. The open area is dominated by grasses, thistle, kochia and weedy forbs. Seed from this vegetation type provides the majority of food for birds and rodents. Probably all of the open grassland along the South Platte River consists of a disturbed open park community.

Location: Reach 1 through 8.

7. Cattail Marsh Community

The cattail marsh community is exceptionally rich in wildlife including birds, reptiles, crustaceans, amphiabians and insects. Algae and other aquatic vegetation along with insects are an important food source for birds.

Location: Reach 1, 3 and 8.

8. Sandbar Community

Most sandbars are unstable and in various stages of development. They can disappear and reappear annually. However, once a sandbar is vegetated they usually become more stable and can eventually change the

course of the river channel. Sandbars can be isolated and are often densely vegetated with Narrowleaf Willows, providing refuge for many wildlife species.

Location: Reach 1 through 8.

9. Cactus

Prickly pear cacti are very inconspicuous along the South Platte River and as such their importance is often overlooked. Native grasses growing within cactus patches are protected against grazing by hoofed animals, thus providing redistribution centers. The fruits and fleshy stems provide food for rodents and reptiles.

Location: Reach 1, 3 and 8.

10. Introduced Shortgrass

Native grasses have been reintroduced by man including blue gramma, buffalograss and side oats gramma. This plant community is part of a project to provide water saving, sod forming grasses in Habitat and Overland Parks.

Location: Reach 4.

NATURE STUDY ALONG THE SOUTH PLATTE RIVER

TREES AND SHRUBS

Name	Community	Form	Site	Comments
Acer negundo (Boxelder)	Open-mixed Cottonwood, Strip Cottonwood and Strip Elm	tree/native	swamp and streamside	fruit eaten by birds and squirrels; weed tree - discourage use
Acer saccharum (Sugar Maple)	Parks	tree/native	shade tolerant/shallow root system	good form and fall color
Ailanthus altissima (Tree of Heaven)	Parks	weedy tree/ introduced	fast growing/ thrives under adverse conditions	immune to dust and smoke
Crataegus crus-galli (Cockspur Hawthorn)	Parks	small tree/ native	____	songbird nesting; apple-like fruit eaten by upland gamebirds, fox & rabbit; fall color
Crataegus species (Common Hawthorn)	Open-mixed Cottonwood	small tree/ native	____	songbird nesting; apple-like fruit eaten by upland gamebirds, fox & rabbit; fall color
Elaeagnus angustifolia (Russian Olive)	Open-mixed Cottonwood	small tree/ introduced	cool moist	attracts songbird; good for wind breaks
Fagus species (Beech)	Parks	tree/native and introduced	____	acorns eaten by rabbits, squirrel, porcupine, opossum and birds

Name	Community	Form	Site	Comments
Fraxinus nigra (Black Ash)	Parks	tree/native	drought resistant	moderate importance to wildlife
Fraxinus pennsylvanica (Green Ash)	Open-mixed Cottonwood/ Parks	tree/native	drought resistant	see above
Gleditsia triacanthos (Honey Locust)	Parks	tree/native	semi-drought resistant	pods eaten by rabbits squirrels and bobwhite; good for windbreaks
Juniper species (Cedar Juniper)	Parks	coniferous/ native or shrub/tree introduced	____	berry-like eaten by songbirds, gamebirds and mammals
Picea pungens (Spruce)	Parks	coniferous tree/native	____	good nesting and winter cover; foliage and twigs browsed by rabbits in winter
Pinus edulis (Pinyon Pine) Pinus ponderosa (Ponderosa Pine) Pinus flexilis (Limber Pine) Pinus aristata (Bristlecone Pine)	Parks	Coniferous tree/native	dry sites; sensitive to air pollution	porcupines and rodents eat bark, some seeds rank high among foods of nearly all upland game birds, rabbits, & squirrels;
Populus deltoides (Eastern Cottonwood) Populus angustifolia (Narrowleaf Cottonwood) Populus X acuminata (Lanceleaf Cottonwood) Populus sargenti (Plains Cottonwood)	Parks, Open-mixed, Closed and Strip Cottonwood	tree/native	common along drainageways	seeds, buds and twigs important foods for mammals, birds, good wind break
Quercus species (Oaks)	Parks	tree/native or introduced	____	bird cover; acorns prized by ducks, geese, songbirds, raccoons and squirrels; sturdy growth
Salix amygdaloides (Peachleaf Willow) Salix exigua (Shrub Willow)	Open, Closed, Strip, & Sandbar Cottonwood	tree/native or introduced	intermittantly flooded areas, near drainage ways	twigs, buds, leaves, and fruit eaten by game birds some small mammals; erosion control
Symphoricarpos occidentalis (Snowberry, Waxberry, Wolfberry, Buckbrush)	Open, Closed & Strip Cottonwood	shrub/native	tolerant of most soils, adverse conditions	fruit attractive to birds in autumn, grows well under adverse conditions
Thuja species (Cedar, Red Cedar)	Parks	coniferous tree/shrub/ introducted	tolerates dry conditions	dense evergreen foliage
Tilia species (Basswood, Lime, Linden)	Parks	tree/native	____	buds and fruits eaten by squirrels and chipmunks; twigs eaten by cottontail, quail & grouse
Ulmus american (American Elm) Ulmus pamila (Siberian Elm)	Open Cottonwood & Strip Elm	tree/native shrub, tree/ introduced	____	early seed crop eaten by songbirds, squirrel, opposum; nesting; twigs browsed; subject to disease

Downed trees and standing snags	Open Cottonwood and mixed Cottonwood	larger trees all species	----	used by cavity nesters and secondary cavity nesters rabbits, squirrel, skunk, fox, woodpeckers chickadee, nuthatch, house wren, etc.

SOUTH PLATTE RIVER PROVIDES HABITAT FOR WATER FOWL

GRASSES

Name	Community	Form	Site	Comments
Agropyron desertorum (Crested Wheatgrass)	Disturbed Open Park	perennial bunchgrass	resistant to extreme temperatures & drought; soil holding rhizomes	eaten by cottontail rabbit
Agropyron psuedorepens (Slender Wheatgrass)	Disturbed Open park	perennial Bunchgrass	____	____
Agropyron repens (Quackgrass)	Disturbed Open Park	perennial bunchgrass	waste places, meadows and pastures	good soil binder on slopes
Bouteloua curtipendula (Side-oats Gramma)	Introduced Shortgrass	perennial bunchgrass	dry sites	grazing forage & seeds eaten by birds
Bouteloua gracilis (Blue Gramma)	Introduced Shortgrass	perennial bunchgrass	dry sites; excellent soil binder	seeds eaten by songbird
Bromus inermis (Smooth Bromegrass	Distrubed Open Park	perennial grass	____	large seeds eaten by birds & rodents
Bromus tectorum (Cheat, Chess)	Distrubed Open park	annual pesty grass	____	common pest in winter wheat & rye fields in U.S. & Canada
Buchloe dactyloides (Buffalo grass)	Disturbed Open Park & Introduced Shortgrass	perennial sod-forming	heavy textured soils	grazing forage. Running roots

Name	Community	Form	Site	Comments
Cenchrus longispinus (Sandbur)	Disturbed Open Park	annual grass	disturbed sandy soils	often attaches to clothing & animal fur
Digitaria sanguinalis (Hairy Crabgrass)	Disturbed Open Park	perennial bunchgrass	fields,lawns & disturbed sites	running roots
Digitaria ischaemum (Smooth Crabgrass)	Disturbed Open Park	____	____	____
Distichlis stricta (Saltgrass)	Disturbed Open Park	perennial sod-forming	alkaline soils	running roots
Echinochloa crus-galli (Cockspur)	Disturbed Open Park	annual grass	moist open places, fields, ditches, seasonally flooded	important to waterfowl
Elymus canadensis (Ryegrass)	Disturbed Open Park	perennial grass	widely disturbed sites	____
Hordeum jubatum (Foxtail Barley)	Disturbed Open Park	perennial pesty bunchgrass	____	seeds and leaves eaten by waterfowl and rodents
Koeleria cristata (Junegrass)	Disturbed Open Park	perennial bunchgrass	sandy soils	occurs as scattered plants, not in pure stands
Orzopsis species (Ricegrass)	Disturbed Open Park	perennial bunchgrass	dry, sandy & clay soils	seeds eaten by birds
Panicum species (Panicgrass)	Disturbed Open Park	annual or perennial grass	fields and upland waste places	wide distribution makes this an important food source for ground feeding songbirds
Phragmites communis (Reedgrass)	Disturbed Open Park	perennial emergent plant	wetlands	grows to 12'
Poa spp. (Bluegrass)	Disturbed Open Park	annual or perennial grass	____	seeds eaten by songbirds, & rodents; leaves grazed by rabbits
Setaria species (Bristlegrass)	Disturbed Open Park	annual weedy grass	____	seeds eaten by waterfowl, songbirds & small mammals
Sitanion hystrix (Bristlegrass)	Disturbed Open Park	perennial bunchgrass	dry and gravelly soils	
Sporobolus species (Dropseedgrass)	Disturbed Open Park	chiefly perennial, mostly bunchgrass	____	seeds important to ground feeding birds
Typha species (Cattails)	Cattail Marsh	grass-like perennial marshplant	marshes and shallow water	seeds eaten by geese & muskrat; shelter for yellow-headed and redwing blackbird

FORBS

Note: All weeds may occur in the Disturbed Open Park Community.

NAME	FORM	SITE	WILDLIFE VALUES	COMMENTS
Amaranthus retroflexus (Redroot Pigweed)	annual weedy forb	cultivated fields & waste places	seed important to songbirds	____
Ambrosia coronopifolia (Ragweed, Hayfever Weed)	perennial weedy forb	waste places and fields	fall and winter food birds	____
Ambrosia trifida (Giant Ragweed, Hayfever weed)	annual weedy forb	____	tough-coated seeds of little value	hayfever source
Apocynum suksdorfii (Dogbane, Indian-America Hemp)	perennial tall forb	____	may be poisonous to grazing animals	____
Aster species (Aster, Wild Daisies)	mostly perennial showy forb	old fields, roadsides	seeds important fall and winter songbird food	hayfever source
Chenopodium species (Goosefoot, Pigweed)	annual or weedy forb	____	seeds relished by songbirds; persist into winter	____
Cirsium arvense (Canada thistle)	biennial/ perennial	pastures, waste places	seeds a favorite of Goldfinches	____
Convolvulus arvensis (Field Morning-Glory, Creeping Jenny)	perennial weedy forb	____	extensive root system, difficult to eradicate	____
Cucurbita foetidissima (Wild Gourd)	perennial trailing forb	____	____	____
Echinocystis lobata (Mock Cucumber)	annual climbing vine	brush, banks, waste places	climbing vines can kill host	____
Grindelia squarrosa (Gum weed, Rosin weed)	annual or perennial sticky forb	primarily dry sites	____	____
Helianthus petiolaris (Prarie Sunflower)	annual weedy forb	roadsides, waste places	seeds outstanding wildlife food value	____
Ipomoea species (Morning-Glory)	annual weedy forb	old fields, waste places	____	attractive flowers
Kochia scoparia (Summer Cypress)	annual forb	____	____	____
Medicago sativa (Alfalfa, Medic)	perennial forb	well-distributed in the U.S.	foliage eaten by waterfowl, cottontail, rodents; seeds by rodents	soil enriching legume
Melilotus officinalis (Biennial Yellow Sweet Clover)	annual/ biennial forb	waste places, roadsides	nectar attracts bees	nitrogen fixing bacteriain root nodules
Melilotus alba (White Sweet Clover)	biennial forb	____	____	____
Opuntia comressa (Prickly Pear)	perennial cacti	sunny, dry, sandy soil	fruits eaten by rodents and reptiles	distribution center for grasses after overgrazing

Name	Form	Site	Wildlife Values	Comments
Parthenocissus engelmanni (Engelman Ivy)	perennial climbing vine	____	fruits eaten by songbirds, mice and skunk	ornamental value
Polygonum species (Smartweed)	annual or perennial amphibious	aquatic and moist	seeds eaten by game birds and songbirds	____
Rudbeckia species (Black eyed Susan, Coneflower)	perennial weedy forb	____	____	____
Rumex species (Curly Dock, Dock)	mostly perennial forb	____	seeds occasionally eaten by western ducks	____
Salsola Kali (Russian Thistle Tumblewood)	annual weedy forb	best on dry land	seeds eaten by rodents and birds; form pure	____
Scirpus species (Bullrush, Tule)	annual or perennial rush	marshlands	important food of ducks and certain marsh birds; stems and roots: muskrat	nesting cover for waterfowl, concedment for raccoon muskrat
Taraxacum species (Dandelion)	perennial weedy forb	ubiquitous, but prefers moist soils	songbirds and rodents eat seeds	deep taproot
Tribulus species (Puncture Vine)	annual weedy forb	____	____	spines can hurt livestock and bicycle tires
Verbascum thapsus (Common Mullein)	biennial forb	sunny, often on otherwise barren soil	____	____
Vitis species (Wild Grape)	perennial climbing vine	____	important food for over 100 species of songbirds and small mammals; foliage provides dense cover	____
Xanthium species (Cocklebur)	annual forb	solid stands can cover a crest river-plains		

SOUTH PLATTE RIVER PROVIDES HABITAT FOR MAMMALS

WILDLIFE INVENTORY

General

The following lists of mammals, fish, reptiles, birds and amphibians that can be seen along the South Platte River have been prepared because of the need to insure their continued habitation during and after river improvements. The river is now an excellent source of study both for the casual observers and students of biology, and should remain so.

One will usually be able to observe most species from the surface of the water, however one should not expect to see more than 20% on any one trip down the river.

Reptiles

Although the list is based on actual sightings by qualified individuals, all the reptiles do not use the river corridor for the same kind of habitat, nor do they inhabit all the reaches between Chatfield and Brighton. Some use the river areas during breeding season, some during non-breeding season. Some can be found throughout the study area, others reside only in certain areas that offer a specialized environment. These distinctions are not made in this list.

More detailed information with regard to the habits and habitats of these reptiles can be obtained from the Colorado Division of Wildlife.

COMMON SNAPPING TURTLE
ORNATE BOX TURTLE
WESTERN PAINTED TURTLE
WESTERN SPINY SOFTSHELL
SHORT-HORNED LIZARD
NORTHERN EARLESS LIZARD
RED-LIPPED PRAIRIE LIZARD
NORTHERN MANY-LINED SKINK
PRAIRIE-LINED RACERUNNER
EASTERN YELLOWBELLY RACER
PLAINS HOGNOSE SNAKE
RED-SIDED GARTER SNAKE
NORTHERN LINED SNAKE
MILK SNAKE
WESTERN PLAINS GARTER SNAKE
WANDERING GARTER SNAKE

Mammals

Although the list is based on actual sightings, all the mammals do not use the river corridor for the same kind of habitat, nor do they inhabit all the reaches between Chatfield Reservoir and Brighton. Some use the river area during breeding season, some during non-breeding season. Some can be found throughout the study area, others reside only in certain areas that offer a specialized environment. These distinctions are not made in this list.

More detailed information with regard to the habits and habitats of these mammals can be obtained from the Colorado Division of Wildlife.

VIRGINIA OPOSSUM
MASKED SHREW
DUSKY SHREW
WATER SHREW
LEAST SHREW
SILVER-HAIRED BAT
BIG BROWN BAT
RED BAT
HOARY BAT
EASTERN COTTONTAIL
NUTTALL'S COTTONTAIL
DESERT COTTONTAIL
LEAST CHIPMUNK
YELLOW-BELLIED MARMOT
WYOMING GROUND SQUIRREL
THIRTEEN-LINED GROUND SQUIRREL
ROCK SQUIRREL
FOX SQUIRREL
ORD'S KANGAROO RAT
BEAVER
DEER MOUSE
MEADOW VOLE
MONTANE VOLE
LONG-TAILED VOLE
PRAIRIE VOLE
MUSKRAT
NORWAY RAT
HOUSE MOUSE
COYOTE
RED FOX
SWIFT FOX
GRAY FOX
BLACK-TAILED PRAIRIE DOG
RACCOON
LONG-TAILED WEASEL
NORTHERN POCKET GOPHER
PLAINS POCKET GOPHER
HISPID POCKET MOUSE
PLAINS HARVEST MOUSE
BUSHY-TAILED WOODRAT
MEADOW JUMPING MOUSE
SPOTTED SKUNK
STRIPED SKUNK
BOBCAT
WHITE-TAILED DEER
NORTHERN GRASSHOPPER MOUSE
WESTERN HARVEST MOUSE

Amphibians

Although the list is based on actual sighting by qualified individuals, all the amphibians noted might not use the river corridor for the same kind of habitat, nor reside in all the reaches between Chatfield and Brighton. These distinctions are not made in this list.

More detailed information with regard to the habits and habitats of these amphibians can be obtained from the Colorado Division of Wildlife.

TIGER SALAMANDER
PLAINS SPADEFOOT
GREAT PLAINS TOAD
STRIPED CHORUS FROG
BULLFROG
NORTHERN LEOPARD FROG

Fish

The following species of fish life can be found in various segments of the South Platte River from Chatfield Reservoir to Brighton.

SPECIES	SEGMENT DISTRIBUTION	ABUNDANCE
BROWN TROUT	CHATFIELD RESERVOIR TO UNION	FAIRLY COMMON IN AREAS OF SUITABLE HABITAT
RAINBOW TROUT	CHATFIELD RESERVOIR TO A POINT 2 MILES BELOW DAM	COMMON
JOHNNY DARTER	WITHIN 3 MILES OF RESERVOIR	RARE
CHANNEL CATFISH	WITHIN 2 MILES OF RESERVOIR	VERY COMMON
BLACK BULLHEAD	CHATFIELD TO BRIGHTON	UNCOMMON
YELLOW PERCH	CHATFIELD TO BRIGHTON	COMMON
LARGEMOUTH BASS	CHATFIELD TO BRIGHTON	UNCOMMON
BLUEGILL	CHATFIELD TO BRIGHTON	UNCOMMON
GREEN SUNFISH	CHATFIELD TO BRIGHTON	UNCOMMON
CRAPPIE	CHATFIELD TO BRIGHTON	COMMON
CARP	CHATFIELD TO BRIGHTON	COMMON
WHITE SUCKER	CHATFIELD TO BRIGHTON	COMMON
LONGNOSE SUCKER	CHATFIELD TO BRIGHTON	COMMON
SAND SHINER	CHATFIELD TO BRIGHTON	ABUNDANT

Notes:

1. According to the Colorado Division of Wildlife, fish would become far more abundant if suitable habitats, such as dams or white water areas for kayaks, were developed. A kayak course would greatly improve fishing downstream from Chatfield Reservoir to the Littleton/Englewood Waste Water Treatment Plant discharge. Five Pound Brown Trout in size are currently being taken by anglers, although infrequently, in an area about 4-5 miles downstream of Chatfield Reservoir.

2. The fish species list was obtained from the Colorado Division of Wildlife.

3. The Johnny Darter is currently listed as a threatened species in Colorado.

Birds

The following list was gleaned from several sources, including the Colorado Department of Wildlife, the Colorado Wildlife Federation, the Denver Field Ornithologists, the Audubon Society and numerous independent field check lists supplied by qualified individuals.

This listing is based primarily on the theoretical "latilong" compilation prepared by the Colorado Division of Wildlife for birds in the general Front Range area. All of these birds have been noted in latilongs 11 or 12 (see Colorado Bird Distribution Latilong Study). An asterisk (●) designates those species rarely seen in the riparian habitat of the South Platte River.

All the birds do not use the river corridor for the same kind of habitat nor at the same time of year. Some use the river during breeding season, some during non-breeding season. Some reside here during winter, some do not. Others visit only during their migration. Some birds are more common than others. These distinctions are not made in this study.

More detailed information related to when the birds are here and for what reasons can be obtained from the organizations mentioned above, especially the Colorado Division of Wildlife, and the Denver Field Ornithologists.

RED-THROATED LOON
ARCTIC LOON
COMMON LOON
YELLOW-BILLED LOON
PIED-BILLED GREBE
HORNED GREBE
RED-NECKED GREBE
EARED CREBE
WESTERN GREBE
AMERICAN WHITE PELICAN
DOUBLE-CRESTED CORMORANT
AMERICAN BITTERN
LEAST BITTERN
GREAT BLUE HERON
GREAT EGRET
SNOWY EGRET
LITTLE BLUE HERON
●TRICOLORED HERON
CATTLE EGRET
GREEN-BACKED HERON
BLACK-CROWNED NIGHT HERON
YELLOW-CROWNED NIGHT HERON
WHITE-FACED IBIS
TUNDRA SWAN
●TRUMPETER SWAN
GREATER WHITE-FRONTED GOOSE
SNOW GOOSE
ROSS' GOOSE
●BRANT
CANADA GOOSE
WOOD DUCK
GREEN-WINGED TEAL
AMERICAN BLACK DUCK
MALLARD
NORTHERN SHOVELER
BLUE-WINGED TEAL
CINNAMON TEAL
NORTHERN PINTAIL
GADWALL
●EURASIAN WIGEON
AMERICAN WIGEON
CANVASBACK

REDHEAD
RING-NECKED DUCK
GREATER SCAUP
LESSER SCAUP
OLDSQUAW
BLACK SCOTER
SURF SCOTER
WHITE-WINGED SCOTER
COMMON GOLDENEYE
BARROW'S GOLDENEYE
BUFFLEHEAD
HOODED MERGANSER
COMMON MERGANSER
RED-BREASTED MERGANSER
RUDDY DUCK
TURKEY VULTURE
OSPREY
BALD EAGLE
NORTHERN HARRIER
SHARP-SHINNED HAWK
COOPER'S HAWK
NORTHERN GOSHAWK
●RED-SHOULDERED HAWK
BROAD-WINGED HAWK
SWAINSON'S HAWK
RED-TAILED HAWK
FERRUGINOUS HAWK
ROUGH-LEGGED HAWK
GOLDEN EAGLE
AMERICAN KESTREL
MERLIN
PEREGRINE FALCON
●GYRFALCON
PRAIRIE FALCON
CHUKAR
RING-NECKED PHEASANT
●SHARP-TAILED GROUSE
●WILD TURKEY
NORTHERN BOBWHITE
VIRGINIA RAIL
SORA
AMERICAN COOT
SANDHILL CRANE
BLACK-BELLIED PLOVER
LESSER GOLDEN PLOVER
SNOWY PLOVER
SEMIPALMATED PLOVER
● PIPING PLOVER
KILLDEER
MOUNTAIN PLOVER
BLACK-NECKED STILT
AMERICAN AVOCET

GREATER YELLOWLEGS
LESSER YELLOWLEGS
SOLITARY SANDPIPER
WILLET
SPOTTED SANDPIPER
UPLAND SANDPIPER
WHIMBREL
LONG-BILLED CURLEW
●HUDSONIAN GODWIT
MARBLED GODWIT
RUDDY TURNSTONE
RED KNOT
SANDERLING
SEMIPALMATED SANDPIPER
WESTERN SANDPIPER
LEAST SANDPIPER
WHITE-RUMPED SANDPIPER
BAIRD'S SANDPIPER
PECTORAL SANDPIPER
DUNLIN
STILT SANDPIPER
● BUFF-BREASTED SANDPIPER
SHORT-BILLED DOWITCHER
LONG-BILLED DOWITCHER
COMMON SNIPE
●AMERICAN WOODCOCK
WILSON'S PHALAROPE
RED-NECKED PHALAROPE
RED PHALAROPE
● POMARINE JAEGER
● PARASITIC JAEGER
● LAUGHING GULL
FRANKLIN'S GULL
● LITTLE GULL
BONAPARTE'S GULL
●MEW GULL
RING-BILLED GULL
CALIFORNIA GULL
HERRING GULL
THAYER'S GULL
●LESSER BLACK-BACKED GULL
●GLAUCOUS-WINGED GULL
GLAUCOUS GULL
GREAT BLACK-BACKED GULL
●BLACK-LEGGED KITTIWAKE
SABINE'S GULL
CASPIAN TERN
COMMON TERN
FORSTER'S TERN
●LEAST TERN
BLACK TERN
ROCK DOVE
BAND-TAILED PIGEON
MOURNING DOVE

BLACK-BILLED CUCKOO
YELLOW-BILLED CUCKOO
COMMON BARN OWL
EASTERN SCREECH-OWL
WESTERN SCREECH-OWL
GREAT HORNED OWL
SNOWY OWL
LONG-EARED OWL
SHORT-EARED OWL
NORTHERN SAW-WHET OWL
COMMON NIGHTHAWK
COMMON POORWILL
●BLACK SWIFT
CHIMNEY SWIFT
●BLUE-THROATED HUMMINGBIRD
●MAGNIFICENT HUMMINGBIRD
●BLACK-CHINNED HUMMINGBIRD
BROAD-TAILED HUMMINGBIRD
CALLIOPE HUMMINGBIRD
RUFOUS HUMMINGBIRD
BELTED KINGFISHER
LEWIS' WOODPECKER
RED-HEADED WOODPECKER
●RED-BELLIED WOODPECKER
YELLOW-BELLIED SAPSUCKER
DOWNY WOODPECKER
HAIRY WOODPECKER
NORTHERN FLICKER
OLIVE-SIDED FLYCATCHER
WESTERN WOOD-PEWEE
WILLOW FLYCATCHER
LEAST FLYCATCHER
HAMMOND'S FLYCATCHER
DUSKY FLYCATCHER
WESTERN FLYCATCHER
EASTERN PHOEBE
SAY'S PHOEBE
VERMILION FLYCATCHER
ASH-THROATED FLYCATCHER
GREAT CRESTED FLYCATCHER
CASSIN'S KINGBIRD
WESTERN KINGBIRD
EASTERN KINGBIRD
SCISSOR-TAILED FLYCATCHER
HORNED LARK
●PURPLE MARTIN
TREE SWALLOW
VIOLET-GREEN SWALLOW
NORTHERN ROUGH-WINGED SWALLOW

BANK SWALLOW
CLIFF SWALLOW
BARN SWALLOW
BLUE JAY
SCRUB JAY
PINYON JAY
BLACK-BILLED MAGPIE
AMERICAN CROW
COMMON RAVEN
BLACK-CAPPED CHICKADEE
MOUNTAIN CHICKADEE
BUSHTIT
RED-BREASTED NUTHATCH
WHITE-BREASTED NUTHATCH
●PYGMY NUTHATCH
BROWN CREEPER
●CAROLINA WREN
BEWICK'S WREN
HOUSE WREN
WINTER WREN
MARSH WREN
AMERICAN DIPPER
GOLDEN-CROWNED KINGLET
RUBY-CROWNED KINGLET
BLUE-GRAY GNATCATCHER
EASTERN BLUEBIRD
WESTERN BLUEBIRD
MOUNTAIN BLUEBIRD
TOWNSEND'S SOLITAIRE
VEERY
GRAY-CHEEKED THRUSH
SWAINSON'S THRUSH
HERMIT THRUSH
WOOD THRUSH
AMERICAN ROBIN
●VARIED THRUSH
GRAY CATBIRD
NORTHERN MOCKINGBIRD
SAGE THRASHER
BROWN THRASHER
WATER PIPIT
●SPRAGUE'S PIPIT
BOHEMIAN WAXWING
CEDAR WAXWING
NORTHERN SHRIKE
LOGGERHEAD SHRIKE
EUROPEAN STARLING
●WHITE-EYED VIREO

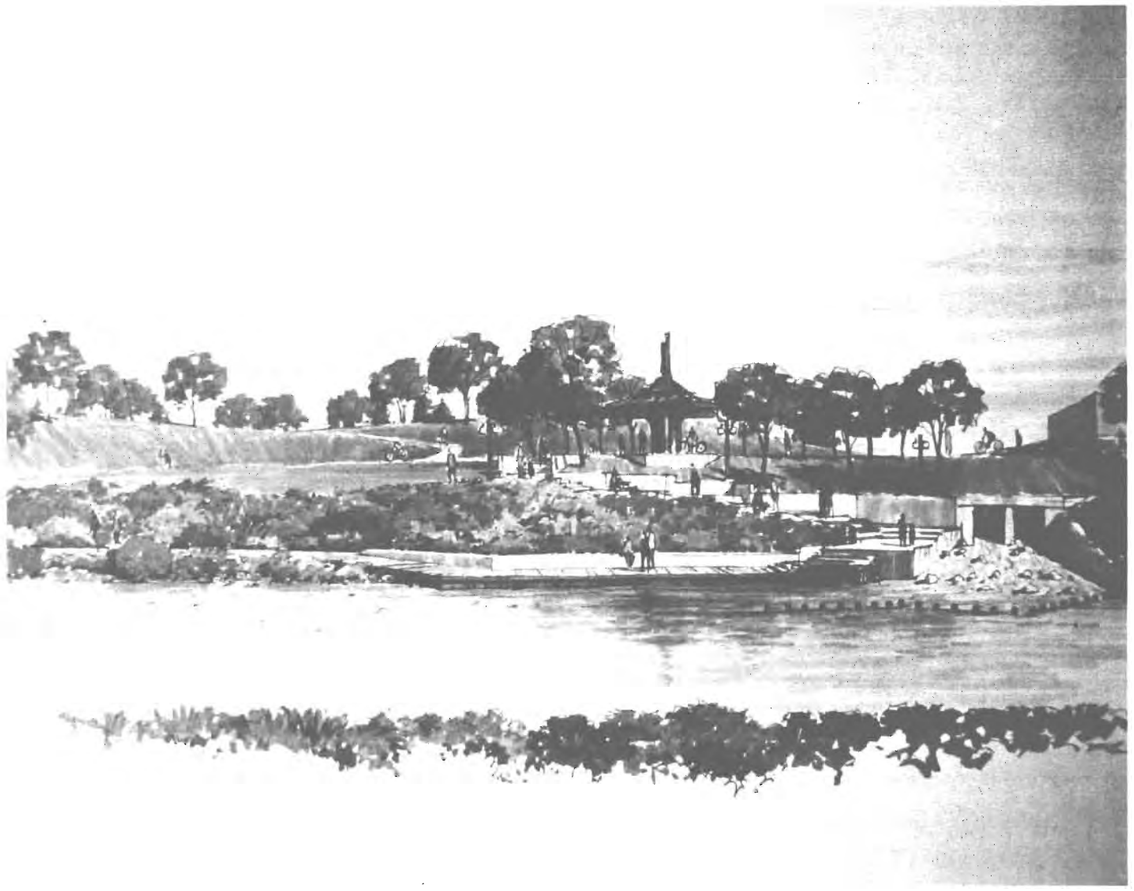
SOLITARY VIERO
YELLOW-THROATED VIREO
WARBLING VIREO
PHILADELPHIA VIREO
RED-EYED VIREO
●BLUE-WINGED WARBLER
●GOLDEN-WINGED WARBLER
TENNESSEE WARBLER
ORANGE-CROWNED WARBLER
NASHVILLE WARBLER
VIRGINIA'S WARBLER
NORTHERN PARULA
YELLOW WARBLER
CHESTNUT-SIDED WARBLER
MAGNOLIA WARBLER
●CAPE MAY WARBLER
BLACK-THROATED BLUE WARBLER
YELLOW-RUMPED WARBLER
BLACK-THROATED GRAY WARBLER
TOWNSEND'S WARBLER
●HERMIT WARBLER
BLACK-THROATED GREEN WARBLER
BLACKBURNIAN WARBLER
YELLOW-THROATED WARBLER
GRACE'S WARBLER
●PINE WARBLER
●PRAIRIE WARBLER
PALM WARBLER
BAY-BREASTED WARBLER
BLACKPOLL WARBLER
BLACK-AND-WHITE WARBLER
AMERICAN REDSTART
PROTHONOTARY WARBLER
WORM-EATING WARBLER
OVENBIRD
NORTHERN WATERTHRUSH
KENTUCKY WARBLER
MACGILLIVRAY'S WARBLER
COMMON YELLOWTHROAT
HOODED WARBLER
WILSON'S WARBLER
CANADA WARBLER
●PAINTED REDSTART
YELLOW-BREASTED CHAT
SUMMER TANAGER
SCARLET TANAGER
WESTERN TANAGER
NORTHERN CARDINAL

ROSE--BREASTED GROSBEAK
BLACK-HEADED GROSBEAK
BLUE GROSBEAK
LAZULI BUNTING
INDIGO BUNTING
●PAINTED BUNTING
DICKCISSEL
GREEN-TAILED TOWHEE
RUFOUS-SIDED TOWHEE
AMERICAN TREE SPARROW
CHIPPING SPARROW
CLAY-COLORED SPARROW
BREWER'S SPARROW
FIELD SPARROW
●VESPER SPARROW
LARK SPARROW
●BLACK-THROATED SPARROW
LARK BUNTING
SAVANNAH SPARROW
FOX SPARROW
SONG SPARROW
LINCOLN'S SPARROW
SWAMP SPARROW
WHITE-THROATED SPARROW
WHITE-CROWNED SPARROW
HARRIS' SPARROW
DARK-EYED JUNCO
LAPLAND LONGSPUR
BOBOLINK
RED-WINGED BLACKBIRD
WESTERN MEADOWLARK
YELLOW-HEADED BLACKBIRD
RUSTY BLACKBIRD
BREWER'S BLACKBIRD
COMMON GRACKLE
BROWN-HEADED COWBIRD
ORCHARD ORIOLE
NORTHERN ORIOLE
●SCOTT'S ORIOLE
ROSY FINCH
PURPLE FINCH
CASSIN'S FINCH
HOUSE FINCH
COMMON REDPOLL
PINE SISKIN
LESSER GOLDFINCH
AMERICAN GOLDFINCH
EVENING GROSBEAK
HOUSE SPARROW

SOUTH PLATTE RIVER PROVIDES HABITAT FOR MAMMALS

APPENDIX B

EXISTING AND PROPOSED PARKS



EXISTING AND PROPOSED PARKS TABLE

The following table summarizes existing and proposed parks by reach, location, type, jurisdiction and use.

REACH 1: CHATFIELD RESERVOIR TO COLUMBINE VALLEY

EXISTING:

Chatfield State Recreation Area

Location:	Adjacent to Chatfield Reservoir	
Type:	Regional park	
Jurisdiction:	Colorado Division of Parks & Outdoor Recreation	
Uses:	boating/sailing	swimming
	picnic	parking
	landscaped areas	trails

South Platte Park

Location:	Both sides of river between C-470 and Columbine Valley	
Type:	Regional park reserve	
Jurisdiction:	South Suburban Metropolitan Recreation and Park District	
Uses:	fishing	shelter
	parking	trails
	benches	landscaped areas
	restroom	wildlife observation
	picnic area	ponds
	boat landings	wildlife and vegetation preserve
	picnic areas	focal point park and historical marker

REACH 2: COLUMBINE VALLEY TO OXFORD AVENUE

EXISTING:

Centennial Park

Location:	West side of river near Union Avenue	
Type:	Pocket park	
Jurisdiction:	City of Englewood	
Uses:	play structures	fishing
	picnic areas	active - baseball etc.
	pond	trails
	shelter	parking
	benches	landscape areas
	wildlife observation	

PROPOSED:

Watson Lake Park

Location: Watson Lake on west side of river near Bowles Avenue
Type: Active pocket park
Jurisdiction: Denver Water Board
Uses:

boating	river access point
picnic areas	fishing
benches	wildlife observation
trails	parking

Riverfront and Riverwalk Pocket Parks

Location: Within Talley & Writer commercial/residential developments. Planned for construction both sides of river between Bowles Avenue and Belleview Avenue.
Type: Focal point parks
Jurisdiction: Each developer
Uses:

trails	landscape areas
benches	picnic area
river access	commercial/residential
shelters	fishing
parking	

Lee Gulch Park

Location: Confluence of Lee Gulch and river
Type: Focal point park - emphasizes natural waterfall
Jurisdiction: South Suburban Metropolitan Recreation and Park District.
Uses:

trails	picnic
wildlife observation	landscaped areas
natural feature	preservation

REACH 3: OXFORD AVENUE TO BATES AVENUE

EXISTING:

Englewood Wildlife Preserve

Location: Mouth of Bear Creek south of Hampden Avenue
Type: Reserve park
Jurisdiction: City of Englewood
Uses:

wildlife preserve	vegetation preserve
observation	

PROPOSED:

Little Dry Creek Park

Location: On east side of river at Little Dry Creek near Dartmouth Avenue
Type: Pocket park
Jurisdiction: City of Englewood
Uses:

trails	parking
landscaped areas	benches
picnic areas	river access point
boating access	

REACH 4: BATES AVENUE TO COLFAX AVENUE

EXISTING:

Grant-Frontier Park

Location: Both sides of river at Harvard Avenue
Type: Pocket park
Jurisdiction: City of Denver and Greenway Foundation
Uses:

picnic areas	parking
benches	trails
wildlife observation	fishing

Pasquenel's Landing Park

Location: East side of river at Evans Avenue
Type: Pocket park
Jurisdiction: City of Denver and Greenway Foundation
Uses:

parking	picnic area
tot lot	trails

Ruby Hill Park

Location: West side of river south of Florida Avenue
Type: Regional park
Jurisdiction: City of Denver
Uses:

softball - active	shelter
parking	trails
restrooms	sled riding
benches	landscaped areas
picnic areas	

Overland Pond Park

Location: East side of river near Florida Avenue
Type: Pocket park
Jurisdiction: City of Denver and Greenway Foundation
Uses:

parking	wildlife observation
picnic area	trails
restroom (seasonal)	fly casting pad

Vanderbilt Park

Location: West side of river north of Mississippi Avenue
Type: Pocket park
Jurisdiction: City of Denver
Uses:

baseball	restrooms
parking	fishing
trails	landscaped areas

Habitat Park

Location:	West side of river north of Vanderbilt Park	
Type:	Pocket park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	Boy Scout day camp	natural vegetation preserve
	wildlife observation	trails
	picnic areas	parking

Valverde Park

Location:	West side of river north of Alameda	
Type:	Pocket park	
Jurisdiction:	City of Denver	
Uses:	softball	benches
	landscaped areas	restrooms
	parking	picnic area
	trails	

6th Avenue Park

Location:	East side of river south of 6th Avenue	
Type:	Pocket park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	picnic area	boating
	wildlife observation	

Frog Hollow Park

Location:	East side of river between 6th Avenue and 8th Avenue	
Type:	Pocket park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	picnic area	landscaped area
	boat landing	parking
	trails	

Weir Gulch Marina Park

Location:	West side of river north of 8th Avenue	
Type:	Pocket park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	boating	basketball
	river access	landscaped areas
	picnic area	parking
	play structure	trails

Rude Park

Location:	About 1/4-mile west of river along Lakewood Gulch	
Type:	Pocket park	
Jurisdiction:	City of Denver	
Uses:	recreation center	softball
	trails	parking
	landscaped areas	picnic areas

REACH 5: COLFAX AVENUE TO CHERRY CREEK

EXISTING:

Gates-Crescent Park

Location:	West side of river near 17th Avenue	
Type:	Regional park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	Children's Museum of Denver	trails
		parking
	play structures	picnic areas
	benches	volleyball
	horseshoes	landscaped areas

Fishback Landing Park

Location:	East side of river just south of Speer Boulevard	
Type:	Pocket park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	picnic areas	trails
	landscaped area	boat landing
	restrooms	parking

Confluence Park

Location:	At mouth of Cherry Creek	
Type:	Pocket park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	picnic areas	amphitheatre
	landscaped areas	trails
	benches	boat landing
	whitewater boat chute	river plaza

PROPOSED:

Central Platte Valley Pocket Parks

Location:	Within private developments slated for both sides of river between Colfax Avenue and Cherry Creek	
Type:	Focal point/pocket park	
Jurisdiction:	Each developer, City of Denver and Greenway Foundation	
Uses:	trails	active recreation - baseball, etc.
	picnic areas	benches
	wildlife observation	river access
	landscaped areas	commercial/residential
	fishing	boating
	parking	shelters

REACH 6: CHERRY CREEK TO FRANKLIN STREET

EXISTING:

Riverfront Park

Location:	Both sides of river north of 19th Street	
Type:	Pocket park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	picnic areas	natural vegetation preserve
	landscaped areas	trails
	parking	wildlife observation
	boating	river access

Globeville Landing

Location:	East side of river north of 38th Street	
Type:	Pocket Park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	picnic	parking
	benches	landscaped areas
	boat landing	trails
	shelter	

PROPOSED:

Washington Street Park

Location:	West bank of river between 38th Street and I-70	
Type:	Pocket Park	
Jurisdiction:	City of Denver and Greenway Foundation	
Uses:	picnic	landscaped areas
	benches	trails
	parking	wildlife observation
	river access	

REACH 7: FRANKLIN STREET TO SAND CREEK

PROPOSED:

Franklin Street Park

Location:	Franklin Street	
Type:	Pocket Park	
Jurisdiction:	The City of Denver and Greenway Foundation	
Uses:	parking	boat landing
	picnic areas	

York Street Park

Location:	York Street	
Type:	Pocket Park	
Jurisdiction:	Adams County and Commerce City	
Uses:	picnic areas	wildlife observation

64th Avenue Park

Location:	64th Avenue and York Street	
Type:	Pocket Park	
Jurisdiction:	Adams County and Commerce City	
Uses:	picnic areas	wildlife observation
	river access	parking

Sand Creek Park

Location:	Confluence with Sand Creek	
Type:	Reserve park	
Jurisdiction:	Adams County and Commerce City	
Uses:	wildlife observation	boating
	picnic areas	trails
	river access	

REACH 8: SAND CREEK TO BASELINE ROAD

Sub-Reach A

EXISTING:

Rendezvous Recreation Area

Location:	Both sides of river near Clear Creek	
Type:	Focal point and pocket Park	
Jurisdiction:	Adams County	
Uses:	fishing	picnic
	lake	trails and bridge over river
	boating access	parking (proposed)
	camping (proposed)	swimming (proposed)
	shelter (proposed)	

Sub-Reach B

EXISTING

Thornton Regional Park

Location:	East side of river just north of Rendezvous Park	
Type:	Regional Park	
Jurisdiction:	City of Thornton	
Uses:	variety of passive uses	

Steele Street Park (undeveloped)

Location:	West side of river near Steele Street	
Type:	Pocket Park	
Jurisdiction:	Adams County	
Uses:	parking	picnic areas
	trails	river access
		access/parking for horses

Sub-Reach C

PROPOSED:

88th Avenue Park

Location: 88th Avenue and the river
Type: Pocket Park
Jurisdiction: Adams County and City of Thorton
Uses: to be determined

104th Avenue Park

Location: 104th Avenue and river
Type: Pocket Park
Jurisdiction: Adams County
Uses: to be determined

Sub-Reach E

EXISTING

Adams County Regional Park

Location: On west side of river between 120th Avenue and 128th Avenue
Type: Regional park
Jurisdiction: Adams County
Uses:

fairgrounds	tennis
golf course	equestrian center
historical museum	BMX track
camping	playground
nature preserve	wildlife observation
parking	

Note: Final park uses are to be determined as part of the future Adams County Regional Park Master Planning Process

Sub-Reach F

EXISTING

Smith Natural Area

Location: East of river, north of 160th Avenue
Type: Reserve park
Jurisdiction: City of Brighton
Uses: wildlife observation, wildlife and vegetation preserve

Veteran's Park

Location: 160th and the river
Type: Pocket park
Jurisdiction: City of Brighton
Uses:

wildlife observation	picnic areas
parking	river access

PROPOSED:

160th Avenue Park

Location: East of the river and south of 160th Avenue
Type: Pocket park
Jurisdiction: Adams County
Uses: to be determined

TYPICAL REST AREA

WHITE-WATER RAFTING ALONG THE SOUTH PLATTE RIVER

APPENDIX C

RIVER OBSTRUCTIONS TABLE

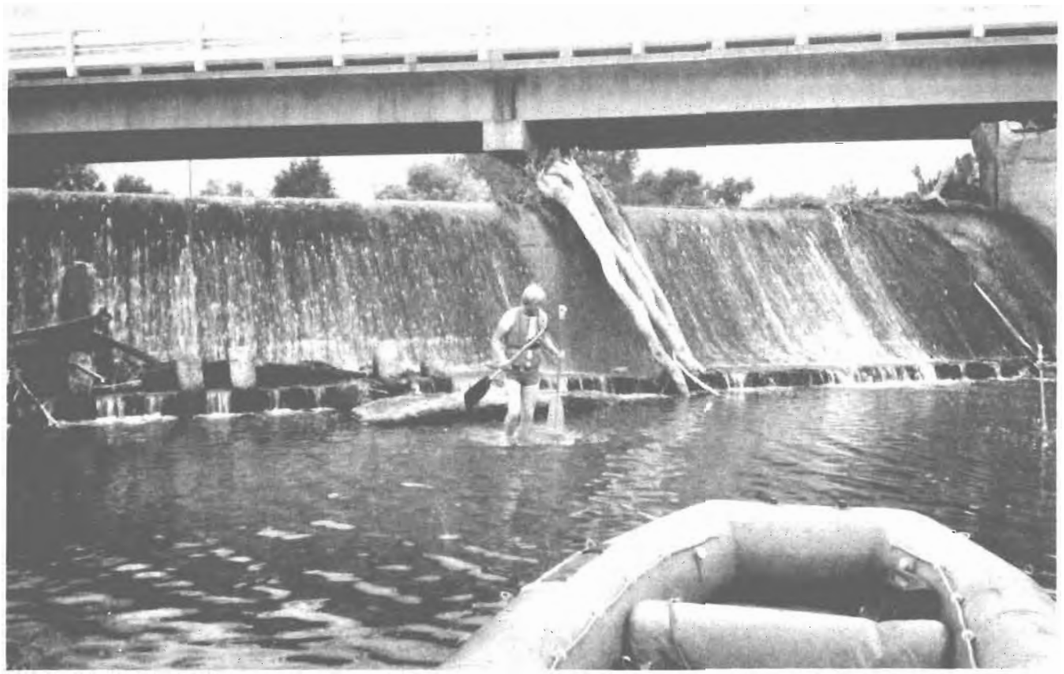


TABLE VIII-2
INVENTORY OF ENGINEERING FEATURES

Reach 1; Chatfield Reservoir to Columbine

Description of Subreach or Location	River Stationing	Comparison of 1963 vs. 1983 Erosion or Aggradation	Description or Inventory of Engineering Feature
Chatfield Dam to C-470			Begin Master Plan study reach with artificial channel
Gaging station	3120		o Measuring point for chatfield releases
Control weir	2120		o 1 foot concrete weir control for gaging station
Drop structure	2080		o Channel cobbled. Bank willow and cottonwoods
Natural channel	2060 to 2060	Thalweg 3 ft. lower than 1963	
C-470 bridge	2060		o C-470 bridge. Two 2 lane bridges
C-470 to Cooley Bridge		Erosion of 6' maximum in subreach	Channel bed and banks eroded. Riffles and pools.
Ken Caryl sewer	2060	Erosion downstream of sewer	o Ken caryl District sewer crossing eroded and exposed 3 to 4 feet due to erosion
	2060 to 2020	D_{50} size of gravel bottom 3"; max. cobble, 6"	o Active erosion area. Tree debris in river channel
	2060 to 2020	Left bank erosion	o Willow, Russian olive, cottonwoods on banks
Exposed cobble	2020	Right bank erosion	o Topsoil ranges from 6" to 24". Exposed cable, right bank
Breached gravel pit	2020	Bank erosion	o River breach of berm. River flows into pit broken concrete riprap. Power line B.G.W., right bank
Wooded banks	2020 to 2000	Bank erosion	o Cottonwoods both banks
High vertical bank	2020 to 2000	Bank erosion	o Vertical right bank 18' high
Concrete weir	2000		o Old diversion dam, about 18" drop, boatable
Temporary bridge	2000		
Cooley Bridge to Columbine		Thalweg 2' lower than 1963	Well cobbled streambed with riffles and pools
Dad Clark gulch	2000		o Right bank tributary with sediment load
Shale outcrop	1950		o Denver formation banks
Columbine Dam	1945	Aggradation of 2' upstream of dam and erosion of 4' downstream	o Dam badly damaged. Drop of about 7'. Water flowing through dam and under sewer crossing

Reach 2; Columbine to Oxford Avenue

Columbine to Bowles Ave.			
Lee Gulch	1942		o Tributary from the east
Dutch Creek	1933		o Left bank tributary, irrigation drainage
Shale outcrop	1930 to 1910		o Solid shale bottom, steep shale banks
Steel sheet pile check dam	1905		o Continuous sheet piling completely across river, 1' above low water surface
Bowles Avenue	1885	Thalweg 2' lower than 1963	o Gravel bars, deposition apparent
Bowles Avenue to Belleview Avenue			
Crestline Avenue	1858		o Earth dike along west bank of river
Shale outcrop	1855	No thalweg change	o Solid shale channel bottom
	1850 to 1840		o Earth dike along east river bank, concrete slabs placed on bank
Belleview Avenue	1833	No thalweg change	o Concrete sewerline encasement crossing north of bridge concrete encasement causes a 1 foot drop. Some water goes under encasement
Belleview Avenue to Union Avenue			
	1820		o 36" abandoned concrete sewerline crosses river. Abandoned manhole in the center of the channel
Union Avenue dam	1799		o 12' vertical concrete diversion dam. Exposed solid bedrock at the base of dam

TABLE VIII-2
(Continued)

Description of Subreach or Location	River Stationing	Comparison of 1963 vs. 1983 Erosion or Aggradation	Description or Inventory of Engineering Feature
Union Avenue to Oxford Avenue			
	1790-1775	No thalweg change	o Many 1'-3' diameter rocks deposited in channel. Bedrock exposed in channel
Concrete cap rubble dam	1751	No thalweg change	o 6' high dam, smooth, curved slope on dam
Oxford Avenue	1739	Thalweg 2' lower than 1963	o Very high, steep river banks. Concrete fragments, asphalt, and car bodies used as riprap. Discharge from sanitary landfill upstream: water quality deteriorates
Reach 3; Oxford Avenue to Bates Avenue			
Oxford Avenue to Hampden Avenue			
Englewood golf course	1735 to 1700	Thalweg 3' lower than 1963	o River velocity decreases: earth dike along right bank
Bear Creek confluence	1710	Aggradation of 2'	o Bear Creek flows from the west. Gravel bars and deposition apparent: dredging operations; channel widens
Hampden Avenue	1685	Thalweg 4' lower than 1963	o River slope increases, velocity increases
Hampden Avenue to Bates Avenue			
Hamilton Place	1681	Thalweg 3' lower than 1963	o Rock in channel forms small riffles. River channelized with steep banks. Overhanging trees on both banks
Dartmouth Avenue	1655		o Little Dry Creek tributary from the east; sediment deposited in South Platte River channel
Bedrock outcrop	1647	No thalweg change	o Solid bedrock protrudes in channel bottom. Low-flow channel eroded through rock
Shale outcrop	1635	No thalweg change	o Shale bedrock in channel forms small riffles
Bates Avenue	1630		
Reach 4; Bates Avenue to Colfax Avenue			
Bates Avenue to W. Alameda Avenue			
Public Service Diversion Dam	1625	Thalweg 1' lower than 1963	o 5' rubble dam; concrete wall core. Englewood-Littleton sewage discharge on right bank
	1625 to 1537		o River channelized with steep banks
Florida Avenue dam	1537	Aggradation of 4' upstream of dam No thalweg change at base of dam	o 7' rock rubble dam; pump intake on west bank
Pedestrian bridge	1525	No thalweg change	o 2' double sheet pile check dam filled with concrete: boat chute through center
Mississippi Avenue	1500	Thalweg 2' lower than 1963	o 2' sheet pile and rock rubble dam; boat chute through center
Highway Department dam	1480	Thalweg 2' lower than 1963	o Collapsed concrete cap gabion dam: exposed sheet pile core
	1470 to 1445	Aggradation of 1-2 feet	o Deposition apparent; gravel bars. Steep banks; overhanging trees on both banks
Alameda Avenue	1442	Aggradation of 2' upstream of dam No thalweg change downstream of dam	o 3' sheet pile - rubble check dam with boat chute through center
West Alameda Avenue to 8th Avenue			
1' weir, small riffles	1415	No thalweg change	o Resistant channel o I-25 concrete retaining wall along east bank
3rd Avenue dam	1370	Aggradation of 3' upstream of dam	o 7' concrete dam: major whitewater bypass chute
8th Avenue bridge	1355	Aggradation of 5'	o Low river velocity; backwater from Public Service fabri-dam
Pedestrian bridge	1357		
8th Avenue to Colfax			
Weir gulch	1349	Aggradation of 5'	o Tributary from the west
13th Street bridge	1328	Aggradation of 3'	
Public Service fabri-dam	1328		o Inflatable 8' dam for Public Service intake; boat chute placed on dam
Lakewood gulch	1319	Aggradation of 2'	o Tributary from the west
Colfax Avenue	1314	Aggradation of 2'	o New pre-stressed concrete viaduct under construction

TABLE VIII-2
(Continued)

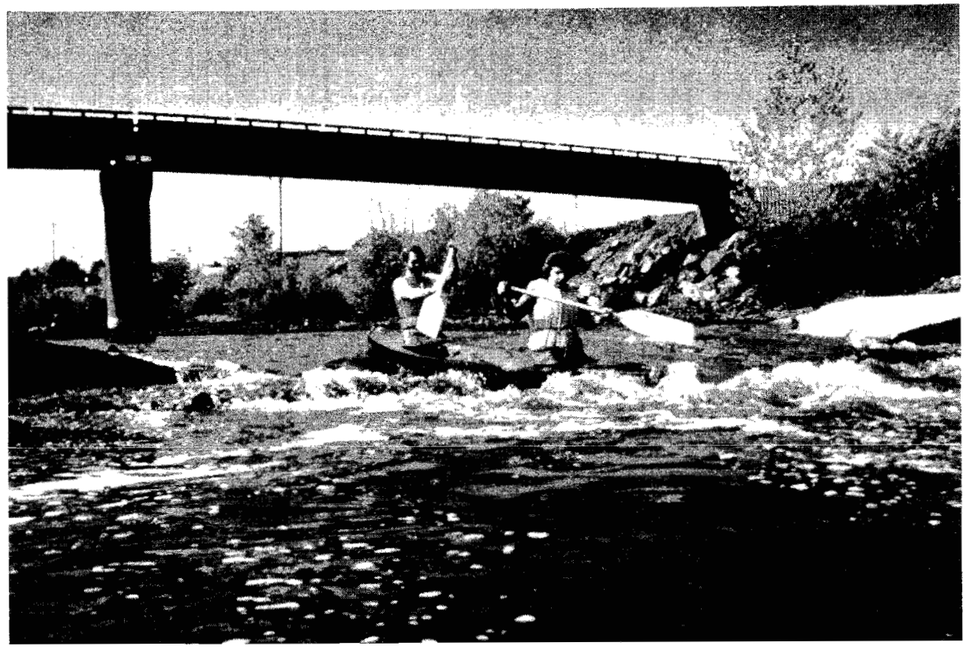
Description of Subreach or Location	River Stationing	Comparison of 1963 vs. 1983 Erosion or Aggradation	Description or Inventory of Engineering Feature
Reach 5; Colfax Avenue to Cherry Creek			
Colfax Avenue to Cherry Creek			
I-25 bridge	1302		o High, steel arch 8-lane bridge
2' sheet pile check dam	1298	No thalweg change	o Sheet pile drop structure: boat chute constructed along west bank
	1298 to 1260	Thalweg 1'-2' lower than 1963	
Speer Boulevard	1258	Thalweg 2' lower than 1963	o High concrete viaduct above river
Confluence Park drop & boat channel	1255		o 1' concrete weirs and pools along right bank
Cherry Creek	1253	No thalweg change	o Tributary from the southeast
Reach 6; Cherry Creek to Franklin Street			
Cherry Creek to 20th Street			
16th Street viaduct	1245	No thalweg change	o 1' drop under bridge to consolidate low flow
Rock gabion jettles	1237	No thalweg change	o Gabion boating control jettles extending from both banks
19th Street to 20th Street	1231 to 1225	No thalweg change	o Rock gabion across center of channel. Shale outcrop in channel
	1225 to 1215	Thalweg 3' lower than 1963	o Boulders placed in channel for boating improvement
20th Street to Franklin Street			
Colorado Southern R.R.	1214	Thalweg 3' lower than 1963	o Channelized area; sandy river bed
	1214 to 1140	No thalweg change	o Many bridges visible from this point o Mild slope; sandy bottom; channelized
38th Avenue	1135	No thalweg change	o Shale outcrop in channel; small riffles
	1130 to 1070	No thalweg change	o Mild slope; channelized
Franklin Street	1070	Thalweg 1' lower than 1963	o Very low bridge
Reach 7; Franklin Street to Sand Creek			
Franklin Street to York Street			
D & RGW R.R. bridge	1069	Thalweg 1' lower than 1963	o Closely spaced bridge supports. Debris collectors
Burlington Dam	1064		o 10' concrete diversion dam; Burlington Ditch begins on east bank; tainter gate on east bank
Check dam	1059	No thalweg change	o 2' sheet pile check dam
	1059 to 1025	No thalweg change	o Steep banks; overhanging trees
York Street	1020	No thalweg change above dam 2' erosion below dam	o Wood and rubble dam upstream of York St. Total drop 6'-8'
York Street to Sand Creek			
Chicago R.I.R.R. bridge	1015	No thalweg change	o Closely-spaced bridge supports; debris collectors
Check dam	1015	No thalweg change	o 6" high sheet pile and rubble dam; debris piled against upstream face of dam
	1015 to 1000	Aggradation of 2'	o Flat slope; slow pools
Check dam	997		o 4' concrete rubble check dam
Check dam	996		o 3' sheet pile check dam
	996 to 980		o Mild slope; sandy bottom
Sewerline crossing	976		o Major crossing under construction 10/83
Sewage outlet	965	Thalweg 2' lower than 1963	o Metro-sewer district outfall on right bank
Sand Creek	956		o Tributary from the east; river water quality degraded
Reach 8; Sand Creek to Baseline Road			
Sand Creek to C-224			
I-270 bridge	954		o Wide channel; 4-lane bridge structure
	954 to 910		o Wide channel; sloping banks; cobble bottom
I-76 bridge	910		o 4-lane bridge; pedestrian bridge
Clear Creek	902		o Tributary from the west
C-224	890	Thalweg 3' lower than 1963	o 2-lane highway bridge; pink rock riprap placed on west bank for erosion protection
C-224 to E. 88th Avenue			
	885		o Concrete rubble jetties on west bank for erosion protection
	890 to 780	Up to 4' lower than 1963	o Concrete sections randomly dumped along banks for bank protection; wide channel, low banks; large sand and gravel bars
Niver Creek	858		o Tributary from the west
Union Pacific R.R. bridge	857	No thalweg change	o Gravel operations on west bank
	840		o On right bank; Thornton water supply facilities
Water supply wells	850 to 820	Aggradation of 2'	o Dike along right bank; concrete rubble dumped intermittently along banks; gravel mining operations on left bank
88th Street	780	Aggradation of 2'	o Highway bridge, concrete rubble check dam downstream of bridge with 4' drop
Check dam	780		

TABLE VIII-2
(Continued)

Description of Subreach or Location	River Stationing	Comparison of 1963 vs. 1983 Erosion or Aggradation	Description or Inventory of Engineering Feature
E. 88th Avenue to 104th Street			
	780 to 630	No thalweg change	o Sand and gravel bars; earth dikes on the outside of river banks; concrete and asphalt dumped on banks for erosion protection. Thick gravel layer exposed by river; gravel mining operation on both sides
Gravel pit lake	720	Aggradation of 1'-2'	o Breached gravel pit lake - left bank
McKay Road	662	No thalweg change	o Sewage outlet 100 yards downstream of bridge
Fulton Diversion dam	630	Thalweg 4' lower than 1963	o Concrete diversion dam; Fulton Irrigation ditch begins on right bank. Concrete rubble in channel below dam
East 104th Avenue	600	Thalweg 2' lower than 1963	o Busy highway bridge; right bank downstream of bridge covered with packed-in-place asphalt
East 104th Avenue to Henderson Road			
Grange Hall Creek	585	No thalweg change	o Tributary from the west.
Waste dump	515	No thalweg change	o Solid waste dumped over left bank
Brantner Ditch diversion	508	Aggradation of 3' upstream of dam	o 10', 2 step concrete diversion dam; Brantner Ditch begins on left bank
	505 to 370	No thalweg change	o Mild slope; small riffles and pools; bank erosion on both banks. Concrete rubble used for protection. Gravel operations on both banks
Henderson Road	370	No thalweg change	
Henderson Road to Brighton Ditch			
	300		o Major gravel operations on west side
	370 to 142	Thalweg up to 4' lower than 1963	o Channel widens; 3"-4" cobbles in channel; bank erosion apparent; large trees and debris deposited during high flow
Gravel pit lake	240		o Breached gravel pit
	300 to 140	Thalweg up to 4' lower than 1963	o Bank erosion on outside bank at river bends; concrete, asphalt, and solid waste dumped over banks for erosion protection. Banks 4'-6' high.
Radio towers	220	Bank erosion (hazard to one tower)	o 3 radio towers, one on east bank; guy wires extend across the river. Cottonwood trees on both banks
	150		o Concrete rubble jetties protruding from east bank for erosion protection; sediment with willows growing downstream at each jetty
	145		o Solid waste dump on left bank
Brighton Ditch diversion	140	No thalweg change	o 4' concrete dam with wooden stop logs. Channel is constricted to approximately 100'. Brighton Ditch begins on left bank
Brighton Ditch to Baseline Road			
	140 to 80	Thalweg up to 4' lower than 1963	o 6' diameter concrete pipe sections dumped along west bank for erosion protection
	140 to 0	Thalweg up to 4' lower than 1963	o Wide channel; cobble bars on inside corner of river bends; bank erosion on outside bank; many trees have fallen into river
E. 160th Avenue (Colorado 7)	58	Thalweg 2' lower than 1963	o No direct diversion from river
McCann Ditch	30		
Baseline Road	0	Thalweg 1' lower than 1963	o End of project

Field studies by:

Gary Lacy, P.E., Principal Investigator
K.R. Wright, P.E.
Curt Chandler, P.E.
Rick Lamoreau
Robert Smith
Richard Smith

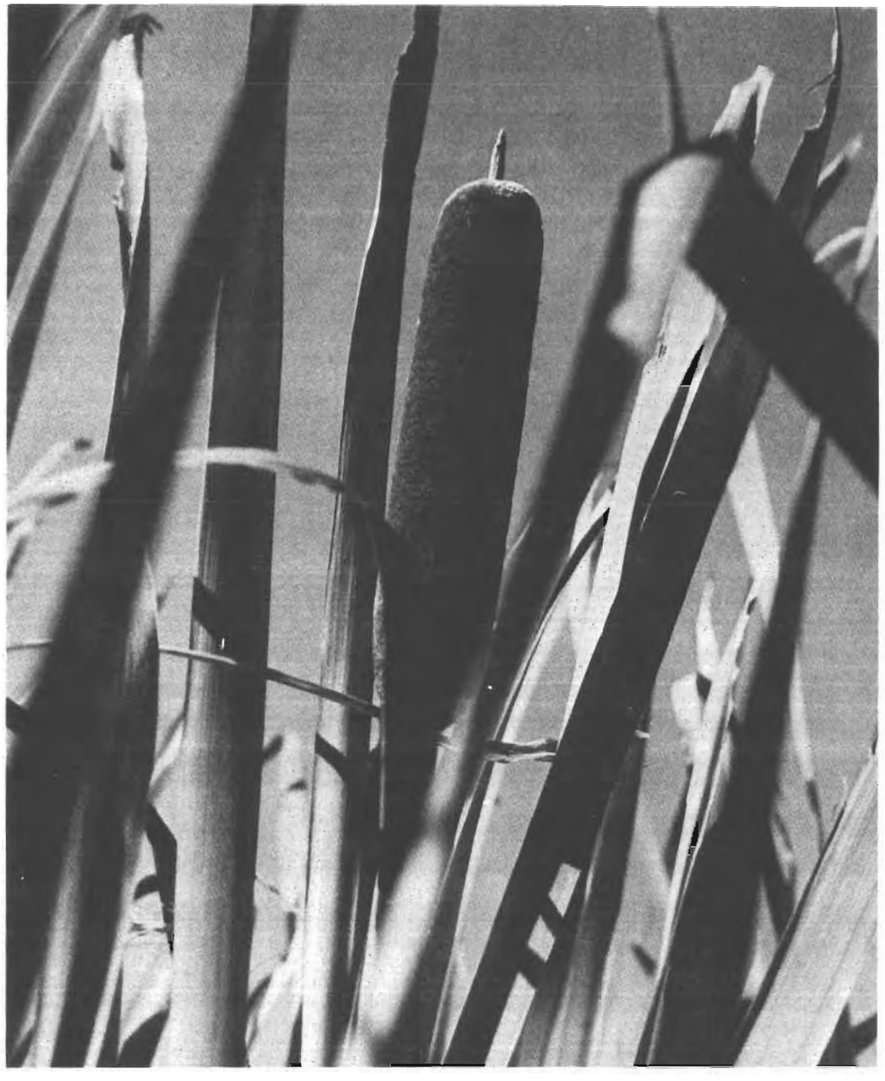


BOAT CHUTE FOR SMALL CHECK DAM

BOAT CHUTE FOR LARGE CONCRETE DIVERSION DAM

APPENDIX D

ACKNOWLEDGEMENTS



ACKNOWLEDGEMENTS

The consultant wishes to publicly thank the following organizations, groups, offices and departments for their information, comments and guidance during the process of producing the recreation and wildlife volume of the master planning study. Needless to say, without the input of each of them, this document would not have been so complete and meaningful.

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

ADAMS COUNTY
- PLANNING DEPARTMENT
- DIVISION OF PUBLIC WORKS
- DEPARTMENT OF PARKS
- DIVISION OF COMMUNITY AND RECREATION RESOURCES

CITY OF BRIGHTON
- DEPARTMENT OF PUBLIC WORKS
- DEPARTMENT OF CITY PARKS

COMMERCE CITY
- OFFICE OF COMMUNITY DEVELOPMENT
- OFFICE OF THE CITY ENGINEER
- DEPARTMENT OF PLANNING

CITY OF THORNTON
- DEPARTMENT OF PUBLIC WORKS
- DEPARTMENT OF PARKS AND RECREATION

CITY AND COUNTY OF DENVER
- DEPARTMENT OF PUBLIC WORKS
- PARKS AND RECREATION DEPARTMENT
- PLANNING OFFICE
- OFFICE OF THE MAYOR
- WASTEWWATER MANAGEMENT DIVISION
- DENVER WATER DEPARTMENT

CITY OF ENGLEWOOD
- PARKS DEPARTMENT
- OFFICE OF THE CITY ENGINEER
- DEPARTMENT OF PUBLIC WORKS

CITY OF SHERIDAN
- OFFICE OF THE CITY ADMINISTRATOR

ARAPAHOE COUNTY
- COUNTY ENGINEER

CITY OF LITTLETON
- COMMUNITY DEVELOPMENT PLANNING COMMISSION
- DEPARTMENT OF PUBLIC WORKS
- OFFICE OF THE CITY MANAGER
- PLATTE RIVER REDEVELOPMENT AUTHORITY

COLUMBINE VALLEY
- CITY ADMINISTRATOR

JEFFERSON COUNTY
- OPEN SPACE DEPARTMENT
- CITY ENGINEER

DOUGLAS COUNTY
- COUNTY COMMISSION
- DEPARTMENT OF PARKS AND RECREATION
- BUILDING DEPARTMENT

STATE OF COLORADO
- GOVERNOR AND DOTTIE LAMM
- DEPARTMENT OF HIGHWAYS
- WATER CONSERVATION BOARD
- GEOLOGICAL SURVEY
- DIVISION OF PARKS AND OUTDOOR RECREATION
- DIVISION OF WILDLIFE
- STATE ENGINEER
- DEPARTMENT OF NATURAL RESOURCES
- MINED LAND RECLAMATION BOARD

U.S. FEDERAL GOVERMENT ARMY CORPS OF ENGINEERS

PLATTE RIVER GREENWAY FOUNDATION

SOUTH SUBURBAN METROPOLITAN RECREATION AND PARK DISTRICT

SOUTH SUBURBAN PARK FOUNDATION

COLORADO WHITE WATER ASSOCIATION

NATIONAL ORGANIZATION FOR RIVER SPORTS

AUDUBON SOCIETY

COLORADO WILDLIFE FEDERATION

DENVER FIELD ORNITHOLOGISTS

NATIVE PLANT SOCIETY

COOLEY SAND AND GRAVEL COMPANY

MOBILE PRE-MIX

COLORADO ROCK PRODUCTS ASSOCIATION

PUBLIC SERVICE COMPANY OF COLORADO

MILE HIGH LAND PROJECT
- MILLER KLUTZNICK DAVIS GRAY CO.
- SELLARDS & GRIGG, INC.

TALLEY CORPORATION

WRITER CORPORATION

AMERICAN/HAMPDEN JOINT VENTURE, LTD.

DR. MICHAEL A. STEVENS

URBAN EDGES, INC.

AERIAL VIEW OF SOUTH PLATTE RIVER IN ADAMS COUNTY