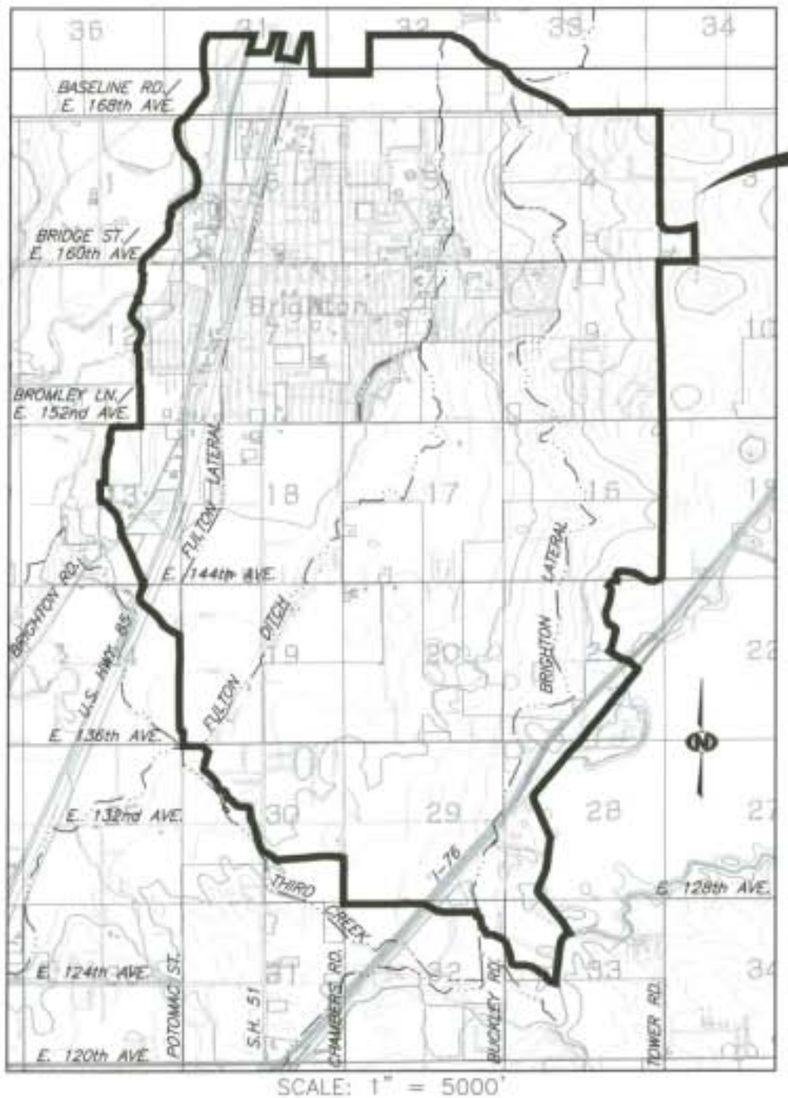
BRIGHTON WATERSHED TRIBUTARY TO SOUTH PLATTE RIVER OUTFALL SYSTEMS PLANNING



SCALE: 1" = 5000'

PRELIMINARY DESIGN REPORT

CITY OF BRIGHTON • ADAMS COUNTY • URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

DECEMBER, 2006

WRC ENGINEERING, INC.
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BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER
OUTFALL SYSTEMS PLANNING

PRELIMINARY DESIGN REPORT

Prepared For:

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

Prepared By:

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DECEMBER 1998
UPDATED DECEMBER 2006
WRC File: 2154/6

BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER
OUTFALL SYSTEMS PLANNING
PRELIMINARY DESIGN REPORT

2006 UPDATE

This 2006 Update of the Preliminary Design Report for Brighton Watershed Tributary to South Platte River, Outfall Systems Planning is presented in the same general organizational layout as was the original 1998 report. This page describes which sections of the report were updated and the methods used to differentiate original from modified text and figures.

The following sections were updated:

- Transmittal Letter
- Executive Summary - Text updated and replaced as required, update of figures, new Figure ES-3, update of table.
- I. Introduction - Addition of data sources used for 2006 Update, update of figure.
- II. Study Area Description - Addition of new text, update of figure.
- III. Hydrologic Analysis - Addition of text describing changes to storm water management model.
- V. AlternativesDevelopment and Selection - Addition of text from previously submitted "North Outfall System Alternatives Analysis" describing the alternatives presented to Brighton for the "north" and "core" watershed areas. These areas were added to the study area subsequently to the original 1998 OSP report.
- VI. Preliminary Design of the Selected Outfall System - Addition of text to provide updated details on costs, regional detention and conveyance facilities, and additional study areas. Table VI-1 was updated to reflect 2006 dollars, and Table VI-2 was updated to reflect the costs of added, removed, and redesigned facilities in 2006 dollars.
- Appendix A: Hydrologic Analysis Figures and Tables - Dwg. Nos. A-5 - A-8 updated to reflect changed study area and adjusted future conditions imperviousness.
- Appendix H: Final Master Plan Hydrology - All tables and figures replaced/updated.
- Preliminary Design Drawings - Updated as required.

Note that no changes were made to Section *IV. Hydraulic Analysis* or Appendices *B* through *G*. Updates to these sections were unnecessary due to sufficient data presented elsewhere in the report and in other documents previously submitted to the City of Brighton. In most cases, original text (and tables/figures in the appendices) was (were) not deleted to ensure completeness of the report.

In Sections *I.* through *VI.*, added and changed text is printed in **boldface type** for easy recognition.

WRC ENGINEERING, INC.

December 28, 2006

Ms. Shonnie Cline
City of Brighton
22 South 4th Avenue
Brighton, Colorado 80601

Mr. Ben Urbonas, P.E.
Urban Drainage & Flood Control District
2480 West 26th Avenue, Suite 156-B
Denver, Colorado 80211

WRC File: 2154/6

RE: 2006 Update Brighton Watershed Tributary to
South Platte River
Outfall Systems Planning

Sponsors:

Enclosed herein is the 2006 Update of the Preliminary Design Report for Brighton Watershed Tributary to South Platte River, Outfall Systems Planning. This report documents the Outfall Systems Planning Process from initiation of the study through preliminary design of the outfall systems for the Brighton Watershed, both for the original 1998 plan effort and the 2006 update planning effort. This report presents a synopsis of the project history, description of the study area, summary of project hydrology and hydraulics, evaluation of existing facilities, identification of drainage problem areas, discussions on the selection, evaluation and conclusions of the alternatives evaluation process, preliminary design of the outfall systems including estimated costs of the outfall system, and phasing/implementation recommendations for master planned drainage improvements in the Brighton Watershed.

The Brighton watershed is slowly being developed both south of Bromley Lane and east of the Brighton Lateral. Drainage problems in the developed portion of the City (Core City area) were initially evaluated by McLaughlin Water Engineers in 1991. The City adopted a Core area outfall system plan to alleviate those problems and has implemented a portion of the recommended improvements. The analysis prepared by McLaughlin Water Engineers did not take into account runoff from the undeveloped areas south and east of the City. Runoff from the areas south and east of the City generally flow towards the City. As development occurs in these areas, significant drainage problems could result in the City of Brighton if planning of properly sized drainage facilities is not performed.

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The proposed outfall systems presented herein from the 1998 report were developed from decision matrices to obtain the most cost effective, feasible and publicly acceptable solutions. Direction from the City Council was solicited during this alternatives process to obtain feedback and suggestions as to the desirability and acceptability of the proposed improvements. Modifications and updates to these systems were prepared as part of the 2006 update process and are included herein.

The proposed outfall systems presented herein include approximately $43,624,225 in drainage conveyance facilities and detention ponds costs and $7,406,346 in land acquisition costs for a total estimated cost, including engineering and contingencies, of $70,661,472 in 2006 dollars. The proposed improvements provide a reasonable level of improvements to minimize future potential problems and costs and still allow for improvements which are the most cost effective to solve existing drainage problems.

In conclusion, this document should continue to assist the City of Brighton and Adams County in planning and implementation of the master planned facilities for development of the Brighton Watershed area.

We appreciate the opportunity to prepare this preliminary design report and look forward to future implementation of the Master Planned Facilities.

Respectfully Submitted,

WRC ENGINEERING, INC.



Alan J. Leak, P.E.
Project Manager

ajl/ell
Enclosure

BRIGHTON WATERSHED

TRIBUTARY TO SOUTH PLATTE RIVER

OUTFALL SYSTEMS PLANNING

PRELIMINARY DESIGN REPORT

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BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER
OUTFALL SYSTEMS PLANNING
PRELIMINARY DESIGN REPORT

EXECUTIVE SUMMARY

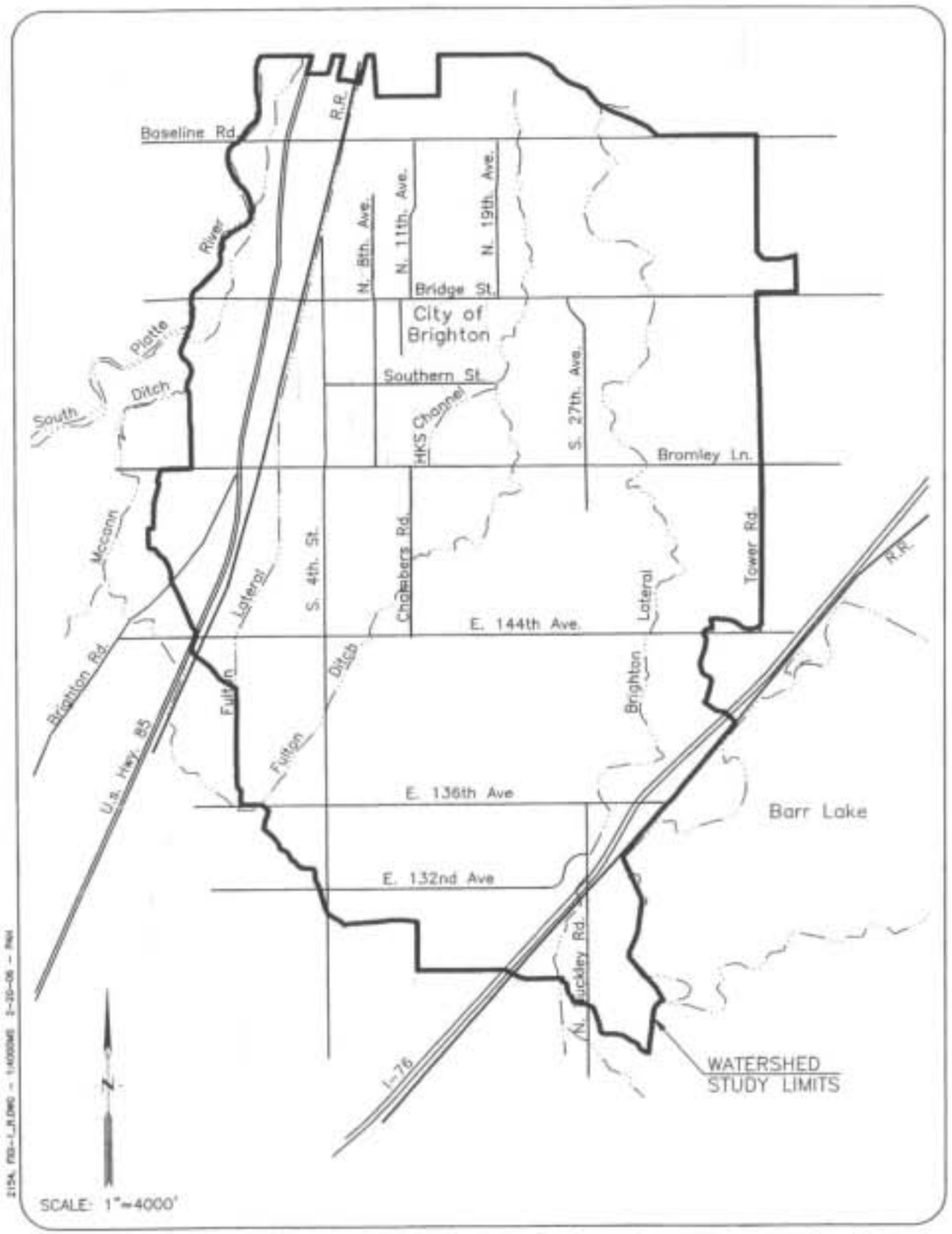
The development, evaluation, and preliminary design of a drainage system master plan for the Brighton Watershed Tributary to South Platte River Outfall Systems Planning are presented in this report. This effort is a jointly-sponsored effort of the City of Brighton, Adams County, and the Urban Drainage and Flood Control District (UDFCD). WRC Engineering, Inc. is the consultant for this project whom, in cooperation with the project sponsors, has prepared this preliminary design report.

2006 Update

This planning effort and the Preliminary Design Report was initially completed in December 1998. In 2004 and 2005, the City of Brighton contracted for preparation of an update to certain portions of the 1998 plan to a) address minor storm flooding conditions in certain of the Core City areas such as southeast of the intersection of Longs Peak Street and Great Western Road/Highway 85 and along Denver Street between 5th and 8th Avenues, b) address outfall systems needed north of the Core City area in future growth areas not included in the 1998 plan, and c) update the plan in the eastern and portions of the southern watershed areas based upon land use changes, revised development plans, and recent construction of drainage facilities which have occurred subsequent to the 1998 plan. This report includes the original study documentation with updates and revisions to those portions of the plan affected by the update effort.

Purpose and Objectives

The purpose of this project is to prepare an outfall systems master plan for the Brighton Watershed. The Brighton Watershed encompasses an area of about 17.2 square miles of land in Adams County (See Figure ES-1). The watershed is generally undeveloped both south of Bromley Lane and east of the Brighton Lateral ditch. The major objectives include protection of the City of Brighton from adverse effects of increased storm runoff that will result as development occurs south and east of the City, and to reduce potential flood damages, enhance stormwater quality, and reduce loss of groundwater resources that are the water supply for the City of Brighton.



WRC | BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING | VICINITY MAP | FIGURE ES-1

Planning Process

The planning effort began in July, 1996. Since that time, a series of progress meetings have taken place to exchange information and discuss ideas and findings of the study. Participants that regularly attended meetings included the project sponsor staff and representatives from the Brighton Lateral Ditch Company, Fulton Ditch Company, Colorado Department of Transportation, E-470 Authority, and the Ready Mix Concrete Company. Staff from the Brighton Planning Department and Adams County Long-Range Planning Department provided information on existing and future land use. Other agencies invited to attend and kept informed of this effort's progress include the Colorado Division of Wildlife, Colorado Water Quality Control Division, State Engineer's Office, South Adams County Water and Sanitation District, Union Pacific Railroad, and the U.S. Army Corps of Engineers.

A hydrology report was published in December, 1996. The report serves as the foundation for estimating potential future problems and for the development of alternatives to deal with them. Following this, various alternative drainage solutions were developed, their costs estimated, and an Alternatives Evaluation Report was published in July, 1997. The sponsors reviewed the Alternatives Evaluation Report and recommendations and subsequently selected an alternative to proceed through to preliminary design.

The preliminary design shows the type, size and location of various improvements that are necessary to the outfall system. In the process, cost estimates were refined and the relative priorities and phasing of these facilities were identified. The preliminary design and outfall systems plan implementation of the selected alternative are described in detail in this report.

The 2006 update process consisted of several meetings with City staff and the UD&FCD to obtain information on drainage activities which occurred subsequent to the 1998 study. The 2006 update process includes revisions to the Master Plan hydrology models as well as alternatives analysis for the northern portion of the Core City area and for the north outfall systems area.

Background

A drainage system plan for the developed portion of the City of Brighton (Core City area) was prepared by McLaughlin Water Engineers in 1991. The City adopted the plan in that report and implemented portions of the recommended improvements for the developed portion of the City. However, the analysis did not account for runoff from the undeveloped areas south and east of the City that flow towards the City.

The findings of the 1998 study showed that the new storm sewers currently in place and those being built within the current City limits of Brighton have insufficient capacity to handle the additional runoff from new development for both minor and major storm events. Significant flooding problems will result in the City if adequate drainage facilities are not built during new development and a major new outfall is not built to convey this additional surface runoff to the South Platte River.

Significant increases in runoff rates and volumes between existing and future conditions are due to urbanization of the undeveloped areas and elimination of numerous "closed basins" that exist in the areas south and east of the City. The closed basins are naturally-occurring depressions that pond runoff to depths of up to eight feet, potentially storing 134 acre-feet of water that does not reach the City at this time. Storm runoff at present is retained in the undeveloped closed basins until it infiltrates or evaporates.

Since the 1998 study, significant development has occurred both east and south of the Core City area. In numerous cases, subdivisions and retail/commercial developments have subsequently been platted, approved, or constructed in such a way as to require reconfiguration of the proposed outfall systems. Some constructed or planned local detention/retention facilities have been integrated into the 2006 updated plan as sub-regional facilities under the assumption that maintenance responsibilities would be assumed by the City of Brighton or other public entities.

Development has also begun to take place north of the City (north of Baseline Road). Alternatives were developed for the 100-year storm event outfall system for this area, capable of conveying detained flows from the east watershed area and parts of the Core City area. The selected alternative is indicated in this updated study.

Even with no additional runoff entering the City from the south or east watershed areas, the Core area experiences relatively frequent flooding in certain areas. WRC developed alternatives to help alleviate flooding in these areas. Preliminary designs for the selected alternatives are now incorporated into this study.

Alternatives Analysis

Several initial concepts were developed and discussed with the Brighton City Council on February 10, 1997. The general concepts included: (1) Conveyance of the 5-year storm runoff without any detention; (2) On-site detention for all future development in accordance with current City criteria; (3) On-site extended detention for the 5-year event; (4) Sub-regional detention with restricted release rates for the 100-year storm runoff, and (5) and

minimizing directly connected impervious areas (MDCIA). After evaluating these options, the City Council directed the staff to focus further analysis on alternatives that would:

- Use MDCIA along or in new collector and arterial streets and also in rural residential areas with lot size of 1.5 acres or greater (Subsequently, this was adjusted to 1.0 acres per discussions with City Staff);
- Continue to use traditional drainage practices of curb-and-gutter in urban residential areas;
- Use sub-regional detention with 5-year extended detention in new developments; and
- Consider only alternatives that would not increase the 100-year runoff rate into the City.

Alternatives were then developed further that followed this direction by the City Council. What resulted were alternatives that reduced or maintained the 100-year runoff rate into the City to levels that were no greater than existed prior to the preparation of the 1998 plan. In addition, alternatives were sought that reduced the size (and cost) of downstream conveyance facilities by incorporating detention requirements into the plan. Whenever feasible, stormwater and irrigation water systems were separated from each other to reduce random flooding problems that were expected to occur if that were not done as the lands urbanized.

For the 2006 update, alternatives for two City areas were evaluated. Minor storm outfall system alternatives were analyzed for the northern Core City area to primarily address historic flooding problems in the area around 7th Avenue and Denver Street and the area around Longs Peak Street and Great Western Road. Major Storm (100-year) outfall system alternatives were analyzed for the north study area along Baseline Road and north to Weld County Road 2½. This included analysis of facilities needed to convey runoff from the east study area to the South Platte River.

Selected Plan

The final plan selected for the master plan presented in this report is shown on Figures ES-2 and ES-3 and includes the following features:

- A total of 25-sub-regional detention basins in the watershed. These will provide extended detention for the 5-year storm event, will enhance stormwater quality, and will reduce the size and cost of downstream conveyance facilities (outfall channels) needed by detaining the 100-year event with restricted release rates. The locations of the detention basins can be adjusted to some degree as long as the hydrology and hydraulics of the attendant structures are not adversely affected. **Results of the 2006 update show that some of the original 1998 planned facilities have been replaced with additional but smaller sub-regional detention basins. For this plan to work, all facilities must be designed in accordance with the intent of the 1998 Master Plan.**

  In addition, several of the sub-watersheds have been developed with local detention facilities. "Local detention" typically refers to a privately-owned facility designed to detain runoff from a smaller area such as an individual development. These facilities reduce the size and cost of drainage conveyances from the local detention facility to other local detention facilities or to the sub-regional detention basins. However, the use of these local detention facilities must not be construed as a replacement for the system of sub-regional detention basins. From a flood control standpoint, it is prudent to assume that only the publically owned and maintained (sub-regional) detention facilities can be relied upon to perform as designed. Therefore, all developed runoff, even if previously detained in a local facility, is routed to a sub-regional detention pond. These sub-regional ponds, which are designed to function according to UD&FCD "extended detention" parameters, discharge directly to regional conveyance facilities.

  If a sub-watershed area is adjusted or split into smaller areas, either a) one sub-regional detention pond is needed to serve the entire area, or b) multiple sub-regional detention ponds can be used, designed as extended detention basins in accordance with the criteria herein, but must not be routed through each other or another detention basin but rather discharged to the regional outfall system channels and pipes. The suggested minimum area for a single sub-regional detention pond service area is 130 acres, as the water quality, land requirement, and economic advantages of the sub-regional system diminish with smaller areas.

- Outfall and Collector Channels. Collector channels are channels which collect the initial watershed runoff and deliver this runoff to the sub-regional detention basins. Outfall channels collect and combine runoff released from the sub-regional detention basins and convey this runoff ultimately to the South Platte River. In this manner, releases from the sub-regional detention basins are never routed through another sub-regional detention basin. Some of the open channels are proposed along and in arterial and collector streets. These channels will require right-of-way in addition to that needed for streets. The amount of required right-of-way will vary depending on the design flow rate at that location. It is estimated that a width of 25-feet in upstream areas to 150-feet in downstream areas will be required for the new outfall channels. However, by combining street and channel right-of-ways, a net savings in the land

0 1000 2000 4000 6000

SCALE: 1"=2000'

Brighton

Refer To Figure ES-3 For Core Area Minor Storm Outfall Systems Maximum 100-year Detention Release Rate=0.1cfs/acre

South Outfall

LEGEND

- REACH LIMITS
- S1 SOUTH AREA REACH ID
- E1 EAST AREA REACH ID
- DETENTION BASIN
- NON-REGIONAL CONVEYANCE FACILITY
- AA SUBREGIONAL DETENTION BASIN ID & DRAINAGE AREA
- STUDY AREA BOUNDARY
- SUBWATERSHED BOUNDARY

MAP AND AUTOCAD FILE PROVIDED BY: LANDMARK MAPPING LTD. 7500 WEST MISSISSIPPI AVENUE, SUITE 21 LAKEWOOD, COLORADO 80232 PHONE: (303) 922-2417 FAX: (303) 922-2866

TOWNSHIP 1 S.
RANGE 68 W.
SECTION N 1/2 7

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DESIGNED	ITC	DATE	5/28/05
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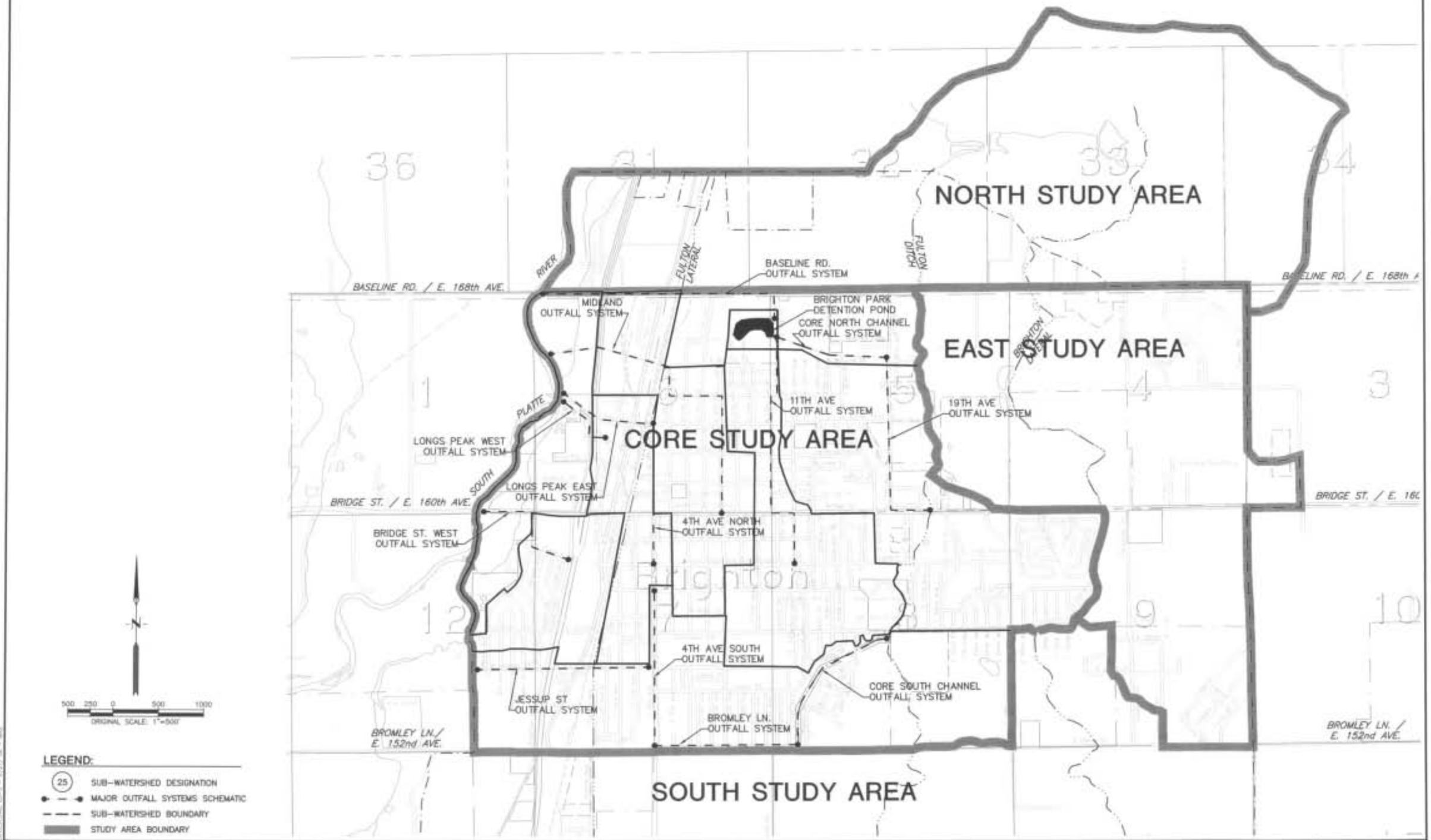
REVISED	APM	DATE	7/24/06
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

OUTFALL SYSTEMS MAP

FIGURE ES-2



	WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 759-3308 DESIGNED AJS DATE 7/28/05 DRAWN MKS DATE 7/28/05 CHECKED AJS DATE 7/28/05 REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED OUTFALL SYSTEMS PLANNING	CORE CITY MINOR STORM OUTFALL AREAS	FIGURE ES-3

required for both is realized and can result in an attractive "green" boulevard look along these transportation routes.

- Culvert crossings at collector and arterial streets. These drainageway crossings must be sized to adequately convey the flow under the street without overtopping during the design storm.

- Major outfall conduit crossings under U.S. Highway 85 and the railroad.

The priority and implementation schedule of the master-planned improvements depends to a large degree on the timing and location of development in the watershed. Many of these facilities can be built at the time of development. However, it should be emphasized that the crossings of U.S. Highway 85 and the Union Pacific Railroad at the north and south outfalls are critical to the success of the overall plan as they provide the major outfalls from the watershed to the South Platte River.

The proposed outfall systems plan provides for full conveyance of the 100-year releases from the detention basins around the present extent of the downtown City of Brighton (Core City area). When the master plan facilities are constructed, the City will not experience additional flooding that is the result of development that occurs south of Bromley Lane and east of the Fulton Ditch.

The total cost in 2006 dollars of the proposed outfall system is $70,661,472. This includes capital improvements ($43,624,225), land value for right-of-way ($7,406,346), and engineering, legal, administration and contingencies ($19,630,901). A summary of the total outfall system improvement costs is presented in Table ES-1.

This master plan identifies the type and location of facilities needed to serve both proposed developments as well as solve some of the drainage problems in the Core City area. The cost of improvements for new development will occur over time as land development takes place. Many of these facilities will be built and funded by private interests at the time of development. Funding to construct improvements determined to be public could include drainage fees, bonds, and funding assistance by the Urban Drainage and Flood Control District. If this outfall system master plan is not adopted and systematically implemented, the City of Brighton will likely experience increased drainage and flooding problems during all major and minor storm events as development occurs in the watershed.

Table ES-1 OUTFALL SYSTEM IMPROVEMENT COSTS [See Note 1]

Description			Cost			
Reach / Detention Facility	Length (miles)	Detention Drainage Area (sq. mi.) [See Note 2]	Facility Improvements	Land Acquisition	Engineering, Administrative, Contingencies (45%)	Total
E01	0.5		$462,000	$63,000	$207,900	$732,900
E02	0.4		$94,600	$42,600	$42,570	$179,770
E03	1.2		$273,500	$112,400	$123,075	$508,975
E04	0.5		$246,600	$0	$110,970	$357,570
E05	0.7		$405,100	$92,200	$182,295	$679,595
Detention Basin T	NA	0.31	$515,625	$283,140	$232,031	$1,030,796
E06	0.69		$359,900	$0	$161,955	$521,855
E07	0.2		$140,500	$20,200	$63,225	$223,925
Detention Basin U	NA	0.33	$590,625	$187,853	$265,781	$1,044,259
E08	0.3		$49,200	$12,400	$22,140	$83,740
Detention Basin PRE		0.23	$0	$0	$0	$0
E11	0.3		$240,200	$0	$108,090	$348,290
Detention Basin W	NA	0.25	$0	$0	$0	$0
E12	0.2		$115,900	$18,000	$52,155	$186,055
E13	0.9		$603,000	$73,400	$271,350	$947,750
Detention Basin X	NA	0.44	$750,000	$236,858	$337,500	$1,324,358
E15	0.4		$128,100	$30,900	$57,645	$216,645
Detention Basin V	NA	0.30	$0	$0	$0	$0
Sub-total East:	**6.24**	**1.85**	**$4,974,850**	**$1,172,950**	**$2,238,683**	**$8,386,483**
S01	1.6		$9,835,300	$342,000	$4,425,885	$14,603,185
S02	0.7		$1,276,300	$300,200	$574,335	$2,150,835
Detention Basin Q	NA	0.13	$281,250	$117,068	$126,563	$524,880
S03	0.7		$2,397,900	$166,000	$1,079,055	$3,642,955
S04	0.5		$148,200	$62,000	$66,690	$276,890
S05	0.7		$374,400	$0	$168,480	$542,880
Detention Basin Y	NA	0.06	$0	$0	$0	$0
Detention Basin SC	NA	0.13	$0	$0	$0	$0
S07	0.9		$46,300	$0	$20,835	$67,135
Detention Basin R	NA	0.29	$0	$0	$0	$0
S10	0.5		$50,300	$0	$22,635	$72,935
Detention Basin O	NA	0.25	$0	$0	$0	$0
S11	0.6		$123,800	$0	$55,710	$179,510
Detention Basin S	NA	0.25	$0	$0	$0	$0
S13	0.2		$139,100	$20,300	$62,595	$221,995
S14	0.3		$318,100	$19,400	$143,145	$480,645
Detention Basin J	NA	0.37	$750,000	$255,915	$337,500	$1,343,415
S15	0.3		$38,400	$0	$17,280	$55,680
Detention Basin M2	NA	0.09	$0	$0	$0	$0
S16	0.9		$138,500	$26,300	$62,325	$227,125
Detention Basin M3	NA	0.12	$0	$0	$0	$0
S17	0.2		$147,400	$39,200	$66,330	$252,930
Detention Basin Z	NA	0.30	$412,500	$189,214	$185,625	$787,339
S18	0.9		$534,200	$173,300	$240,390	$947,890
S19	1.0		$393,600	$137,100	$177,120	$707,820
S20	0.6		$543,000	$51,400	$244,350	$838,750
Detention Basin C	NA	0.61	$843,750	$323,978	$379,688	$1,547,415
S21	1.4		$475,613	$132,500	$214,026	$822,138
S22	0.3		$75,000	$25,900	$33,750	$134,650
Detention Basin A	NA	0.38	$468,750	$204,188	$210,938	$883,875
S23	0.61		$425,400	$67,800	$191,430	$684,630
S24	0.21		$168,313	$12,000	$75,741	$256,053
Detention Basin B	NA	0.30	$468,750	$193,298	$210,938	$872,985
S25	0.3		$131,600	$35,800	$59,220	$226,620
S26	0.3		$91,400	$35,200	$41,130	$167,730
S27	0.3		$133,300	$30,200	$59,985	$223,485
S28	0.2		$111,300	$0	$50,085	$161,385
S29	0.8		$1,080,200	$105,200	$486,090	$1,671,490
S30	0.5		$770,900	$38,600	$346,905	$1,156,405
S31	1.3		$931,900	$140,400	$419,355	$1,491,655
S32	0.7		$321,800	$118,100	$144,810	$584,710
Detention Basin D	NA	0.57	$937,500	$288,585	$421,875	$1,647,960
S33	0.0		$0	$0	$0	$0
Detention Basin E	NA	0.29	$468,750	$0	$210,938	$679,688
S34	0.2		$150,300	$17,900	$67,635	$235,835
S35	0.3		$31,250	$0	$14,063	$45,313
Detention Basin G	NA	0.42	$656,250	$296,753	$295,313	$1,248,315
S36	0.5		$477,325	$29,400	$214,796	$721,521
Detention Basin I	NA	0.62	$937,500	$326,700	$421,875	$1,686,075
S37	0.7		$25,000	$0	$11,250	$36,250
Detention Basin K	NA	0.25	$0	$0	$0	$0
S38	0.5		$225,500	$62,600	$101,475	$389,575
S39	1.4		$261,300	$88,000	$117,585	$466,885
Detention Basin F	NA	0.22	$328,125	$210,449	$147,656	$686,231
Detention Basin Lutz	NA	0.25	$0	$0	$0	$0
S40	0.9		$424,125	$37,400	$190,856	$652,381
Detention Basin L	NA	0.34	$0	$0	$0	$0
S41	1.0		$797,500	$97,800	$358,875	$1,254,175
S42	1.0		$970,200	$45,000	$436,590	$1,451,790
S43	0.1		$0	$0	$0	$0
S44	0.2		$99,025	$32,300	$44,561	$175,886
Detention Basin P	NA	0.33	$562,500	$272,250	$253,125	$1,087,875
Sub-total South:	**24.44**	**6.56**	**$31,798,675**	**$5,167,696**	**$14,309,404**	**$51,275,774**
N01	0.6		$1,841,900	$452,000	$828,855	$3,122,755
N02	0.6		$836,300	$272,200	$376,335	$1,484,835
N03	0.5		$1,288,900	$327,400	$580,005	$2,196,305
Sub-total North:	**1.8**	**0.00**	**$3,967,100**	**$1,051,600**	**$1,785,195**	**$6,803,895**
C01	1.3		$1,542,000	$14,100	$693,900	$2,250,000
C02	0.2		$216,900	$0	$97,605	$314,505
C03	0.2		$148,100	$0	$66,645	$214,745
C04	0.8		$976,600	$0	$439,470	$1,416,070
Sub-total Core:	**2.5**	**0.00**	**$2,883,600**	**$14,100**	**$1,297,620**	**$4,195,320**
Grand Total	**30.7**	**8.42**	**$43,624,225**	**$7,406,346**	**$19,630,901**	**$70,661,472**

Notes:

1. All Outfall Systems are within the Brighton watershed, Direct Flow Area 0051-03, as described in "Drainage Basin Description Maps", UDFCD, December 1990. Drainage Areas do not include the City of Brighton as Master Planned in 1991 (See Figure ES-1) except the drainage Reaches identified by a "C" prefix.

2. Areas in this column are the total drainage area tributary to each Detention Basin.

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I. INTRODUCTION

A. AUTHORIZATION

This report is part of a study authorized by the Urban Drainage and Flood Control District (UD&FCD) in the agreement regarding Outfall Systems Planning Brighton Watershed Tributary to South Platte River, dated July 1, 1996 (Agreement Nº. 96-03.13). The study area, shown in Figure I-1, consists of the Brighton watershed tributary to the South Platte River which encompasses the City of Brighton and unincorporated parts of Adams County.

The study is divided into two phases. The first phase (Phase A) covers the hydrological, hydraulic, and alternative evaluation aspects. The second phase (Phase B), which is documented in this report, covers the preliminary design of the selected alternative. The Hydrology Report (Reference 1), summarized herein, was submitted for review on December 29, 1996. The Alternatives Evaluation Report (Reference 2), summarized herein, was submitted on July 24, 1997.

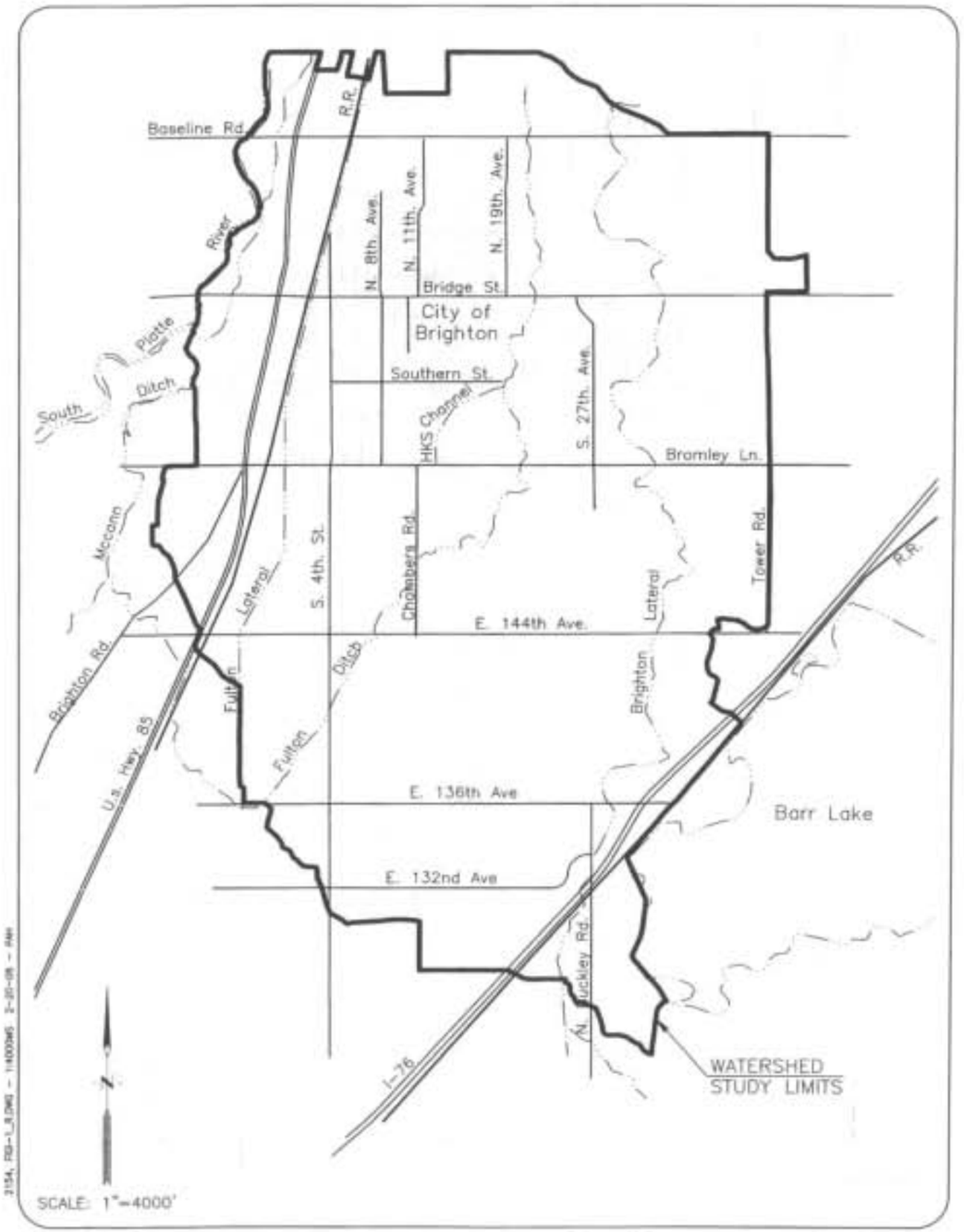
B. PURPOSE AND SCOPE

The purpose of this study is to prepare an outfall systems plan that identifies the drainage improvements needed to address drainage problems that exist in the developed portion of the City and those improvements that will need to be constructed as development occurs south and east of the City of Brighton.

The general scope of the alternatives evaluation phase of this project is as follows:

1. Gather and assemble available information on existing drainage facilities, comprehensive plans, land use plans, zoning and land ownership maps, and other applicable information.

2. Perform a field investigation to identify all major drainage structures and environmentally sensitive areas.



WRC | BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING | VICINITY MAP | FIGURE I-1

3. Determine the hydrologic aspects of the drainage area including runoff rates and volumes under existing and full development scenarios for various return periods of storm events.

4. Evaluate the hydraulic capacity of the existing drainage systems and the relative level of protection provided by these facilities.

5. Identify existing and potential future drainage problems within the study area by comparison of anticipated future runoff rates with the hydraulic capacity of existing and current planned systems.

6. Develop alternative plans for addressing the identified drainage problems.

7. Evaluate alternatives using factors such as cost, public acceptance, cost effectiveness, applicability, stormwater quality benefits, and public health and safety to result in a specific recommendation for further actions and/or improvements.

8. Document the first phase in an Alternative Evaluation Report.

The scope of the preliminary design phase of this project includes:

1. Prepare preliminary plan and profile drawings for the selected alternative.

2. Prepare preliminary cost estimates for the proposed facilities.

3. Prepare design guidelines for the proposed facilities.

4. Prepare an implementation plan for the proposed facilities.

5. Prepare a final report presenting the outfall systems planning process and preliminary design information.

C. MAPPING AND SURVEYS

The topographic maps for this project were prepared by Landmark Mapping under separate contract to UD&FCD. The maps were compiled and prepared at a scale of 1" = 200' with 2-foot contour intervals. The maps were submitted in electronic format in an AutoCAD Version 12.0 drawing. The topography was compiled from aerial photographs taken on April 17, 1996. Base mapping for the hydrologic maps consist of U.S.G.S. 7½ minute quadrangle maps at a scale of 1" = 2000'. Soil surveys prepared by the U.S. Department of Agriculture Soil Conservation Service were used to determine soil types and hydrologic soil groups (Reference 3).

D. INFORMATION PROCUREMENT

WRC staff contacted several agencies, organizations and individuals to obtain data within the study area. The City of Brighton provided the following documents and construction drawings:

Final Drainage Report for Bromley Creek Filing Nº. 1
Comprehensive Land Use Plan (December 1989)
Land Use Map (January 1998)
Drainage Outfall Systems Planning
Drainage Report Mountain View Estates
Zoning Maps
North Outfall System Preliminary Plan
Construction Drawings for City of Brighton Fishing Lake
South Outfall System Phase IV Drainage Improvements
North Outfall System Phase III Drainage Improvements
North 11th Avenue Reconstruction and Drainage Improvements
North Outfall System Phase II Drainage Improvements
City of Brighton Storm Sewer Inventory
North Outfall System Phase I Drainage Improvements
Fulton Avenue and Bromley Lane Transportation and Storm Drainage
Jessup Street Outfall Phase II Drainage Improvements
South Outfall System Phase III Drainage Channel Improvements
Brighton Park Construction Drawings

Adams County provided:

Adams County Transportation Plan
Third Creek Estates Plat and Street Plans
Bromley Lane Culvert Construction Plans
Street and Drainage Improvement Plans
Brighton East Horizons Subdivision
Welch's Hilltop Acres Street Improvement Plan.
Comprehensive Land Use Plan

The Colorado Department of Transportation provided construction drawings for Interstate 76 and State Highway 85.

Additional data sources utilized for the 2006 Update:

Adams County Future Land Use Map (2003)
City of Brighton Zoning Map (2004)
Adams County Sheriff's & Coroner's Bldg: Phase III Final Drainage Report
Almost Home Brighton Site: Final Drainage Report
Amendment to Brighton Watershed OSP for Hishinuma Farms
Bridge Crossing Subdivision Filing No. 1: Final Drainage Report
Brighton Business Center: Master Drainage Study
Brighton Charter School: Preliminary Site Plans
Brighton Pavilion: Preliminary Drainage Report
Buckley Road, Bromley Lane to 136th Avenue: Final Drainage Report
Case Farms: Preliminary Drainage Report
Chapel Hill Subdivision Filing No. 2: Final Drainage Report
Corbin Kidder Subdivision: Preliminary Drainage Report
Cottage Crossing: Final Drainage Report
Cottonwood Countryhomes: Drainage Report
Crescent Village PUD Replat (Lot B): Drainage Report
Hishinuma Farms: Preliminary Drainage Report
Homestead Subdivision: Master Drainage Report
Indigo Trails: Phase 2 Final Drainage Report
Jacob's Run Subdivision: Master Drainage Study
Meadows Townhomes at Brighton East Farms, The: Final Drainage Report
Mountain View Subdivision Filing No. 1: Final Drainage Report
Mountain View Subdivision Filing No. 2: Final Drainage Report
NE Quadrant of Bromley Ln. & South 27th Ave.: Conceptual Drainage Study
Overland Park (Lots 1-4): Drainage Report
Palizzi Marketplace: Final Drainage Report
Park Place Subdivision: Preliminary Drainage Report
Pheasant Ridge Subdivision: Final Drainage Plan
Platte River Ranch Filing No. 4: Final Drainage Report
Platte River Ranch Filing No. 5: Final Drainage Report
Prairie Center Major Retail 3: Final Drainage Report
Prairie Center Master: Drainage Report
Prairie Center Parkway, Buckley Road to 144th Avenue: Final Drainage Report
Prairie Center: Phase 1 Final Drainage Report
Preserve, The: Preliminary Drainage Report
Safeway Marketplace: Preliminary Drainage Report
Spring Hollow: Final Drainage Report
Springs Ranch: Phase I Drainage Report
Sugar Creek Subdivision Filing No. 1: Final Drainage Report
Wal-Mart #1659: Final Drainage Report

E. ANALYSIS AND DESIGN CRITERIA

The Outfall Systems Plan analysis was performed in accordance with the guidelines and criteria set forth in the Adams County Storm Drainage Design and Technical Criteria (Criteria, Reference 4). The Criteria includes, by reference, the methodologies, parameters and design criteria set forth in the Urban Storm Drainage Criteria Manual (USDCM, Reference 5).

Subsequent to the initial data gathering and field reconnaissance work to establish watershed boundaries and existing storm drainage features, the study area was divided into separate sub-watersheds within the major watershed. The physical parameters (i.e., area, length, slope, and percent imperviousness of each sub-watershed for future development conditions) were then defined and the design storm hydrographs developed for the various recurrence intervals using the Colorado Urban Hydrograph Procedure (CUHP, Reference 6). The combining of the hydrographs, channel routing, and routing of the flood hydrographs through the existing ponds were performed using the Storm Water Management Model (SWMM, Reference 7).

F. PROJECT ADVISORY COMMITTEE

This study is sponsored by UD&FCD, City of Brighton and Adams County. In addition to the sponsors, the project participants included the Colorado Department of Transportation, Brighton Lateral Ditch Company, Fulton Ditch Company, Ready Mix Concrete and E-470 Authority. Various

community groups and citizens also provided input to the project. The following agencies, companies and citizen groups were notified and invited to participate in the progress meetings:

ORGANIZATION

Adams County Planning Department
Adams County Parks Department
Adams County Department of Public Works
Brighton Lateral Ditch Company
City of Brighton Planning Department
Colorado Department of Transportation
Colorado Division of Wildlife
Colorado Division of Minerals and Geology
Colorado Water Quality Control Division
E-470 Authority
EPA Region VIII
Fulton Ditch Company
Office of the State Engineer
South Adams County Water & Sanitation District
Union Pacific Railroad
U.S. Army Corps of Engineers

G. PROJECT HISTORY AND CORRESPONDENCE

A series of project meetings were held to discuss various aspects of the project, to obtain information and guidance from the project sponsors, and to present results at the various stages of the project's progress. In addition, draft copies of the hydrologic analysis and alternative analysis were submitted and reviewed. A list of the project meetings, submittals, and a brief summary of the meetings discussions follows. Copies of the meeting minutes are included in Appendix C. Correspondence received during the Phase-B portion of the Study are included in Appendix E.

PHASE - A

August 26, 1996	Entities/groups to be invited to participate in progress meetings were identified. The availability of information and reports was discussed. Separation of stormwater and irrigation water was discussed.
October 15, 1996	Project participants identified items they thought to be critical to the project. Additional information needs were identified. Hydrologic maps were reviewed.
October 22, 1996	Existing and most probable future land uses were reviewed.
November 5, 1996	Development of alternatives was discussed including regional detention and roadside ditches.
November 26, 1996	A preliminary review of the hydrologic modeling was presented.
December 7, 1996	Results of the hydrologic modeling were presented. Modeling included diversions and the closed basins. It was agreed that the report would present existing and future conditions, with and without closed basins. Alternatives including full conveyance, regional detention and policy decisions were discussed.
December 29, 1996	Hydrology report was submitted.
January 7, 1997	The final hydrology report was reviewed. Conceptual alternatives that would reduce the future developed runoff into the City were reviewed.
February 10, 1997	Alternatives were presented at a City Council work session. Input from the Council regarding which alternatives merited further consideration was requested.
February 19, 1997	Alternatives based upon the direction received from the City Council were reviewed. Sub-regional detention pond locations and outfall alignments were reviewed.
April 2, 1997	Detailed discussions of the alternatives, including cost estimates were held. Adding an alternative that provides for a more restrictive detention pond release east of the City was discussed.
May 7, 1997	Draft Alternative Analysis and Evaluation Report was submitted for review.
June 18, 1997	Discussion of draft Report with the City of Brighton.
June 24, 1997	Comments received by WRC on the Draft Alternatives Analysis and Evaluation Report.
July 24, 1997	Final Alternatives Analysis and Evaluation Report was submitted.

PHASE - B

January 12, 1998	Notice-to-Proceed with Phase-B of project

January 26 1998	Start-up meeting for Phase -B. Discussed South Outfall ROW design. Coordination of sanitary sewer along South Outfall alignment. Recreation access under U.S. 85 not required with this project. Discussed status of Parks/Recreation planning.
February 25, 1998	Discussed possible Comprehensive Plan changes with City of Brighton
March 13, 1998	Discussed South Outfall across U.S. 85 and railroad. Discussed layout/sizing of sub-regional detention basins U and T.
May 1, 1998	Discussed South Outfall channel upstream of Fulton Street. Reviewed proposal to use Brighton Lateral as an outfall system. Include pond sizing recommendations versus percent imperviousness in final report.
May 21, 1998	Discussed South Outfall channel design. Draft sub-regional detention basin designs were presented and discussed. Basin sizing chart was presented and discussed.
June 3, 1998	Discussed reduction of the sub-regional detention overbanks area. Examined potential multi-use locations. Discussed current South Outfall channel design.
July 9, 1998	Meeting with City of Brighton staff to discuss proposed implementation guidelines.
September 9, 1998	Draft Preliminary Design Report was submitted for review.
October 9, 1998	Comments received by WRC on the draft Report.

H. ACKNOWLEDGMENTS

We would like to acknowledge the participation of the following individuals in the project meetings and discussions (original project):

ORGANIZATION	INDIVIDUAL
Adams County	Besharah Najjar Nickole Stoner
City of Brighton	Terry Benton Scott Bernhart Tim McCandless Marve Falconburg Charlie Kiepe Blair Renfro Joe Gerdom
Urban Drainage & Flood Control District	Ben Urbonas John Doerfer
Brighton Lateral Ditch Company	Ivan Grein John Case Margy Sadler John Akolt
Fulton Ditch Company	Cecil King Lyle Dirrim
Ready Mix Concrete	Bill Timmons
E-470 Authority	Steve McQuilkin
CDOT Hydraulics Section	Garth Englund

Their insights, information and guidance contributed to the accuracy and completeness of this study.

Additionally, we would like to acknowledge the participation following individuals in the subsequent 2006 Update to the Brighton Watershed Outfall Systems Plan:

ORGANIZATION	INDIVIDUAL
City of Brighton	**Joe Smith** **Shonnie Cline**
Urban Drainage & Flood Control District	**Laura Kroeger** **John Doerfer** **Ken MacKenzie**

II. STUDY AREA DESCRIPTION

Note: Some portions of this Section II: Study Area Description were affected by the 2006 Update of the Outfall Systems Plan. Additional text, outlining changes and presenting updated information, follows this section.

A. GENERAL

The Brighton Watershed study area is located in portions of Sections 3-10, 15-21, 28-33, Township 1 South, Range 66 West, and Sections 12 and 13, Township 1 South, Range 67 West of the 6th Principal Meridian, Adams County, Colorado. The study area is generally bound by Baseline Road on the north, 120th Avenue on the south, the Platte River on the west and Tower Road on the east. The watershed encompasses approximately 14.7 square miles.

B. TOPOGRAPHIC FEATURES

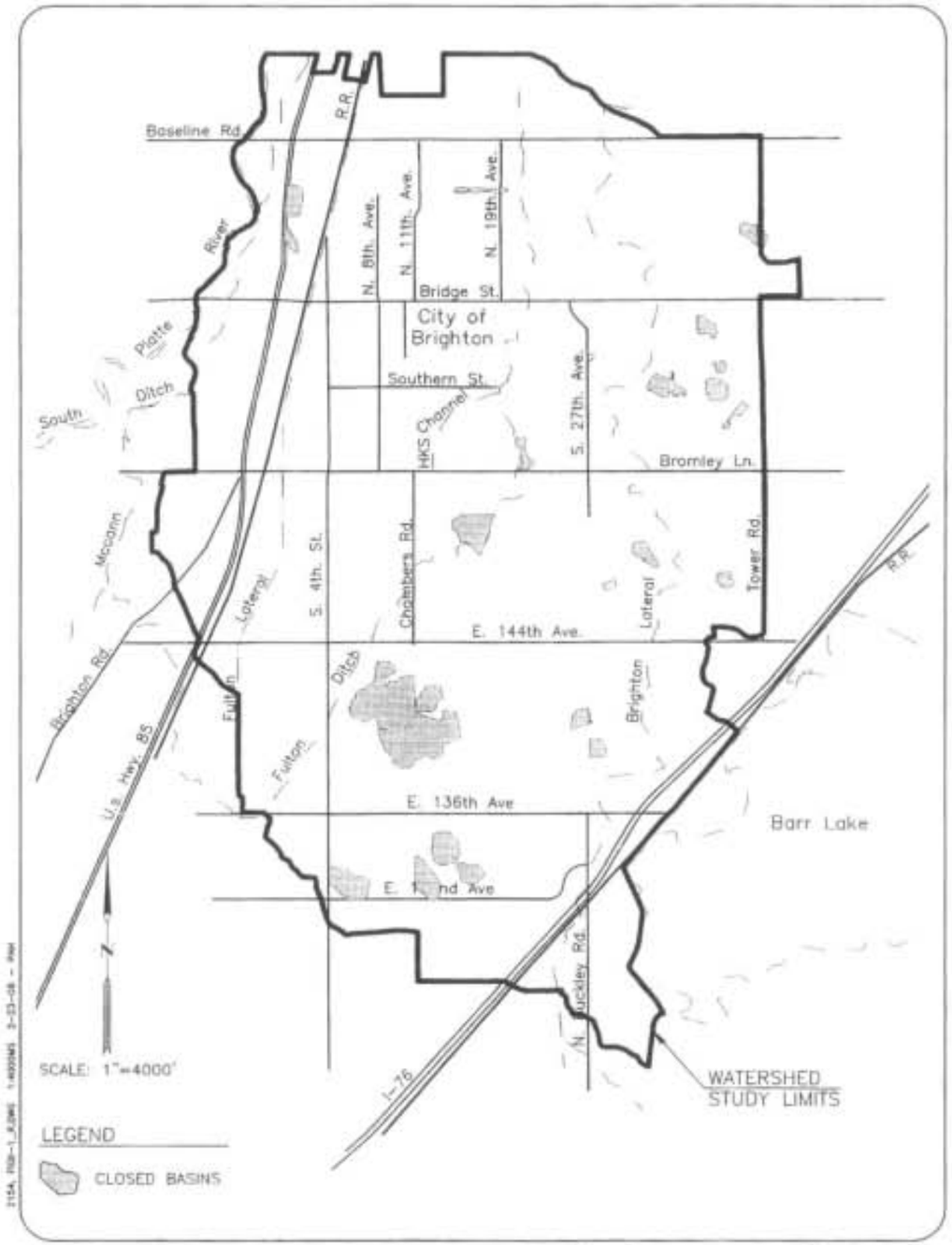
There are no defined outfalls within the study area. The study area generally slopes to the north at 0.2 to 1.0 percent. There are numerous closed basins within the study area. The closed basins retain storm runoff from tributary areas and have ponding capacities of up to a depth of 8 feet. The runoff retained infiltrates into the ground or evaporates. Figure II-1 identifies the location of the closed basins in the study area.

C. SUB-WATERSHED DELINEATION AND DRAINAGE PATTERNS

Drainage sub-watershed boundaries were determined using topographic mapping, review of construction drawings for existing drainage structures and field observations. In addition, potential future development patterns were assessed in layout of the final sub-watershed boundaries.

D. SOIL CHARACTERISTICS

Soils in the study area were identified with the soil survey for Adams County, prepared by the Soil Conservation Service (SCS, Reference 3). The soils identified represent all four hydrologic soil groups as defined by the SCS: Types A, B, C, and D. Type A soils have the highest infiltration rates, with Type B and C having decreasing infiltration rates. Type D soils have the slowest infiltration rate. Soils in the watershed are primarily Type B soils. A Hydrologic Soils Group Map is presented in Figures A-1 and A-2.



WRC | BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING | CLOSED BASINS | FIGURE II-1

E. WATERSHED IMPERVIOUSNESS

The percent watershed imperviousness assumptions used for the study area were based upon the existing and anticipated future land uses within the study area. The existing land use conditions were determined using aerial photographs taken on April 17, 1996, which were used to prepare mapping of the study area. The future developed condition of imperviousness was estimated based upon the Adams County Future Land Use Plan. The estimated percent imperviousness for each land use type was based upon computed imperviousness percentages of existing developments, proposed future developments and Table 3-1 of the Runoff Chapter of the USDCM (Reference 5).

F. VEGETATION

Vegetation in the undeveloped portion of the study area in general consists of irrigated crops. The developed areas consist of mature deciduous and evergreen trees, small shrubs, turf lawns and landscaping.

Aquatic and Wetland Company was retained to identify possible wetland and riparian areas in the watershed. A copy of their preliminary wetland assessment is included in Appendix F. Figures F-1 and F-2 show the areas with wetland type vegetation, including irrigation ditches, ponds, lakes, major drainage ditches and constructed wetlands. Under a more detailed investigation, some of these areas may not be classified as "jurisdictional wetlands" or waters of the U.S.

G. EROSION/WATER QUALITY

There were no existing erosion or water quality problems reported by the project sponsors. However, concern was expressed as to potential surface water quality degradation from future developments if water quality enhancement features were not implemented with future development. Possible water quality enhancements were considered as part of the outfall systems planning process.

CHANGES AND ADDITIONAL INFORMATION FOR 2006 UPDATE

The Brighton Watershed study area was expanded to encompass portions of Sections 31-34, Township 1 North, Range 66 West of the 6th Principal Meridian. This additional area lies north of Baseline Road, thus a part of Weld County, Colorado. The general northern boundary of the study area is now Weld County Road 2.5. The new area adds approximately 0.85 square mile to the study area. However, the additional north area is affected hydrologically by tributary area that is outside of the new study area limits. The majority of this 1.62 square mile tributary area is located to the northeast of the expanded study area. The expanded study area, then, encompasses approximately 15.6 square miles, with an approximate total catchment area of 17.2 square miles.

The sub-watershed boundaries were updated for this revision to better reflect existing and planned development within the Brighton Watershed. Numerous drainage plans and construction drawings were reviewed in order to determine compatibility with the original (1998) Outfall Systems Plan. In many locations, sub-watershed boundaries were adjusted to coincide with development boundaries and the tributary areas of on-site (local) detention facilities.

Land use conditions, and thus imperviousness values, were adjusted to more accurately reflect existing or planned development where applicable.

III. HYDROLOGIC ANALYSIS

Note: Some portions of this Section III: Hydrologic Analysis were affected by the 2006 Update of the Outfall Systems Plan. Additional text, outlining changes and presenting updated information, follows this section.

A. GENERAL

The initial (baseline) hydrologic analysis for the study area was performed to define the storm runoff peak flows and volumes for the various sub-watersheds of the Brighton Watershed. The runoff information was subsequently used to evaluate the existing drainage facilities, potential drainage problems, and potential alternative drainage improvement plans. The hydrologic analysis was modified during the preliminary design phase to reflect the locations and routes of the proposed outfall systems and facilities.

For the baseline hydrologic analysis, the study area was divided into a total of 125 sub-watersheds. Peak flows at each sub-watershed outlet point were calculated for the 2-, 5-, 10-, 50-, and 100-year recurrence interval storms for existing and future land use conditions. The study area and baseline sub-watershed areas are shown in Figures A-3 and A-4.

B. DESIGN RAINFALL

The one-hour design point rainfall depths obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas and contained in the Adams County Storm Drainage Design and Technical Criteria (ACSDDTC, Reference 4) were used in the hydrologic analysis. The one-hour design point rainfall depths in inches are as follows:

2-year	5-year	10-year	50-year	100-year
1.00	1.42	1.68	2.35	2.71

The one-hour point rainfall depths for all storm events were adjusted to a 2-hour rainfall distribution.

C. COLORADO URBAN HYDROGRAPH PROCEDURE PARAMETERS

The CUHP computer program was used to compute storm runoff hydrographs for the various sub-watersheds. The version used for the study was CUHPF/PC2. The sub-watershed input parameters required for CUHP are: sub-watershed identification number, drainage area, length and centroidal length, drainageway slope, impervious percentage, detention and retention storage losses, and infiltration loss rates. The weighted channel slopes were adjusted using Figure 4-1 of the Runoff Chapter of the USDCM (Reference 4) for input into CUHP. The CUHP rational method option was used for sub-watersheds less than 90-acres in size. Therefore, times of concentration (T_c) were input into CUHP for these basins. T_c was computed using the equation $T_c=T_i+T_t$. The initial travel time (T_i) was computed using Figure 3-1 from the USDCM. The C_5 (5-year rational method runoff coefficient) value used in Equation 3-3 to calculate T_i was estimated based on a plot of C_5 values and corresponding percent impervious data from the USDCM Table 3-1. For the urbanized areas, an overland flow length was estimated from the topographic mapping (typically 100′ feet for developments already constructed in the study area). For undeveloped areas an overland flow length of 500′ was used. The travel time (T_t) was computed using the velocity determined from Figure 3-2 of the USDCM.

For the baseline analysis, the CUHP traditional drainage practices methods were used. Thus, the optional parameters for pervious/impervious area connections and water quality capture volume were not used for this baseline analysis but were considered in the development of conceptual alternatives. Sub-watershed geometries were measured directly from the mapping prepared for this study. The existing and projected imperviousness percentage for each sub-watershed was estimated as the composite value resulting from a weighted-area average computation for the imperviousness zones presented on Figures A-5, 6, 7 and 8. Several areas within the project area were evaluated in detail in order to more truly determine the appropriate composite imperviousness values for the residential areas within this study area.

Detention, retention and infiltration parameters were assigned to each hydrologic soil group as recommended in Tables 2-1 and 2-2 of the Runoff Chapter of the USDCM. Parameters were then determined for each sub-watershed using the predominate soil zones. A summary of the baseline CUHP parameters used for the analysis are presented in Tables A-1 and A-2 for existing and future conditions, respectively.

D. STORM WATER MANAGEMENT MODEL

The personal computer version of the UD&FCD SWMM (Reference 4) was used to route the CUHP-generated runoff hydrographs. The version of the software used was UDSWMM3. The routing

slope, and Manning's "n" value. The type of SWMM routing elements used were based on the existing drainageway configurations and shapes. The SWMM routing element parameters used for the baseline analysis are presented in Tables A-3 and A-4 for existing and future development with closed basins conditions, respectively.

Existing systems for the baseline flow routing model included all structures that are currently in place. The existing Jessup Street Outfall (conveyance elements 142, 177, 178, 376 and 397) and the outfall storm sewer along Denver Street, Longs Peak Street and North 9th Avenue (conveyance elements 171, 174, 344, 362, 398 and 399) are modeled to divert storm runoff, up to the pipe capacity, to the South Platte River. Flows in excess of the pipe capacity was modeled as overflow street sections, whose routing was dependant on the surface topography. The existing facilities are shown on Figures A-9 and A-10. The SWMM Routing Elements for the baseline hydrology are shown on Figures A-11 and A-12. A schematic of the routing elements for the baseline hydrology is presented in Figures A-13A, B, C, D, E and F.

Closed basins exist in the undeveloped portions of the watershed which currently retain various amounts of storm runoff. These closed basins are modeled with existing and future development conditions. Storage volumes of the closed basins were calculated using the 2-foot contour mapping provided by UD&FCD for this project. The closed basins were modeled to retain all runoff up to the available volume and to release all runoff after the basin was full. The baseline SWMM models for the future land use conditions were run both with and without the closed basins that exist in the watershed. Results for both conditions are included herein.

Detention ponds which are publicly owned and maintained were included in the SWMM routing. These ponds include the City Park detention pond (Design Point 361), the HKS channel (Design Point 346) and the Bromley Creek pond (Design Point 333). Storage-discharge relationships were taken from as-built construction drawings, drainage studies approved by the City of Brighton and the 2-foot contour mapping provided for the project. Due to the small size of the City park detention pond (Design Point 361) and the high flow rate and volume of runoff entering the pond, the SWMM program was not able to achieve a proper mass-balance to model the detention pond inflow and outflow for the 100-year event. This pond was removed to model the 100-year event. Because the pond is small and fills quickly, the peak runoff from the pond and at the watershed study limit (design point 157) did not change when the pond was removed.

E. MODELING RESULTS

A summary of the baseline model peak runoff rates are presented in Table A-5. The 2-, 5-, 10-, and 100-year peak runoff rates for the existing development, future development with closed basins and future development without closed basins are presented. The future development condition was modeled with and without the closed basins so that the effect of eliminating the closed basins, when development occurs, could be determined. Due to the large number of conveyance elements required to route the flow, and the limited number of elements allowed in the SWMM program, an element was not assigned to the outflow point of each sub-watershed. However, an additional SWMM run was made with no routing to prepare a concise sub-watershed peak flow summary of the CUHP generated sub-watershed flows. This summary of sub-watershed peak flows for existing and future conditions is presented in Table A-6. Typical runoff hydrographs at primary design points are presented in Figure III-1A through III-1D. The location of the design points and peak flow rates at these design points are presented in Table III-1. The future peak flow rates reported in Table III-1 exclude the impacts of existing closed basins. These flow rates are baseline flow rates and do not consider the effects of proposed master planned detention and outfall system improvements.

Table III-1

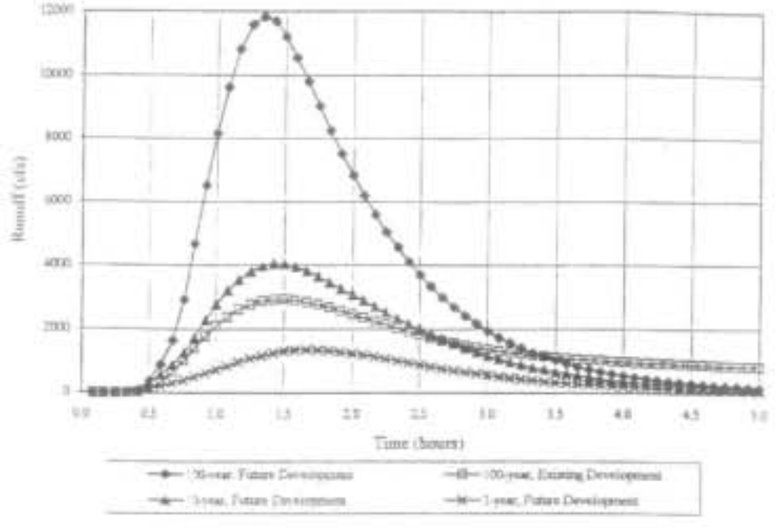
Peak Flow Rates At Selected Design Points

Location	WRC Design Point	Peak Flow Rate			
		100-Yr Existing (cfs)	2-Yr. Future (cfs)	10-Yr Future (cfs)	100-Yr. Future (cfs)
North 7th Avenue & Baseline Road	157	2927	1366	4054	11850
City Park detention pond	361	2067	1163	3401	9857
South 9th Ave. & Bromley Lane	383	787	1049	2821	7705
August Lane and 19th Avenue	124	545	239	668	1800
East 136th Avenue and dirt road ½ mile East of Chambers Road	149	22	50	111	254
Bromley Lane and 15th Street	347	470	592	1583	4262
East 144th Avenue and Chambers Road	175	100	213	611	1754

FIGURE III-1A

(Design Point 157)

HYDROGRAPH AT NORTH 7TH AVE. AND BASELINE ROAD



(Design Point 361)

HYDROGRAPH AT CITY PARK DETENTION POND

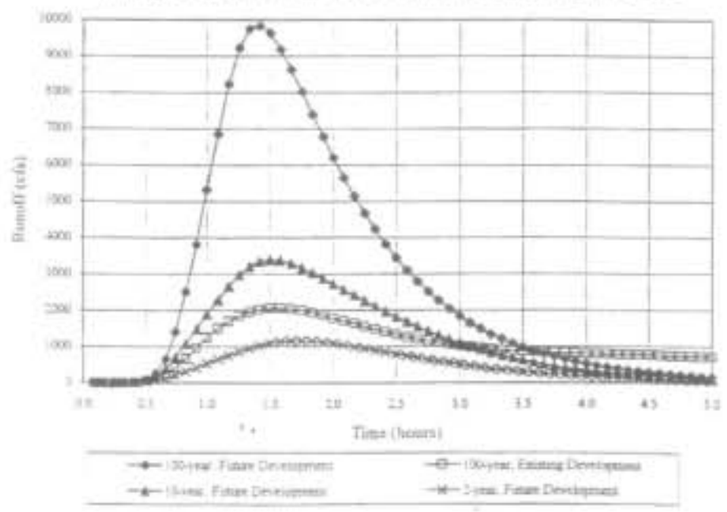
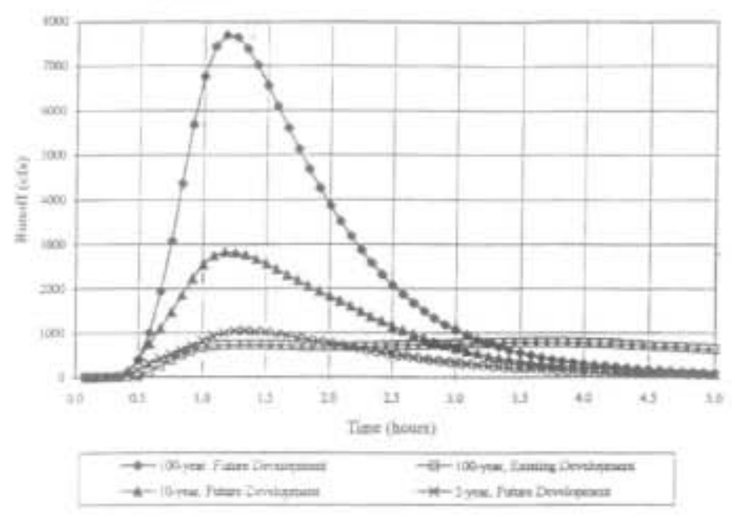


FIGURE III-1B

(Design Point 383)

HYDROGRAPH AT SOUTH 9TH AVE. & BROMLEY LANE



(Design Point 124)

HYDROGRAPH AT AUGUST LANE AND 19TH AVENUE

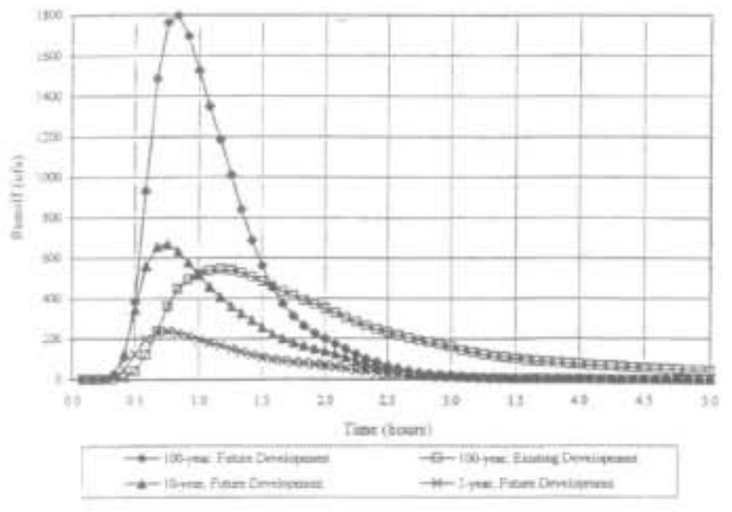


FIGURE III-1C

(Design Point 149)

HYDROGRAPH AT EAST 136TH AVENUE AND

DIRT ROAD 1/2 MILE EAST OF CHAMBERS ROAD

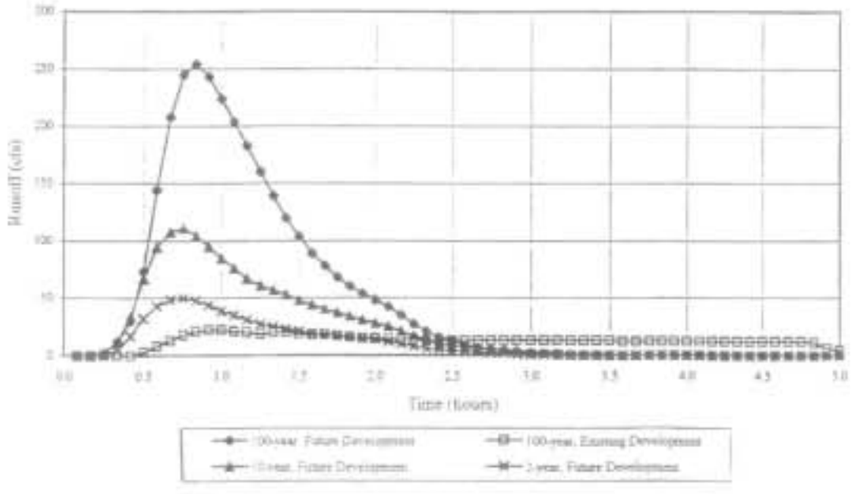
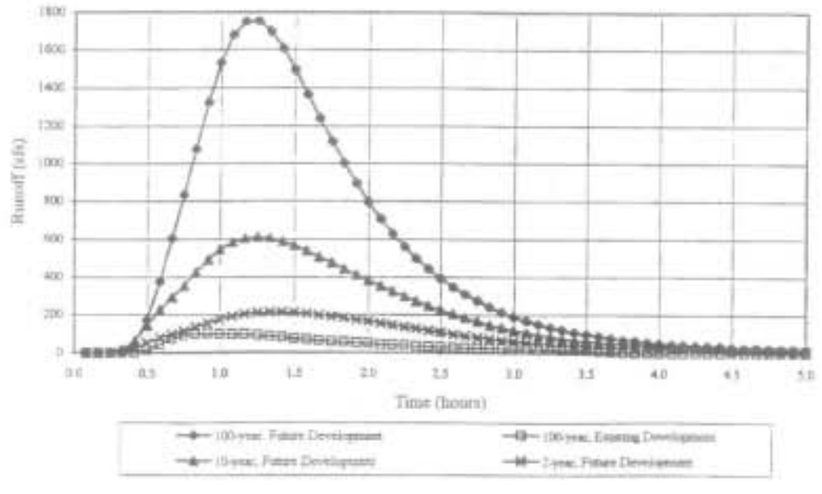


FIGURE III-1D

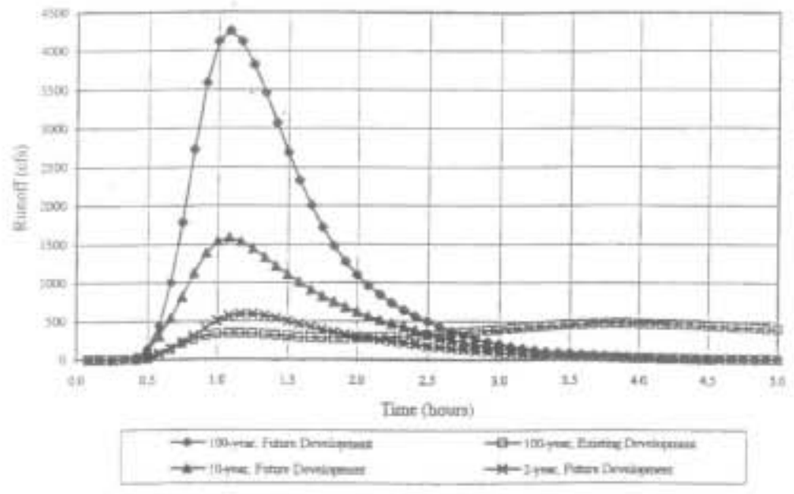
(Design Point 175)

HYDROGRAPH AT EAST 144TH AVE. AND CHAMBERS ROAD



(Design Point 347)

HYDROGRAPH AT BROMLEY LANE AND 15TH STREET



The area north of Bromley Lane and west of the Fulton Ditch was modeled by McLaughlin Water Engineers (MWE) in 1991 (Reference 8). Table III-2 presents a comparison of the MWE and WRC peak runoff rates at select points. For the purposes of the MWE modeling, no runoff was considered to enter the City from east of the Fulton Ditch nor from south of Bromley Lane. WRC's baseline analysis considers that, without improvements, runoff can and will enter the City from these two areas. The large difference in flow rates is due to the additional areas south of Bromley Lane and east of the Fulton Ditch being included in WRC's model.

Table III-2
Comparison of MWE and WRC Peak Flow Rates
(Future Development Conditions Without Closed Basins)

Location	WRC Design Point	Peak Flow Rate					
		MWE			WRC		
		2-Yr (cfs)	10-Yr (cfs)	100-Yr (cfs)	2-Yr. (cfs)	10-Yr. (cfs)	100-Yr (cfs)
Brighton Park	361	280	610	1485	1163	3401	9857
Bridge Street/27th Avenue	307	120	250	520	212	606	1630
Southern Street/8th Avenue	351	55	125	290	1008	2817	8085

CHANGES AND ADDITIONAL INFORMATION FOR 2006 UPDATE

GENERAL

Subsequent to the 1998 Outfall Systems Plan, the study area was expanded to include additional area north of Baseline Road. This resulted in the addition of 12 new sub-watersheds. However, changes to the south, east, and core areas resulted in a net reduction of sub-watersheds in those areas, bringing the total number of sub-watersheds tributary to the study area to 132.

STORM WATER MANAGEMENT MODEL

With the addition of master plan improvements that limit the amount of flow entering the City Core area from the east, the City Park detention pond (Brighton Park Lake, Design Point 361) plays an important role in control of the more frequent storm events. The proposed 19th Avenue storm sewer drains to this facility, thus making it an integral part of the overall core area system.

Furthermore, Design Point 157 (just north of Brighton Park Lake) remains the outfall point for that facility, but now drains to the north outfall system via Reach N3. With the expanded study area limits, Design Point 157 is at the boundary of only the core area, not the overall study area.

IV. HYDRAULIC ANALYSIS

A. GENERAL

The hydraulic analysis was performed to estimate the capacities of existing storm sewers. The estimated capacities were used as a basis for determining problem areas. The major existing facilities are presented on Figures A-9 and A-10.

B. EVALUATION OF EXISTING FACILITIES

Storm sewer capacities were estimated using normal depth pipe flow computations. Information obtained from as-built construction drawings were used in the analysis. The estimated capacities are presented in Table IV-1.

C. IRRIGATION DITCHES

The study area is traversed by a number of irrigation ditches. These irrigation conveyance systems include the Brighton Lateral, Fulton Ditch, Fulton Lateral, and McCann Ditch. The primary function of these ditches is to convey irrigation water to the irrigated areas. Prior to the beginning of irrigation practices in the study area, storm runoff was conveyed as sheet flow into natural drainageways, and ultimately was conveyed to the South Platte River. Since the construction of the subject ditches, they have intercepted and conveyed storm runoff to various degrees.

Irrigation ditches are designed with flat slopes and limited carrying capacity, which decreases in the downstream direction. Because of these physical limitations, irrigation ditches typically cannot be used for major drainageway outfall systems. Furthermore, after urbanization and the end of irrigation practices, they are often abandoned. In certain instances, however, irrigation ditches have been successfully utilized as outfall points for the initial drainage system, but only after a thorough hydrological and hydraulic analysis. The approval of the ditches' owners must be secured if they are to be used to convey storm runoff. The owners' liability increases with the acceptance of storm runoff over and above its primary function of delivering irrigation water. In the past, communities have entered into specific agreements that allow the discharge of storm runoff into the irrigation conveyance and storage systems, subject to certain constraints.

It is our understanding that the Brighton Lateral flows have been decreasing in recent years. It is possible that at some future time, the primary functions of this ditch will cease. If the City of Brighton desires to utilize this ditch for drainage conveyance, it must:

TABLE IV-1
EXISTING DRAINAGE FACILITIES
ESTIMATED CAPACITIES

FEATURE DESCRIPTION	EST. SLOPE	PIPE DIAMETER (IN)	TYPE OF PIPE	EST. CAPACITY (cfs)	EXISTING FLOWS Q2 (cfs)	EXISTING FLOWS Q10 (cfs)	EXISTING FLOWS Q100 (cfs)	FUTURE FLOWS Q2 (cfs)	FUTURE FLOWS Q10 (cfs)	FUTURE FLOWS Q100 (cfs)
DET POND (BASIN 33) > BROMLEY/H.K.S CHANNEL	0.90%	27	RCP	24	16	48	121	27	63	142
BROMLEY/H.K.S CHANNEL > BROMLEY/6TH	0.13%	48	RCP	41	5	100	534	509	2061	142
BROMLEY/6TH > BROMLEY/4TH	0.50%	42	RCP	58	29	89	223	155	277	496
BROMLEY/4TH > JESSUP/4TH	0.50%	42	RCP	58	0	0	13	19	72	197
JESSUP/8TH > JESSUP/4TH	0.12%	48	RCP	40	46	219	1012	801	2826	6157
MATHER/4TH > JESSUP/4TH	0.08%	42	RCP	23	0	61	225	0	63	227
JESSUP/4TH > JESSUP/FULTON AVE	0.10%	66	RCP	86	80	170	352	87	173	355
FULTON/BROMLEY + 900'S > FULTON/JESSUP	0.22%	42	RCP	38	9	23	59	68	129	277
JESSUP/FULTON AVE > S OUTFALL CHANNEL	0.31%	72	RCP	192	82	108	125	117	124	124
MATHER/4TH > BRIDGE/4TH	0.50%	24	RCP	13	16	95	311	16	97	315
BRIDGE/4TH > LONGSPEAK/4TH	0.50%	24	RCP	13	30	108	354	30	110	357
LONGSPEAK/4TH > WWTP OUTFALL	0.50%	36	RCP	38	75	161	341	75	161	341
BRIDGE/12TH > BRIDGE/9TH	0.14%	18	RCP	3	203	505	1285	260	835	1694
BRIDGE/9TH > DENVER/9TH	0.40%	24	RCP	12	NA	NA	NA	NA	NA	NA
DENVER/9TH > LONGSPEAK/4TH	0.23%	36	RCP	26	253	726	2184	877	3324	7585
DENVER/11TH > DENVER/9TH	0.09%	30	RCP	10	NA	NA	NA	NA	NA	NA
LONGSPEAK/16TH > DENVER/16TH	0.50%	36	RCP	38	12	70	221	12	70	221
DENVER/16TH > DENVER/11TH	0.50%	42	RCP	58	12	70	221	12	70	221
DENVER/11TH > BRIGHTON PARK	0.46%	42	RCP	55	71	113	207	71	113	207

1. Conduct a detailed hydraulic analysis of the ditch to determine its carrying capacity and its suitability to convey storm runoff.
2. Improve the capacity of the downstream reaches of the ditch, as necessary.
3. Ensure that the City obtains an easement for the drainage and maintenance access purposes after the ditch ceases its primary functions of conveying irrigation water.
4. Secure a terminal outfall point for the ditch that may be located outside the current study area for this project.

For the purposes of this study, it is assumed that the proposed drainage improvements will be implemented to allow a complete separation of stormwater runoff from irrigation water.

D. DRAINAGE PROBLEM AREAS

Drainage problem areas were identified by comparing the capacities of the existing system to the developed condition 2-year, 5-year and 100-year peak flows. In general, future development east and south of the City will significantly increase storm runoff into the City during all storm events. The City's existing storm sewer is inadequate to convey 100-year developed flows. The City has adopted and is implementing outfall system improvements that will provide for conveyance of the 2-year storm runoff from that portion of the City that is north of Bromley Lane and west of the Fulton Ditch. These improvements do not have capacity to convey storm runoff from larger storm events or from those areas south and east of the City.

As development occurs to the south and east of the City, runoff rates will increase for all storm events. The increased runoff rates are due to the urbanization of undeveloped areas and the elimination of the closed basins that currently exist. The closed basins retain storm runoff and keep it from flowing into the City. Because there is no defined outfall system, the increased storm runoff will flow into the City at various locations. Table IV-2 presents the storm runoff rates at major select locations from the baseline hydrologic analysis for existing and future development conditions.

Table IV-2
Comparison of Existing and Future Peak Flow Rates at Select Design Points
Without Master Plan Improvements

Location	Design Point	2-year		5-year		100-year	
		Existing (cfs)	Future (cfs)	Existing (cfs)	Future (cfs)	Existing (cfs)	Future (cfs)
South 9th Avenue and Bromley Lane	383	27	1049	115	2111	787	7705
Mather Street and Brighton Lateral	314	0	34	9	67	66	179
Murtle Street and Fulton Ditch	307	78	212	156	447	526	1630
Baseline Road and Fulton Ditch	339	8	109	58	217	339	685

V. ALTERNATIVES DEVELOPMENT AND SELECTION

Note: Some portions of this Section V: Alternatives Development and Selection were affected by the 2006 Update of the Outfall Systems Plan. Additional text, outlining changes and presenting updated information, follows this section.

A. CONCEPTUAL ALTERNATIVES DEVELOPMENT

Review of the existing and potential drainage problems resulted in the development of several initial conceptual alternative outfall systems which were evaluated and reviewed with the project participants and sponsors. These conceptual alternatives included:

- Full Conveyance for the 2- and 5-year developed storm runoff without any detention. Conveyance for the 100-year developed storm runoff was not considered a feasible alternative. Future 100-year runoff into the City would increase significantly.

- Require on-site 100-year detention for all future developments, pursuant to the current criteria. The closed basins that presently exist retain storm runoff, reducing the runoff that flows into the City. It is anticipated that future development will eliminate the closed basins. With the elimination of the closed basins and the combined 100-year release rate from all the future on-site detention ponds, runoff into the City would be significantly higher than existing conditions 100-year runoff and would require extremely large conveyance facilities.

- Require on-site extended detention for the 5-year storm event for all future development.

- Require sub-regional detention with restricted release rates for the 100-year storm event.

- Require minimizing directly connected impervious areas (MDCIA) for future developments. This drainage concept directs storm runoff for the minor storm events over grass strips and through grass-lined roadside ditches. This provides an opportunity to enhance storm water quality and allows for additional stormwater infiltration.

Combinations of open channels and storm sewers for various storm events were also considered. After review of the various conceptual alternatives by the project review committee and the City Council at a work session on February 10, 1997 (presentation materials are included in Appendix D), the analysis focused on alternatives that would:

1. Use the minimizing directly connected impervious areas (MDCIA) concept on new collector and arterial streets and also in rural residential areas with lot size of 1.5 acres or more. (Subsequently, this was adjusted to 1.0 acres per discussions with City Staff).

2. Continue to use curb and gutter in the urban residential areas.

3. Use sub-regional detention with 5-year extended detention as a standard for new development.

A copy of the City's March 10, 1997, letter is included in Appendix E. In addition, direction was provided to consider only those alternatives that would not increase the 100-year runoff into the City. A legal opinion that was used in the initial evaluation of the alternatives is included in Appendix G.

B. FINAL ALTERNATIVES DEVELOPMENT

The criteria used to develop the final alternatives was to maintain or reduce future flow rates into the City to the same 100-year runoff rate that presently occurs under existing conditions; reduce the size of conveyance facilities by incorporating sub-regional detention requirements into the plan; and separate stormwater and irrigation water.

Because there are no defined outfalls in the study area, future conveyance systems are generally aligned with proposed collector and arterial streets and discharge away from the existing City's storm sewer system. This significantly alters the SWMM routing from the baseline presented in the Hydrology Report (Reference 1). Therefore, the SWMM routing schematics and SWMM routing element maps used for the master plan outfall system hydrology are presented in Figures H-1 (A-F) and H-2 and H-3, respectively. Figures H-4 and H-5 present the revised sub-watershed maps for use with the master plan outfall system hydrology. Figure H-6 presents typical future hydrographs at selected design points. Revised CUHP sub-watershed parameters, SWMM Routing Element parameters, and Peak Flow Summary for future development are presented in Tables H-1 through H-4. It should be noted that the SWMM model does not allow for use of 25 detention elements and all the diversion elements in the baseline model. Therefore, for the Master Plan model, the diversion elements are not used. If needed in the future, the City portion of the model could be separated out and the diversion elements reinstated.

The study area was separated into two areas for describing the alternatives. The south area includes the watershed south of Bromley Lane. Storm runoff from the south area is conveyed to facilities south of Bromley Lane and then west to the South Platte River. The east area includes the watershed north of Bromley Lane and east of the Fulton Ditch. Storm runoff from the east area, except two sub-watersheds, is conveyed north to Baseline Road and then west to the South Platte River. The south and east areas are delineated on Figures H-4 and 5. Two sub-watersheds (17 and 29) are located in the east area but drain into the south area at Bromley Lane and Buckley Road. For purposes and analysis (and preliminary design) these two sub-watersheds were considered to be in the east area.

1. SUB-REGIONAL DETENTION BASIN ALTERNATIVES

The City Council selected a sub-regional detention system as the primary basis upon which alternative conveyance systems and sub-regional detention basin sizes would be based. For the alternatives analysis, the conceptual location of 24 sub-regional detention basins and tributary areas were identified (See Figures V-1 and 2). The size of the tributary areas varied from 107 acres to 413 acres. The sub-regional detention basins were analyzed to restrict outflow during the 5-year and 100-year storm events. For all alternatives, as a result, three south area and two east area alternatives were developed for investigation.

The basins were proposed to be designed to detain the storm runoff from a 5-year storm event and release it over a 40-hour period. The resulting 5-year basin release rates were from 5 cfs to 26 cfs. Two alternative detention basin sizings were used for the 100-year event. For the south area and Alternative N°. 1E for the east area, the 100-year storm event would be detained and released at a rate of 0.50 cfs/acre of tributary area. The resulting 100-year basin releases were from 53 cfs to 206 cfs. The basin volumes range from 10.6 acre-feet to 54.6 acre-feet.

In the south area, the large size and flat slope of the watershed spreads out the timing of the sub-watershed hydrographs such that the peaks of these hydrographs are distributed over time. Thus the peak flow from these watersheds is much less than the sum of the sub-watershed peak flows. In the east area, however, watershed conditions are just the opposite. The steepness of the east area results in hydrograph peaks that accumulate at approximately the same time. Thus, the peak flow from these east area watersheds is close to the summation of the sub-watershed peak flows.

As a result, the magnitude of increase of the future developed peak runoff rates for the east area is greater than that for the south area. To account for this, a more restrictive detention alternative for the east area was considered in order to balance the cost of detention facilities and the cost of conveyance facilities. In Alternative N°. 2E the 100-year storm event would be detained and released at a rate of 0.10 cfs per acre of tributary area. The resulting 100-year release rates were from 17 cfs to 184 cfs. The basin volumes range from 10.6 to 63.8 acre-feet.

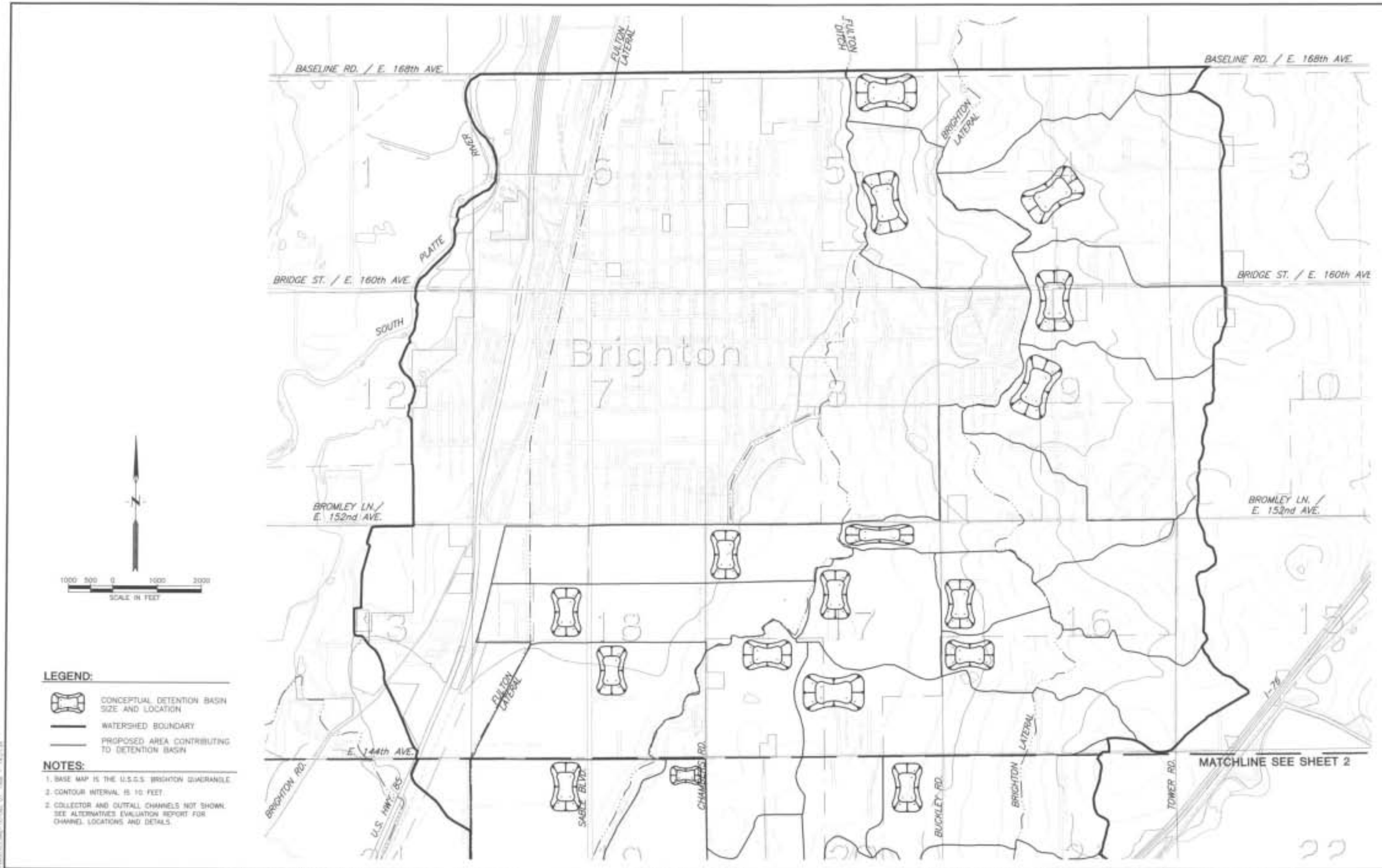
In the alternatives analysis, the estimated land requirement for the sub-regional detention basins was determined by assuming an average basin depth of 2 feet (This was refined in the preliminary design phase). An additional 30 feet was added to the basin perimeter to provide for maintenance access and 1-foot of freeboard.

Tables B-1 and B-2 present a summary of the 100-year sub-regional detention basin volumes, right-of-way requirements and estimated costs used in the alternatives evaluation. The estimated construction cost for the basins included the cost of excavation, native grass seeding and mulching. An additional $25,000 was included in the estimated cost for outlet structure construction.

2. CONVEYANCE SYSTEM ALTERNATIVES

a. South Side Alternatives

Alternative N°. 1S consisted of a conveyance system with capacity to carry the 100-year release from the sub-regional ponds. Along arterial and major collector streets, the conveyance would be an open channel with 4:1 side slopes. The bottom width of the channel would vary depending on peak flow. Maximum depth of flow would be 5.0 feet. This alternative included an open channel along 150th Avenue (Reaches 112, 37, 38, and



LEGEND:

- CONCEPTUAL DETENTION BASIN SIZE AND LOCATION
- WATERSHED BOUNDARY
- PROPOSED AREA CONTRIBUTING TO DETENTION BASIN

NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.
2. COLLECTOR AND OUTFALL CHANNELS NOT SHOWN. SEE ALTERNATIVES EVALUATION REPORT FOR CHANNEL LOCATIONS AND DETAILS.

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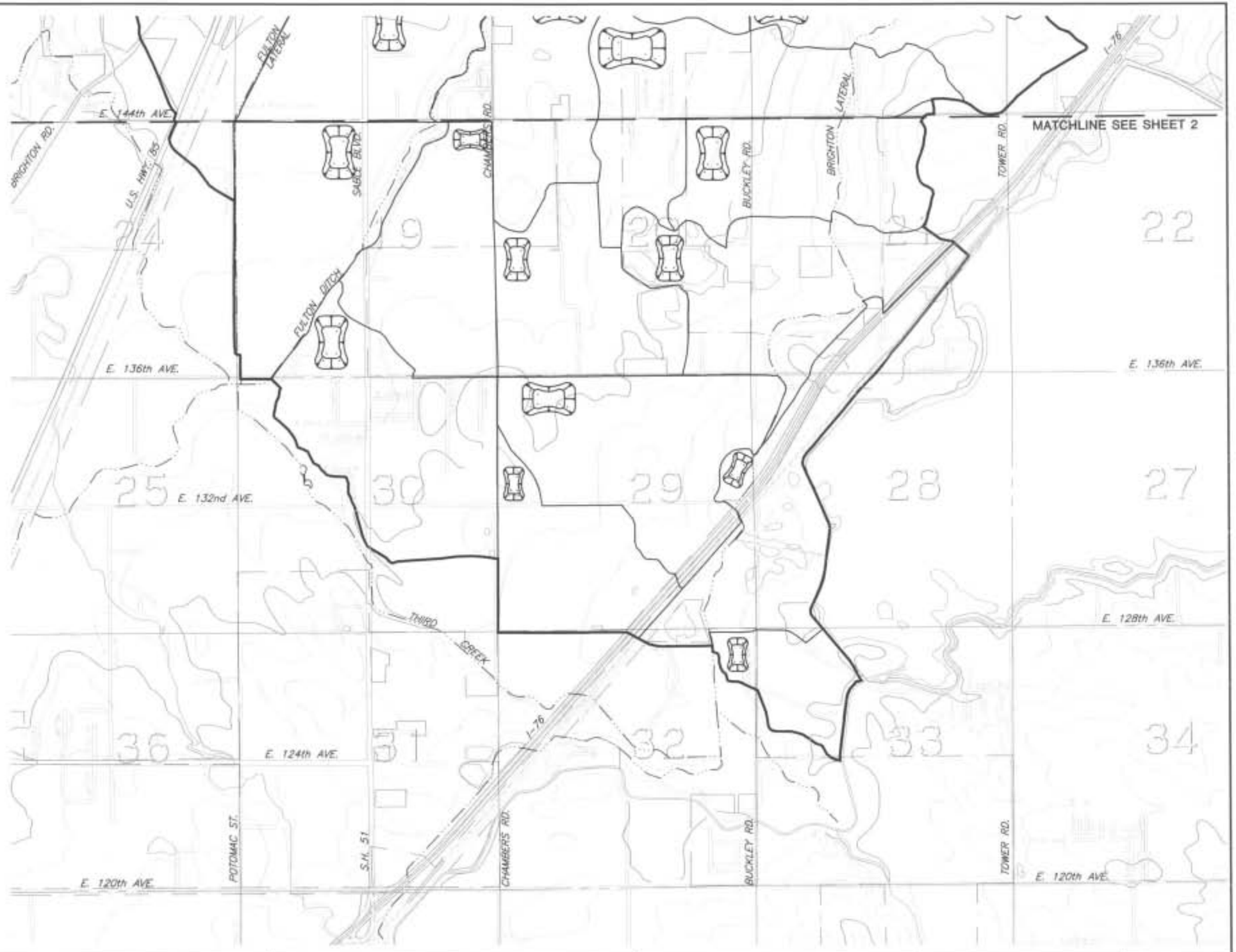
DESIGNED	DPH	DATE 09-17-98
DRAWN	EJM	DATE 10-08-98
CHECKED		DATE
REVISED		DATE
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

ALTERNATIVE ANALYSIS
SUBREGIONAL
DETENTION BASINS

FIGURE
V-1



1000 500 0 1000 2000
SCALE IN FEET

LEGEND:

- CONCEPTUAL DETENTION BASIN SIZE AND LOCATION
- WATERSHED BOUNDARY
- PROPOSED AREA CONTRIBUTING TO DETENTION BASIN

NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.
2. COLLECTOR AND OUTFALL CHANNELS NOT SHOWN. SEE ALTERNATIVES EVALUATION REPORT FOR CHANNEL LOCATIONS AND DETAILS.

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	DRAWN CJM	DATE 10-08-96
	CHECKED	DATE
	REVISED	DATE
	AS-BUILT	DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

ALTERNATIVE ANALYSIS
SUBREGIONAL
DETENTION BASINS

FIGURE
V-2

47). A 6'H x 22'W storm sewer would need to be constructed to convey runoff under the railroad and U.S. Highway 85. West of the highway the storm sewer would discharge into an open channel that would convey the flow to the South Platte River. With this alternative, the developed storm runoff from the south area would be diverted around the City for all storm events.

Alternative Nº. 2S consists of the conveyance system described in Alternative Nº. 1. However, along 150th Avenue (Reaches 112, 37, 38, and 47) the open channel would be replaced with a 6' H x 22' W storm sewer. With this alternative, the developed storm runoff from the south area would be diverted around the City for all storm events.

Alternative Nº. 3S consists of the conveyance system described in Alternative Nº. 1. Along 150th Avenue (Reaches 112, 37,38, and 47) the open channel would be replaced with a 6' H x 12' W i storm sewer sized to convey 860 cfs. This flow rate is the difference between the 100-year historic flow rate and the 100-year developed flow rate from the sub-regional detention basins. With this alternative the historic 100-year runoff of approximately 800 cfs will continue to flow into the City at South 9th Avenue and Bromley Lane from the south area. Approximately 1080 cfs will flow into the City from the east area.

b. East Side Alternatives

Alternative Nº. 1E consisted of a conveyance system with capacity to carry the 100-year release from the sub-regional basins. The conveyance system would consist of open channels with 4:1 side slopes and varying bottom widths. Maximum depth of flow would be 5.0 feet. Stormwater would be collected in the channel east of the Fulton Ditch and conveyed north to Baseline Road. It would then be conveyed west along Baseline Road, in a combination of open channels and 6' high by 8'wide storm sewers. The conveyance system would cross under the railroad and U.S. Highway 85 and discharge into the South Platte River. The proposed outfall would be parallel to the existing 54-inch storm sewer in Baseline Road. The existing system was designed to convey the 2-year storm runoff from the existing developed portion of the City and does not have capacity to convey the 100-year detention basin releases.

Alternative Nº. 2E is a conveyance system alternative for the area east of the City that is based upon the more restrictive detention basin release rate described in Section V.B.1 (0.1 cfs per acre of tributary area) for the east area sub-regional detention basins. The conveyance system alignment would be the same as that described for Alternative Nº. 1E. A 54-inch storm sewer would convey flow under U.S. Highway 85 and the railroad.

An example of the typical cross-sections of outfall channels is presented in Figures B-1 and B-2. Preliminary cost estimates were prepared for each alternative element. The preliminary costs include: land acquisition costs, improvement construction cost, and construction contingencies and engineering (25 percent for construction contingencies; 10 percent for engineering; 10 percent for legal and administration; and 5 percent for contractor mobilization). The unit-cost data used as the basis for the alternative analysis is presented in Table B-10. Tables B-3 thru B-7 present cost estimates for the conveyance system alternatives. The conveyance alternatives could require culverts at street intersections for the roadside ditches. Estimated costs for the culvert crossings at principal arterial and commercial collector streets are presented in Table B-8 and B-9. It was assumed that the cost of culvert crossing at the intermediate streets would be paid for by the property owners and/or developers. An alternatives cost estimate summary is presented in Table V-1. In this table the total estimated cost of the conveyance alternatives, street crossings and sub-regional detention basins are presented separately for the south side and the east side outfall systems.

TABLE V-1
ALTERNATIVES COST ESTIMATE SUMMARY

EAST AREA

	Alternative No. 1E	Alternative No. 2E
Sub-regional Detention Ponds	$6,810,798	$8,236,789
Street Crossings	$891,000	$566,250
Conveyance Costs	$14,797,751	$8,704,704
TOTALS	$22,499,549	$17,507,743

SOUTH AREA

	Alternative No. 1S	Alternative No. 2S	Alternative No. 3S
Sub-regional Detention Ponds	$24,120,557	$24,120,557	$24,120,557
Street Crossings	$3,899,250	$3,899,250	$3,899,250
Conveyance Costs	$28,470,062	$33,899,766	$31,538,368
TOTALS	$56,489,869	$61,919,573	$59,558,175

C. RECOMMENDED ALTERNATIVE

Review of the alternatives evaluated showed that Alternative N°. 1S for the south area and Alternative N°. 2E for the east area were the most cost effective and beneficial outfall system for the study area. These alternatives provide full conveyance of the detained, 100-year developed storm runoff from the undeveloped areas south of Bromley Lane and east of the Fulton Ditch, around the present extent of the core area of the City of Brighton.

The recommended alternative included open channels and extended detention for the minor storm events which would provide opportunities to enhance the quality of stormwater runoff and promote infiltration to the groundwater. The recommended alternative also provided for a detention criteria that is in balance with the recommended outfall systems capacities and protects the City of Brighton from increased flooding and resultant damages. It is more restrictive than current criteria but is necessary to reduce the size of the future conveyance facilities.

The total estimated cost of the recommended outfall systems, including estimated right-of-way value, engineering, legal and administrative costs is $73,997,613 (This cost estimate was refined during the preliminary design phase and is included in Chapter VI). Approximately 25 percent of the total cost is for estimated land and right-of-way values with an additional 25 percent for construction contingencies, engineering, engineering, legal, administration and contractor mobilization. Without this system or a restrictive total 100-year on-site retention policy, the City of Brighton will experience ever increasing drainage and flooding problems as the Brighton watershed is developed.

2006 Update

In 2005, WRC Engineering, Inc. submitted to the City of Brighton a report titled "North and Core City Outfall System Alternatives Analysis" that presented 100-year storm event outfall alternatives for the area north of the City Core area. Also presented were alternatives for two proposed minor storm outfall systems for certain areas within the City Core area. Text from the North Outfall System Alternatives Analysis is included here, with figures from the report following the text:

CITY OF BRIGHTON
NORTH AND CORE CITY OUTFALL SYSTEM
ALTERNATIVES ANALYSIS

WRC Engineering, Inc. (WRC) has prepared an analysis of alternative 2-year and 100-year storm drainage outfall systems for the northern area of the City of Brighton. These alternatives were developed to address drainage problems identified upon review of the capacity of the existing drainage outfall systems as compared to the estimated existing and future peak stormwater flows in this area.

The alternatives have been developed to address two specific areas of the City of Brighton. First, outfall system improvements are needed to solve existing drainage problems in the Core City study area (Figure V-3). Second, a future outfall system is needed to serve the area of the City north of Baseline Road (North study area) as well as the area south of Baseline Road but east of the Core City area (East study area).

The Core City study area potentially served by a major northern outfall system extends to Baseline Road on the north, to the South Platte River on the west, and to Bromley Lane on the south. The Core City study area boundary on the east varies from the Fulton Ditch north of Bridge Street, to 33rd Avenue from Bridge Street to Southern Street, and to 27th Avenue from Southern Street to Bromley Lane.

The storm sewer system in this area was primarily constructed during the initial development of the City. Several upgrades to the system have been constructed over the past 15 years to relieve the severe deficit capacity of the original storm sewer system. These include outfall storm sewers on Jessup Street, Long's Peak, and Baseline Road, as well as internal storm sewer system upgrades on 11th Avenue and Bridge Street. However, some of the Core City area still lacks an adequate outfall system and thus suffers from frequent flooding of streets and private property. For the area north of Baseline Road and east of the Fulton Ditch (the North and East study areas), alternatives are needed to serve future development of these areas as well as convey major storm flows from the Core City area to the South Platte River.

The north outfall system alternatives were developed using a two step process. In the first step, alternatives to provide a 2-year outfall system capacity for the Core City area were developed and analyzed. The second step was to evaluate alternatives for conveyance of 100-year runoff from the Core City area at Baseline Road in conjunction with providing a future 100-year outfall for the North and East study areas.

The existing outfall system's plan for the East study area provides for a new parallel outfall system in Baseline Road. This current study is evaluating alternatives to this parallel system.

2-Year Core City Alternatives

WRC has reviewed the existing storm sewer outfalls for the Core City area to identify areas of deficient outfall system capacity. Presented on Figure V-4 is an overview map of the Core City area showing the various outfall systems as well as approximate service areas. The solid color service areas are areas of the City in which, with minor local storm sewer and inlet improvements, there exists an adequate 2-year storm sewer outfall system. The existing Jessup Street outfall system serves the solid red area approximately south of Jessup Street. The Long's Peak outfall system serves the solid green area mainly west of 5th Avenue. The 11th Avenue and Bridge Street outfall storm sewers serve the solid blue area, mainly the central portion of the Core area up to the City's recreation center and detention pond. The Denver Street and North Channel Systems serve the solid yellow area in the northeast portion of the Core study area. The solid orange area is served by several local storm sewer systems which drain directly to the South Platte River. These local systems may require some minor upgrades to achieve full 2-year capacity. Analysis of these local systems was not included as part of the scope of this project.

The remaining cross-hatched areas are areas which are either not served by an existing major outfall system or where the existing system capacity is already used to serve the solid colored areas. In addition, the existing detention pond and outfall system from the recreation center to the South Platte River in Baseline Road is inadequate to convey the 2-year inflows from the upstream storm systems without additional diversions into the pond.

Two alternative plans were developed for the 2-year outfall systems analysis. Alternative Plan 1 consists of two new Core City systems (See Figure V-5). The first system would extend from the Recreation Center detention pond south along 8th Avenue to Bridge Street. This system would serve the red cross-hatched area except that area north of about Midland Street. This system would require 66" and 78" RCPs to carry up to 160 cfs (2-year storm capacity). The second Core City system would consist of construction of about a 66" RCP system in 19th Avenue from the North Channel to the Fulton Ditch to serve the green-hatched area east of the Fulton Ditch. This system would be designed for a 2-year flow of 170 cfs. For this plan, the Recreation Center detention pond would store about 36 A.F. of 2-year runoff at an elevation of about 4970.8 which is below the current recreation center parking lot. However, based upon original recreation center plans, this would inundate a proposed parking lot northwest of the current parking lot.

In addition, this plan requires all new development within the Core City area to provide on-site detention with a release rate not to exceed 0.1 cfs/acre.

Alternative Plan 2 consists of a new storm sewer outfall from the South Platte River to 8th and Bridge Street (See Figure V-6). Option A would construct this storm sewer along the Long's Peak alignment. Option B would construct this storm sewer along the Midland Street extended alignment. Either of these alignments would serve the red cross-hatched area as well as divert runoff from the solid blue area away from the recreation center detention pond. This diversion frees up some capacity in the recreation center detention pond for further recreation center parking expansion. This plan also includes the previously described 19th Avenue system improvements. The existing Baseline Road outfall system would be at capacity to drain the recreation center detention pond and the remaining cross-hatched areas. This system has benefits in that a small portion of new development in the Core City area may not need on-site detention at a 0.1 cfs/acre release rate. Also, some of the recreation center detention pond storage capacity is available for storage of runoff from the 2-year to about the 5-year storm event.

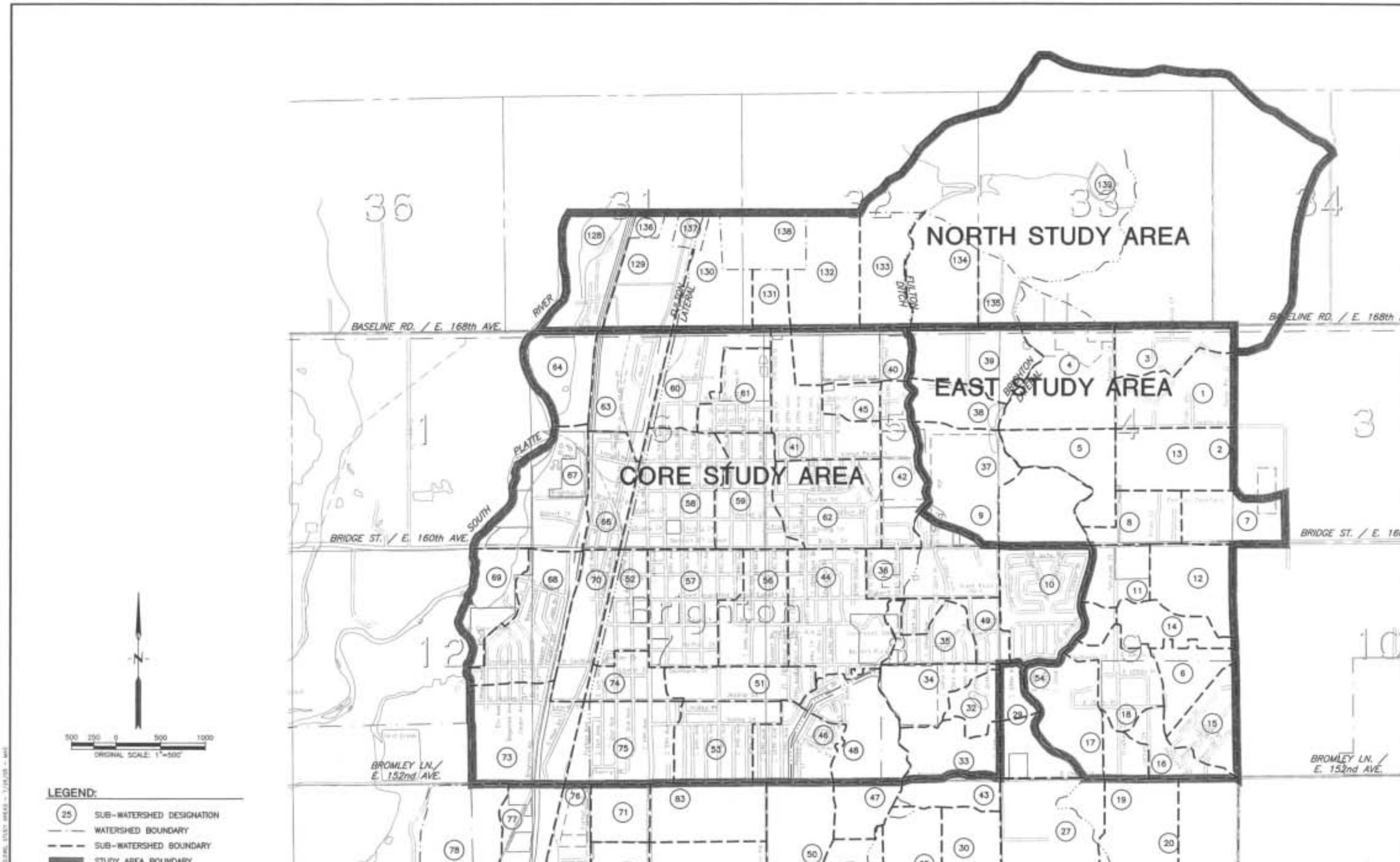
A 2-year outfall system alternative along Baseline Road was also considered but was eliminated due to problems with existing utilities and conflicts with the existing outfall system in Baseline Road. Consideration was also given to allowing runoff from the East study area to drain through new storm sewers into the Core study area. This option was eliminated since it would transfer flows into the Core City area which already is undersized to convey Core City runoff without addition of East study area runoff.

100-Year Outfall Systems Alternatives.

Two Alternative plans were evaluated for a new 100-year outfall for the Core, North and East study areas. Alternative Plan 1 (See Figure V-7) consists of an open channel extending from the South Platte River at Weld County Road 2½ east to the Fulton Lateral (Segment A), thence in a southeastern direction to Baseline Road at about 10th Avenue extended (Segment B), then east along Baseline Road to the Fulton Ditch (Segment C). A second channel would extend from the Fulton Lateral along Weld County Road 2½ east to the Fulton Ditch (Segment D). Segment C would collect the 100-year runoff from the Core City area as well as the detained runoff from the East study area per the current outfall system plan. All areas north of Baseline Road would be allowed to release fully developed 100-year runoff into this outfall system.

Alternative Plan 2 (See Figure V-8) would consist of the same outfall alignments and segments as Alternative Plan 1. In this alternative plan, sub-regional detention ponds would be constructed to reduce the 100-year outflow from the future development areas north of Baseline Road to a 0.5 cfs/acre release rate. This is the same release rate currently used in the Brighton South Outfall Study area but is more than the 0.1 cfs/acre used in the East Study area and the Core City area. Analysis of the 0.1 cfs/acre alternative showed little actual benefit in downstream facility sizes with substantial additional storage and land area required for the modeled alternative ponds.

For purposes of alternative evaluation, the proposed sub-regional detention was modeled as two detention ponds. One pond would be located near the Fulton Lateral at Weld County Road 2½. The second pond would be located downstream of the Fulton Ditch and County Road 2½.



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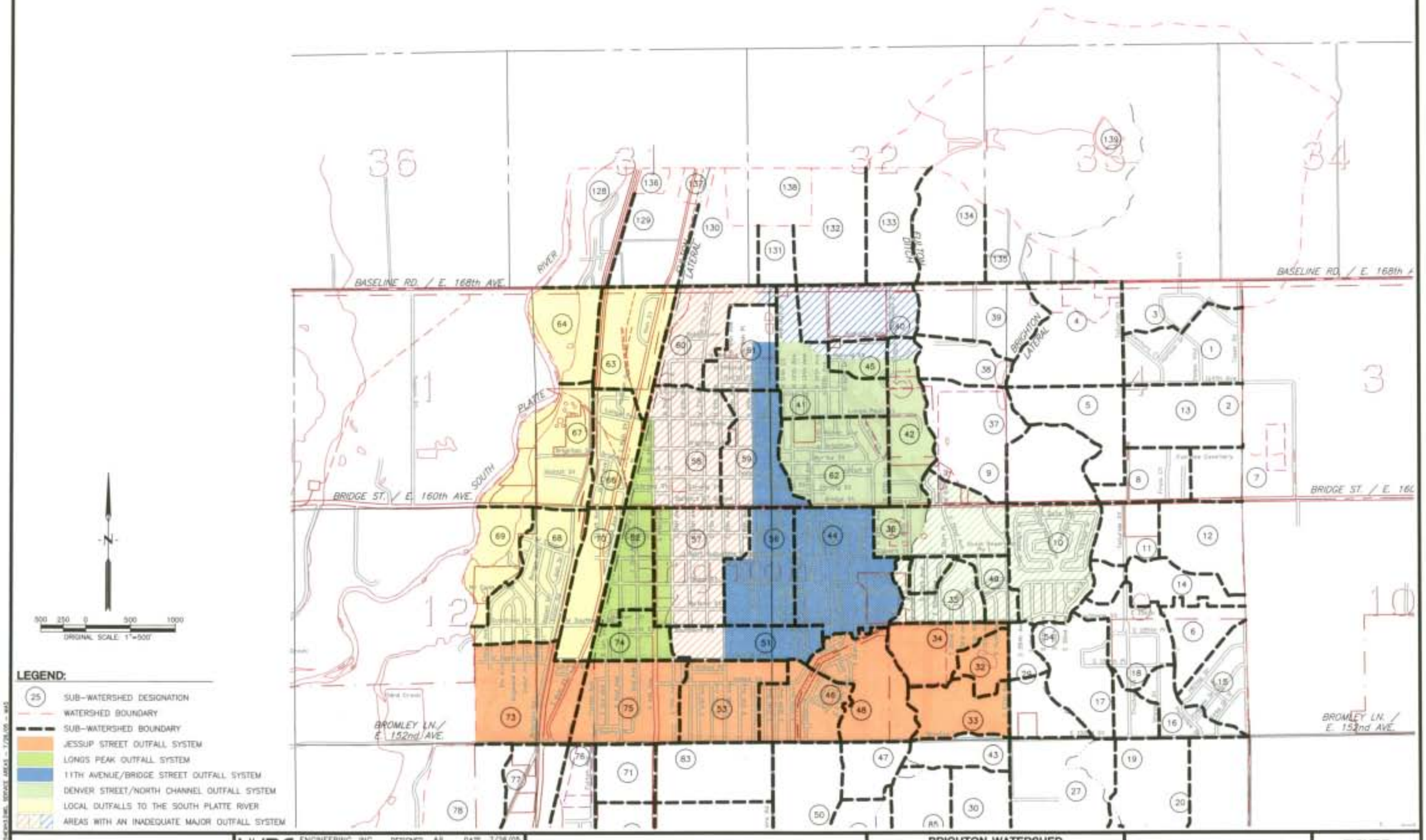
DESIGNED	AJL	DATE	7/26/05
DRAWN	MAS	DATE	7/26/05
CHECKED	AJL	DATE	7/26/05
REVISED		DATE	
AS-BUILT		DATE	

CITY OF BRIGHTON
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

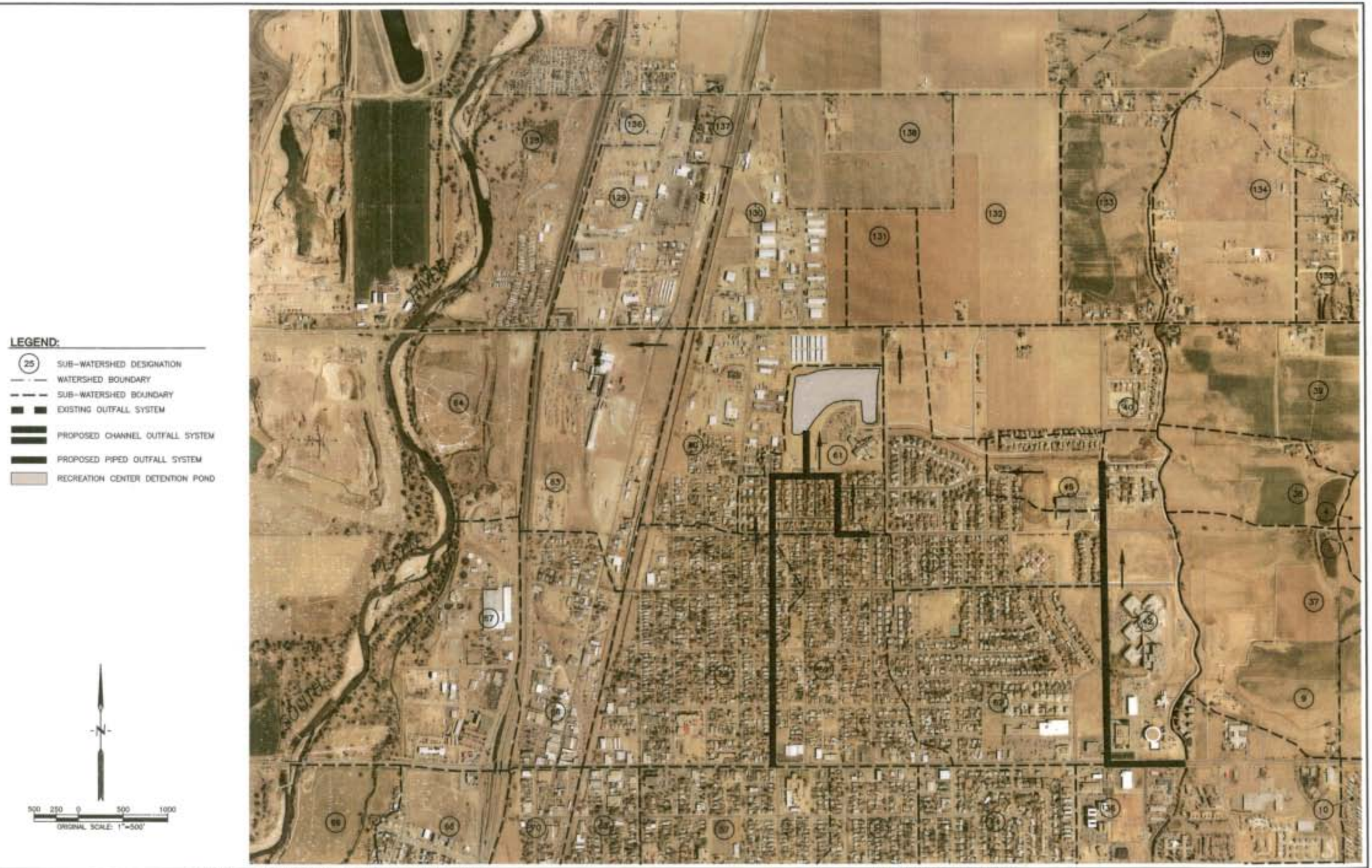
BRIGHTON WATERSHED
NORTH AREA
OUTFALL SYSTEMS PLANNING

NORTH OUTFALL SYSTEM
STUDY AREAS

FIGURE
V-3



WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404, DENVER, COLORADO 80222, PHONE NO (303) 757-8913, FAX NO (303) 759-3208	DESIGNED AL DATE 7/28/05 DRAWN MAS DATE 7/28/05 CHECKED AL DATE 7/28/05 REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED NORTH AREA OUTFALL SYSTEMS PLANNING	CORE CITY AREA SERVICE AREAS	FIGURE V-4



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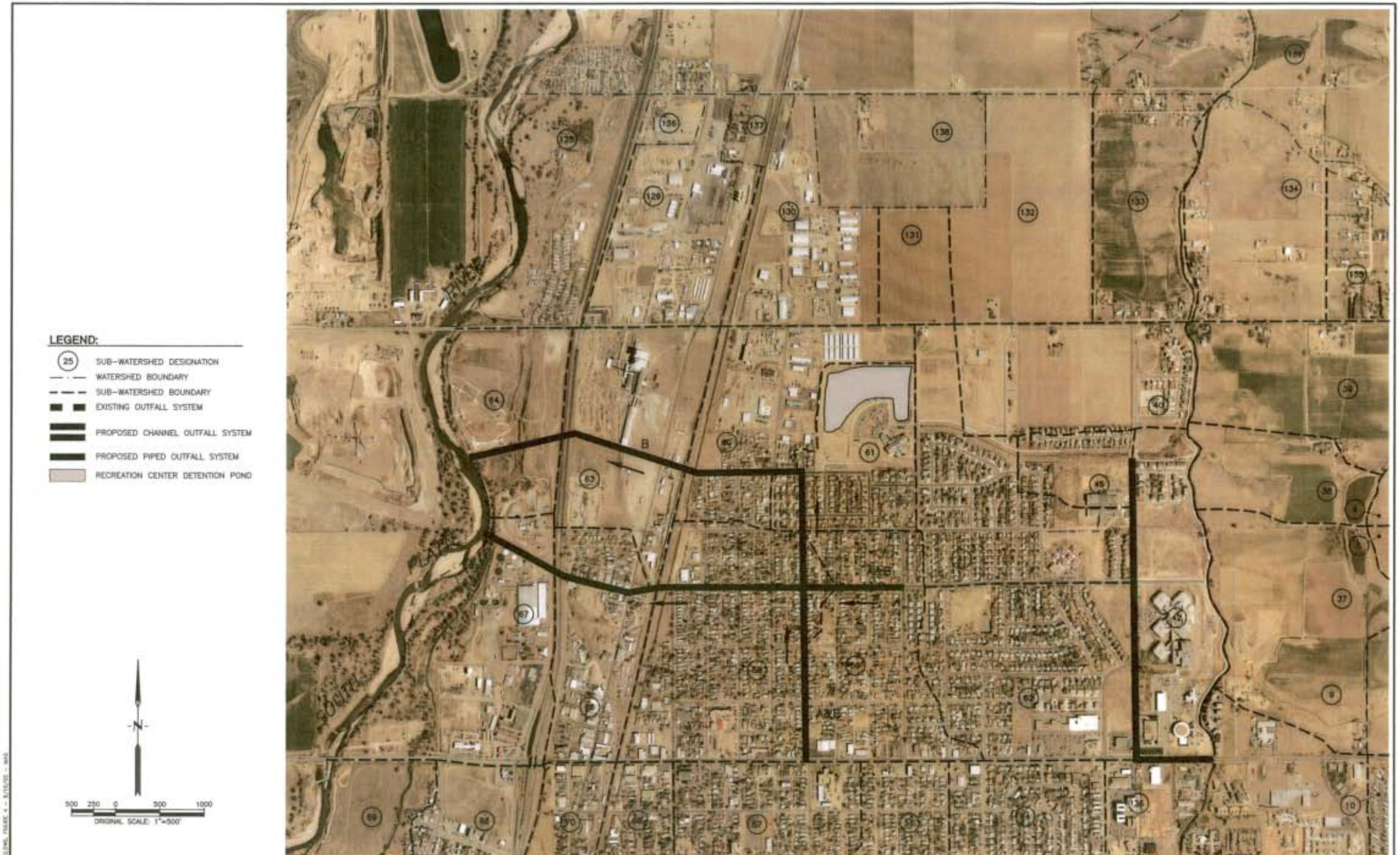

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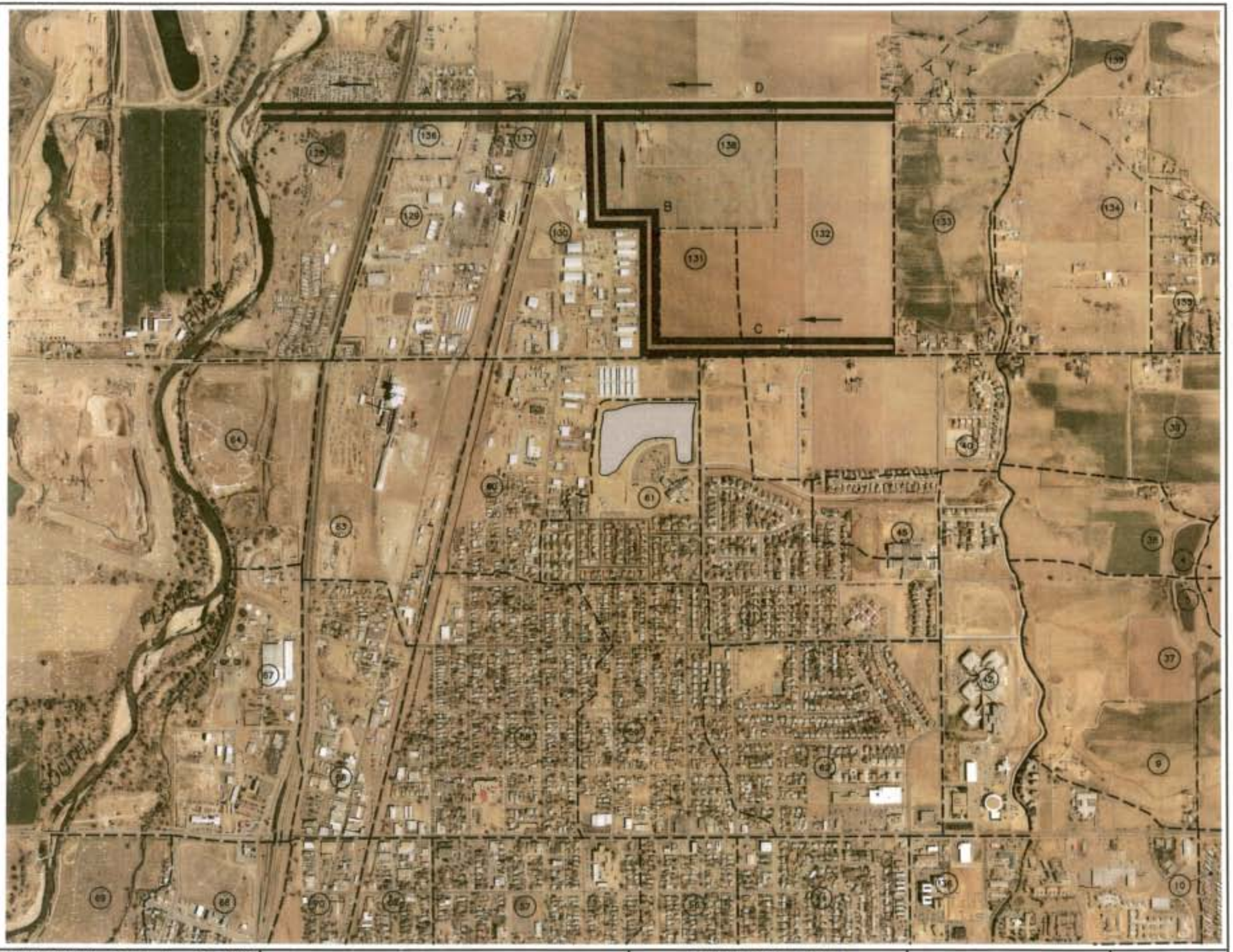

LEGEND:

- (25) SUB-WATERSHED DESIGNATION
- WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY
- EXISTING OUTFALL SYSTEM
- PROPOSED CHANNEL OUTFALL SYSTEM
- PROPOSED PIPED OUTFALL SYSTEM
- RECREATION CENTER DETENTION POND

N

500 250 0 500 1000

ORIGINAL SCALE: 1"=500'

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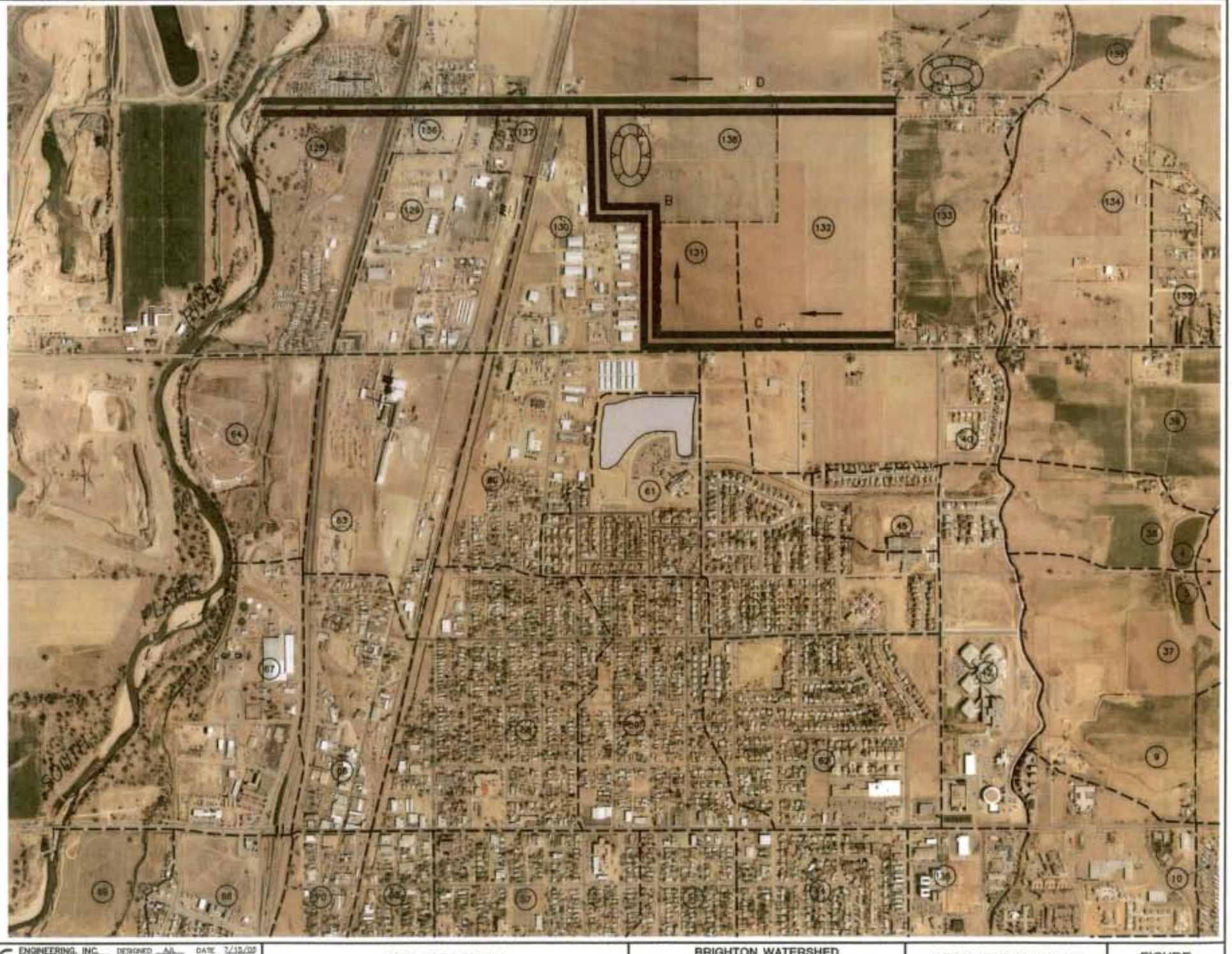

LEGEND:

- (25) SUB-WATERSHED DESIGNATION
- WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY
- EXISTING OUTFALL SYSTEM
- PROPOSED CHANNEL OUTFALL SYSTEM
- PROPOSED PIPED OUTFALL SYSTEM
- RECREATION CENTER DETENTION POND
- PROPOSED REGIONAL DETENTION POND

N

500 250 0 500 1000

ORIGINAL SCALE: 1"=500'

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CHECKED	AJL	DATE 7/15/05
REVISED		DATE
AS-BUILT		DATE

CITY OF BRIGHTON
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
NORTH AREA
OUTFALL SYSTEMS PLANNING

ALTERNATIVE PLAN NO. 2
100 YEAR SYSTEM CAPACITY

FIGURE
V-8

D. OUTFALL SYSTEM SELECTION

On January 5, 1998, WRC received from UD&FCD the project sponsor's selection of Alternatives 1S and 2E as recommended for preliminary design purposes. A general description of the selected plan and additional direction provided to WRC for preliminary design is preserved in the document titled Selected Plan for Brighton Watershed Outfall Systems Planning Study Preliminary Design Report (Appendix E). The General Description of the Selected Plan is as follows:

1. The Selected Plan, unless specifically directed otherwise, is the recommended alternative as defined in the Alternatives Evaluation Report dated July 1997. This plan is based on a total of 24 sub-regional detention basins within the watershed (modified to 25 basins in the preliminary design phase). Each detention basin will be sized with a volume to detain the 5-year storm event for an extended period of time (40-hours) and provisions to enhance water quality will be included within detention basins. Downstream of each detention basin will be an open channel sized to convey the release from a 100-year storm event. These channels will be located adjacent to arterial and major collector streets to the extent feasible, and two major outfalls (one south of Bromley Lane and the other north of Baseline Road) are required to prevent flooding of the downtown area.

2. Drainage systems in residential areas with lot size of 1.5 acres or greater will be designed to minimize directly connected imperviousness. Drainage systems in residential areas with lot size less than 1.5 acres, and in commercial and other dense areas, will utilize curb-and-gutter with storm sewers (the 1.5 acre size was subsequently adjusted to 1.0 acres per discussions with the City Staff). The City of Brighton will need to modify its present drainage criteria to incorporate these principles when approving new development within the watershed area.

3. The selected plan recommends the use of certain areas for detention purposes. As a first step, acquisition of right-of-way should be secured. One possible way to do this is through adequate assurances agreements between the City of Brighton and the District. Acquisition of properties can then be completed by obtaining a permanent runoff-storage easement from the landowners at the time of proposed development or through the purchase in fee simple by the City of Brighton, with District assistance whenever such acquisition becomes a problem for the city.

4. Incorporate the following note on each drawing: "This drawing is for master planning purposes and represents preliminary and conceptual engineering. Alternatives to this outfall system will be considered by local reviewing agencies and the Urban Drainage and Flood Control District provided the alternative offers equal hydraulic capacity and stream stability. The alternative must comply with all requirements of the local jurisdiction and the Urban Drainage and Flood Control District. This drawing shall not be used for construction purposes."

In summary, the Additional Direction was as follows:

1. Include a statement that "If a downstream sub-regional detention basin and conveyance system are in place, all development upstream within that tributary watershed will be allowed to release undetained on-site flows into the drainage system".

2. Minimize to the extent feasible the land area requirements of each sub-regional detention basin. Include a discussion on the extent of flexibility in final design of the sub-regional detention basin with regard to basin depth and longitudinal and lateral position along the outfall.

3. The final plan should clearly show the McLaughlin Water Engineers 1991 drainage plan for the City core area as differentiated from the existing street flow paths. The plan should also show the existing storm sewer system and use the existing and proposed storm sewer systems to the maximum extent practicable.

4. Provide a note in the preliminary design report that the City of Brighton has committed to a right-of-way (ROW) width of 100-feet from U.S. 85 to the existing South Outfall.

5. Costs for maintenance of the sub-regional detention basins, channels, and storm sewer systems should be reported in the preliminary design.

6. Jurisdictional boundary lines between the City of Brighton and Adams County need to be clearly drawn and labeled as: "...in effect as of 1998" on all figures, plan and profile drawings, and sheets included in the Preliminary Design report.

7. Recommend by a note on each sheet of the preliminary design that the City of Brighton and Adams County zone, manage, and regulate the development in this watershed to prevent future flood damages by following the recommendations of this plan.

8. Prioritize the section of channel north of Bromley Lane that runs to the existing South Outfall east of Jessup Street in the preparation of the preliminary design. Schedule a meeting with project

sponsors to discuss this section of channel and also the regional detention basin locations adjacent to the City of Brighton.

The Additional Direction Items 1, 2, and 4 through 8 are provided for in this report. For Item 3, the outfall systems proposed by McLaughlin Water Engineers for the core Brighton area (in general, Bromley Lane to Baseline Road, Fulton Ditch to South Platte River) are shown on the design drawings. These systems were designed for a 2-year event from the core Brighton area only. These minor storm systems would typically be inadequate to convey additional runoff from outside the core Brighton area. However, the sub-regional extended detention system delays the runoff peaks substantially longer than standard detention facilities. This could potentially allow a single pipe to convey both undetained local runoff as well as the delayed peak runoff releases from the sub-regional system.

This concept was applied to the existing north outfall system along Baseline Road. For this location, a second north outfall is proposed to convey runoff from areas to be developed east of the Fulton Ditch. The results of this analysis were two-fold. For the minor storm events, the existing north outfall system can function to convey runoff from both the core Brighton area and from the areas east of the Fulton Ditch. This is due to the 40-hour release from the sub-regional detention facilities.

For the major storm event, the existing north outfall is overwhelmed by 100-year runoff from the core Brighton area. Thus, no excess capacity exists for conveyance of runoff from east of the Fulton Ditch. Therefore, the proposed plan includes a parallel north outfall system for conveyance of all 100-year runoff from the area east of the Fulton Ditch. Due to the difference in timing of the peak flows, the major benefit of the parallel system is to provide additional minor storm capacity as well as a reduction in 100-year flooding from the core Brighton area.

The 2006 update to the Outfall Systems Plan included the replacement of the 1991 McLaughlin Water Engineers drainage plan for the Core City area by the selected 2006 alternative for that area. Therefore, Additional Direction Note #3 as included in this section is void. The selected alternatives for the Core City and North areas are described below.

The selected 2-year Core City alternative is Plan 2, Option B. This alternative includes a proposed storm sewer from the South Platte River approximately along the Midland Street alignment, with its upstream end at the intersection of 8th Avenue and Bridge Street. A proposed outfall to the Brighton Park Lake detention facility includes the addition of a storm sewer from the existing drainage channel at approximately 19th Avenue and Midland Place to the south along 19th Avenue to Bridge Street, and then east to the Fulton Ditch.

For the North Study Area, all alternatives presented were designed with the capacity to convey 100-year flows from the North, East, and Core City areas. The flow contribution from the East Study Area is limited by the previously proposed 100-year detention facilities with a maximum discharge rate of 0.1 cfs/acre. The selected North outfall alternative is Plan 1, which consists of open channels with the capacity to convey the previously indicated flows including the 100-year undetained runoff from the entire north tributary area.

VI. PRELIMINARY DESIGN OF THE SELECTED OUTFALL SYSTEM

Note: Some portions of this Section VI: Preliminary Design of the Selected Outfall System were affected by the 2006 Update of the Outfall Systems Plan. Additional text, outlining changes and presenting updated information, follows this section.

A. DESCRIPTION OF THE OUTFALL SYSTEM

This chapter presents detailed descriptions of the proposed improvements, implementation guidelines, improvement cost estimates, and a proposed prioritization of improvements. Plan and profile drawings and details of the proposed improvements are included in the project drawings located in the back of this report. Also included on the pages facing the plan drawings are descriptions and cost estimates of the improvements located on that drawing.

The selected outfall system consists of four major components: sub-regional detention facilities, outfall channels and storm sewers, the existing master planned outfall systems for the core Brighton area, and on-site detention requirements for in-fill areas. A description of each of these components is as follows:

1. **SUB-REGIONAL DETENTION FACILITIES.** The preliminary design of the selected outfall system resulted in a total of 25 sub-regional detention facilities draining 25 sub-regions (See Figure VI-1). Twenty of the sub-regional detention facilities (Sub-regions AA through SS and YY) drain to the proposed South Outfall System. All of these "south" sub-regional detention facilities (except Sub-region YY) are sized to store and subsequently release 100-year developed basin runoff at a rate of 0.5 cfs/acre of tributary area. Sub-region YY was originally considered to be in the "east" area and thus was sized for a 0.1 cfs/acre of tributary area release rate. This release rate was used for Sub-region YY, despite being reclassified as tributary to the "south" area, due to the difficulties and large costs of providing a significantly larger outfall system to drain this area if the 0.5 cfs release rate was allowed.

   For the "east" area, five sub-regional detention facilities (Sub-regions TT through XX) are sized to store and subsequently release 100-year developed basin runoff at a rate of 0.1 cfs/acre of tributary area.

   All the sub-regional detention facilities are also sized to store and subsequently release the 5-year developed basin runoff over a 40-hour period (extended detention).

2. **OUTFALL CHANNELS AND STORM SEWERS.** Each of the 25 sub-regional detention facilities drains to either a 100-year outfall storm sewer or channel. Storm sewers are used when a detention facility outlet elevation is lower than can be economically or physically drained in an open channel.

   Most of the outfall channels follow the alignment of existing or proposed collector and arterial streets. Where this occurs, the outfall channels are proposed to be roadside channels in order to minimize right-of-way requirements. Ultimately, the "south" sub-regions drain to the main south outfall channel. This channel is proposed to extend from the South Platte River near W. Egbert Street south to about 1,200 feet south of Bromley Lane, thence east under U.S. 85 along the 150th Avenue alignment to Chambers Road. The segment under U.S. 85 and adjacent areas is proposed to be (3) 9' diameter RCP culverts. The culverts were used due to the depth of the outfall (up to 20'), to reduce right-of-way requirements, and to allow jacking of the outfall segments under U.S. 85 and the adjacent railroad tracks.

   The "east" sub-regions drain to a 100-year outfall storm sewer and channel along the north side of Baseline Road. The storm sewer segments along this north outfall are used where pipe jacking is required and where right-of-way can be minimized on developed properties along Baseline Road.

3. **EXISTING MASTER PLANNED OUTFALL SYSTEMS FOR THE CORE BRIGHTON AREA.** In 1991, McLaughlin Water Engineers finished an outfall systems plan for the core city area. This plan consisted of several proposed 2-year storm sewer systems in order to alleviate frequent flooding of several areas of the city. The current plan does not change this 1991 plan and thus the 1991 plan is shown herein for reference purposes only. The reader is referred to the 1991 document for further information on these proposed storm sewers. The City has been implementing various phases of said plan over the last several years.

4. **ON-SITE DETENTION REQUIREMENTS.** The City of Brighton area is characterized by the lack of adequate outfall systems and by the large costs needed to construct new outfall systems. Therefore, it is imperative that the City adopt a strict on-site detention policy for those areas which are not tributary to the sub-regional detention facilities included in this plan (except as noted below). These areas consist mostly of smaller in-fill areas which, due to their physical location, can not be readily drained to the sub-regional detention facilities. This plan proposes that the city adopt an on-site detention policy which limits releases of developed runoff to a rate of 0.1 cfs/acre

0 1000 2000 4000 6000
SCALE: 1"=2000'

Brighton

Refer To Figure VI-2 For Core Area Minor Storm Outfall Systems Maximum 100-year Detention Release Rate=0.1cfs/acre

South Outfall

LEGEND

- REACH LIMITS
- S1 SOUTH AREA REACH ID
- E1 EAST AREA REACH ID
- DETENTION BASIN
- NON-REGIONAL CONVEYANCE FACILITY
- AA SUBREGIONAL DETENTION BASIN ID & DRAINAGE AREA
- STUDY AREA BOUNDARY
- SUBWATERSHED BOUNDARY

MAP AND AUTOCAD FILE PROVIDED BY: LANDMARK MAPPING LTD. 7300 WEST MISSISSIPPI AVENUE, SUITE 21 LAKEWOOD, COLORADO 80232 PHONE: (303) 922-2417 FAX: (303) 922-2866

TOWNSHIP 1 S.
RANGE 66 W.
SECTION N. 1/2 7

WRC ENGINEERING, INC. 282 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80246 PHONE NO.: (303) 757-8513 FAX NO.: (303) 759-3206

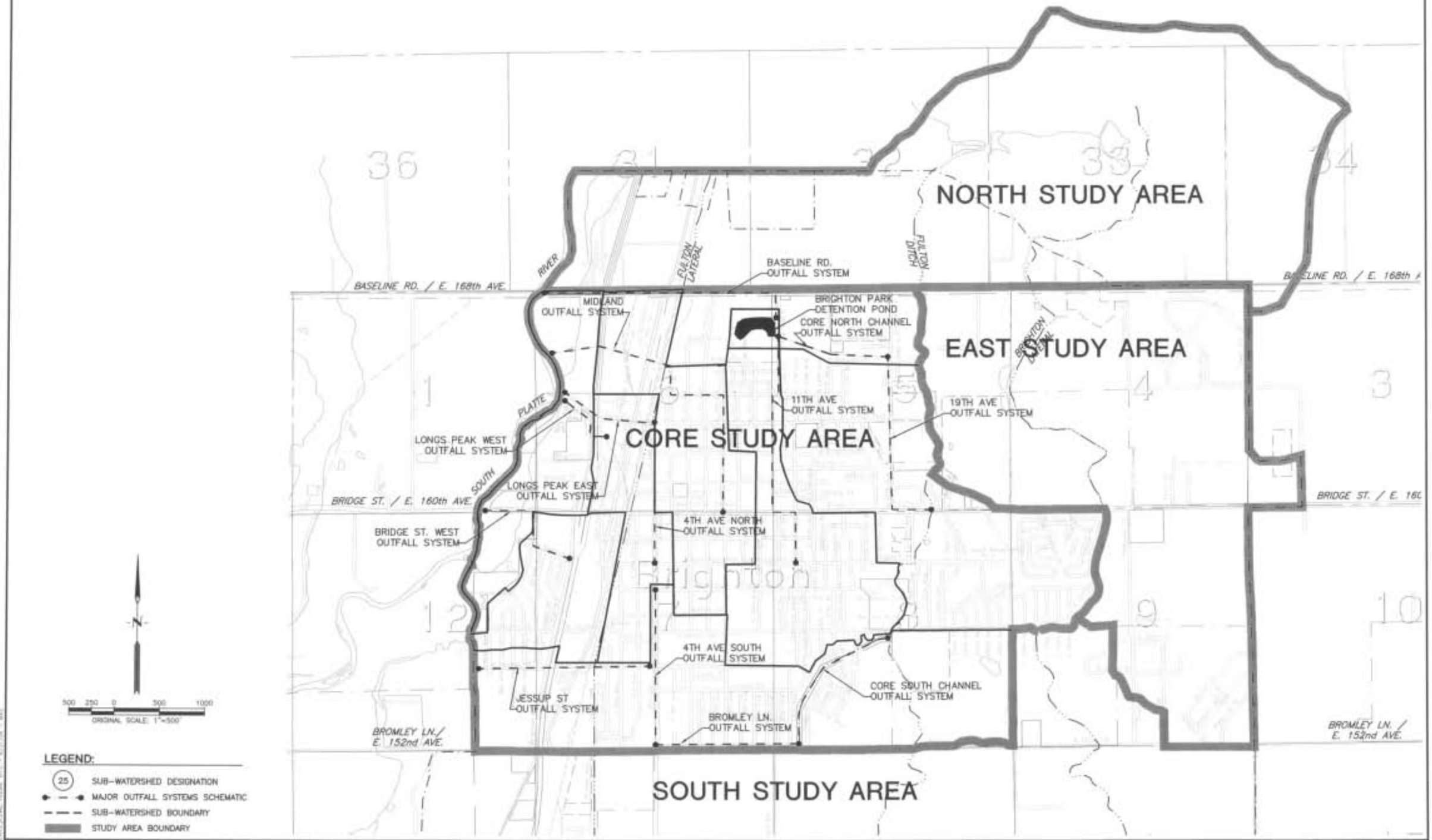
DESIGNED	TTC	DATE	1/28/05
DRAWN	MAS	DATE	1/28/05
CHECKED		DATE	
REVISED	APN	DATE	7/24/08
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

OUTFALL SYSTEMS MAP

FIGURE VI-1



WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 759-3208	DESIGNED AJL DATE 7/26/05 DRAWN MAS DATE 7/26/05 CHECKED AJL DATE 7/26/05 REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED OUTFALL SYSTEMS PLANNING	CORE CITY MINOR STORM OUTFALL AREAS	FIGURE VI-2

of tributary area. The on-site policy should also include a requirement to provide for a 5-year extended detention storage volume to be released over a minimum 40-hour time period. The exception to this on-site requirement would be for areas draining to the South Outfall System which is designed to accommodate undetained runoff from areas downstream of the sub-regional detention facilities.

Overall, the proposed outfall system is designed to promote infiltration of runoff into the groundwater table in order to recharge the City's current groundwater water supply system. This system also minimizes the sizes of the outfall channels and storm sewers and provides for water quality enhancement from the sub-regional detention basins.

B. DESIGN CRITERIA

The "Urban Storm Drainage Criteria Manual" (Reference 5) and the "Adams County Storm Design and Technical Criteria" (Reference 4) were used as the basis of the outfall systems design. Specifically, open channels were designed as grass-lined channels with concrete trickle channels except for the South Outfall Channel (See Improvement Details Sheet 68). The South Outfall channel was designed as a wetland bottom channel due to the likelihood that groundwater would be encountered during and after construction. All channels were designed with a maximum velocity of 7 fps and a minimum bottom width of 5 feet for the 100-year design event. ROW requirements assumed 1 foot of freeboard and a 15' wide maintenance bench area. Culverts were designed to allow a maximum headloss of 1 foot. The sub-regional detention facilities were designed with 4:1 sideslopes and 1 foot of freeboard on the 100-year storage elevation (See Improvement Details Sheet 68). Two storage levels were included in the design (5-year and 100-year). The five-year extended detention area is typically 2' to 3' deep and has a flat bottom to promote infiltration and minimize ROW. The 100-year volume is typically contained in a 3' to 5' high benched area above the 5-year flood volume. Where an active recreation area was sought within the sub-regional detention facility, a 1 percent sloped area above the 5-year ponding level was provided to ensure positive drainage.

C. IMPLEMENTATION GUIDELINES

The most important aspect of this plan is the technical and institutional implementation of the sub-regional detention facilities. The implementation guidelines presented in this section are provided to assist the City of Brighton and Adams County in the implementation of the outfall systems plan presented in this report. These guidelines detail the methods, procedures, and flexibility allowed in the sizing and siting of the sub-regional detention facilities. These guidelines also detail the institutional issues which must be addressed in order to proceed with the implementation of this plan.

1. **TECHNICAL CONSIDERATIONS.** The two main considerations regarding implementation of the sub-regional detention facilities concern sizing and siting of said facilities. The guidelines for sizing and siting of the sub-regional detention facilities are as follows:

a) Sub-regional Detention Facility Sizing. The sizing of said facilities is accomplished through a five step process. First, the 5-year extended detention volume is set equal to the 5-year excess precipitation volume from the tributary area. The excess precipitation volume is provided in the CUHP output for each sub-watershed and must be totaled for the sub-watersheds tributary to the sub-regional detention facility. Second, the 5-year outlet is sized to release the 5-year stored runoff over a 40-hour time period. For the preliminary design included herein, the 5-year outlet was assumed to be pipe orifice structure as shown on Sheet 68. Third, the required 100-year storage volume is set equal to 95 percent of the 100-year excess precipitation volume for the "east" sub-regions (0.1 cfs/acre release rate) and 80 percent of the 100-year excess precipitation for the "west" sub-regions (0.5 cfs/acre release rate). The 5-year storage volume is part of the total 100-year storage volume as computed above. Fourth, the 100-year release rate is computed based upon either 0.1 cfs/acre (east area) or 0.5 cfs/acre (south area) of tributary area. The 100-year basin outlet is assumed for the standard configuration to be a rectangular weir overflow structure as shown on Sheet 68. Finally, the outlet pipe must be sized and sloped to pass the full 100-year pond release under gravity flow conditions.

For the design of the detention facility itself, adjustments in the size of the minor and major storm storage areas can be accommodated but, if adjusted, the overall facility size will change. For example, if a large, manicured, active use park is desired, the facility size may need to be increased in order to minimize the frequency of inundation of the active use area. In contrast, it may be desirable in another area to use the facility as open space (no active recreation). In this example, the facility and size may be reduced but will have a larger area that may be frequently inundated with runoff.

b). Sub-regional Detention Facility Siting. Siting of the sub-regional detention facilities is constrained by the location of the outfall system and topographic constraints. The sub-regional detention facility locations shown on the enclosed preliminary design drawings were selected based upon an optimal balance between facility size and location. Where possible, basins were located away from major intersections but within the general existing drainage flow paths.

The purpose of the Master Plan is to preliminarily locate and size the required sub-regional detention facilities and to size the downstream collection facilities based upon these defined sub-regional detention facilities and locations.

Minor adjustments in size and location of the sub-regional detention facilities can be accommodated as long as the master plan design criteria (i.e. 5-year extended detention, 100-year restricted release rates) and the hydrologic/hydraulic function of the entire master planned drainage system are maintained.

A sub-regional detention facility may be moved upstream or downstream along the proposed outfall system if the following guidelines are addressed:

1. Pond size must be adjusted for the increase/decrease in tributary area.

2. The new location must not interfere with the outfall system draining from upstream sub-regional detention facilities. Outfalls from upstream sub-regional detention facilities should not drain through downstream sub-regional detention facilities to preserve the storage capacity of the downstream facilities.

3. The Master Plan flow rates downstream of the new location must be maintained or reduced. This should be checked using the master plan hydrologic model.

4. The new location/plan should not result in a proliferation of additional sub-regional detention facilities. For purposes of this plan, the minimum drainage area to a sub-regional detention facility should be kept around 130 acres.

5. A sub-regional detention facility may be moved from one side of a road to another as long as all hydraulic functions are maintained. This is a fairly simple change since the basins are "off-line" of the main outfall system.

Tributary basin boundaries can be adjusted as long as the above guidelines are followed. However, a logical reason must exist for said change. Also, as facilities are implemented, some changes will not be possible in order to avoid retro-fitting of previously constructed facilities.

The end result of any of these changes should be a functionally equivalent system that:

- Minimizes maintenance requirements (fewer facilities are better)
- Minimizes land required (fewer facilities are better)
- Maintains public ownership or control (i.e. permanent drainage easement) of sub-regional detention facilities.

c). <u>On-site Detention</u> The implementation guidelines strongly recommend that sub-regional detention areas not be sub-divided into smaller areas in order to avoid a proliferation of additional sub-regional detention facilities. However, if factors currently unknown prevented the implementation of a single sub-regional facility, then use of on-site detention in that area can only be used if the following requirements are met:

1. The total sub-regional watershed outflow rate must be maintained. Thus, <u>all</u> watershed areas must be directed through an on-site detention facility.

2. Runoff discharged through an on-site detention facility must not drain through another on-site detention facility.

3. The on-site detention volume and release rate must be proportionately reduced based upon the proportionate impervious area drawing to the on-site facility.

4. The sizing equations that are used for the sub-regional detention facilities must be applied to the on-site detention facilities.

5. The on-site detention facilities must be publically owned and maintained.

6. Approval of use of on-site detention for part of a sub-watershed must be obtained from the City of Brighton (or Adams County where applicable) with input solicited from the UD&FCD. In addition, since all property owners in the sub-regional watershed will be affected by this change, the City (or County) may require input on the on-site detention plan from the affected property owners.

2. **INSTITUTIONAL CONSIDERATIONS**. The key institutional consideration is that the City of Brighton and Adams County must both adopt and follow this plan within the implementation guidelines

provided herein. This will require a change in the drainage criteria for all areas tributary to these outfall systems to implement the stricter storage volumes and release rates previously defined.

Implementation of this plan can also be facilitated by implementation of a fee collection and reimbursement plan by which the sub-regional detention basin sites can be secured early on in the development process. In this manner, the outfall system costs can be allocated equally to all developers in the watershed.

Implementation is also facilitated by the fact that, once constructed, the outflow from a sub-regional detention facility will be less (and, in some cases, considerably less) than the existing conditions 5- and 100-year flow rates. In this case, the only impact to downstream properties will be an increase in or establishment of a continuous base flow out of the basin. Therefore, development can proceed forward as long as a downstream facilities can accommodate this increased base flow with improvements, as needed, for erosion control. Both the City and County staff need to become familiar with this plan and the benefits/ramifications of plan implementation.

D. IMPROVEMENT COSTS ESTIMATES

The cost of the improvements shown herein have been divided into seven categories: drainage improvements, traffic, utility relocation, contingency, engineering and construction services, legal and administrative, and right-of-way acquisition.

Drainage improvement costs are associated with improving the existing system to handle the design flows according to the established criteria. These include all storm sewers, inlets, manholes, channel grading, low-flow or trickle channels, drop structures, etc. These also include sub-regional detention pond embankment and excavation, landscape and re-vegetation, and outlet and spillway structures.

Traffic costs include all drainage improvements directly related to crossing of existing roads, streets, and highways. These include headwalls and wingwalls, culvert pipe, outlet protection, traffic control, curb, gutter, sidewalk, and asphalt replacement, etc.

Utility costs are for protecting and/or relocating gas, electric, cable TV, telephone, water and sewer improvements as required to allow construction of the proposed outfall system improvements.

Contingency costs are included since the level of detail at the preliminary design stage is not sufficient to accurately determine the actual final costs based on a final design.

The engineering and construction services costs include basic services (i.e. planning, final design, construction documents, and construction observation) and special services (i.e. surveying, soils testing, construction inspection, and special investigations).

Legal and administration costs are for contract administration (design, construction, and overall project tasks) and for legal council services as required for right-of-way acquisition and contract review.

The right-of-way/easement acquisition costs include the costs to purchase right-of-way and/or easements for the proposed improvements where the same are not provided by new development. The cost to purchase right-of-way/easements is dependent on the existing and proposed land use, zoning, and general location of the property. Therefore, the costs included for this item are for budgeting purposes only. The actual cost of such right-of-way/easements will be determined at the time they are slated for acquisition. Right-of-way costs are not included where the proposed improvement is to be located entirely within an existing drainage easement or right-of-way or on property owned by a public entity.

Contingency costs were estimated to be 25 percent of the sum of the drainage improvement costs. Costs for engineering services and legal and administrative services were estimated to be 15 percent and 5 percent respectively, of the drainage improvements costs. The unit cost data used to develop the detailed cost estimates for this project are presented in Table VI - 1. Presented on the facing page of each plan/profile sheet is a cost estimate for each improvement included on that sheet.

Operation and maintenance costs are costs estimated to be incurred manually for the general maintenance and upkeep of the outfall systems and sub-regional detention facilities.

A summary of the total improvement costs for each reach of outfall system improvements is presented in Table VI - 2. This table also includes an estimate of the annual operation and maintenance cost of the proposed drainageway improvements. The grand total improvement costs (in 1998 dollars) for the outfall systems studied herein is estimated to be about $64,920,000.

The costs of improvements provided on the aforementioned tables were updated in 2006 and divided into five categories, not including operations and maintenance (O&M). These are total drainage improvement costs, contingencies, engineering services, legal and administrative services, and right-

of-way acquisition. Total drainage improvement costs reflect an estimate of the total costs associated with the construction of the facility including parts, labor, mobilization, traffic control, and utility relocation.

Unit cost data presented in Table VI-1 has been updated to reflect approximate costs in 2006 dollars. The grand total improvement costs (in 2006 dollars) for the outfall systems described in this 2006 Update of the Brighton Watershed OSP is estimated to be about $70,661,472.

TABLE VI-1

OUTFALL SYSTEMS PLANNING
PRELIMINARY DESIGN
UNIT COST DATA (2006 USD)

RIGHT-OF-WAY ACQUISITION	
Residential - Medium Density (without improvements - land value only)	$0.63/SF
DRAINAGE IMPROVEMENTS	
Excavation Channel	$9.38/CY
Excavation Detention Basin	$9.38/CY
Riprap	$43.75/CY
Filter Bedding Material	$43.75/CY
Seeding and Mulching	$3750/CY
Structural Concrete	$562.5/CY
Culvert Outlet (without Headwall/Wingwalls)	PIPE COST
Culvert Outlet (with Headwall/Wingwalls w/ Riprap less than 100 cfs)	$9375/EA
Culvert Outlet (with Headwall/Wingwalls w/ Riprap 100 to 500 cfs)	$15000/EA
Culvert Outlet (with Headwall/Wingwalls w/ Riprap 500 to 1000 cfs)	$25000/EA
Culvert Outlet (with Headwall/Wingwalls w/ Riprap 1000 to 1500 cfs)	$37500/EA
Culvert Outlet (with Headwall/Wingwalls w/ Riprap 1500 to 2000 cfs)	$50000/EA
Channel Drop Structures (with Q = 0 to 200 cfs)	$18750/EA
Channel Drop Structures (with Q = 200 to 800 cfs)	$43750/EA
Channel Drop Structures (with Q > 800 cfs)	$81250/EA
Manholes	$2500/EA
BOX CULVERTS	
(2) 4' x 7' RCBC	$762.5/LF
(3) 4' x 7' RCBC	$1087.5/LF
(1) 4' x 8' RCBC	$475/LF
(2) 4' x 8' RCBC	$825/LF
(3) 4' x 9' RCBC	$1287.5/LF
(4) 4' x 9' RCBC	$1687.5/LF
(1) 4' x 10' RCBC	$550/LF
(2) 4' x 10' RCBC	$975/LF
(3) 4' x 10' RCBC	$1400/LF
(2) 6' x 12' RCBC	$1200/LF
(3) 6' x 12' RCBC	$1725/LF
(2) 8' x 12' RCBC	$1300/LF
STORM SEWER	
18-inches	$75/LF
21-inches	$81.25/LF
24-inches	$81.25/LF
27-inches	$91.25/LF
30-inches	$100/LF
33-inches	$106.25/LF
36-inches	$106.25/LF
42-inches	$125/LF
48-inches	$156.25/LF
54-inches	$187.5/LF
60-inches	$203.75/LF
66-inches	$218.75/LF
72-inches	$250/LF
78-inches	$281.25/LF
84-inches	$343.75/LF
90-inches	$437.5/LF

TABLE VI-1 (cont.)

OUTFALL SYSTEMS PLANNING
PRELIMINARY DESIGN
UNIT COST DATA (2006 USD)

108-inches	$625/LF
Pipe Jacking	4 X PIPE COST
ADDITIONAL COSTS	
Contingencies	0.25
Engineering Services	0.15
Legal/Administrative	0.05
ANNUAL OPERATION AND MAINTENANCE	
Grass Channel	$5.63/LF
Storm Sewer	$1.25/LF
Detention Areas:	
Active Recreation Area	$5000/AC
Open Space/Passive recreation Area	$1250/AC

BASIS FOR UNIT PRICE DATA:

Property Acquisition: The prices consider the average conditions experienced during drainage construction.

Excavation: The channel excavation price reflects the difficulties encountered when operating heavy equipment in an outfall channel and the problem of access to the outfall channels.

Riprap: Reflects the cost of delivery and installat ion of rock ranging in size from 4" to 21".

Seeding and Mulching: Reflects the cost of hydroseeding with ground preparation, including some manual labor.

Storm Sewers: Reflects the costs for storm sewer construction including excavation, bidding, pipe, backfill, manholes, and mainline inlets. Additional local system laterals and mains are not included in this cost item.

Sub-Regional Detention Ponds: Reflects the average cost to construct a non-irrigated detention facility including appurtenances and outlets. Not all ponds included in the outfall analyses are sub-regional detention ponds, and do not include the cost of purchasing right-of-way.

Right-of-Way Acquisition: These values reflect the cost to acquire raw land or portions of improved land where the improvement will remain after construction. These values are representative of current (2006) values for raw land for drainage acquisition purposes.

Concrete Culverts: Includes cost of excavation, bedding, furninshing, and installing pipe, compacted backfill, replacement of road surface, and traffic control.

Annual Operations and Maintenance: These costs are based on standard values used in the Denver Metro Area for storm drainage and master planning studies (adjusted from 1998 dollars).

TABLE VI-2

OUTFALL SYSTEM IMPROVEMENTS
COST SUMMARY

I. Detention Basins

Detention Basin	Development Name (As Applicable)	Total Drainage Improvement Construction Costs (TDIC)	Contingencies (25% TDIC)	Engineering Services (15% TDIC)	Legal/ Admin (5% TDIC)	R.O.W. Cost	Total Cost	Annual O&M Cost
A	(Regional)	$468,750	$117,188	$70,313	$23,438	$204,188	$883,875	$9,400
B	(Regional)	$468,750	$117,188	$70,313	$23,438	$193,298	$872,985	$8,900
C	(Regional)	$843,750	$210,938	$126,563	$42,188	$323,978	$1,547,415	$14,900
D	(Regional)	$937,500	$234,375	$140,625	$46,875	$288,585	$1,647,960	$13,300
E	(Regional)	$468,750	$117,188	$70,313	$23,438	$0	$679,688	N/A
F	Brighton Lakes PUD	$328,125	$82,031	$49,219	$16,406	$210,449	$686,231	$9,700
G	Brighton Lakes PUD	$656,250	$164,063	$98,438	$32,813	$296,753	$1,248,315	$13,600
I	(Regional)	$937,500	$234,375	$140,625	$46,875	$326,700	$1,686,075	$15,000
J	(Regional)	$750,000	$187,500	$112,500	$37,500	$255,915	$1,343,415	$11,800
K	Indigo Trails	$0	$0	$0	$0	$0	$0	N/A
L	Regional-Prairie Cntr.	$0	$0	$0	$0	$0	$0	N/A
LUTZ	Prairie Center	$0	$0	$0	$0	$0	$0	N/A
M2	Regional-Prairie Cntr.	$0	$0	$0	$0	$0	$0	N/A
M3	Case Farms	$0	$0	$0	$0	$0	$0	N/A
MV-2	Case Farms	$0	$0	$0	$0	$0	$0	N/A
O	(Regional)	$0	$0	$0	$0	$0	$0	N/A
P	Prairie Center	$562,500	$140,625	$84,375	$28,125	$272,250	$1,087,875	$12,500
PC1	Prairie Center	$0	$0	$0	$0	$0	$0	N/A
PC1A	Prairie Center	$0	$0	$0	$0	$0	$0	N/A
PC1B	Prairie Center	$0	$0	$0	$0	$0	$0	N/A
PC2	Prairie Center	$0	$0	$0	$0	$0	$0	N/A
PC2A	Prairie Center	$0	$0	$0	$0	$0	$0	N/A
PC3	The Preserve	$0	$0	$0	$0	$0	$0	N/A
PRESERVE	(Regional)	$0	$0	$0	$0	$0	$0	N/A
Q	Regional-Prairie Cntr.	$281,250	$70,313	$42,188	$14,063	$117,068	$524,880	$5,400
R	Hishinuma Farms	$0	$0	$0	$0	$0	$0	N/A
S	Sugar Creek #1	$0	$0	$0	$0	$0	$0	N/A
SAFEWAY	(Regional)	$0	$0	$0	$0	$0	$0	N/A
SC	(Regional)	$0	$0	$0	$0	$0	$0	N/A
T	Bridge Crossing #1	$515,625	$128,906	$77,344	$25,781	$283,140	$1,030,796	$13,000
U	Mountain View #1	$590,625	$147,656	$88,594	$29,531	$187,853	$1,044,259	$8,600
V	(Regional)	$0	$0	$0	$0	$0	$0	N/A
W	Safeway S.C.	$0	$0	$0	$0	$0	$0	N/A
X	(Regional)	$750,000	$187,500	$112,500	$37,500	$236,858	$1,324,358	$10,900
Z	(Regional)	$412,500	$103,125	$61,875	$20,625	$189,214	$787,339	$8,700
Total Detention Basins:		**$8,971,875**	**$2,242,969**	**$1,345,781**	**$448,594**	**$3,386,246**	**$16,395,464**	**$155,700**

TABLE VI-2 (cont.)

OUTFALL SYSTEM IMPROVEMENTS
COST SUMMARY

II. Outfall Systems

Outfall System Segment	Total Drainage Improvement Construction Costs (TDIC)	Contingencies (25% TDIC)	Engineering Services (15% TDIC)	Legal/ Admin (5% TDIC)	R.O.W. Cost	Total Cost	Annual O&M Cost
E01	$462,000	$115,500	$69,300	$23,100	$63,000	$732,900	$16,700
E02	$94,600	$23,650	$14,190	$4,730	$42,600	$179,770	$12,000
E03	$273,500	$68,375	$41,025	$13,675	$112,400	$508,975	$35,700
E04	$246,600	$61,650	$36,990	$12,330	$0	$357,570	$2,400
E05	$405,100	$101,275	$60,765	$20,255	$92,200	$679,595	$16,600
E06	$359,900	$89,975	$53,985	$17,995	$0	$521,855	$2,600
E07	$140,500	$35,125	$21,075	$7,025	$20,200	$223,925	$4,800
E08	$49,200	$12,300	$7,380	$2,460	$12,400	$83,740	$5,100
E11	$240,200	$60,050	$36,030	$12,010	$0	$348,290	$1,100
E12	$115,900	$28,975	$17,385	$5,795	$18,000	$186,055	$5,200
E13	$603,000	$150,750	$90,450	$30,150	$73,400	$947,750	$19,800
E15	$128,100	$32,025	$19,215	$6,405	$30,900	$216,645	$9,300
Sub-total East Outfalls:	**$3,118,600**	**$779,650**	**$467,790**	**$155,930**	**$465,100**	**$4,987,070**	**$131,300**
S01	$9,835,300	$2,458,825	$1,475,295	$491,765	$342,000	$14,603,185	$31,800
S02	$1,276,300	$319,075	$191,445	$63,815	$300,200	$2,150,835	$20,500
S03	$2,397,900	$599,475	$359,685	$119,895	$166,000	$3,642,955	$26,800
S04	$148,200	$37,050	$22,230	$7,410	$62,000	$276,890	$15,100
S05	$374,400	$93,600	$56,160	$18,720	$0	$542,880	$4,200
S07	$46,300	$11,575	$6,945	$2,315	$0	$67,135	$0
S10	$50,300	$12,575	$7,545	$2,515	$0	$72,935	$11,000
S11	$123,800	$30,950	$18,570	$6,190	$0	$179,510	$10,600
S13	$139,100	$34,775	$20,865	$6,955	$20,300	$221,995	$4,600
S14	$318,100	$79,525	$47,715	$15,905	$19,400	$480,645	$3,400
S15	$38,400	$9,600	$5,760	$1,920	$0	$55,680	$0
S16	$138,500	$34,625	$20,775	$6,925	$26,300	$227,125	$8,400
S17	$147,400	$36,850	$22,110	$7,370	$39,200	$252,930	$10,700
S18	$534,200	$133,550	$80,130	$26,710	$173,300	$947,890	$26,000
S19	$393,600	$98,400	$59,040	$19,680	$137,100	$707,820	$30,800
S20	$543,000	$135,750	$81,450	$27,150	$51,400	$838,750	$12,300
S21	$475,613	$118,903	$71,342	$23,781	$132,500	$822,138	$38,400
S22	$75,000	$18,750	$11,250	$3,750	$25,900	$134,650	$6,300
S23	$425,400	$106,350	$63,810	$21,270	$67,800	$684,630	$16,300
S24	$168,313	$42,078	$25,247	$8,416	$12,000	$256,053	$2,000
S25	$131,600	$32,900	$19,740	$6,580	$35,800	$226,620	$8,900
S26	$91,400	$22,850	$13,710	$4,570	$35,200	$167,730	$9,900
S27	$133,300	$33,325	$19,995	$6,665	$30,200	$223,485	$8,200
S28	$111,300	$27,825	$16,695	$5,565	$0	$161,385	$1,100
S29	$1,080,200	$270,050	$162,030	$54,010	$105,200	$1,671,490	$19,500
S30	$770,900	$192,725	$115,635	$38,545	$38,600	$1,156,405	$9,000
S31	$931,900	$232,975	$139,785	$46,595	$140,400	$1,491,655	$29,800
S32	$321,800	$80,450	$48,270	$16,090	$118,100	$584,710	$17,700
S33	$0	$0	$0	$0	$0	$0	$13,500
S34	$150,300	$37,575	$22,545	$7,515	$17,900	$235,835	$3,100
S35	$31,250	$7,813	$4,688	$1,563	$0	$45,313	$0

TABLE VI-2 (cont.)

OUTFALL SYSTEM IMPROVEMENTS
COST SUMMARY

II. Outfall Systems

Outfall System Segment	Total Drainage Improvement Construction Costs (TDIC)	Contingencies (25% TDIC)	Engineering Services (15% TDIC)	Legal/ Admin (5% TDIC)	R.O.W. Cost	Total Cost	Annual O&M Cost
S36	$477,325	$119,331	$71,599	$23,866	$29,400	$721,521	$6,700
S37	$25,000	$6,250	$3,750	$1,250	$0	$36,250	$0
S38	$225,500	$56,375	$33,825	$11,275	$62,600	$389,575	$14,500
S39	$261,300	$65,325	$39,195	$13,065	$88,000	$466,885	$20,200
S40	$424,125	$106,031	$63,619	$21,206	$37,400	$652,381	$7,300
S41	$797,500	$199,375	$119,625	$39,875	$97,800	$1,254,175	$28,900
S42	$970,200	$242,550	$145,530	$48,510	$45,000	$1,451,790	$6,400
S43	$0	$0	$0	$0	$0	$0	$0
S44	$99,025	$24,756	$14,854	$4,951	$32,300	$175,886	$5,300
Sub-total South Outfalls:	**$24,683,050**	**$6,170,763**	**$3,702,458**	**$1,234,153**	**$2,489,300**	**$38,279,723**	**$489,200**
N01	$1,841,900	$460,475	$276,285	$92,095	$452,000	$3,122,755	$19,400
N02	$836,300	$209,075	$125,445	$41,815	$272,200	$1,484,835	$17,500
N03	$1,288,900	$322,225	$193,335	$64,445	$327,400	$2,196,305	$16,000
Sub-total North Outfalls:	**$3,967,100**	**$991,775**	**$595,065**	**$198,355**	**$1,051,600**	**$6,803,895**	**$52,900**
C01	$1,542,000	$385,500	$231,300	$77,100	$14,100	$2,250,000	$10,800
C02	$216,900	$54,225	$32,535	$10,845	$0	$314,505	$1,400
C03	$148,100	$37,025	$22,215	$7,405	$0	$214,745	$1,600
C04	$976,600	$244,150	$146,490	$48,830	$0	$1,416,070	$5,400
Sub-total Core Outfalls:	**$2,883,600**	**$720,900**	**$432,540**	**$144,180**	**$14,100**	**$4,195,320**	**$19,200**
Total Outfalls:	**$34,652,350**	**$8,663,088**	**$5,197,853**	**$1,732,618**	**$4,020,100**	**$54,266,008**	**$692,600**
Total Detention Basins:	**$8,971,875**	**$2,242,969**	**$1,345,781**	**$448,594**	**$3,386,246**	**$16,395,464**	**$155,700**
Grand Total:	**$43,624,225**	**$10,906,056**	**$6,543,634**	**$2,181,211**	**$7,406,346**	**$70,661,472**	**$848,300**

E. OUTFALL SYSTEM PRIORITIZATION

The priority of the outfall system implementation and phasing is defined by both the need to provide an initial outfall system and by the locations and extent of future development. Since the locations and extent of future development is not known at this time, the outfall systems phasing based on development will be discussed in general terms.

The first priority of the proposed outfall system should be the construction of the South Outfall System from the McCann Ditch to Chambers Road. This will provide the ability to drain runoff from the south area around the core City area, thus reducing existing runoff entering the City and providing the first segment for development south of the City. The second priority should include securing some of the sub-regional detention facility sites through permanent drainage easements and/or right-of-way purchase. If some of these properties become difficult to obtain, UD&FCD can provide assistance to the City or County as long as an adequate assurances agreement is in place between the City or County and the UD&FCD. The adequate assurance agreement provides assurances to UD&FCD that the City or County will follow through with implementation of the master plan. The third priority should be construction of initial outfall channels along the existing roadway system. This would allow development to occur in the interim until the ultimate outfall systems are fully constructed.

The priority of the remaining outfall systems will be dictated by the location and extent of development. Critical to allowing development to occur will be the construction of the portion of the sub-regional detention basin necessary to serve the development under consideration. For example, if a project will develop 50 percent of the projected impervious area of a given sub-region, then at least 50 percent of the sub-regional detention basin serving that site shall be constructed prior to or with the project. Even in this case, the City or County should consider constructing the entire basin which will allow additional development in the sub-region to proceed further. Funds from the additional development could then be used to construct part of the ultimate outfall system.

F. OPERATIONS AND MAINTENANCE

A major consideration in the design of improvements is the operation and maintenance aspects of the improvements. Maintenance of improvements is needed to assure that "design conditions" exist prior to flooding so that maximum flood reduction benefits can be derived. The operation and maintenance aspects of the major elements of outfall system improvements are as follows:

Maintenance of the natural and grass-lined channels consists of periodic mowing of the channel sides and removal of debris and large deposits of sands and silts from the channel bottom. Maintenance also includes removal and replacement of damaged concrete trickle channels, repair of eroded banks, and repair of drop structures and erosion protection.

Maintenance of culverts consists of debris removal, removal of sand and silt deposits from the culvert and downstream stilling basins, and repair of damage caused by major storm events and vandalism. Decreases in culvert capacity due to sediment accumulations may cause streets to overtop or may increase the depth of street overtopping during the design storm event.

The major benefit of any storm sewer system is that most drainageway maintenance problems are eliminated up to the design capacity of the system. The most critical maintenance item in the system are the storm inlets. If the inlets are either partially or completely clogged, the design flood peaks cannot be intercepted, and flooding can result. To minimize the possibility of the inlets clogging, additional length of inlets are recommended by the inclusion of reduction factors applied to the computed capacity of the inlet. A regular debris removal program must be included to assure the system will operate properly.

Other regular maintenance items include removal of the silt and sand deposits from manholes, inspection and repair of the sewer pipe, and cleaning of excessive deposits in the storm sewer pipe.

Maintenance of the sub-regional detention facilities includes routine mowing; periodic removal of accumulated sand, silt, and debris; repair or replacement of erosion protection at drainage entrances to the basin; repair of bank sloughs; and brush and tree removal affecting embankment stability. In addition, the water quality outlets must be regularly maintained to avoid ponding of water for longer than the design release period.

G. WATER QUALITY

Water quality enhancement in the Brighton Watershed has been partially addressed by the proposed construction of extended detention within the sub-regional detention facilities. The amount of water quality capture volume provided by this plan in the sub-regional detention facilities is 395 A.F. This amount is based upon storage of runoff from a 5-year storm event and release of said runoff over a 40-hour period. This volume exceeds the requirements for water quality capture volume but also exceeds the required water quality release rates. The net effect results in a system that has water quality benefits equivalent to an approximate two-year water quality control volume release over 40 hours.

The 25 sub-regional detention facilities are currently designed as "dry" detention basins (no permanent water pools). As such, the bottoms of the detention basins should be constructed above the existing groundwater table. The construction of permanent pools in these detention basins is an option during final design as long as the permanent pool does not encroach into the 5-year and 100-year flood control storage volumes presented herein. This amount exceeds the requirements for water quality capture volume since the plan provides for a 40-hour release of the 5-year storm event. Future development in the Brighton Watershed outside of the 25 sub-regions but draining to the South Outfall System should use best management practices for water quality enhancement. On-site detention for the remaining developing area should include 5-year extended detention within the on-site detention facility. In total, this outfall system plan will provide significant benefits to the quality of water entering the South Platte River.

H. CONCLUSIONS

The relatively flat topography and closed basins which make up the Brighton Watershed Area do not allow for a traditional "typical" outfall system design (i.e. few regional detention basins and/or a full conveyance system with no detention). In addition, a "typical" outfall system would not provide significant groundwater recharge benefits on which the City of Brighton partially relies for its raw water supply. The proposed outfall system of 25 sub-regional detention facilities and associated channels/storm sewers meets the requirements of an economic design which allows for gradual implementation as development occurs. The proposed plan also provides the desired groundwater recharge benefits while minimizing negative water quality impact on the South Platte River. The sub-regional detention facilities will also provide much needed open space and recreational opportunities for both existing and future Brighton residents.

Implementation of this plan requires a commitment by the City of Brighton and Adams County to follow and promote the plan within the implementation guidelines provided in this report. The guidelines provide flexibility in the sizing and siting of the sub-regional detention facilities while maintaining the integrity of the entire outfall system.

Finally, this plan provides a major benefit to Brighton in that future development will reduce the amount of both major and minor stormwater flows currently contributing to the flooding problems within the core City area.

CHANGES AND ADDITIONAL INFORMATION FOR OSP UPDATE DATED 2-2006

SUB-REGIONAL DETENTION FACILITIES

Since the 1998 version of the Brighton Watershed Outfall Systems Plan, numerous developments have been planned and/or built at locations containing planned sub-regional detention facilities. In some cases, a development's facility may coincide with the design parameters previously set forth for the sub-regional facility, and in others may not. For the former, minimal changes were made to the sub-regional detention basin at that location. In the latter and more common case, a planned or constructed development does not include the full size or proper release rates for the sub-regional detention facility at that location. Using adjusted sub-watershed data, the development's facility was adapted to comply with storage and release requirements per the OSP. In some cases, multiple detention facilities within a development were treated as one for the purposes of master plan modeling.

The "south" area now includes 21 sub-regional detention facilities, 9 of which are incorporated into developments as on-site facilities. The original OSP Detention Basin "H" was deleted to adapt to constraints set forth by the Brighton Lakes PUD. Basins "F" and "G" were also altered for this development. Due to the undersized construction of Basin "K", a new Basin "Z" was added at 144th Avenue and Chambers Road. The Prairie Center development, located primarily east of Buckley Road between Bromley Lane (152nd Avenue) and 136th Avenue, utilizes a system of sequential detention facilities that outfall to four "primary" detention basins. All runoff from Prairie Center is designed to flow through one of these "primary" basins, which are designed to release at the rates set forth by the OSP for the corresponding sub-regional detention basins. These "on-site" sub-regional detention basins are "R", "M2", "L", and the Lutz Reservoir Detention Facility. A single detention basin for the Sugar Creek Subdivision and a collection of smaller detention basins in the vicinity of the Safeway Shopping Center work in conjunction to achieve a combined release rate consistent with the OSP Sub-region YY design.

The "east" area includes 5 sub-regional detention facilities (no change from the 1998 OSP). Two of these are incorporated into developments as on-site facilities. Original Detention Basins "V" and "W" were altered to adapt to constraints set forth by the development plans for Bridge Crossing Filing #1 and Mountain View Estates Filing #1, respectively. The Preserve and Mountain View Estates Subdivisions contain systems of detention facilities which, in combination, act per the OSP Sub-region WW and XX designs. Detention Basin "T" was altered from the original plan to adapt to the Pheasant Ridge and Sugar Creek Subdivisions and to conform to the site plan for the Brighton Charter School.

The Core City area contains one modeled detention facility located at Brighton Park. Improvements in this area as well as the service areas for the Brighton Park Lake detention facility and other "core" area outfalls are shown in Figure VI-2.

In locations where multiple detention basins work in conjunction to achieve the design storage and release parameters for a particular sub-region, these basins are labeled as "Sub-regional Detention Systems" in the preliminary design drawings. All storage facilities in such a system must be publically owned and maintained to qualify as a complete sub-regional detention facility.

OUTFALL CHANNELS AND STORM SEWERS

The "east" subregions drain to a 100-year outfall channel (Reach E1) along the north side of Baseline Road in a westerly direction until reaching the proposed north outfall channel (Reach N3). All flow from Reach E1 and all outflow from the Brighton Park Lake detention facility drain to Reach N3.

The Core City area was initially master planned in 1991 by McLaughlin Water Engineers. WRC Engineering, Inc., was retained to investigate possible solutions to alleviate frequent flooding issues in specific areas within the City. However, even with the proposed systems in place, certain areas may still be exposed to flooding due to the 2-year or higher-frequency storm event. Three new systems are presented for the Core City area:

1. The Midland Street Outfall System consists of approximately 7900 feet of storm sewer ranging in size from 54-inch to 72-inch diameter and approximately 500 feet of outfall channel draining to the South Platte River.
2. The West Longs Peak Outfall System consists of approximately 1300 feet of 36-inch storm sewer, also draining to the South Platte River.
3. The 19th Avenue Storm Sewer consists of approximately 4350 feet of 66-inch storm sewer, draining to the existing north drainage channel and thereby to Brighton Park Lake.

The areas serviced by these proposed systems, as well as by other outfalls from the Core City area, are presented in Figure VI-2.

The "north" area contains 100-year outfall channels that drain all sub-watersheds (no sub-regions or detention basins are defined) in the that area to the South Platte River. The alignment of Reach N1 is along Weld County Road 2.5 from the outfall to a point approximately 3400 feet east, where the channel diverges to Reaches N2 and N3. Reach N2 generally serves the "north" area drainage basins to the east of the junction, and Reach N3 primarily conveys flows from the "east" area via Reach E1 and the Core City area via Brighton Park Lake.

Certain stormwater conveyance facilities, such as those connecting one detention basin to another in a sequential detention system, are considered to be "on-site" and are therefore not considered a part of this design. However, these conveyance facilities may be eligible for District maintenance provided that they are designed and constructed per UD&FCD standards.

IMPROVEMENT COSTS ESTIMATES

Right-of-way costs were not included for detention basins and outfall channels that are indicated to be contained within existing or planned developments.

The grand total improvements cost (in 2006 dollars) for the outfall systems studied herein is estimated as approximately $70,661,472.

VII. REFERENCES

1. Hydrology Report Outfall Systems Planning, Brighton Watershed Tributary to South Platte River, WRC Engineering, Inc., December 29, 1996.

2. Alternative Evaluation Report, Outfall Systems Planning, Brighton, Watershed Tributary to South Platte River, WRC Engineering, Inc., July 24, 1997.

3. Soil Survey of Adams County Colorado, United States Department of Agriculture, Soil Conservation Service, October, 1974.

4. Adams County Storm Drainage Design and Technical Criteria, Adams County, Colorado, February 1989.

5. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, March 1969, Revised May 1975, Revised May 1984.

6. Colorado Urban Hydrography Procedure Computer Program- PC Version (CUHPF/PC2) User Manual, Urban Drainage and Flood Control District, January 1985.

7. UDSWM3-PC, A Personal Computer Digital Model for Rainfall/Runoff Prediction and Watershed Simulation, Users Manual, Urban Drainage and Flood Control District, January, 1989.

8. Drainage Outfall Systems Planning, City of Brighton, McLaughlin Water Engineers, Ltd., July 1991.

9. Brighton Basin Master Drainage Plan, Nelson, Haley, Patterson and Quirk, Inc., August 1973.

10. Southeast Brighton Drainage Improvement Project, ARIX, September, 1979.

11. Final Drainage Report for Bromley Creek Filing Nº. 1, P.R. Fletcher and Associates, Revised July, 1995.

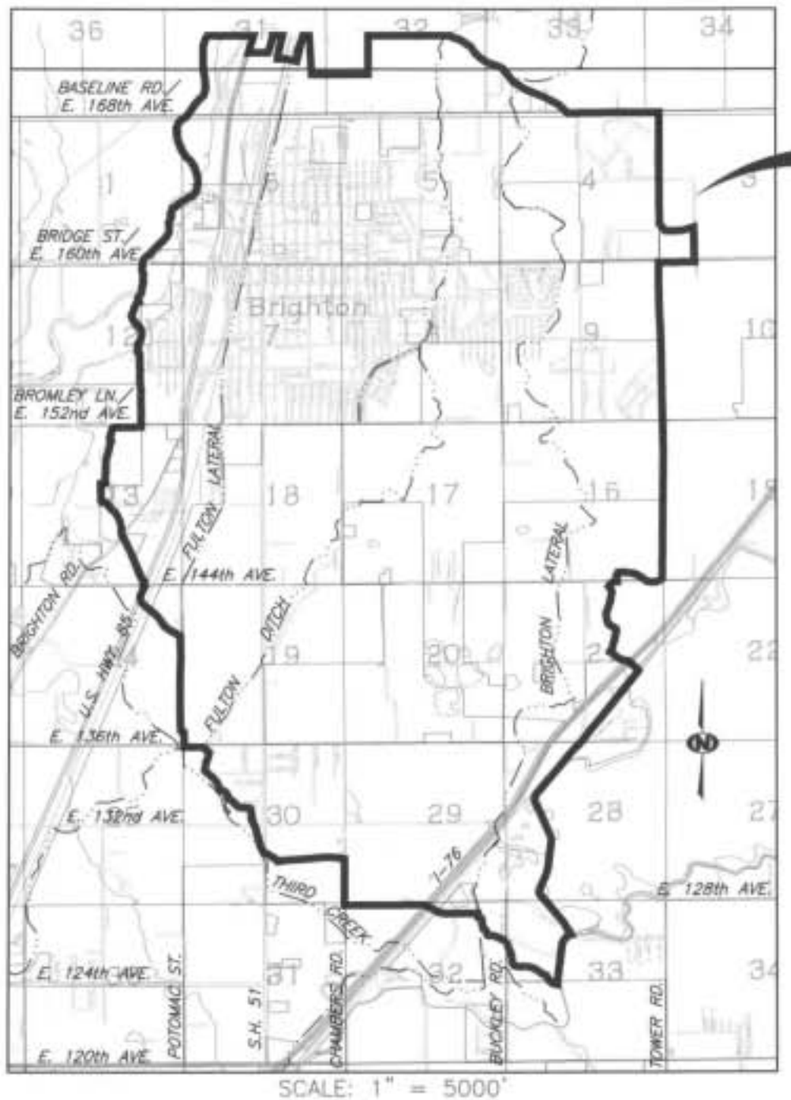
12. Drainage Report Mountain View Estates, Acklam Associates, August 17, 1995.

13. Comprehensive Land Use Plan, City of Brighton, December, 1989.

14. Adams County Transportation Plan, Felsburg, Holt, Ulevig, April 1996.

PRELIMINARY DESIGN DRAWINGS

BRIGHTON WATERSHED TRIBUTARY TO SOUTH PLATTE RIVER
OUTFALL SYSTEMS PLANNING



SCALE: 1" = 5000'

STUDY AREA BOUNDARY

SHEET INDEX

SHEET No.	TITLE
T	TITLE SHEET
1 – 56	PLAN SHEETS
100 – 122	PROFILE SHEETS
200	OUTFALL SYSTEM IMPROVEMENT DETAILS

PRELIMINARY DESIGN REPORT

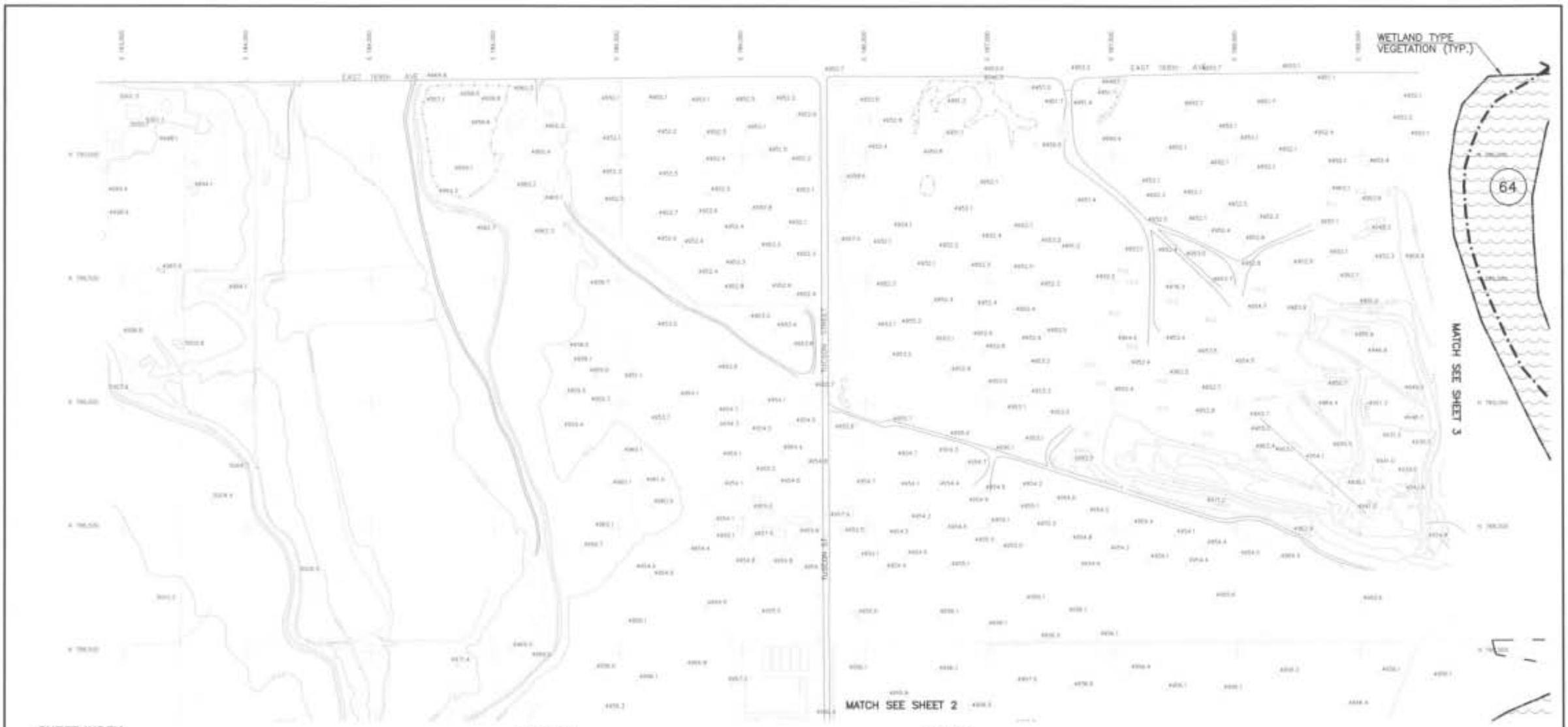
CITY OF BRIGHTON • ADAMS COUNTY • URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

DECEMBER, 2006

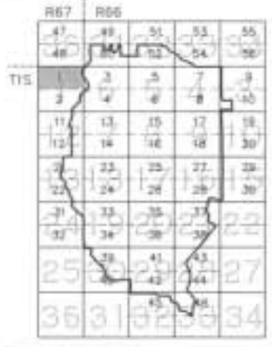
WRC ENGINEERING, INC.
1950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246 (303)757-8513

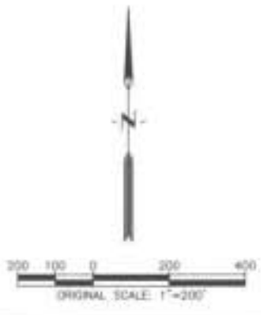
COMMENTARY ON SHEET 1

No improvements are proposed on this sheet.



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

1. THIS DRAWING IS FOR MASTER PLANNING PURPOSES AND REPRESENTS PRELIMINARY AND CONCEPTUAL ENGINEERING. ALTERNATIVES TO THIS OUTFALL SYSTEM WILL BE CONSIDERED BY LOCAL REVIEWING AGENCIES AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PROVIDED THE ALTERNATIVE OFFERS EQUAL HYDRAULIC CAPACITY AND STREAM STABILITY. THE ALTERNATIVE MUST COMPLY WITH ALL REQUIREMENTS OF THE LOCAL JURISDICTION AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.
2. JURISDICTIONAL BOUNDARIES SHOWN ON THIS DRAWING ARE IN EFFECT AS OF JANUARY, 1998.
3. THIS PLAN REQUIRES THAT THE CITY OF BRIGHTON AND ADAMS COUNTY ZONE, MANAGE, AND REGULATE DEVELOPMENT IN THIS WATERSHED IN ACCORDANCE WITH THE RECOMMENDATIONS OF THIS PLAN IN ORDER TO PREVENT FLOOD DAMAGES RELATED TO FUTURE DEVELOPMENT.
4. PRELIMINARY DESIGN INFORMATION FOR SUBREGIONAL DETENTION FACILITIES IS PRESENTED ON SHEET 8B. ANY CHANGE IN SIZE AND/OR LOCATION OF A SUBREGIONAL DETENTION FACILITY MUST COMPLY WITH THE SUBREGIONAL DETENTION FACILITY IMPLEMENTATION GUIDELINES PRESENTED IN THIS OUTFALL SYSTEMS PLANNING DOCUMENT.
5. IF A DOWNSTREAM SUBREGIONAL DETENTION FACILITY AND CONVEYANCE SYSTEM(S) ARE IN PLACE, ALL DEVELOPMENT UPSTREAM WITHIN THAT TRIBUTARY WATERSHED WILL BE ALLOWED TO RELEASE UNDETAINED ON-SITE FLOWS INTO THE OUTFALL DRAINAGE SYSTEM.
6. ANY PROPOSED CHANGES MUST BE APPROVED BY THE CITY OF BRIGHTON (OR ADAMS COUNTY) AND THE UDFCD. ANY POTENTIAL USER SHOULD CONTACT THE LOCAL REVIEWING AGENCY FOR ANY REVISIONS OF THE PLAN IN THE NEARBY VICINITY.
7. DATUM: VERTICAL = NAVD 1988
   HORIZONTAL = NAD 1983-1992

MAP AND AUTOCAD FILE PRODUCED BY:
LANDMARK MAPPING LTD.
7500 WEST MISSISSIPPI AVENUE, SUITE J1
LAKEWOOD, COLORADO 80232
PHONE: (303) 932-2417 FAX: (303) 932-2984

TOWNSHIP 1 S.
RANGE 67 W.
SECTION N. 1/2 1

WRC ENGINEERING, INC.
1604 SOUTH CLEVELAND STREET
SUITE 404
DENVER, COLORADO 80210
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FAX NO. (303) 756-3338

DESIGNED	TTC	DATE	3/28/05
DRAWN	MAS	DATE	3/28/05
CHECKED		DATE	
REVISED	AFW	DATE	12/2024
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

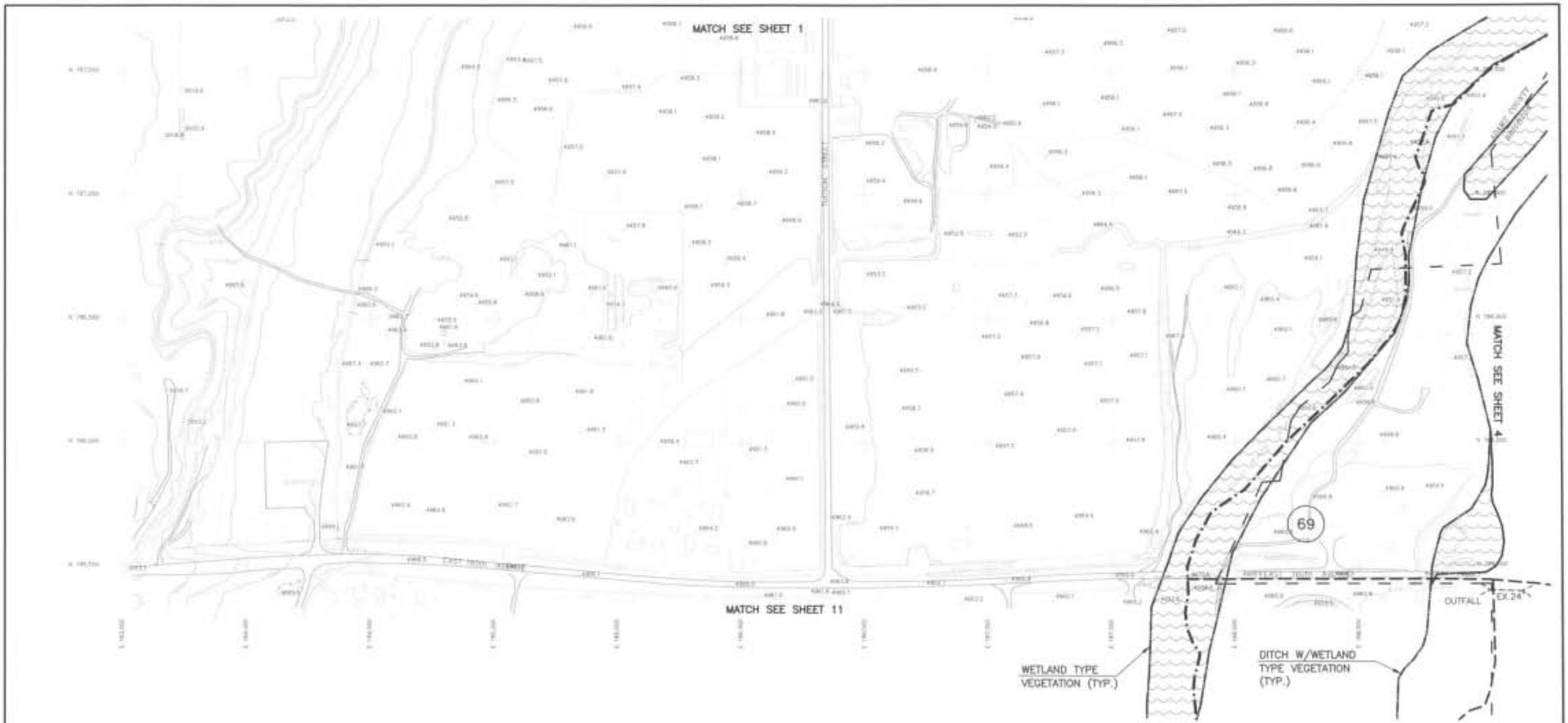
OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

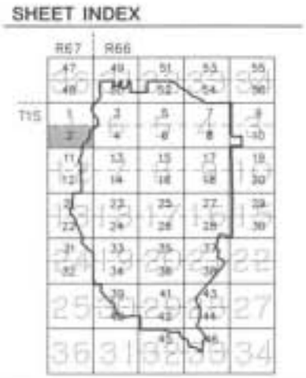
SHEET
1

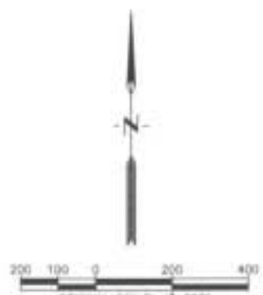
COMMENTARY ON SHEET 2

No improvements are proposed on this sheet.



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
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7. DATUM: VERTICAL = NAVD 1988
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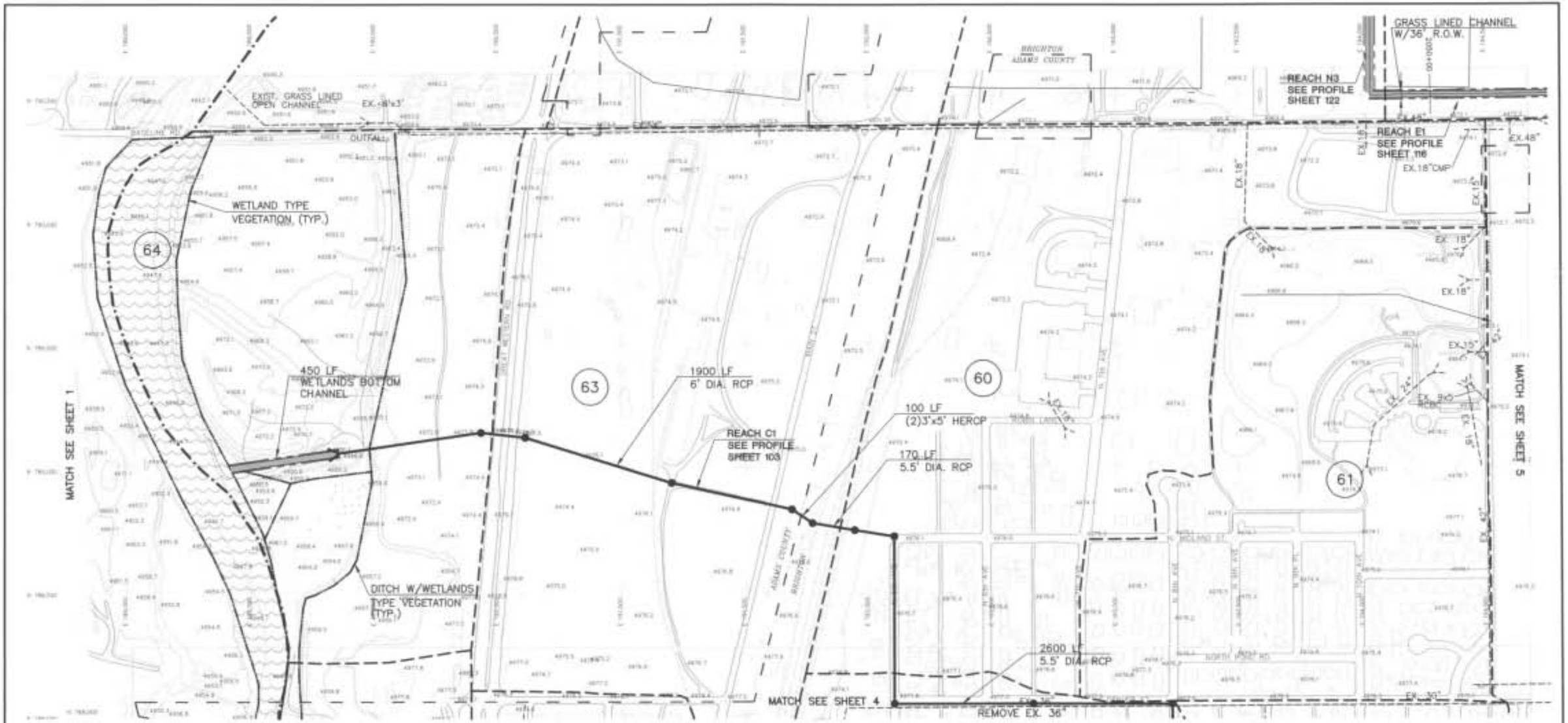
MAP AND AUTOCAD FILE PRODUCED BY: LANDMARK MAPPING LTD. 7500 WEST MISSISSIPPI AVENUE, SUITE 21 LAKEWOOD, COLORADO 80232 PHONE: (303) 922-2417 FAX: (303) 922-2866	TOWNSHIP 1 S. RANGE 67 W. SECTION S. 1/2 1	WRC ENGINEERING, INC. 350 SOUTH CHERRY STREET SUITE 404 DENVER, COLORADO 80246 PHONE NO. (303) 757-8513 FAX NO. (303) 758-3208	DESIGNED TTC DATE 1/28/05 DRAWN MAG DATE 1/28/05 CHECKED DATE REVISED APM DATE 1/27/2006 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PLAN	SHEET 2

COMMENTARY ON SHEET 3

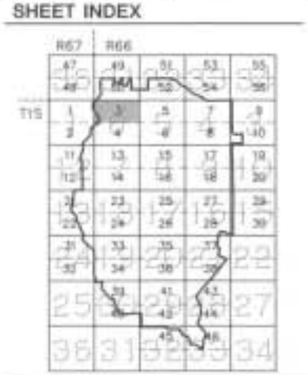
Presented on Sheet 3 are the proposed improvements for Outfall Systems E1, N3, and C1. The improvements were designed for flood peaks based on future development and a 100-year recurrence period with the exception of Reach C1. Reach C1 was designed to reduce flooding resulting from the minor storm event.

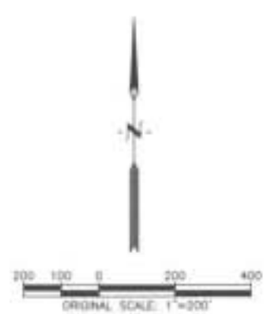
The total costs of improvements for the outfall systems on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
3	C01	Channel	$71,000.00
3	C01	Storm Sewer	$703,000.00
3	C01	Storm Sewer	$631,000.00
3	E01	Channel	$41,000.00
3	N03	Channel	$163,000.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

1. THIS DRAWING IS FOR MASTER PLANNING PURPOSES AND REPRESENTS PRELIMINARY AND CONCEPTUAL ENGINEERING ALTERNATIVES TO THIS OUTFALL SYSTEM WILL BE CONSIDERED BY LOCAL REVIEWING AGENCIES AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT PROVIDED THE ALTERNATIVE OFFERS EQUAL HYDRAULIC CAPACITY AND STREAM STABILITY. THE ALTERNATIVE MUST COMPLY WITH ALL REQUIREMENTS OF THE LOCAL JURISDICTION AND THE URBAN DRAINAGE AND FLOOD CONTROL DISTRICT. THIS DRAWING SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.
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5. IF A DOWNSTREAM SUBREGIONAL DETENTION FACILITY AND CONVEYANCE SYSTEM(S) ARE IN PLACE, ALL DEVELOPMENT UPSTREAM WITHIN THAT TRIBUTARY WATERSHED WILL BE ALLOWED TO RELEASE UNDETAINED ON-SITE FLOWS INTO THE OUTFALL DRAINAGE SYSTEM.
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7. DATUM: VERTICAL = NAVD 1988
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TOWNSHIP 1 S.
RANGE 66 W.
SECTION N. 1/2 6

WRC ENGINEERING, INC.
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DENVER, COLORADO 80246
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DESIGNED	TTC	DATE	5/28/05
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REVISED	APM	DATE	12/2008
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 3

COMMENTARY ON SHEET 4

Presented on Sheet 3 are the proposed improvements for Outfall Systems C1, C2, and C3. The improvements were to reduce flooding resulting from the minor storm event.

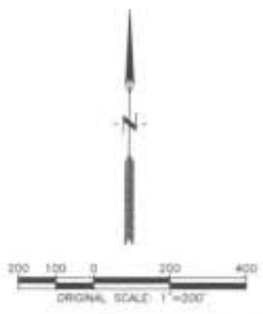
The total costs of improvements for the outfall systems on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
4	C01	Storm Sewer	$489,000.00
4	C01	Storm Sewer	$355,000.00
4	C02	Storm Sewer	$314,000.00
4	C03	Storm Sewer	$215,000.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
4

COMMENTARY ON SHEET 5

Presented on Sheet 5 are the proposed improvements for Outfall Systems C4, E1, E2, E3, E13 and E14. The improvements were designed for flood peaks based on future development and a 100-year recurrence period with the exception of Reach C4. Reach C4 was designed to reduce flooding resulting from the minor storm event. Detention Basin X is also presented on this sheet.

The Detention basin was designed to have a 40 hour release rate for 5-year storm events and a 0.1 cfs /acre release rate for 100-year storms

The improvements for Outfall System E1 includes a 1600 foot grass lined channel with a concrete trickle channel. A proposed 66" RCP culvert and a 42" RCP storm sewer are also presented on this sheet.

The improvements for Outfall System E2 includes a 2130 foot grass lined channel with a concrete trickle channel.

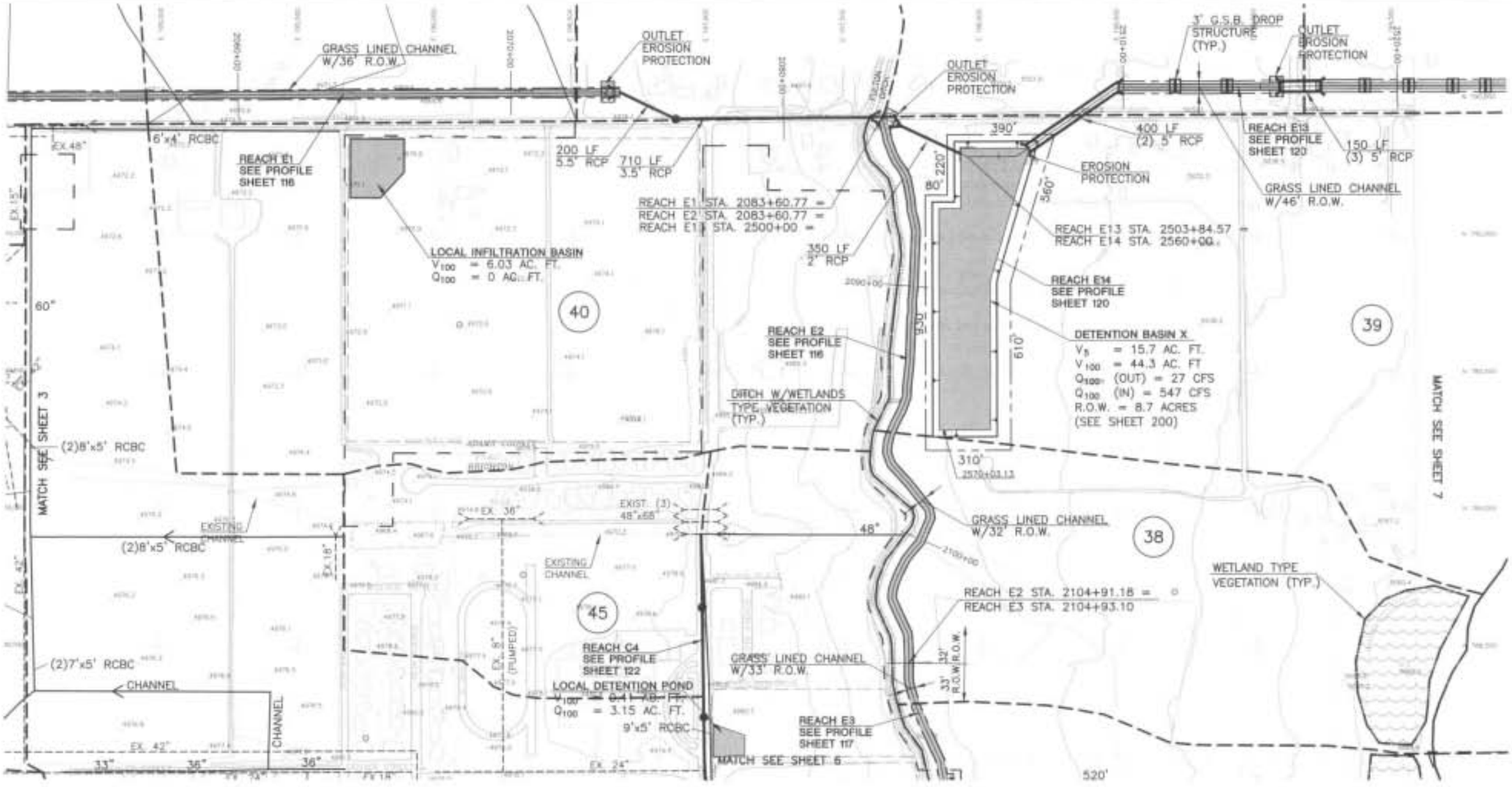
The improvements for Outfall System E3 includes a 400 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System E13 includes a 1100 foot grass lined channel with a concrete trickle channel and drop structures. Also presented on this sheet for this Outfall System are a proposed double 72" reinforced concrete box culvert, a proposed double 60" reinforced concrete box culvert, a 24" RCP Detention Basin Outlet.

Outfall system E14 consists of a trickle channel within Detention basin X

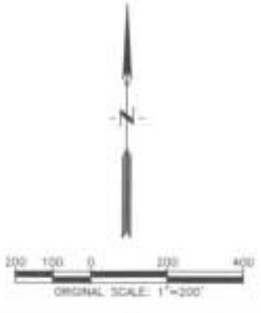
The total costs of improvements for the outfall systems on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
5	C04	Storm Sewer	$293,000.00
5	E01	Channel	$221,000.00
5	E01	Culvert	$85,200.00
5	E01	Jacking	$126,900.00
5	E01	Jacking	$126,900.00
5	E01	Storm Sewer	$132,000.00
5	E02	Channel	$180,000.00
5	E03	Channel	$35,000.00
5	E13	Channel	$114,000.00
5	E13	Culvert	$311,900.00
5	E13	Culvert	$154,700.00
5	E13	Pond Outlet/Culvert	$54,900.00
5	E13	Detention Basin X	$1,324,357.50



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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REVISED	JPM	DATE 12/2006
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 5

COMMENTARY ON SHEET 6

Presented on Sheet 6 are the proposed improvements for Outfall Systems C4, E3, and E15. The improvements were designed for flood peaks based on future development and a 100-year recurrence period with the exception of Reach C4. Reach C4 was designed to reduce flooding resulting from the minor storm event. Detention Basin V is also presented on this sheet.

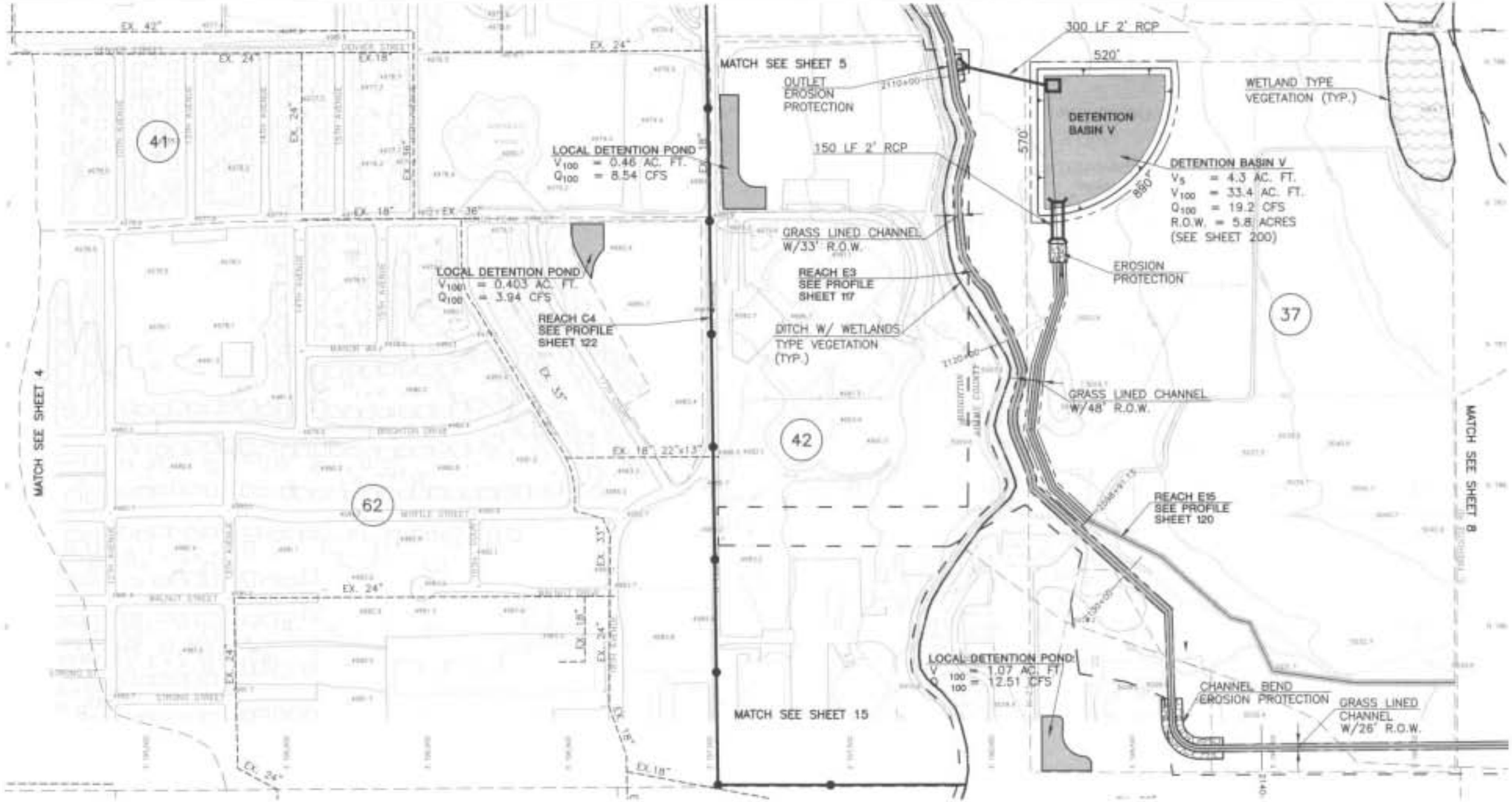
Detention Basin V was designed to have a 40 hour release rate for 5-year storm events and a 0.1 cfs /acre release rate for 100-year storms

The improvements for Outfall System E3 includes a 3300 foot grass lined channel with a concrete trickle channel.

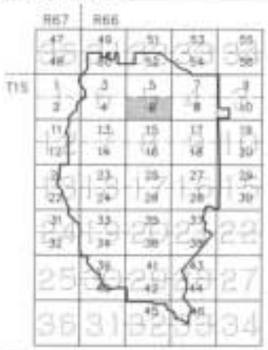
The improvements for Outfall System E15 includes a 1000 foot grass lined channel with a concrete trickle channel. A 24" RCP is also presented on this sheet.

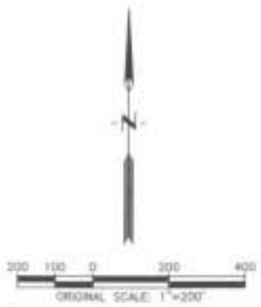
The total costs of improvements on this sheet is as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
6	C04	Storm Sewer	$764,000.00
6	E03	Channel	$95,000.00
6	E03	Channel	$202,000.00
6	E15	Channel	$185,000.00
6	E15	Pond Outlet/Culvert	$31,300.00
6	E15	Detention Basin V	$0.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
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SECTION 5 1/2 5

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
6

COMMENTARY ON SHEET 7

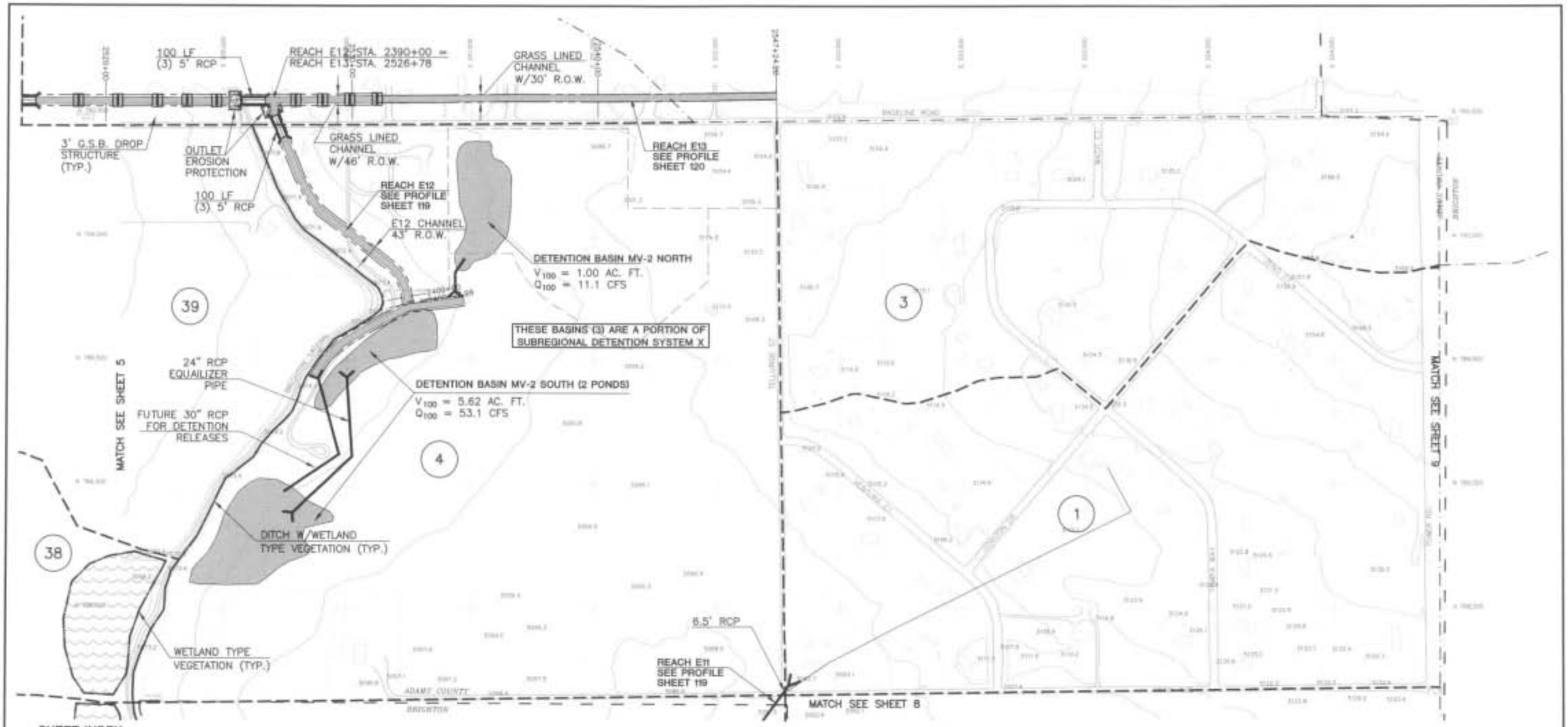
Presented on Sheet 7 are the proposed improvements for Outfall Systems E12 and E13. The improvements were designed for flood peaks based on future development and a 100-year recurrence period

The improvements for Outfall System E12 includes a 930 foot grass lined channel with a concrete trickle channel. Also presented on this sheet for this Outfall System is a proposed triple 60" reinforced concrete pipe culvert.

The improvements for Outfall System E13 includes a 2425 foot grass lined channel with a concrete trickle channel and drop structures. Also presented on this sheet for this Outfall System is a proposed triple 60" reinforced concrete pipe culvert.

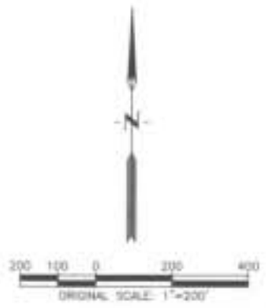
The total costs of improvements for Outfall Systems E12 and E13 on this sheet is as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
7	E12	Channel	$76,000.00
7	E12	Culvert	$110,300.00
7	E12		$0.00
7	E13	Channel	$76,000.00
7	E13	Channel	$126,000.00
7	E13	Culvert	$110,300.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
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- DETENTION BASIN OUTLET

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
7

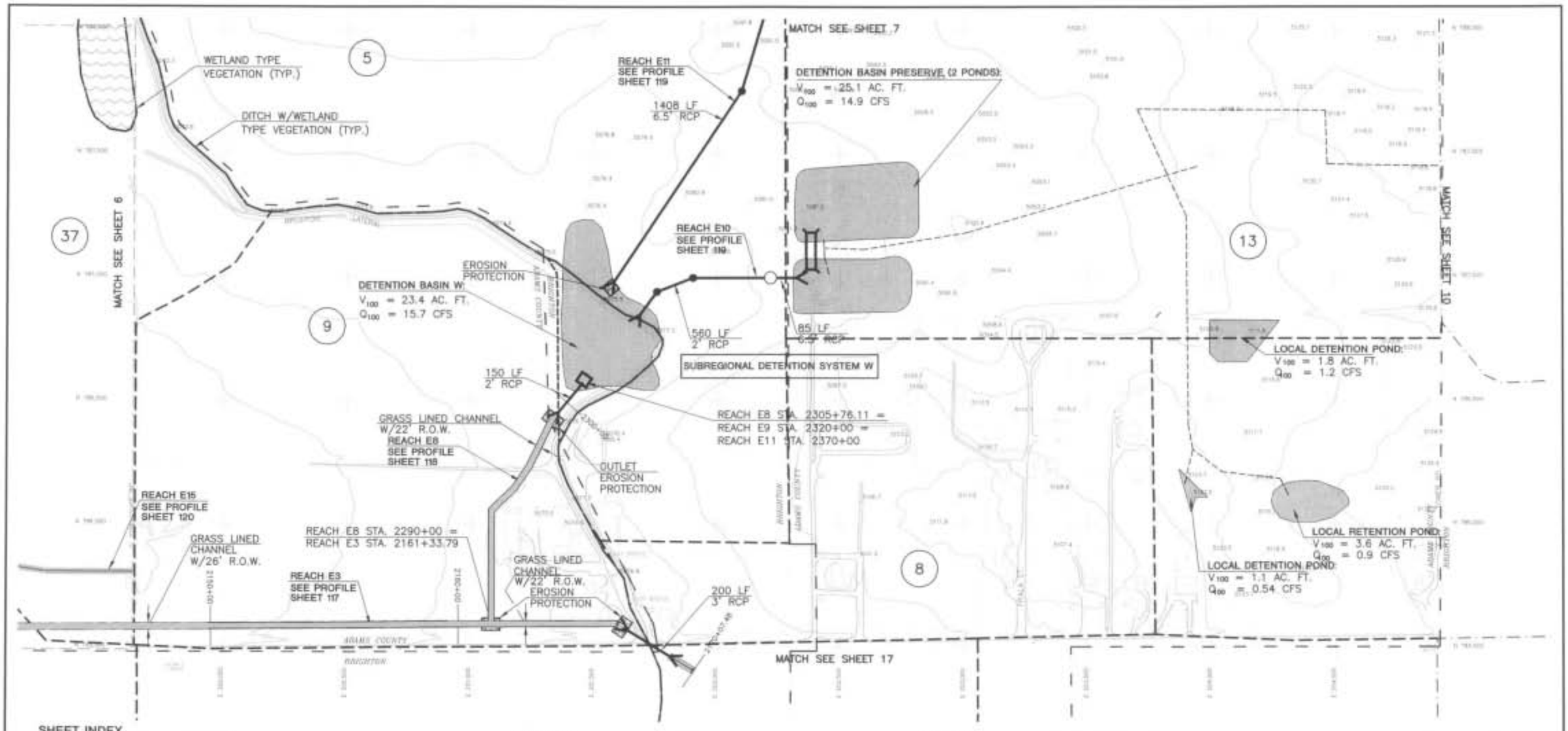
COMMENTARY ON SHEET 8

Presented on Sheet 8 are the proposed improvements for Outfall Systems E3, E8, E10 and E11 . The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basin W is also presented on this sheet.

Detention Basin W was designed to have a 40 hour release rate for 5-year storm events and a 0.1 cfs / acre release rate for 100-year storms

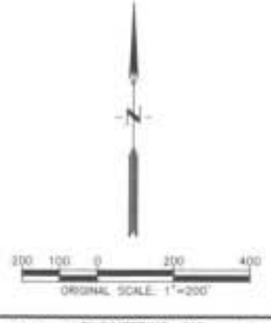
The total costs of improvements for the Outfall System on this sheet and for Detention Basin W are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
8	E03	Channel	$82,000.00
8	E03	Channel	$41,000.00
8	E03	Culvert	$52,600.00
8	E08	Channel	$47,000.00
8	E08	Pond Outlet/Culvert	$37,100.00
8	E11	Storm Sewer	$348,000.00
8	E11	Detention Basin W	$0.00
8	E9	Detention Basin PRESERVE	$0.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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TOWNSHIP 1 S.
RANGE 66 W.
SECTION 5, 1/2 & 8

19600101.dwg

WRC ENGINEERING, INC.
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

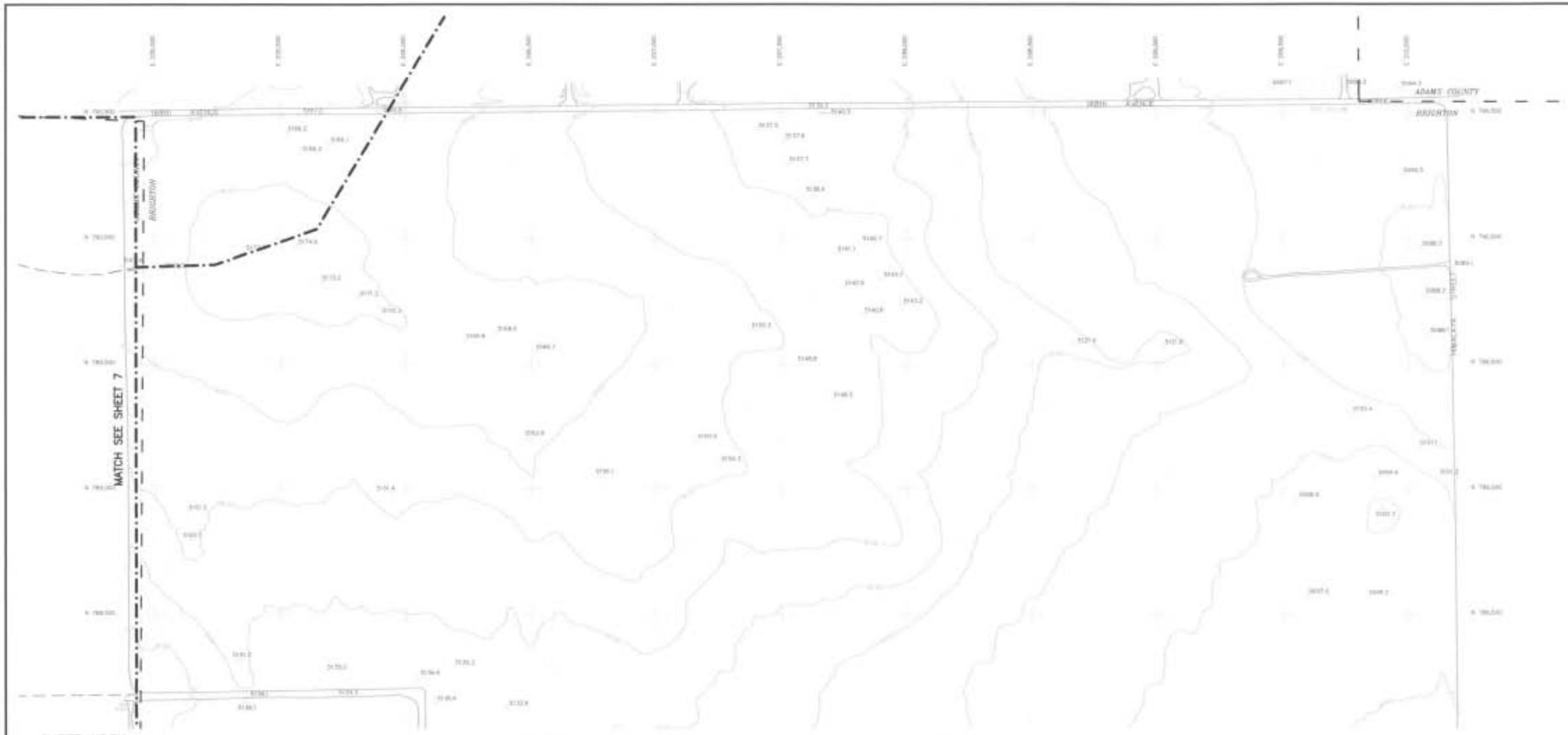
OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

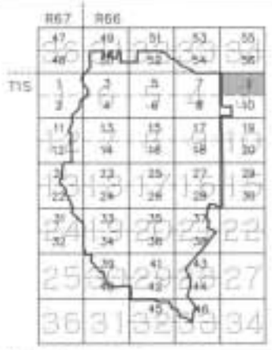
SHEET 8

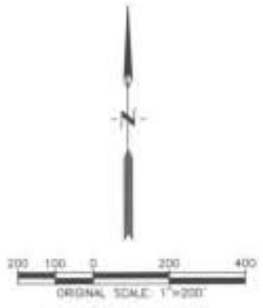
COMMENTARY ON SHEET 9

No improvements are proposed on this sheet.



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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REVISED	APM	12/2009
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 9

COMMENTARY ON SHEET 10

No improvements are proposed on this sheet.

MATCH SEE SHEET 9

MATCH SEE SHEET 8

LOCAL DETENTION POND
V_{100} = 1.55 AC. FT.
Q_{100} = 9.8 AC. FT.

7

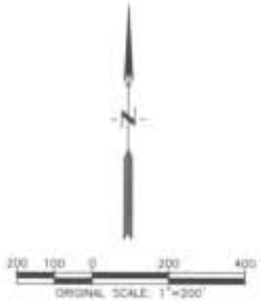
ADAMS COUNTY
BRIGHTON

MATCH SEE SHEET 19

BRIGHTON
ADAMS COUNTY

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
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MASTER PLAN FACILITIES

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
10

COMMENTARY ON SHEET 11

Presented on Sheet 11 are the proposed improvements for Outfall System S1. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

The improvements for Outfall System S1 includes a 2100 foot wetlands bottom channel.

The total costs of improvements for the Outfall System on this are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
11	S01	Channel	$679,000.00

MATCH SEE SHEET 2

WETLAND TYPE VEGETATION (TYP.)

WETLANDS BOTTOM CHANNEL W/100' R.O.W.

DITCH W/WETLAND TYPE VEGETATION (TYP.)

OUTFALL

69

68

ADAMS COUNTY

REACH S1 SEE PROFILE SHEET 100

OUTLET EROSION PROTECTION

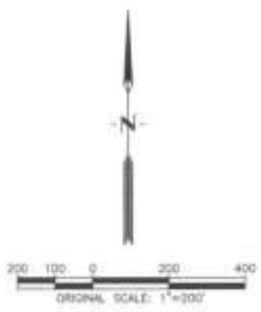
30+00

MATCH SEE SHEET 13

MATCH SEE SHEET 12

SHEET INDEX





LEGEND

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REVISED	MAS	DATE	12/2004
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 11

COMMENTARY ON SHEET 12

Presented on Sheet 12 are the proposed improvements for Outfall Systems S1 and S43. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

The improvements for Outfall System S1 includes a 2300 foot wetlands bottom channel and a 2200 wetland channel.

Outfall system S1 also includes two triple 6' x 12' Reinforce concrete box culverts.

A proposed 54" storm sewer in Outfall System S43 is presented on this sheet.

The total costs of improvements for the Outfall System on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
12	S01	Channel	$884,000.00
12	S01	Culvert	$420,500.00
12	S01	Culvert	$297,700.00
12	S43	Storm Sewer	

MATCH SEE SHEET 11

DITCH W/WETLANDS TYPE VEGETATION (TYP.)

200' (3) 6'x12' RCBC

WETLANDS BOTTOM CHANNEL W/150' R.O.W.

SOUTH OUTFALL CHANNEL

EXIST. 8'x6' RBC

EX. 7'x4'

EX. 72"

EX. 72"

EX. 36"

EX. 24"

ADAMS COUNTY
BRIGHTON

EX. 42"

EX. 24"

EX. 18"

EX. 24"

EXIST. 24"x19" (38)

MATCH SEE SHEET 14

EXIST. 28"x19"

WETLANDS BOTTOM CHANNEL W/100' R.O.W.

EX. 24"

73

REACH S1
SEE PROFILE
SHEET 100

REACH S1 STA. 56+56.97 =
REACH S43 STA. 3170+00

720' LF
4.5' RCP

OUTLET EROSION PROTECTION

REACH S43
SEE PROFILE
SHEET 115

MANHOLE (TYP.)

EX.

EX. 18"

BROMLEY LANE

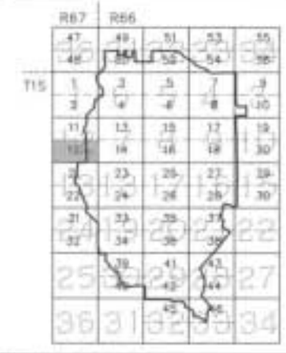
MATCH SEE SHEET 21

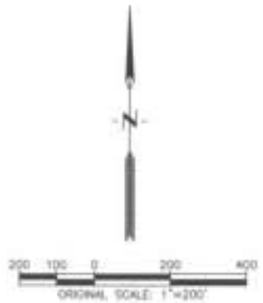
90' (3) 6'x12' RCBC

77

EX. 54"

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 12

COMMENTARY ON SHEET 13

No improvements are proposed on this sheet.



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
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CHECKED		DATE
REVISED	APW	DATE 12/2006
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 13

COMMENTARY ON SHEET 14

No improvements are proposed on this sheet.

MATCH SEE SHEET 13

DITCH WITH WETLANDS TYPE VEGETATION (TYP.)

MATCH SEE SHEET 12

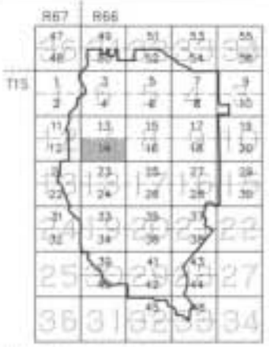
MATCH SEE SHEET 16

MATCH SEE SHEET 23

BRIGHTON

ADAMS COUNTY

SHEET INDEX



LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

200 100 0 200 400

ORIGINAL SCALE: 1"=200'

NOTES:

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7. DATUM: VERTICAL = NAVD 1988
   HORIZONTAL = NAD 1983-1992

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LANDMARK MAPPING LTD.
7500 WEST MISSISSIPPI AVENUE, SUITE J1
LAKEWOOD, COLORADO 80232
PHONE: (303) 922-2417 Fax: (303) 922-2866

TOWNSHIP 1 S.
RANGE 66 W.
SECTION S 1/2 7

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246
PHONE NO: (303) 757-8513
FAX NO: (303) 759-3208

DESIGNED	TTC	DATE	3/28/09
DRAWN	MRS	DATE	3/28/09
CHECKED		DATE	
REVISED	APM	DATE	12/2009
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
14

COMMENTARY ON SHEET 15

Presented on Sheet 15 are the proposed improvements for Outfall System C4. Reach C1 was designed to reduce flooding resulting from the minor storm event

The total costs of improvements for the Outfall Systems on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
15	C04	Storm Sewer	$360,000.00

MATCH SEE SHEET 6

REACH C4
SEE PROFILE
SHEET 122

DITCH WITH
WETLANDS TYPE
VEGETATION (TYP.)

LOCAL DETENTION POND
V_{100} = 0.33 AC. FT.
Q_{100} = 2.5 CFS

LOCAL DETENTION POND
V_{100} = 0.31 AC. FT.
Q_{100} = 2.3 CFS

CHANNEL BEND
EROSION PROTECTION

GRASS LINED CHANNEL
W/33' R.O.W.

REACH E3
SEE PLAN
SHEET 6
SEE PROFILE
SHEET 117

GRASS LINED
CHANNEL
W/26' R.O.W.

33' 26'
R.O.W. R.O.W.

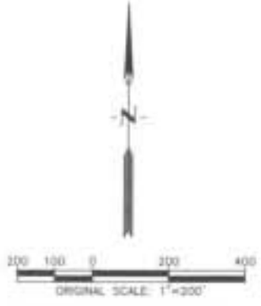
MATCH SEE SHEET 13

MATCH SEE SHEET 17

MATCH SEE SHEET 16

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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MAP AND AUTOCAD FILE PREPARED BY:
LINDMARK MAPPING LTD
7595 WEST MISSISSIPPI AVENUE, SUITE 21
LAKEWOOD, COLORADO 80226
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TOWNSHIP 1 S.
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SECTION N 1/2 8

WRC ENGINEERING, INC.
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FAX NO. (303) 759-3208

DESIGNED	TTL	DATE	5/28/99
DRAWN	MAS	DATE	7/26/99
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REVISED	APM	DATE	12/2006
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

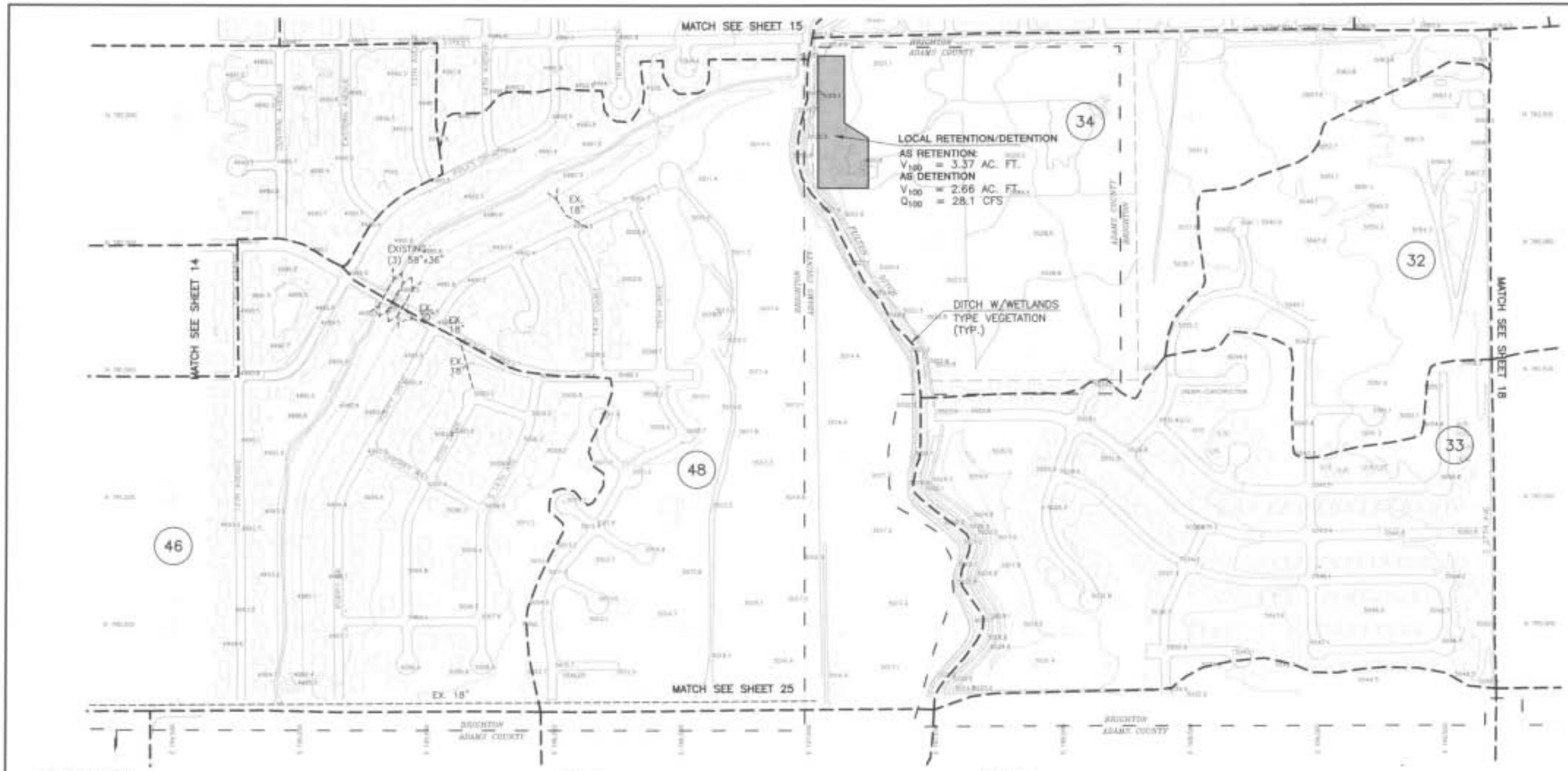
OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

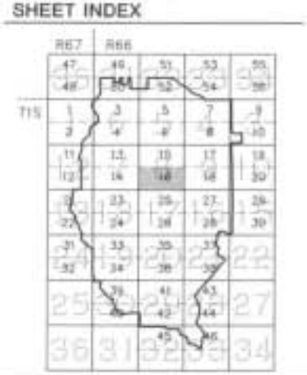
SHEET
15

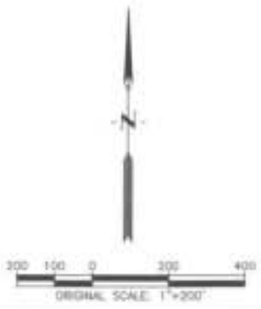
COMMENTARY ON SHEET 16

No improvements are proposed on this sheet.



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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TOWNSHIP 1 S.
RANGE 68 W.
SECTION 5 1/2 8

WRC ENGINEERING, INC.
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DESIGNED	TJC	DATE 5/28/05
DRAWN	MKS	DATE 5/28/05
CHECKED		DATE
REVISED	KRV	DATE 12/2005
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
16

COMMENTARY ON SHEET 17

Presented on Sheet 17 are the proposed improvements for Outfall Systems E4, E5, and E7. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basins T and U are also presented on this sheet.

The Detention Basins T and U were designed to have a 40 hour release rate for 5-year storm events and a 0.1 cfs / acre release rate for 100-year storms.

The improvements for Outfall System E4 include a 1950 foot 36" RCP.

Outfall System E4 also has 175 feet of 30" RCP.

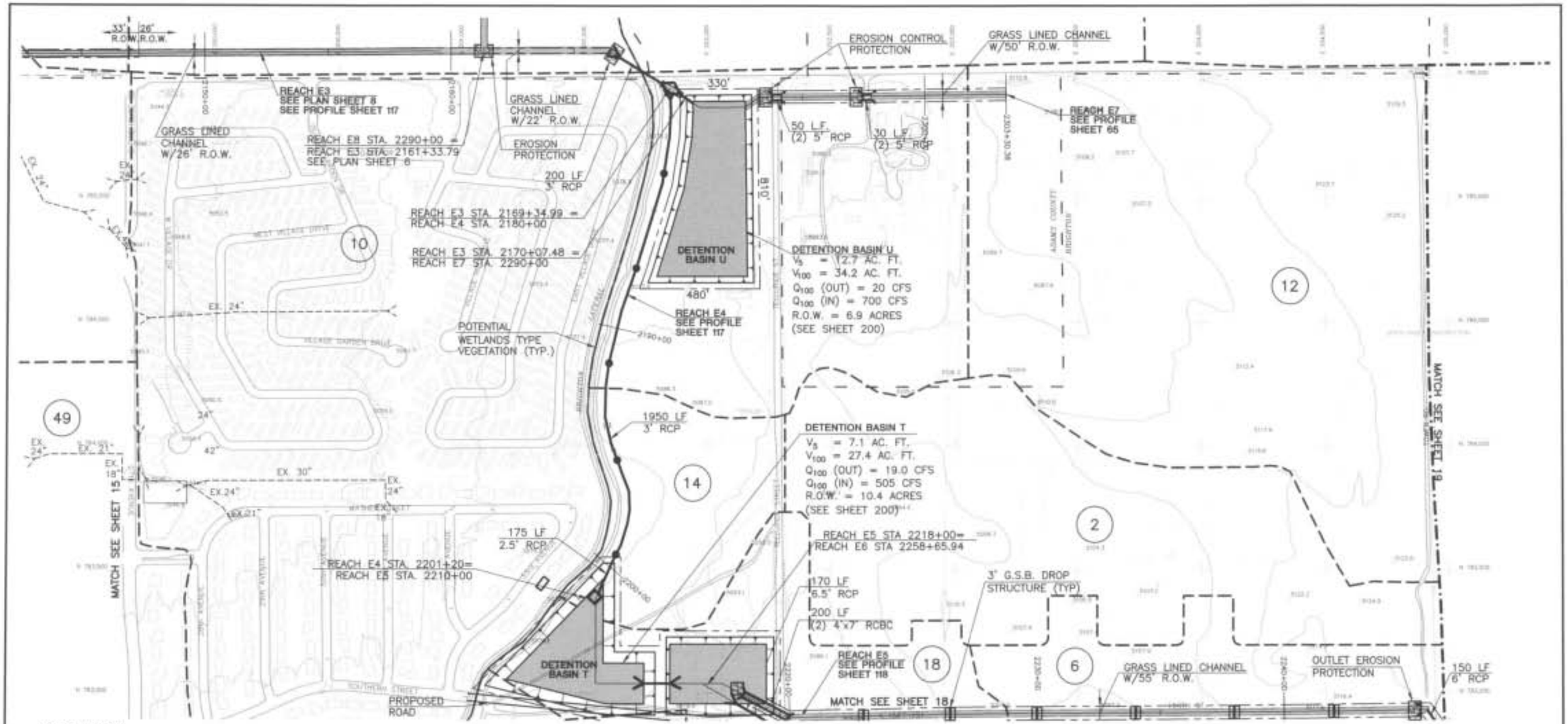
The improvements for Outfall System E5 includes a 2900 foot grass lined channel with a concrete trickle channel and drop structures and a 200 foot double 4' x 7' reinforced concrete box culvert. A 150 foot 72" RCP in also presented for this outfall system.

Proposed 78" storm sewer in Outfall System E6 is presented on this sheet.

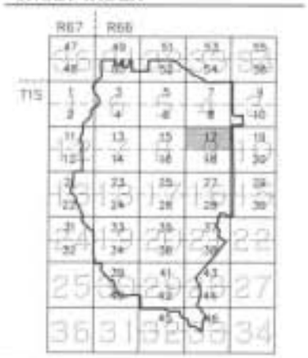
The improvements for Outfall System E7 includes a 740 foot grass lined channel with a concrete trickle channel. Outfall System E7 also includes two double 60" RCP culverts.

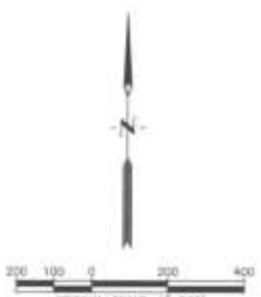
The total costs of improvements for the Outfall Systems on this sheet and for Detention Basin T and U are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
17	E04	Culvert	$38,900.00
17	E04	Storm Sewer	$319,000.00
17	E05	Channel	$208,000.00
17	E05	Channel	$153,000.00
17	E05	Culvert	$242,900.00
17	E05	Culvert	$76,100.00
17	E05	Detention Basin T	$1,030,796.25
17	E06	Storm Sewer	$69,000.00
17	E07	Channel	$92,000.00
17	E07	Culvert	$65,900.00
17	E07	Culvert	$65,900.00
17	E07	Detention Basin U	$1,044,258.75



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
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- DETENTION BASIN OUTLET

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7500 WEST MISSISSIPPI AVENUE, SUITE 31
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WRC ENGINEERING, INC.
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FAX NO: (303) 758-3008

DESIGNED	TTC	DATE 1/28/05
DRAWN	MAS	DATE 1/28/05
CHECKED		DATE
REVISED	APW	DATE 12/2006
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 17

COMMENTARY ON SHEET 18

Presented on Sheet 18 are the proposed improvements for Outfall Systems S5, S6 and E6. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

Proposed 36", 48", and 78" storm sewers in Outfall System E6 are presented on this sheet.

The improvements for Outfall System S5 consist of a 30" storm sewer and a 48" basin outlet structure.

The improvements for Outfall System S6 include a 380 foot grass lined channel with a concrete trickle channel. Also presented on this sheet for this Outfall System is a proposed single 72" reinforced concrete pipe culvert.

The total costs of improvements for the Outfall System on this sheet and for Detention Basins Y and SC are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
18	E06	Storm Sewer	$146,000.00
18	E06	Storm Sewer	$142,000.00
18	E06	Storm Sewer	$165,000.00
18	S05	Pond Outlet/Culvert	$34,000.00
18	S05	Storm Sewer	$167,000.00
18	S05	Detention Basin SC	$0.00
18	S06	Detention Basin SAFEWAY	$0.00

MATCH SEE SHEET 17

350 LF
6.5" RCP

710 LF
4" RCP

REACH E6
SEE PROFILE
SHEET 118

850 LF
3" RCP

MANHOLE
(TYP.)

2280+00

2280+50.39

150 LF
6" RCP

MATCH SEE SHEET 16

LOCAL DETENTION POND
NO DATA

DITCH WITH
WETLANDS TYPE
VEGETATION (TYP.)

DETENTION BASIN SC:
Q_{100} = 8.8 CFS
V_{100} = 14.1 CFS

DETENTION (SAFEWAY 1):
Q_{100} = 1 CFS
V_{100} = 2.3 AC. FT.

1100 LF
24" RCP

REACH S5
SEE PROFILE
SHEET 101, 102

MANHOLE
(TYP.)

3310 FL
2.5' RCP

DETENTION (SAFEWAY 2):
Q_{100} = 3 CFS
V_{100} = 6.5 AC. FT.

230+00

SUBREGIONAL DETENTION SYSTEM Y

DETENTION (SAFEWAY 3):
Q_{100} = 1 CFS
V_{100} = 1.3 AC. FT.

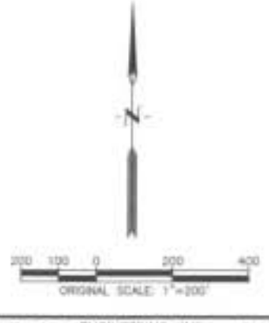
BRIGHTON LATERAL

MATCH SEE SHEET 27

MATCH SEE SHEET 20

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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250 SOUTH CHERRY STREET, SUITE 404
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
18

COMMENTARY ON SHEET 19

No improvements are proposed on this sheet.

MATCH SEE SHEET 10

MATCH SEE SHEET 17

MATCH SEE SHEET 20

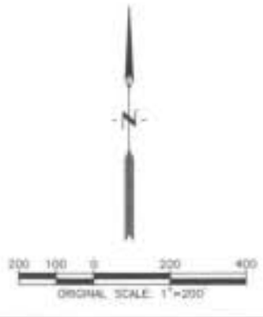
ADAMS COUNTY
BRIGHTON

BRIGHTON
ADAMS COUNTY

160th AVENUE

SHEET INDEX





LEGEND

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- DETENTION BASIN OUTLET

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7. DATUM: VERTICAL = NAVD 1988
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7500 WEST MISSISSIPPI AVENUE, SUITE 21
LAKEWOOD, COLORADO 80232
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TOWNSHIP 1 S.
RANGE 66 W.
SECTION N 1/2 10

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80246
PHONE NO. (303) 757-8513
FAX NO. (303) 756-2208

DESIGNED	TTC	DATE	1/28/09
DRAWN	MAS	DATE	1/28/09
CHECKED	APM	DATE	1/27/2009
REVISED		DATE	
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

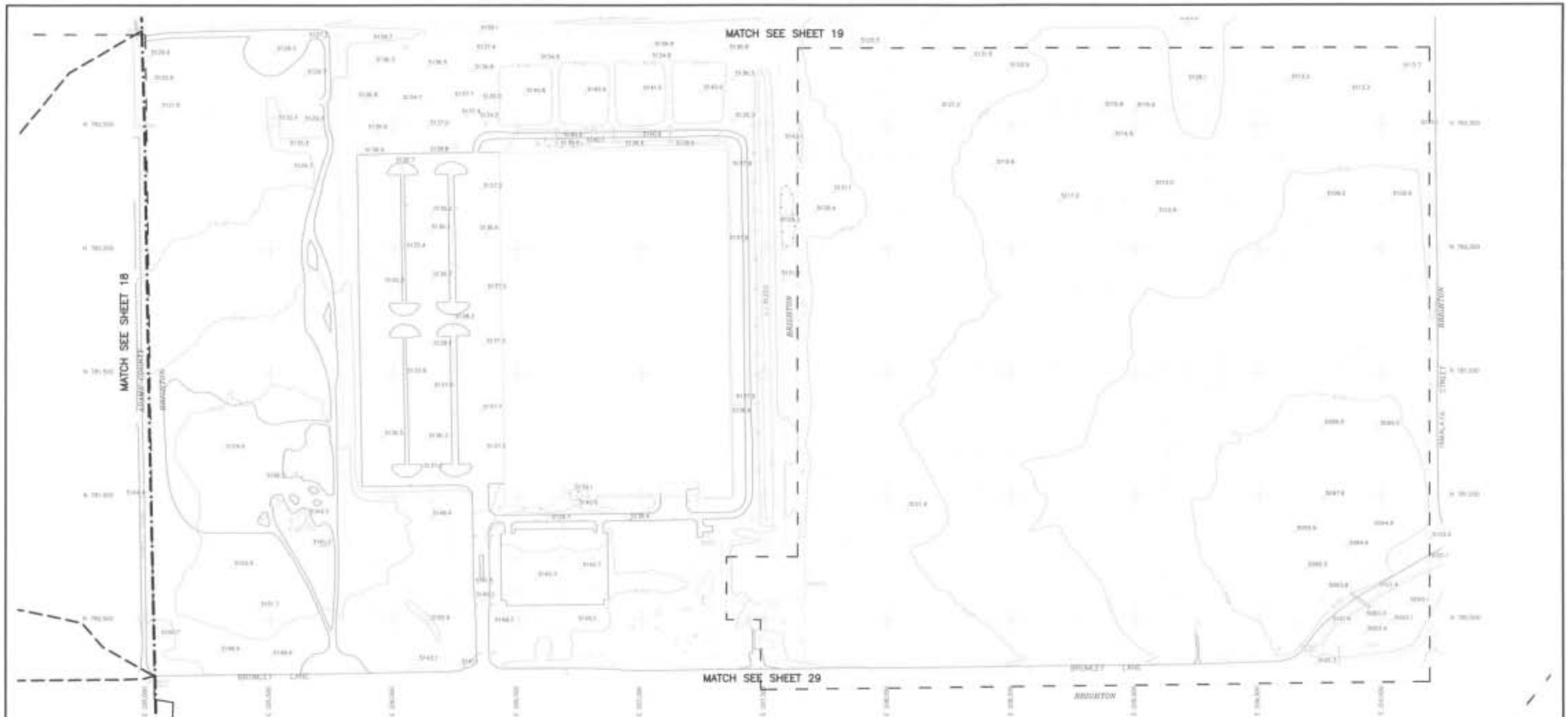
OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

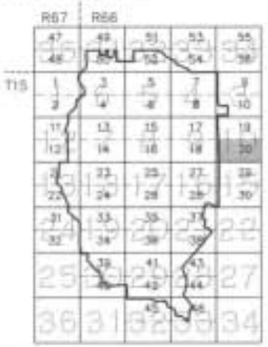
SHEET
19

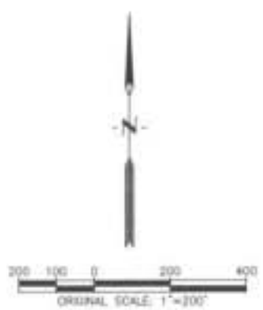
COMMENTARY ON SHEET 20

No improvements are proposed on this sheet.



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

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7500 WEST MISSISSIPPI AVENUE, SUITE 21
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TOWNSHIP 1 S.
RANGE 66 W.
SECTION 5, 1/2 10

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
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FAX NO: (303) 758-5208

DESIGNED	TIC	DATE	1/28/05
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REVISED	APM	DATE	2/2008
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
20

COMMENTARY ON SHEET 21

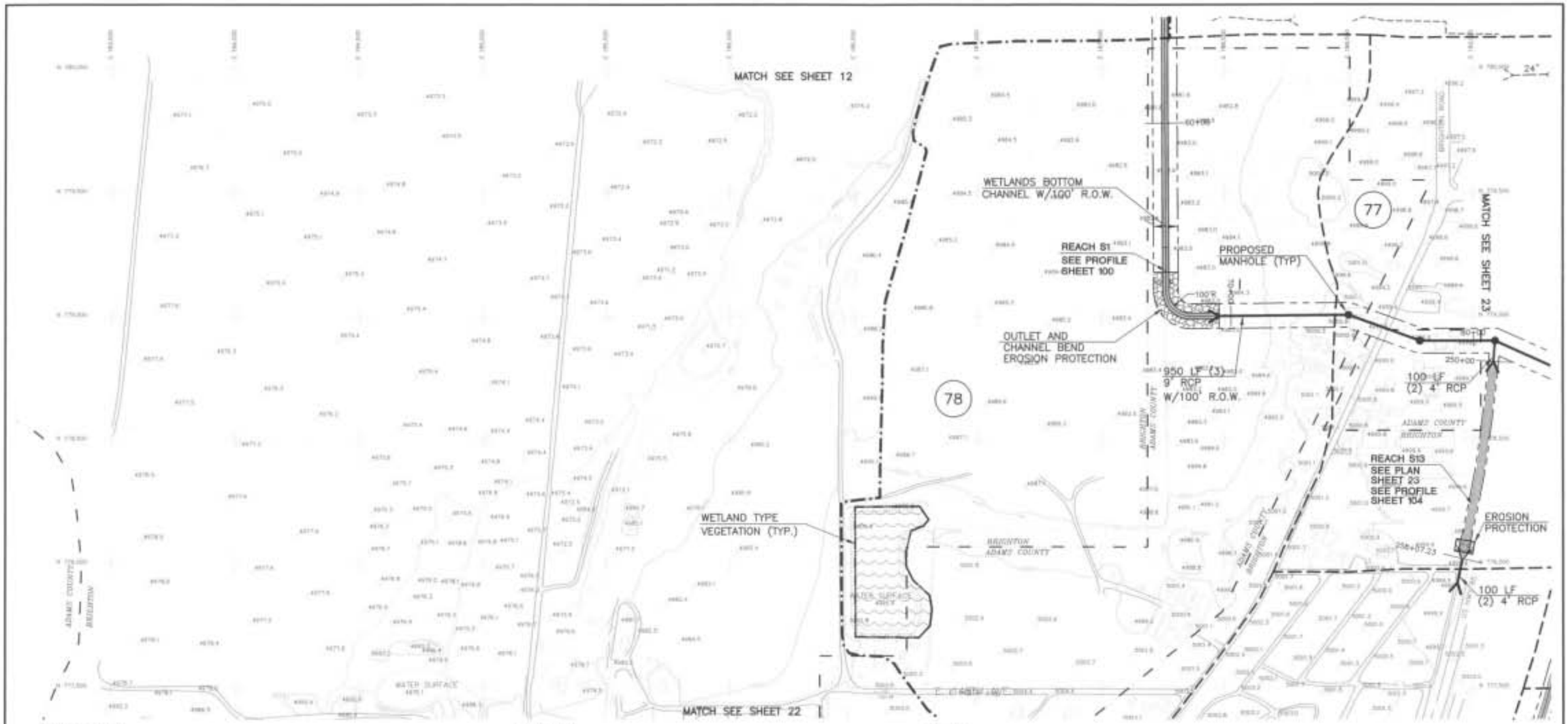
Presented on Sheet 21 are the proposed improvements for Outfall System S1. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

The improvements for Outfall System S1 includes a 1260 foot wetlands bottom channel. A triple 108" inch diameter RCP is also presented for Outfall System S1

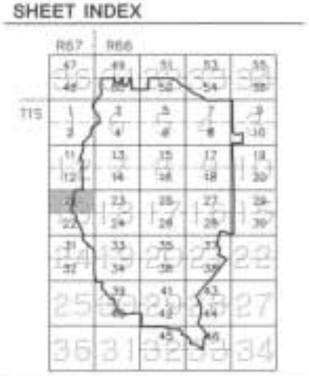
Cost information for Outfall System S13 can be seen on Sheet 23.

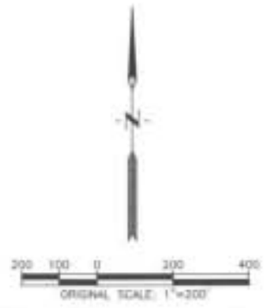
The total costs of improvements for the Outfall System on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
21	S01	Channel	$613,000.00
21	S01	Culvert	$2,655,400.00
21	S01	Culvert	$4,703,600.00
21	S01	Jacking	$2,175,000.00
21	S01	Jacking	$2,175,000.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

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MAP AND AUTOCAD FILE PRODUCED BY LANDMARK MAPPING LTD. 7500 WEST MISSISSIPPI AVENUE, SUITE 21 LAKEWOOD, COLORADO 80232 PHONE: (303) 922-2417 FAX: (303) 922-1999	TOWNSHIP 1 S. RANGE 67 W. SECTION N. 1/2 13	WRC ENGINEERING, INC. 850 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80246 PHONE NO: (303) 757-6513 FAX NO: (303) 758-2208	DESIGNED TTC DATE 3/28/00 DRAWN MAS DATE 3/28/00 CHECKED DATE REVISED APM DATE 12/2009 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PLAN	SHEET 21

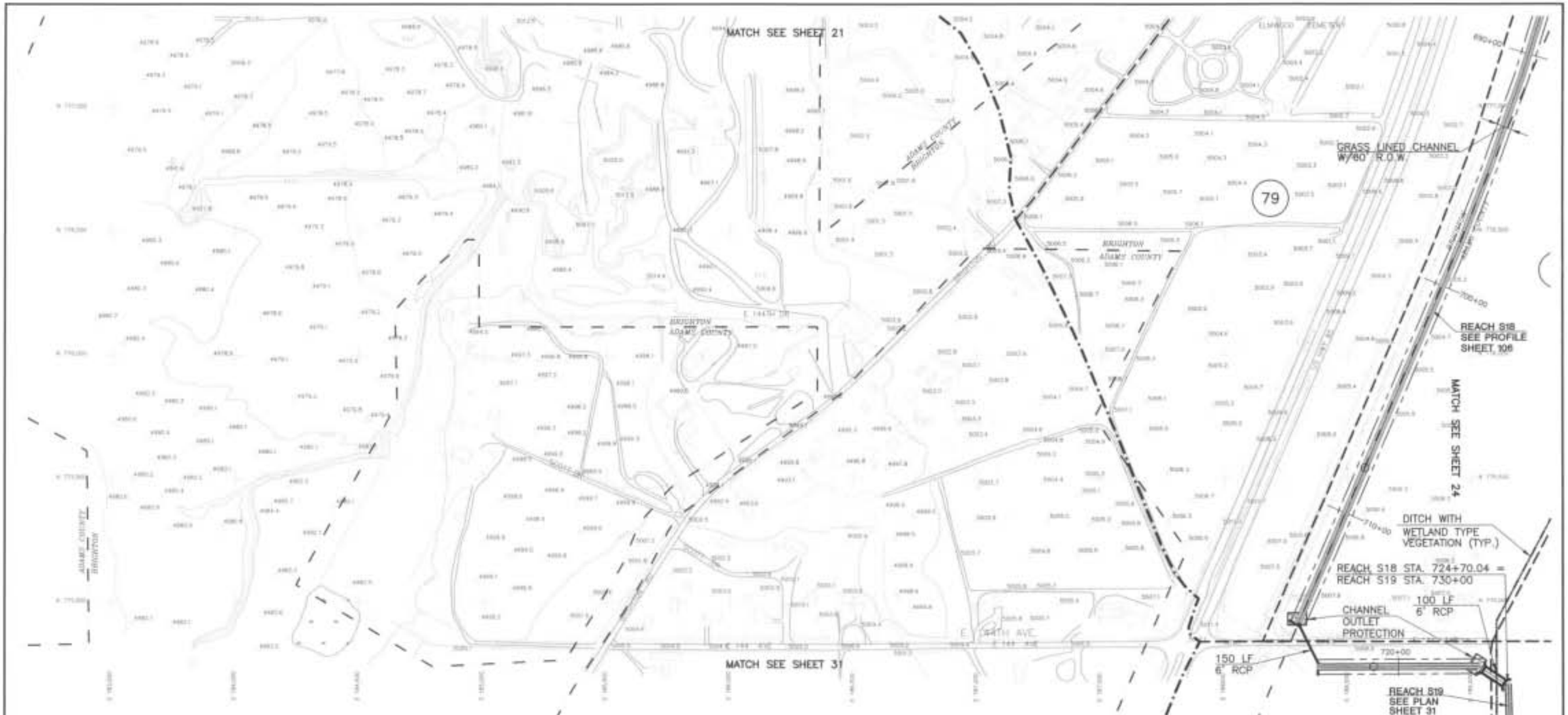
COMMENTARY ON SHEET 22

Presented on Sheet 22 are the proposed improvements for Outfall Systems S18. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

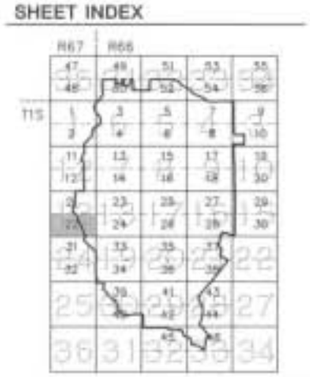
The improvements for Outfall System S18 includes a 3620 foot grass lined channel with a concrete trickle channel. Also presented on this sheet for this Outfall System are two proposed single 72" reinforced concrete pipe culverts.

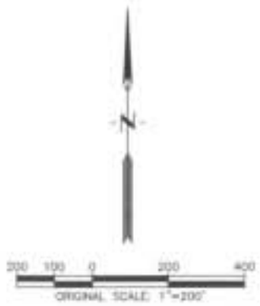
The total costs of improvements for the Outfall System on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
22	S18	Channel	$562,000.00
22	S18	Culvert	$58,000.00
22	S18	Culvert	$76,125.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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LAKEWOOD, COLORADO 80232
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TOWNSHIP 1 S.
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SECTION S. 1/2 13

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
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FAX NO: (303) 758-3208

DESIGNED	TTL	DATE	3/28/05
DRAWN	MRL	DATE	3/28/05
CHECKED		DATE	
REVISED	APM	DATE	12/2006
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 22

COMMENTARY ON SHEET 23

Presented on Sheet 23 are the proposed improvements for Outfall Systems S1, S2, S3, S13, S14, S18, S29 and S44. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basins P, Q, and J are also presented on this sheet.

A triple 108" inch diameter RCP is presented for Outfall System S1.

The Detention basins were designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms

The improvements for Outfall System S2 includes a 3650 foot wetlands bottom channel. Also presented on this sheet for this Outfall System is a proposed double 8' x 12' reinforced concrete box culvert.

The improvements for Outfall System S3 includes a 1360 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System S13 includes a 710 foot grass lined channel with a concrete trickle channel. Two proposed 48" RCP are also presented on this sheet.

The improvements for Outfall System S14 includes a 610 foot grass lined channel with a concrete trickle channel. A proposed 48" RCP is also presented on this sheet.

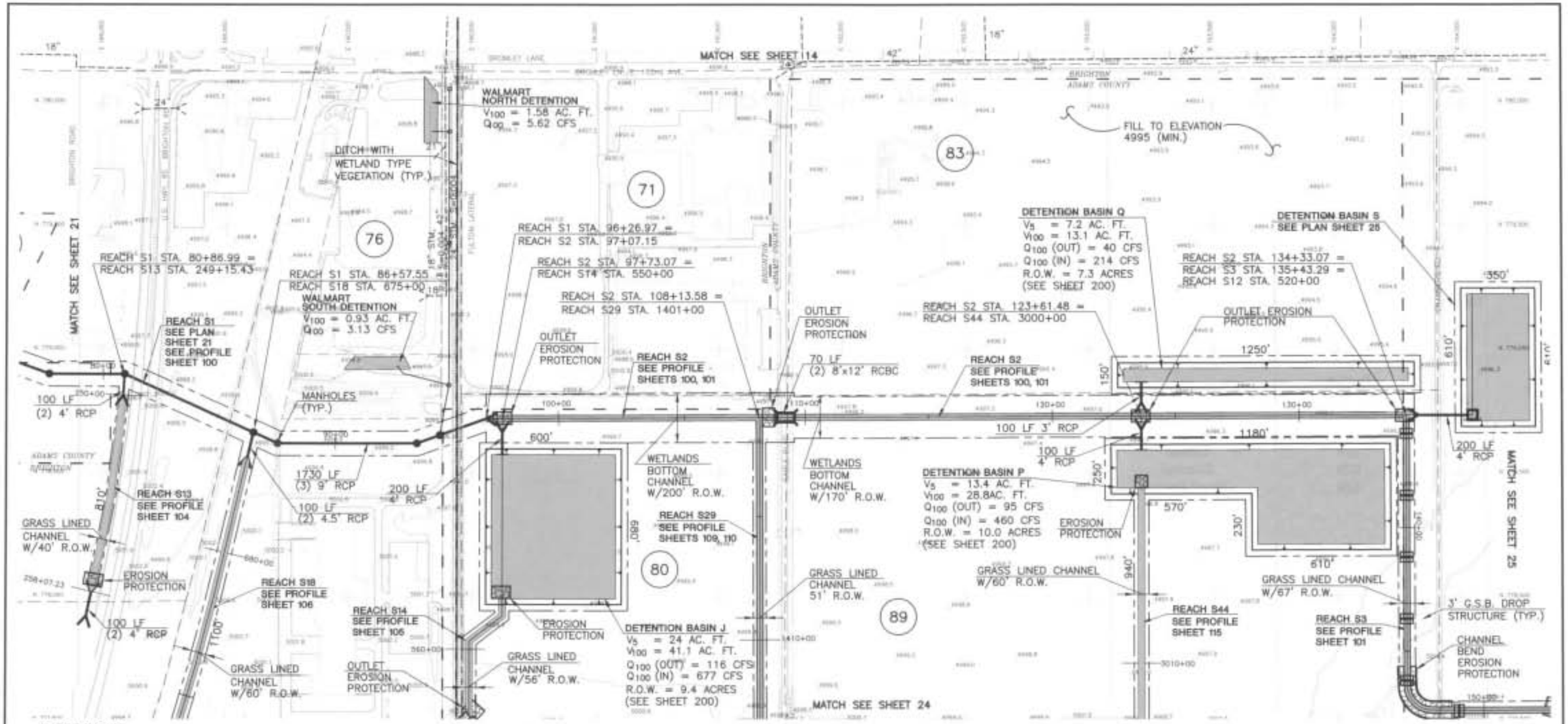
The improvements for Outfall System S18 includes a 1000 foot grass lined channel with a concrete trickle channel. A proposed double 54" RCP is also presented on this sheet.

The improvements for Outfall System S29 includes a 1250 foot grass lined channel with a concrete trickle channel.

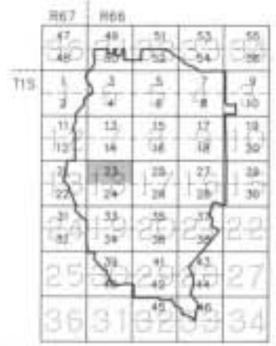
The improvements for Outfall System S44 includes a 985 foot grass lined channel with a concrete trickle channel. Outfall System S44 also includes a single 48" RCP.

The total costs of improvements for the Outfall Systems on this sheet and for Detention Basin P, J and Q are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
23	S02	Channel	$723,000.00
23	S02	Channel	$749,000.00
23	S02	Channel	$475,000.00
23	S02	Culvert	$204,600.00
23	S02	Detention Basin Q	$524,880.00
23	S03	Channel	$251,000.00
23	S13	Channel	$95,000.00
23	S13	Culvert	$67,100.00
23	S13	Channel Outfall	$60,300.00
23	S14	Channel	$119,000.00
23	S14	Pond Outlet/Culvert	$45,400.00
23	S14	Detention Basin J	$1,343,415.00
23	S18	Channel	$176,000.00
23	S18	Channel Outfall	$76,125.00
23	S29	Channel	$217,000.00
23	S44	Channel	$153,000.00
23	S44	Pond Outlet/Culvert	$22,656.25
23	S44	Detention Basin P	$1,087,875.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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SECTION N 1/2 18

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DESIGNED TTC DATE 5/28/05
DRAWN MAS DATE 12/8/05
CHECKED DATE
REVISED APM DATE 12/2008
AS-BUILT DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 23

COMMENTARY ON SHEET 24

Presented on Sheet 24 are the proposed improvements for Outfall Systems S14 and S29. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

Presented on this sheet for Outfall System S14 is a proposed triple 4' x 9' reinforced concrete box culvert.

The improvements for Outfall System 29 includes a 2100 foot grass lined channel with a concrete trickle channel.

A proposed triple 4' x 7' storm sewer in Outfall System S29 is presented on this sheet.

The total costs of improvements for the Outfall Systems on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
24	S14	Culvert	$316,200.00
24	S29	Channel	$366,000.00
24	S29	Storm Sewer	$1,088,000.00

REACH S14
SEE PROFILE
SHEET 105

150 LF
(3) 4'x9' RCBC

GRASS LINED CHANNEL
W/52' R.O.W.

MATCH SEE SHEET 23

REACH S44
SEE PLAN
SHEET 23
SEE PROFILE
SHEET 115

REACH S18
SEE PLAN
SHEET 22
SEE PROFILE
SHEET 106

REACH S29
SEE PROFILE
SHEETS 109, 110

81

82

88

87

MATCH SEE SHEET 22

DITCH WITH
WETLAND TYPE
VEGETATION (TYP.)

OUTLET
EROSION
PROTECTION

MATCH SEE SHEET 26

ADAMS COUNTY
REGIONAL
DETENTION

690 LF
(3) 4'x7' RCBC

REACH S18
SEE PLAN
SHEET 22
SEE PROFILE
SHEET 106

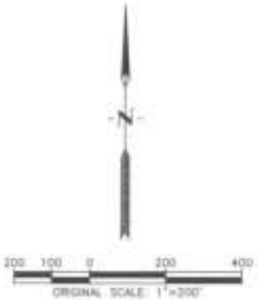
OUTLET
EROSION
PROTECTION

100 LF
4'x9' RCBC

MATCH SEE SHEET 33

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
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TOWNSHIP 1 S.
RANGE 66 W.
SECTION 5, 1/2 18

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DESIGNED	TH	DATE 5/28/08
DRAWN	MAS	DATE 5/28/08
CHECKED		DATE
REVISED	APM	DATE 12/2008
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
24

COMMENTARY ON SHEET 25

Presented on Sheet 25 are the proposed improvements for Outfall Systems S5, S9, S10, S11, and S12. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basins O and S are also presented on this sheet.

The Detention basins were designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms

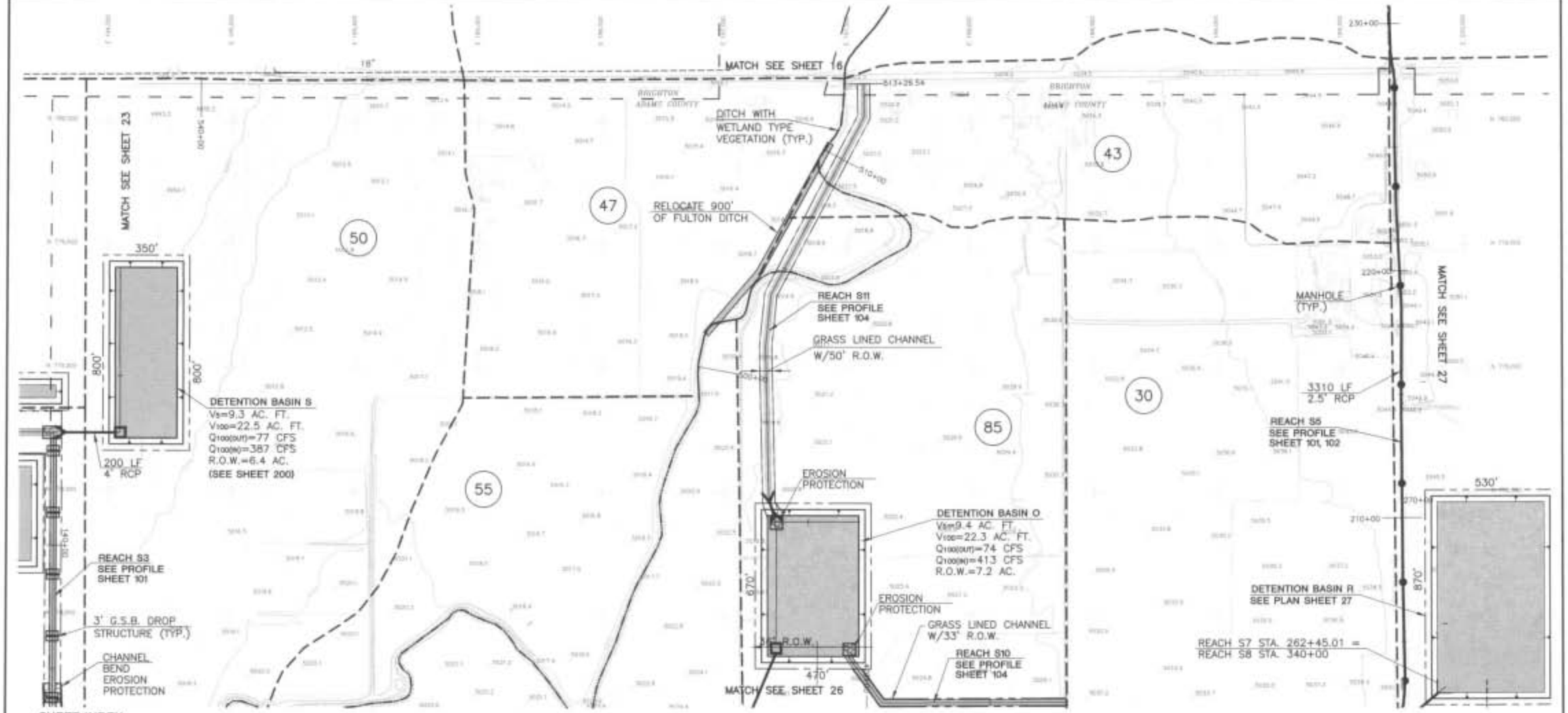
A proposed 30" storm sewer in Outfall System S5 is presented on this sheet.

The improvements for Outfall System S10 includes a 1960 foot grass lined channel with a concrete trickle channel. Also presented on this sheet for this Outfall System is a proposed double 4' x 7' reinforced concrete box culvert.

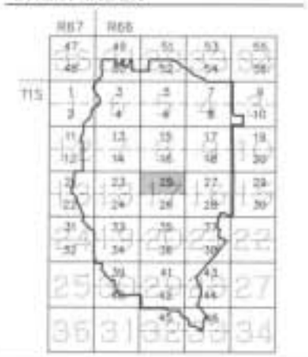
The improvements for Outfall System S11 includes a 1890 foot grass lined channel with a concrete trickle channel. Two proposed 48" RCP are also presented on this sheet.

The total costs of improvements for the Outfall Systems on this sheet and for Detention Basin S and O are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
25	S05	Storm Sewer	$342,000.00
25	S10	Channel	$39,000.00
25	S10	Channel	$34,000.00
25	S10	Detention Basin O	$0.00
25	S11	Channel	$53,000.00
25	S11	Channel	$16,000.00
25	S11	Culvert	$65,700.00
25	S11	Pond Outlet/Culvert	$45,400.00
25	S12	Detention Basin S	$0.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 25

COMMENTARY ON SHEET 26

Presented on Sheet 26 are the proposed improvements for Outfall Systems S3, S4, S15, S16, and S38 The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basins K, M2, and M3 are also presented on this sheet.

The Detention basins were designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms

The improvements for Outfall System S3 include a 2670 foot 12'x7' RCBC. Also presented on this sheet for this Outfall System is a proposed quadruple 4' x 9' reinforced concrete box culvert.

The improvements for Outfall System S4 includes a 2680 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System S15 includes a 130 foot grass lined channel with a concrete trickle channel. A proposed 48" RCP is also presented on this sheet.

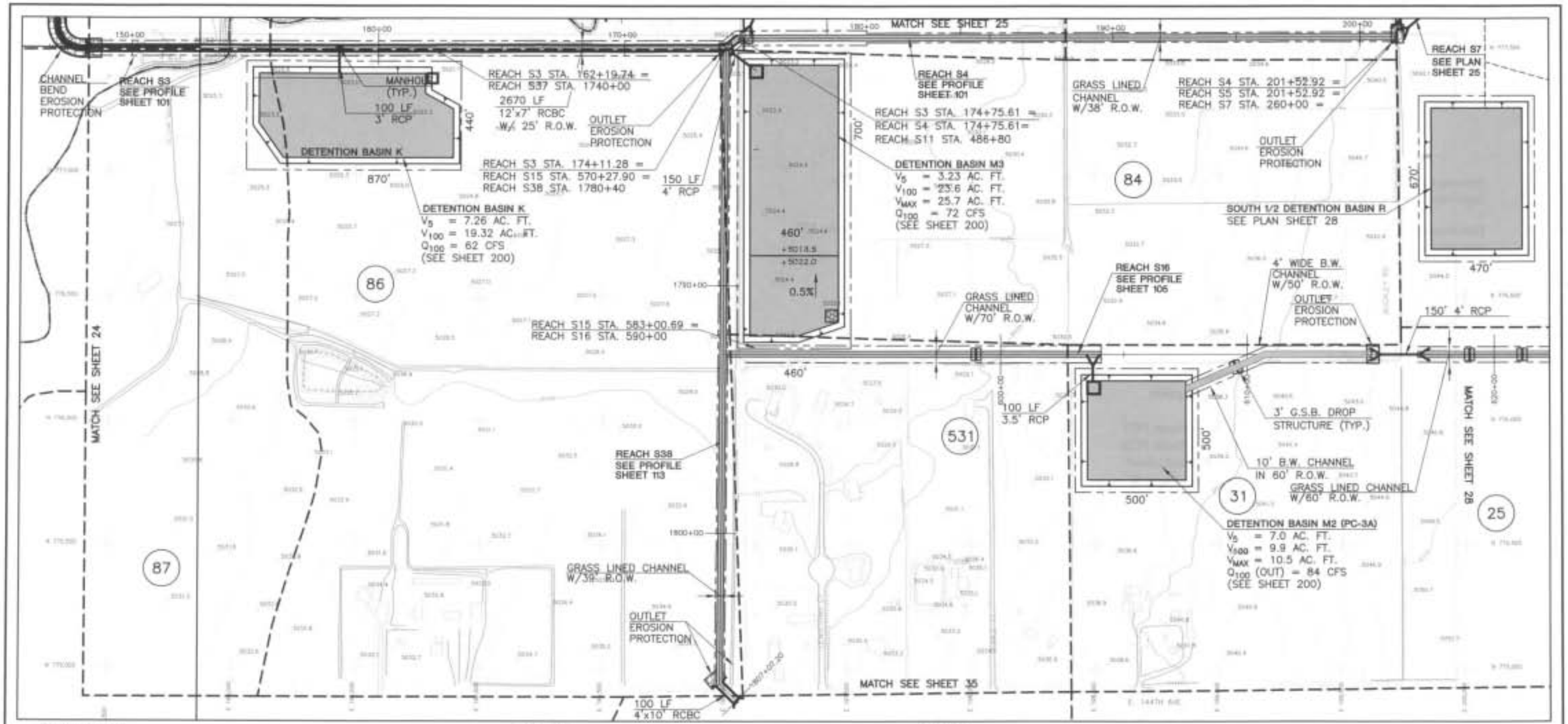
The improvements for Outfall System S16 includes a 1500 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System S38 includes a 2570 foot grass lined channel with a concrete trickle channel. Also presented on this sheet for this Outfall System is a proposed single 4' x 10' reinforced concrete box culvert.

Cost information for Detention Basin N can be found in Sheet 28.

The total costs of improvements for the Outfall Systems on this sheet are as follows

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
26	S03	Channel	$738,000.00
26	S03	Culvert	$525,600.00
26	S03	Storm Sewer	$2,129,000.00
26	S04	Channel	$277,000.00
26	S15	Pond Outlet/Culvert	$55,700.00
26	S15	Detention Basin M3	$0.00
26	S16	Channel	$178,000.00
26	S16	Pond Outlet/Culvert	$49,100.00
26	S16	Detention Basin M2	$0.00
26	S37	Pond Outlet/Culvert	$36,250.00
26	S37	Detention Basin K	$0.00
26	S38	Channel	$288,000.00
26	S38	Culvert	$101,500.00



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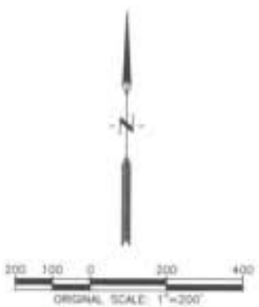

LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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SECTION 5, 1/2, 17

1960010.3.dwg

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950 SOUTH CHERRY STREET, SUITE 404
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 26

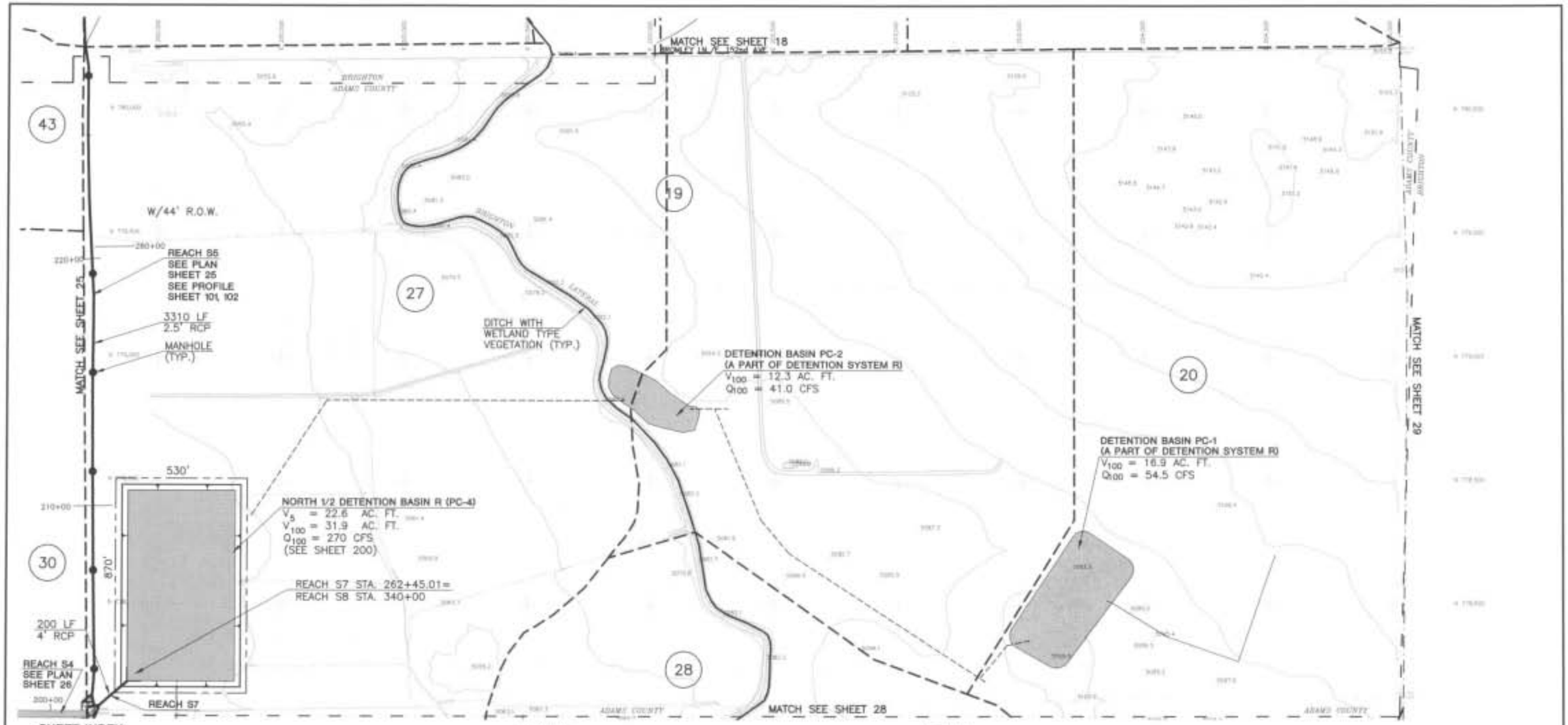
COMMENTARY ON SHEET 27

Presented on Sheet 27 are the proposed improvements for Outfall Systems S7, which includes Detention Basin R. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

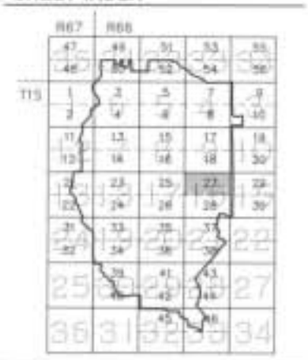
Detention Basin R was designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms

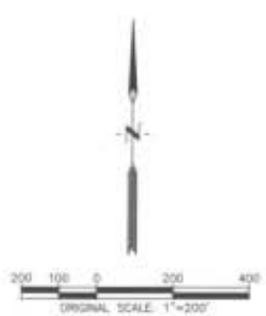
The total costs of improvements for the Outfall Systems on this sheet and for Detention Basin R are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
27	0	Detention Basin PC1	$0.00
27	0	Detention Basin PC2	$0.00
27	S07	Pond Outlet/Culvert	$67,100.00
27	S07	Detention Basin R	$0.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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DRAWN	MAS	DATE	3/28/05
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REVISED	APM	DATE	12/2006
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
27

COMMENTARY ON SHEET 28

Presented on Sheet 28 are the proposed improvements for Outfall Systems within north Prairie Center development. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. On-site Detention Basins PC-3, PC-1A, PC-2A, and PC-3A are also presented on this sheet. The south half of Detention Basin R (PC-4) is presented as well.

The total costs of improvements for the Outfall Systems on this sheet and are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
28	0	Detention Basin PC3	$0.00
28	0	Detention Basin PC1A	$0.00
28	0	Detention Basin PC2A	$0.00

MATCH SEE SHEET 27

DETENTION BASIN PC-3
(A PART OF DETENTION SYSTEM R)
V_{100} = 21.4 AC. FT.
Q_{100}= 68 CFS

SOUTH 1/2 DETENTION BASIN R (PC-4)
SEE NORTH HALF FOR TOTALS
(SEE SHEET 27)

DETENTION BASIN PC-1A
(A PART OF DETENTION SYSTEM M2)
V_{100} = 8.7 AC. FT.
Q_{100}= 28.5 CFS

670'

470'

ADAMS COUNTY
BRIGHTON

70' R.O.W.

60' R.O.W.

MATCH SEE SHEET 26

150 LF
(2) 4'x7' RCBC

3' G.S.B. DROP
STRUCTURE (TYP.)

DETENTION BASIN PC-2A
(A PART OF DETENTION SYSTEM M2)
V_{100} = 4.6 AC. FT.
Q_{100}= 50.3 CFS

DITCH WITH
WETLAND TYPE
VEGETATION (TYP.)

25

24

MATCH SEE SHEET 30

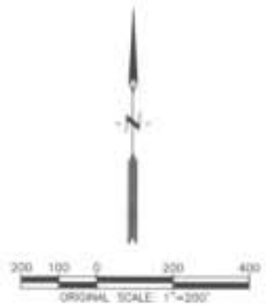
100 LF
(3) 4'x9' RCBC

OUTLET
EROSION
PROTECTION

MATCH SEE SHEET 37

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

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ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
28

COMMENTARY ON SHEET 29

No improvements are proposed on this sheet.

MATCH SEE SHEET 20

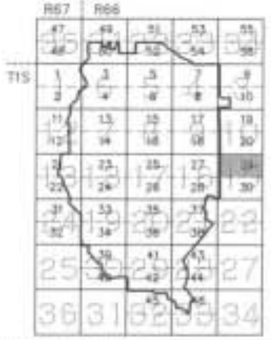
MATCH SEE SHEET 27

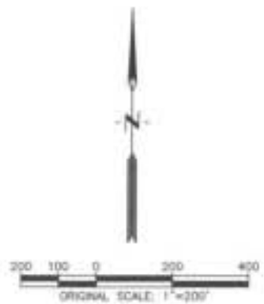
MATCH SEE SHEET 30

ADAMS COUNTY
BRIGHTON

BRIGHTON
ADAMS COUNTY

SHEET INDEX





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7. DATUM: VERTICAL = NAVD 1988
HORIZONTAL = NAD 1983-1992

MAP AND AUTOCAD FILE PRODUCED BY:
LANDMARK MAPPING LTD.
7500 WEST MISSISSIPPI AVENUE, SUITE 31
LAKEWOOD, COLORADO 80232
PHONE: (303) 922-2417 FAX: (303) 922-2868

TOWNSHIP 1 S.
RANGE 68 W.
SECTION N. 1/2 15

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80246
PHONE NO: (303) 757-8513
FAX NO: (303) 758-3238

DESIGNED TTC DATE 3/28/05
DRAWN MAS DATE 7/26/05
CHECKED DATE
REVISED APM DATE 12/2009
AS-BUILT DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
29

COMMENTARY ON SHEET 30

No improvements are proposed on this sheet.

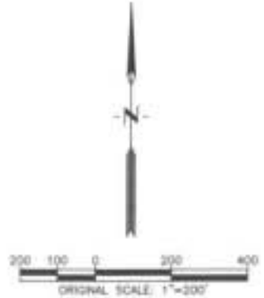
MATCH SEE SHEET 29

MATCH SEE SHEET 28

ADAMS COUNTY
BRIGHTON

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

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7500 WEST MISSISSIPPI AVENUE, SUITE 21
LAKEWOOD, COLORADO 80232
PHONE: (303) 922-2417 FAX: (303) 922-2866

TOWNSHIP 1 S.
RANGE 66 W.
SECTION S 1/2 15

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80246
PHONE NO. (303) 757-4513
FAX NO. (303) 759-3308

DESIGNED	TTC	DATE 1/28/05
DRAWN	MAS	DATE 1/28/05
CHECKED		DATE
REVISED	AFM	DATE 12/2009
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
30

COMMENTARY ON SHEET 31

No improvements are proposed on this sheet.

MATCH SEE SHEET 22

ADAMS COUNTY
BRIGHTON

720+00

OUTLET
EROSION
PROTECTION

REACH S18
SEE PLAN
SHEET 22
SEE PROFILE
SHEET 106

REACH S18 STA. 724+70.04 m
REACH S19 STA. 730+00

125

REACH S19
SEE PLAN
SHEET 33
SEE PROFILE
SHEETS 106, 107

740+00

MATCH SEE SHEET 33

DITCH WITH
WETLAND TYPE
VEGETATION (TYP.)

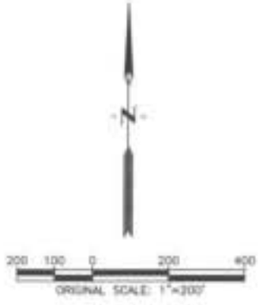
750+00

E 136 AVE

MATCH SEE SHEET 32

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL, W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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TOWNSHIP 1 S.
RANGE 67 W.
SECTION N. 1/2 24

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80246
PHONE NO: (303) 757-8513
FAX NO: (303) 759-3208

DESIGNED	TTC	DATE 1/28/09
DRAWN	MAS	DATE 1/28/09
CHECKED	APW	DATE 12/2009
REVISED		DATE
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
31

COMMENTARY ON SHEET 32

No improvements are proposed on this sheet.

MATCH SEE SHEET 31

GRASS LINED CHANNEL W/43' R.O.W.

REACH 519
SEE PLAN
SHEET 33
SEE PROFILE
SHEETS 106, 107

760+00

770+00

MATCH SEE SHEET 34

DITCH WITH WETLAND TYPE VEGETATION (TYP.)

CHANNEL BEND EROSION PROTECTION

BRIGHTON
ADAMS COUNTY

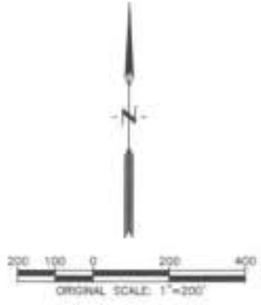
ADAMS COUNTY
BRIGHTON

E. 136TH. AVE.

E. 138TH. AVE.

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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LAKEWOOD, COLORADO 80232
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TOWNSHIP 1 S.
RANGE 67 W.
SECTION 5 1/2 24

WRC ENGINEERING, INC.
350 SOUTH CHERRY STREET,
SUITE 604
DENVER, COLORADO 80246
PHONE NO: (303) 757-6513
FAX NO: (303) 758-3208

DESIGNED	TTC	DATE 3/28/05
DRAWN	MRS	DATE 3/28/05
CHECKED	APM	DATE 12/2004
REVISED		DATE
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
32

COMMENTARY ON SHEET 33

Presented on Sheet 33 are the proposed improvements for Outfall Systems S19, S30, S31, and S36. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basins H and I are also presented on this sheet.

The Detention basins were designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms

The improvements for Outfall System S19 includes a 1980 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System S30 includes a 1310 foot grass lined channel with a concrete trickle channel.

A proposed 4' x 8' storm sewer in Outfall System S30 is presented on this sheet.

The improvements for Outfall System S31 includes a 2380 foot grass lined channel with a concrete trickle channel.

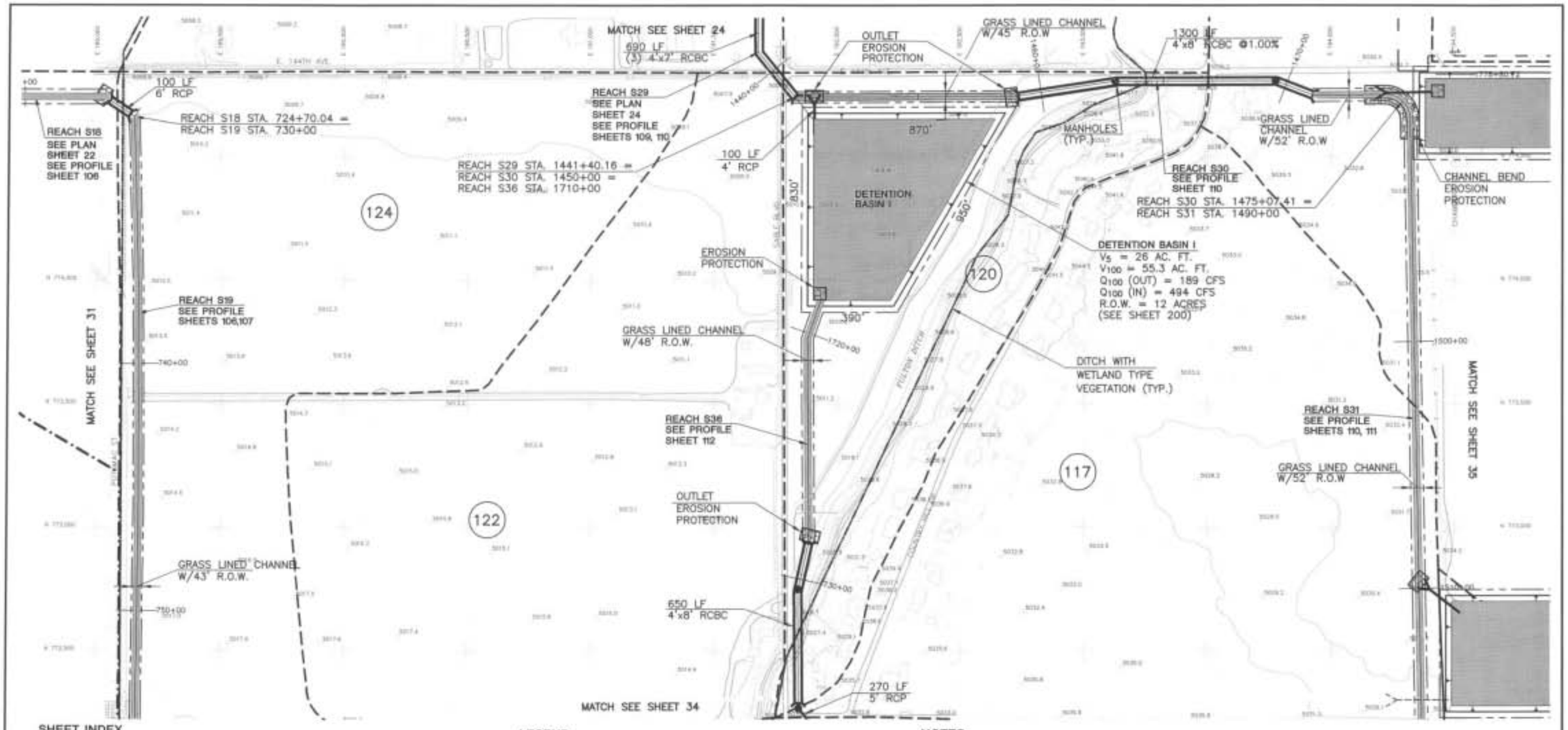
The improvements for Outfall System S36 includes a 850 foot grass lined channel with a concrete trickle channel.

A proposed 60" storm sewer and a single 48" RCP detention basin outlet in Outfall System S36 are also presented on this sheet.

A proposed 4' x 8' storm sewer in Outfall System S36 is presented on this sheet.

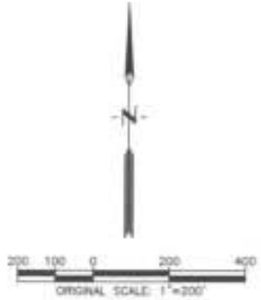
The total costs of improvements for the Outfall Systems on this sheet and for Detention Basins H and I are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
33	S19	Channel	$286,000.00
33	S30	Channel	$192,000.00
33	S30	Channel	$69,000.00
33	S30	Storm Sewer	$895,000.00
33	S31	Channel	$238,000.00
33	S36	Channel	$164,000.00
33	S36	Pond Outlet/Culvert	$22,656.25
33	S36	Storm Sewer	$455,000.00
33	S36	Culvert	$80,000.00
33	S36	Detention Basin I	$1,686,075.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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LANDMARK MAPPING LTD.
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LAKEWOOD, COLORADO 80232
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TOWNSHIP 1 S.
RANGE 67 W.
SECTION N. 1/2 19

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET,
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DENVER, COLORADO 80246
PHONE NO: (303) 757-8513
FAX NO: (303) 758-3208

DESIGNED	TJC	3/28/06
DRAWN	MAS	3/28/06
CHECKED		
REVISED	APM	12/2009
AS-BUILT		

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
33

COMMENTARY ON SHEET 34

Presented on Sheet 34 are the proposed improvements for Outfall Systems S19, S20, S31 and S41. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

The improvements for Outfall System S19 includes a 3500 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System S20 include a quadruple 36" RCP connector pipe.

The improvements for Outfall System S31 includes a 2670 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System S41 includes a 1300 foot grass lined channel with a concrete trickle channel. Two double 42" RCP culverts are also presented on this sheet.

A proposed 60" storm sewer in Outfall System S41is presented on this sheet.

The total costs of improvements for the Outfall System on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
34	S19	Channel	$422,000.00
34	S20	Connector Pipe	$114,187.50
34	S31	Channel	$472,000.00
34	S41	Channel	$288,000.00
34	S41	Culvert	$58,000.00
34	S41	Culvert	$58,000.00
34	S41	Storm Sewer	$273,000.00

MATCH SEE SHEET 33

REACH S36
SEE PROFILE
SHEET 112

270 LF
5' RCP

GRASS LINED CHANNEL
W/43' R.O.W.

760+00

DITCH WITH
WETLAND TYPE
VEGETATION (TYP.)

REACH S19
SEE PROFILE
SHEETS 106, 107

123

119

1520+00

REACH S31
SEE PROFILE
SHEETS 110, 111

MATCH SEE SHEET 32

770+00

121

GRASS LINED CHANNEL
W/36' R.O.W.

1530+00

118

MATCH SEE SHEET 36

REACH S20 STA. 817+34.46 =
REACH S41 STA. 3020+00

DETENTION BASIN C (N 1/2)
V_{WQ} = 20.8 AC. FT.
V_{100} = 49.6 AC. FT.
Q_{100} (OUT) = 171 CFS
Q_{100} (IN) = 425 CFS
R.O.W. = 11.9 ACRES
(SEE SHEET 200)

REACH S19 STA. 784+77.51 =
REACH S20 STA. 810+00

900 LF
5' RCP

700'

GRASS LINED CHANNEL
W/27' R.O.W.

REACH S41
SEE PROFILE
SHEET 114

OUTLET
EROSION
PROTECTION

DETENTION
BASIN C (N 1/2)

370'

250 LF
(4) 3' RCP

REACH S20 STA. 824+79.43 =
REACH S28 STA. 1150+00

GRASS LINED
CHANNEL
W/31' R.O.W.

GRASS LINED CHANNEL
W/38' R.O.W.

EROSION
PROTECTION

CHANNEL
BEND
EROSION
PROTECTION

REACH S20
SEE PLAN
SHEET 39
SEE PROFILE
SHEET 107

3030+00

REACH S28 SEE PLAN SHEET 39
SEE PROFILE SHEET 109

3040+00

3050+00

1540+00

150 LF
4'x9' RCBC

REACH S20

820+00

700'

REACH S41

MATCH SEE SHEET 39

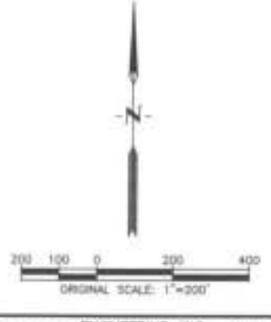
100 LF (2)
3.5' RCP

100 LF (2)
3.5' RCP

3080+00

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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RANGE 67 W.
SECTION 5 1/2 19

WRC ENGINEERING, INC.
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
34

COMMENTARY ON SHEET 35

Presented on Sheet 35 are the proposed improvements for Outfall Systems S17, S35, S39, and S40. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basins G, L, and Z are also presented on this sheet.

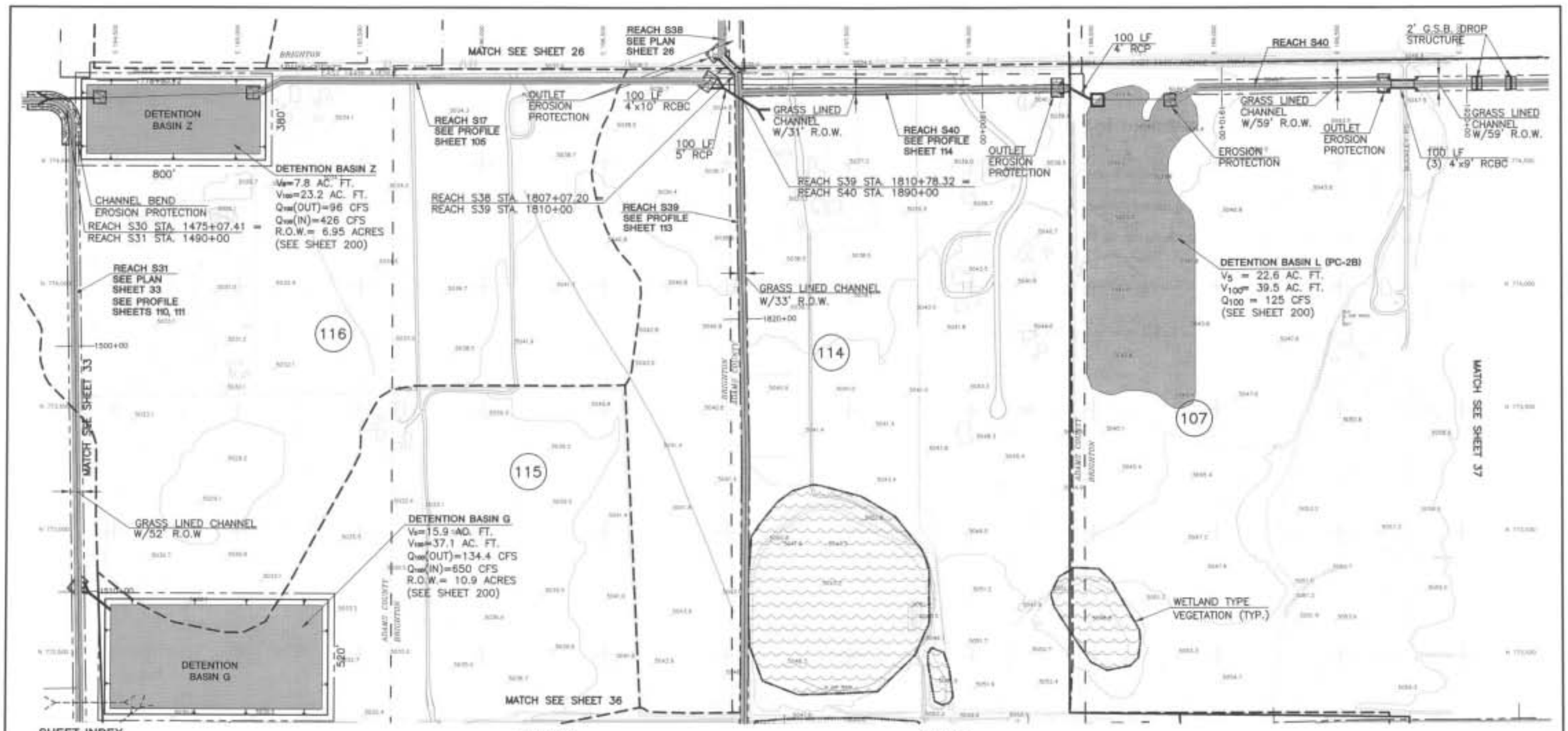
The Detention basins were designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs/acre release rate for 100-year storms.

The improvements for Outfall System S17 include a 1900 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System S39 includes a 1870 foot grass lined channel with a concrete trickle channel.

The total costs of improvements for the Outfall System on this sheet and for the Detention Basins are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
35	S17	Channel	$168,000.00
35	S17	Culvert	$51,400.00
35	S17	Pond Outlet/Culvert	$33,600.00
35	S17	Detention Basin Z	$787,338.75
35	S35	Detention Basin G	$1,248,315.00
35	S39	Channel	$229,000.00
35	S40	Channel	$184,000.00
35	S40	Pond Outlet/Culvert	$22,656.25
35	S40	Culvert	$222,937.50
35	S40	Detention Basin L	$0.00



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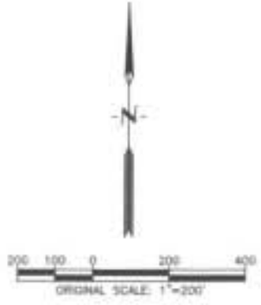

LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

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7. DATUM: VERTICAL = NAVD 1988
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MAP AND AUTOCAD FILE PREPARED BY:
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
35

COMMENTARY ON SHEET 36

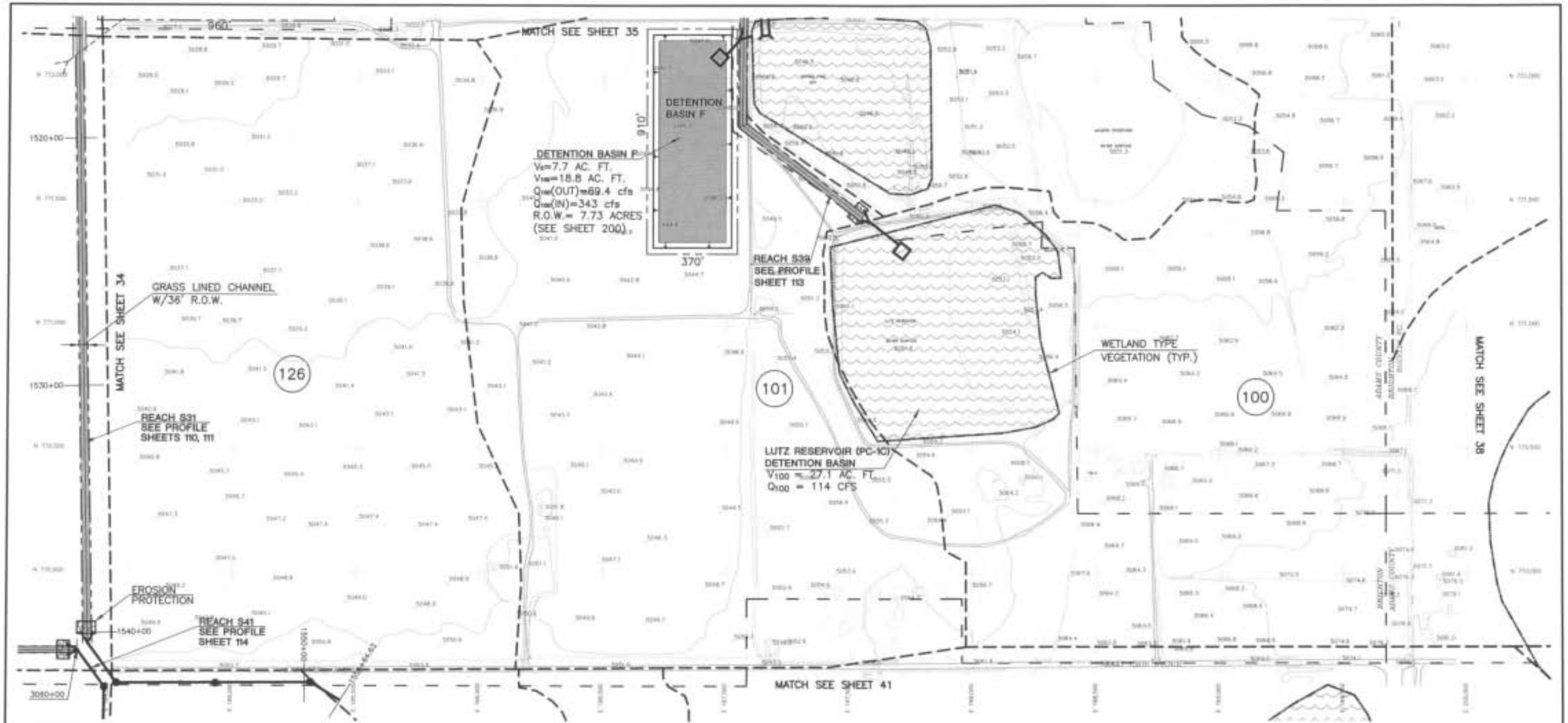
Presented on Sheet 36 are the proposed improvements for Outfall Systems S35 and S39. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basins F and LUTZ, with the latter utilizing improvements to the existing Lutz Reservoir to allow for detention storage, are also presented on this sheet.

The Detention basins were designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms.

The improvements for Outfall System 35 includes a 470 foot grass lined channel with a concrete trickle channel. A proposed 48" RCP is also presented on this sheet.

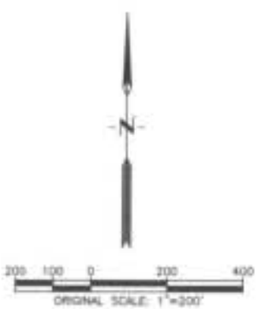
The total costs of improvements for the Outfall System on this sheet and for Detention Basin F are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
36	S39	Channel	$202,000.00
36	S39	Pond Outlet/Culvert	$36,250.00
36	S39	Detention Basin F	$686,230.50
36	S39	Detention Basin LUTZ	$0.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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REVISED	APM	DATE 12/2009
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

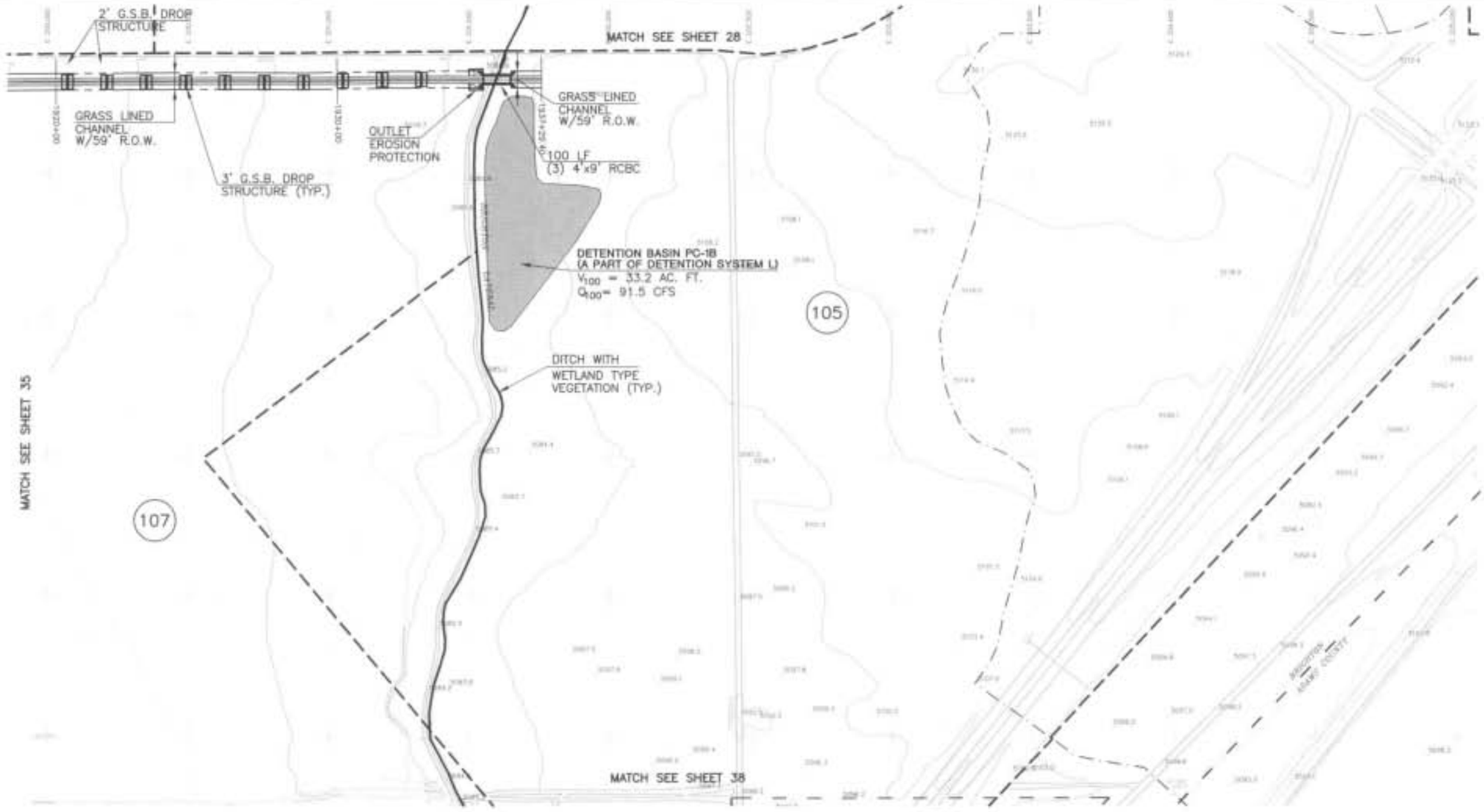
PRELIMINARY
DESIGN PLAN

SHEET
36

COMMENTARY ON SHEET 37

Presented on Sheet 37 are the proposed improvements related to Sub-regional Detention System 'L'. The improvements were designed by others for flood peaks based on future development and a 100-year recurrence period. The improvements fall within the central portion of the Prairie Center development. Detention Basin PC-1B is an on-site, sequentially upstream facility to Detention Basin L.

All improvements shown on this sheet are a part of the Prairie Center development internal drainage system. Therefore, no direct costs are associated with these structures.



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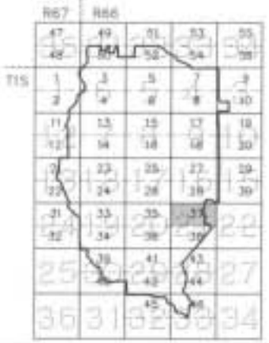

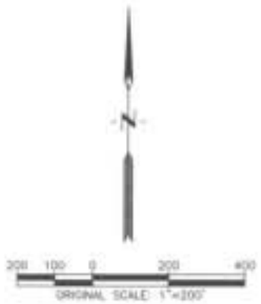

LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

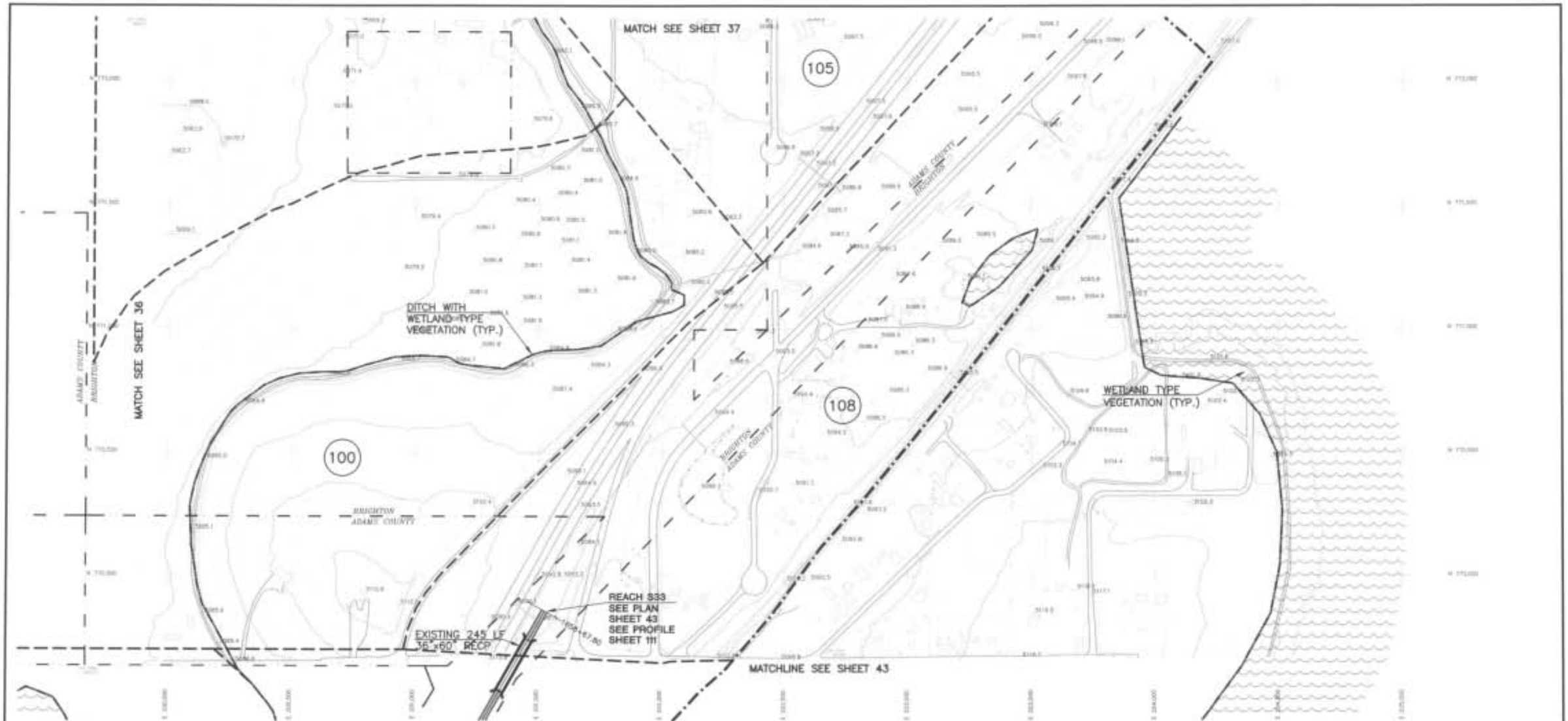
OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

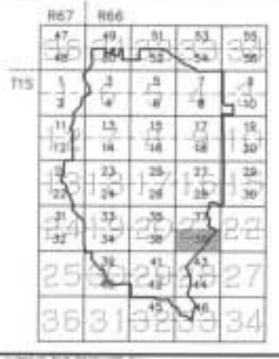
SHEET 37

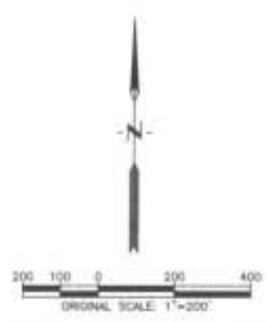
COMMENTARY ON SHEET 38

No improvements are proposed on this sheet.



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
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- DETENTION BASIN
- DETENTION BASIN OUTLET

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
38

COMMENTARY ON SHEET 39

Presented on Sheet 39 are the proposed improvements for Outfall Systems S20, S21, S27, S28, and S41. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basin C is also presented on this sheet.

The Detention Basins C was designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms

The improvements for Outfall System S20 includes a 1300 foot grass lined channel with a concrete trickle channel, a proposed double 4' x 8' reinforced concrete box culvert, a 66" inch RCP storm sewer, and a 54" inch RCP culvert.

The improvements for Outfall System S21 includes a 1220 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System S27 includes a 1450 foot grass lined channel with a concrete trickle channel. A proposed double 42" RCP culvert is also presented on this sheet.

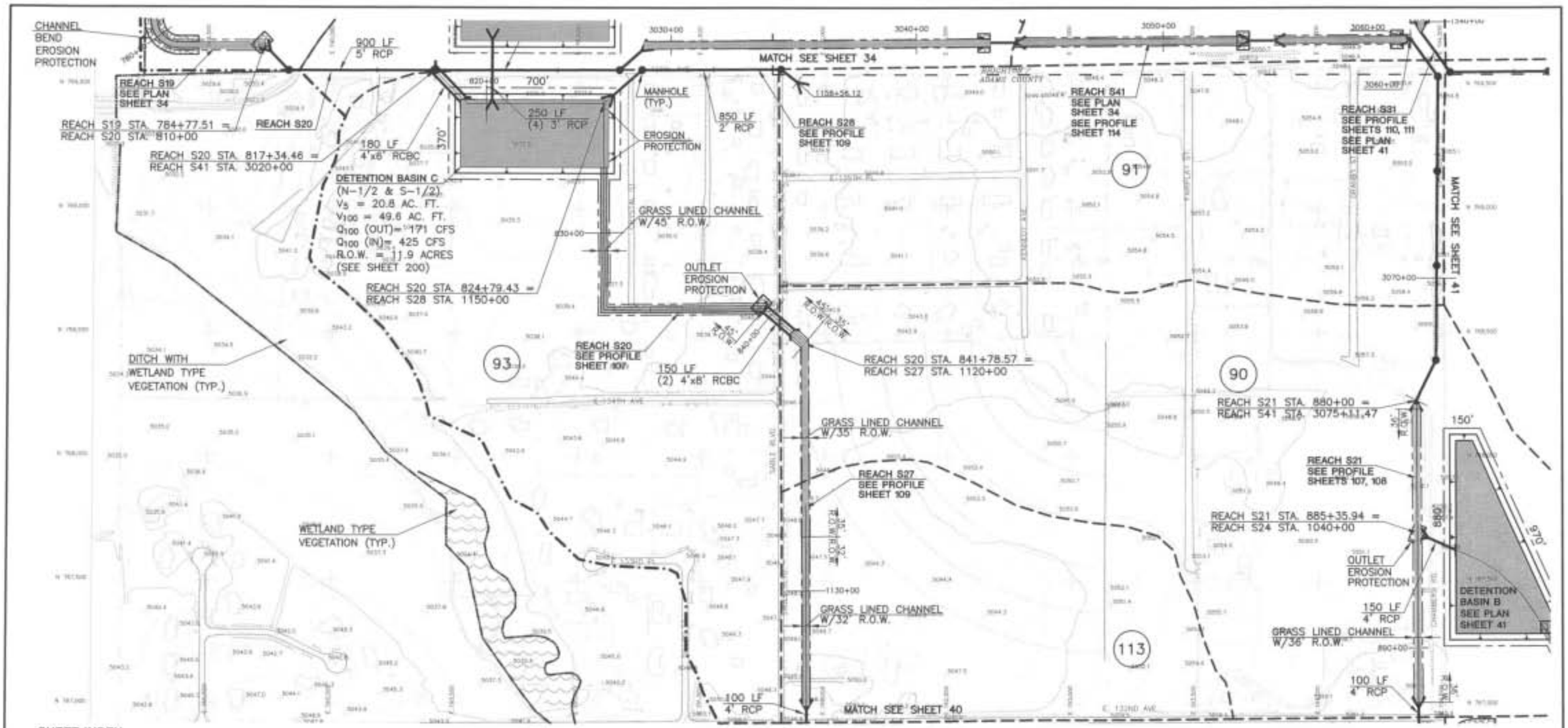
Presented on this sheet for this Outfall System S28 is a proposed 42" inch RCP storm sewer.

The improvements for Outfall System S41 includes a 2900 foot grass lined channel with a concrete trickle channel and a 54" storm sewer.

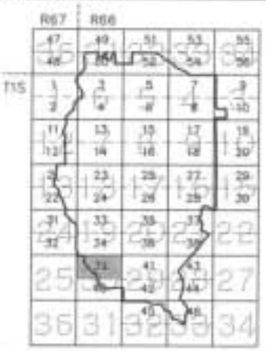
Cost information for Detention Basin B can be found in the commentary following Plan Sheet 41.

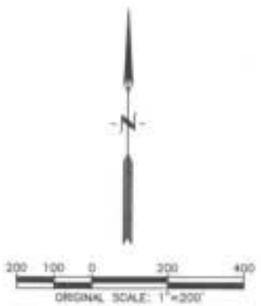
The total costs of improvements for the Outfall System on this sheet and for Detention Basin C are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
39	S20	Culvert	$201,187.50
39	S20	Pond Outlet	$43,500.00
39	S20	Storm Sewer	$238,000.00
39	S20	Detention Basin C	$1,547,415.00
39	S21	Channel	$141,000.00
39	S27	Channel	$80,000.00
39	S27	Channel	$67,000.00
39	S27	Culvert	$76,125.00
39	S28	Storm Sewer	$161,000.00
39	S41	Channel	$139,000.00
39	S41	Storm Sewer	$438,000.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
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- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
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- CHANNEL W/R.O.W.
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TOWNSHIP 1 S. RANGE 66 W. SECTION N. 1/2 7

WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80246 PHONE NO. (303) 757-8513 FAX NO. (303) 756-5208

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CHECKED		DATE
REVISED	APM	DATE 12/2000A
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 39

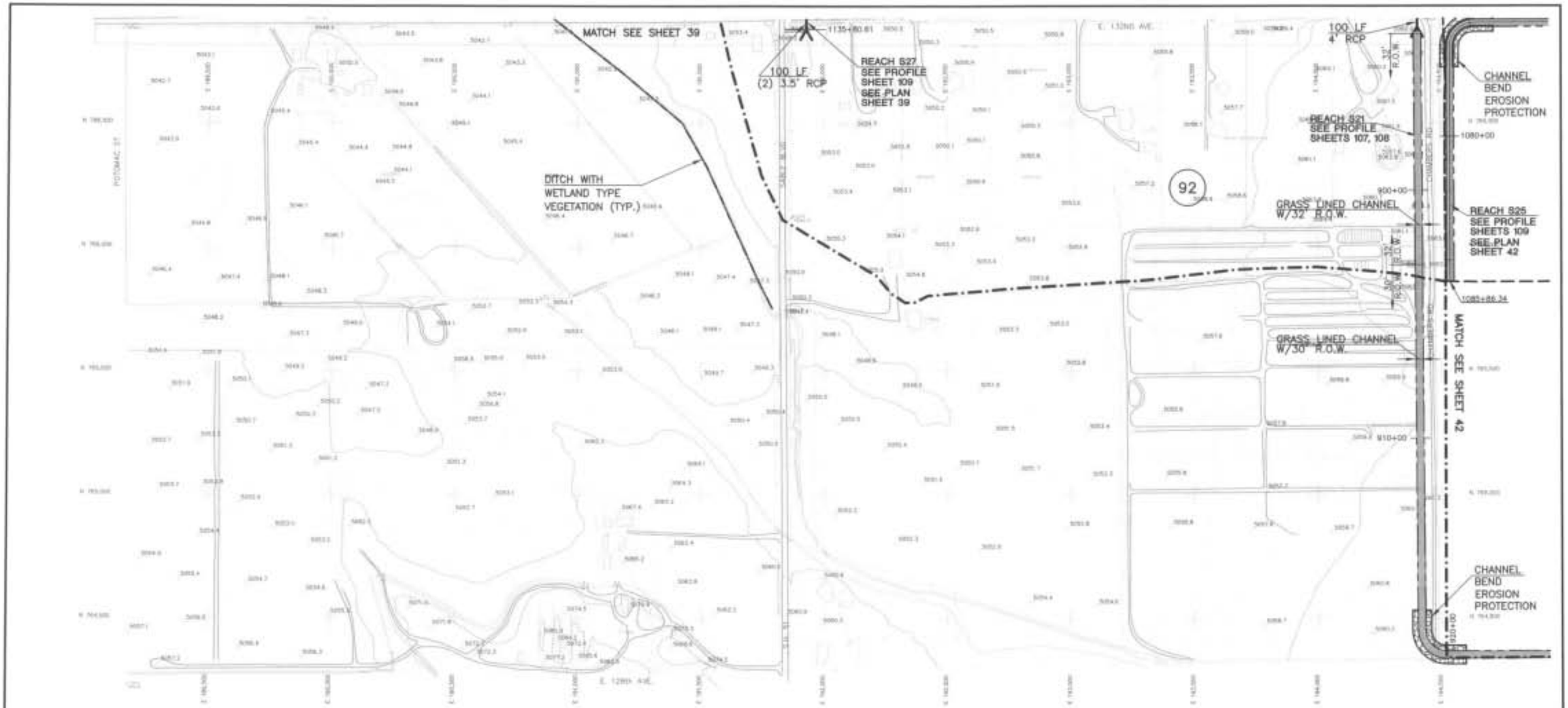
COMMENTARY ON SHEET 40

Presented on Sheet 40 are the proposed improvements for Outfall System S21. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

The improvements for Outfall System S21 includes a 2700 foot grass lined channel with a concrete trickle channel.

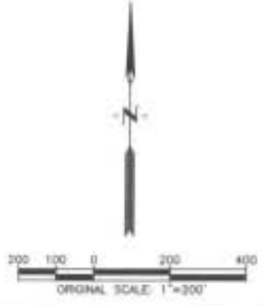
The total costs of improvements for the Outfall System on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
40	S21	Channel	$280,000.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

NOTES:

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5. IF A DOWNSTREAM SUBREGIONAL DETENTION FACILITY AND CONVEYANCE SYSTEM(S) ARE IN PLACE, ALL DEVELOPMENT UPSTREAM WITHIN THAT TRIBUTARY WATERSHED WILL BE ALLOWED TO RELEASE UNDETAINED ON-SITE FLOWS INTO THE OUTFALL DRAINAGE SYSTEM.
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7. DATUM: VERTICAL = NAVD 1988
   HORIZONTAL = NAD 1983-1992

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7500 WEST MISSISSIPPI AVENUE, SUITE 21
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TOWNSHIP 1 S.
RANGE 66 W.
SECTION 5, 1/2 30

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246
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DESIGNED	TTC	DATE	1/28/05
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REVISED	APM	DATE	12/2005
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
40

COMMENTARY ON SHEET 41

Presented on Sheet 41 are the proposed improvements for Outfall Systems S24, S31, S32, S33, S34, and S42.

The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basins B, D, and E are also presented on this sheet.

The Detention basins were designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms

The improvements for Outfall System S24 includes a 350 foot grass lined channel with a concrete trickle channel. Also presented on this sheet for this Outfall System is a proposed double 4' x 7' reinforced concrete box culvert.

Presented on this sheet for Outfall System S31 is a proposed 4' x 8' reinforced concrete box storm sewer

The improvements for Outfall System S32 includes a 3030 foot grass lined channel with a concrete trickle channel. A double 48" RCP culverts are also presented on this sheet.

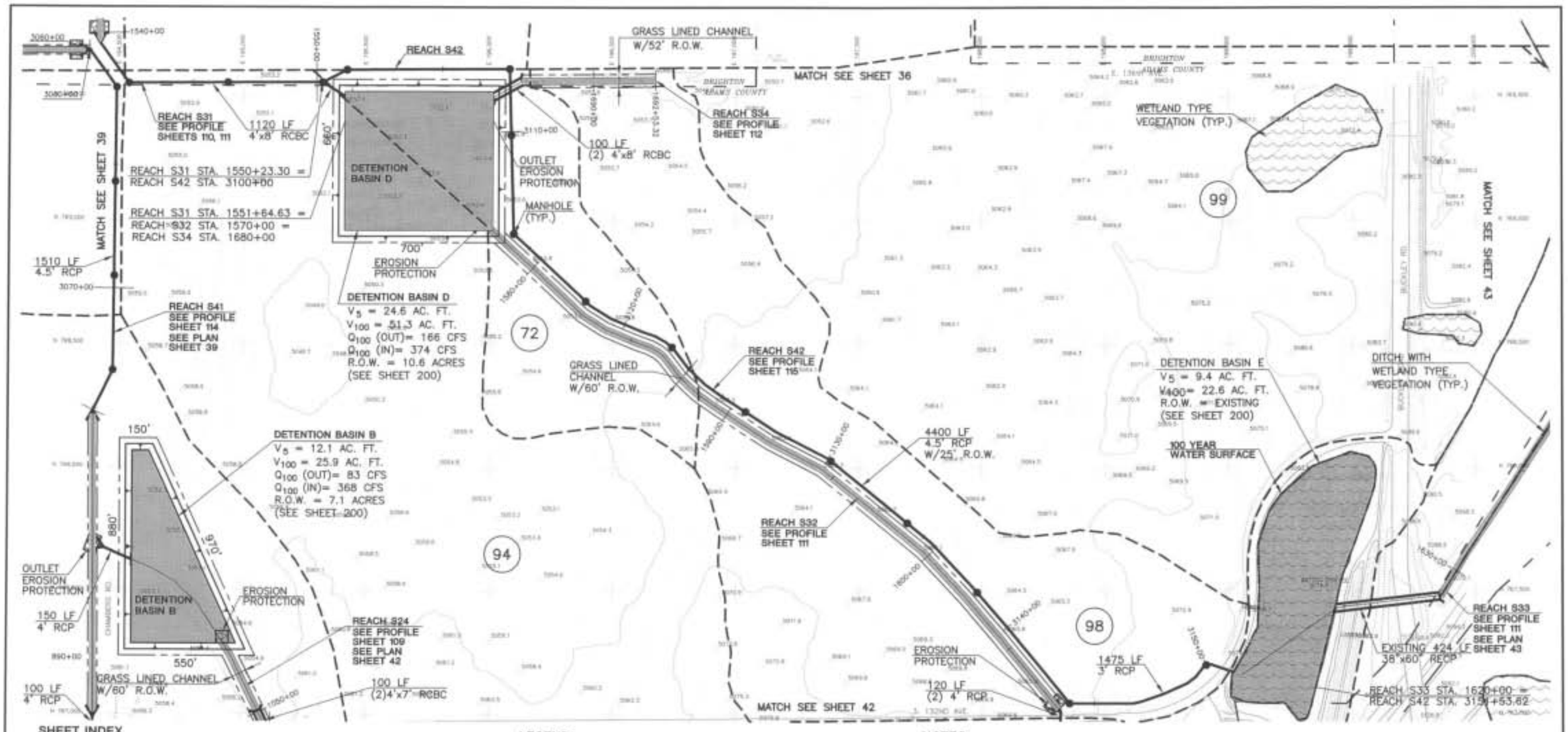
The improvements for Outfall System S34 includes a 680 foot grass lined channel with a concrete trickle channel. Also presented on this sheet for this Outfall System is a proposed double 4' x 8' reinforced concrete box culvert.

Proposed 54" RCP and 36" RCP storm sewers are also presented on this sheet for Outfall system S42.

See commentary for sheet 43 for cost information about Outfall System S33.

The total costs of improvements for the Outfall System on this sheet and for Detention Basin B, D, and E are as follows

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
41	S31	Storm Sewer	$782,000.00
41	S32	Channel	$509,000.00
41	S32	Culvert	$76,125.00
41	S32	Detention Basin D	$1,647,960.00
41	S33	Channel	$0.00
41	S33	Detention Basin E	$679,687.50
41	S34	Channel	$94,000.00
41	S34	Culvert	$141,375.00
41	S42	Storm Sewer	$1,225,000.00
41	S42	Storm Sewer	$227,000.00



SHEET INDEX

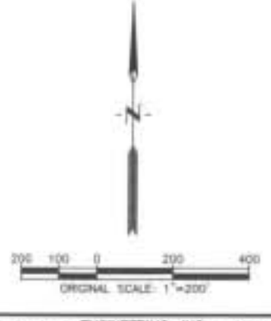


LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET



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DESIGNED	TIC	DATE 5/28/09
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CHECKED		DATE
REVISED	APM	DATE 12/2009
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
41

COMMENTARY ON SHEET 42

Presented on Sheet 42 are the proposed improvements for Outfall Systems S21, S22, S23, S24, S25, and S26. The improvements were designed for flood peaks based on future development and a 100-year recurrence period. Detention Basin A is also presented on this sheet.

The Detention basins were designed to have a 40 hour release rate for 5-year storm events and a 0.5 cfs / acre release rate for 100-year storms

The improvements for Outfall System S21 includes a 2950 foot grass lined channel with a concrete trickle channel. Two proposed 48" RCP culverts are also presented on this sheet.

The improvements for Outfall System S23 includes a 1935 foot grass lined channel with a concrete trickle channel. Two proposed 48" RCP culverts and eight 30" RCP culverts are also presented on this sheet.

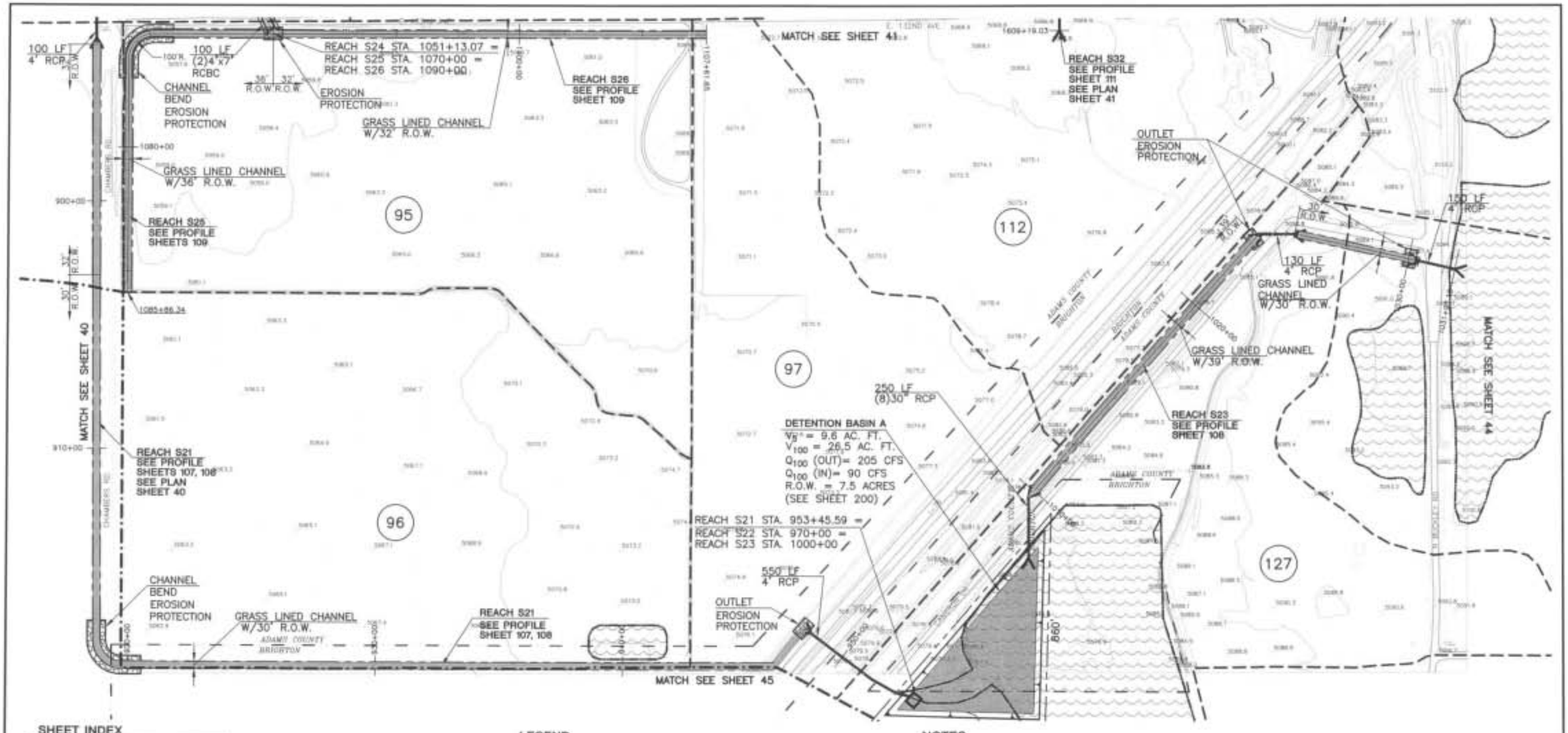
The improvements for Outfall System S24 includes a 1935 foot grass lined channel with a concrete trickle channel. Two proposed 48" RCP culverts and eight 30" RCP culverts are also presented on this sheet.

The improvements for Outfall System S25 includes a 1600 foot grass lined channel with a concrete trickle channel.

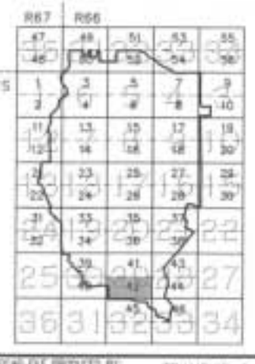
The improvements for Outfall System S26 includes a 1760 foot grass lined channel with a concrete trickle channel.

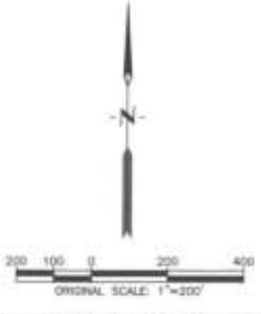
The total costs of improvements for the Outfall System on this sheet and for Detention Basin A are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
42	S21	Channel	$227,000.00
42	S21	Culvert	$36,250.00
42	S21	Culvert	$138,203.13
42	S22	Detention Basin A	$883,875.00
42	S23	Channel	$266,000.00
42	S23	Channel	$38,000.00
42	S23	Culvert	$47,578.13
42	S23	Culvert	$43,046.88
42	S23	Culvert	$290,000.00
42	S24	Channel	$85,000.00
42	S24	Culvert	$132,312.50
42	S25	Channel	$227,000.00
42	S26	Channel	$168,000.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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WRC ENGINEERING, INC.
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950 SOUTH CHERRY STREET
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PHONE NO. (303) 757-6313
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DESIGNED	TTL	DATE	3/28/05
DRAWN	MAS	DATE	3/28/05
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REVISED	APM	DATE	12/2008
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

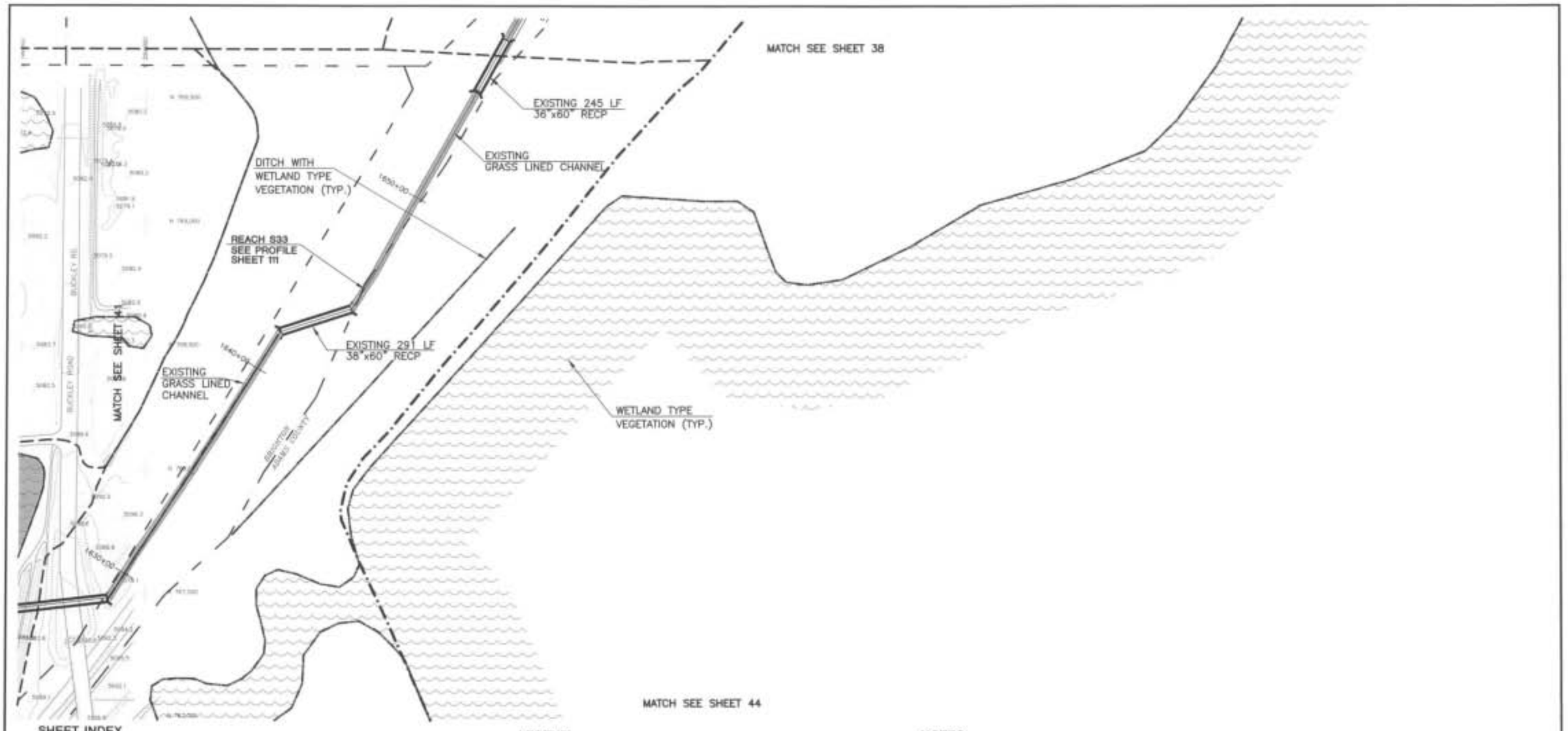
PRELIMINARY DESIGN PLAN

SHEET 42

COMMENTARY ON SHEET 43

No improvements are proposed on this sheet.

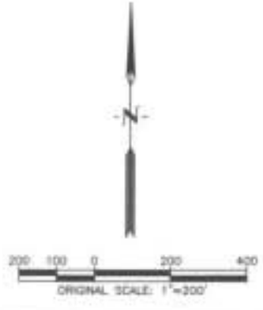
Improvements for Outfall System S33 on this sheet are existing.



MATCH SEE SHEET 44

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

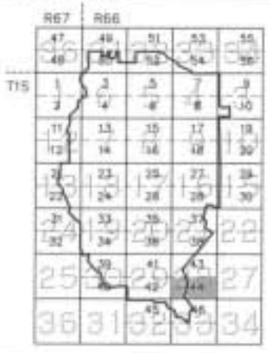
SHEET
43

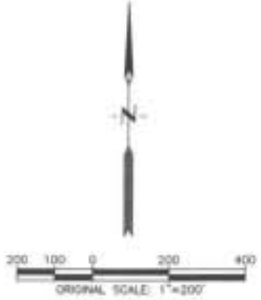
COMMENTARY ON SHEET 44

No improvements are proposed on this sheet.



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

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REVISED	APM	DATE 07/2006
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
44

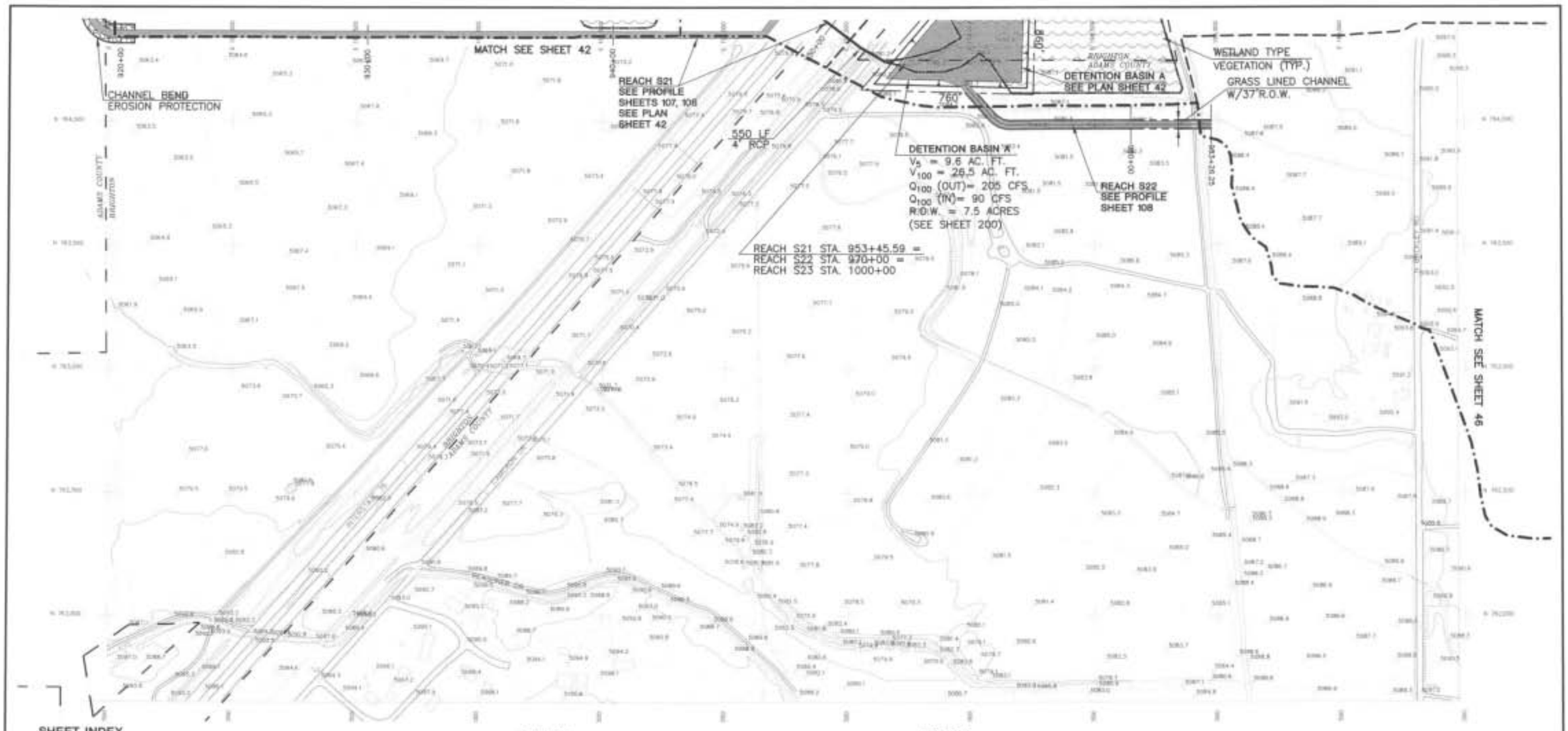
COMMENTARY ON SHEET 45

Presented on Sheet 45 are the proposed improvements for Outfall Systems S22. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

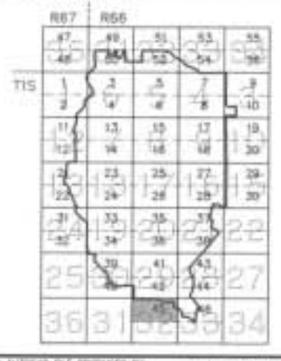
The improvements for Outfall System S22 includes a 1120 foot grass lined channel with a concrete trickle channel.

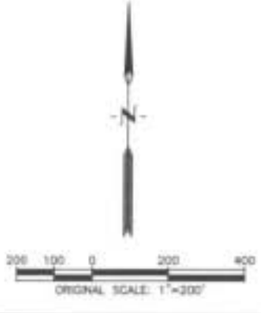
The total costs of improvements for Outfall System on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
45	S22	Channel	$135,000.00



SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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7. DATUM: VERTICAL = NAVD 1988
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LAKEWOOD, COLORADO 80232
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TOWNSHIP 1 S.
RANGE 66 W.
SECTION N. 1/2 32

WRC ENGINEERING, INC.
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REVISED	APM	DATE	12/2008
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
45

COMMENTARY ON SHEET 46

There are no improvements on this sheet.

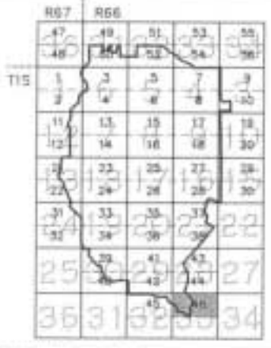
MATCH SEE SHEET 44

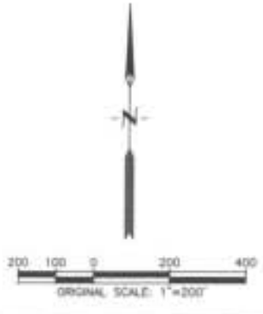
MATCH SEE SHEET 45

WETLAND TYPE VEGETATION (TYP.)

E 120TH AVE

SHEET INDEX





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TOWNSHIP 1 S.
RANGE 66 W.
SECTION N. 1/2 32

WRC ENGINEERING, INC.
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FAX NO: (303) 756-5258

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 46

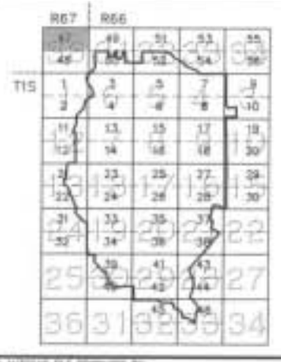
COMMENTARY ON SHEET 47

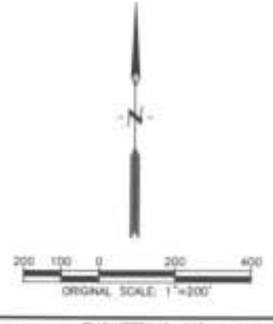
There are no improvements on this sheet.

MATCH SEE SHEET 46

MATCH SEE SHEET 48

SHEET INDEX





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- WATERSHED BOUNDARY
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LAKEWOOD, COLORADO 80232
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TOWNSHIP 1 S
RANGE 67 W
SECTION N. 1/2 1

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
47

COMMENTARY ON SHEET 48

There are no improvements on this sheet.

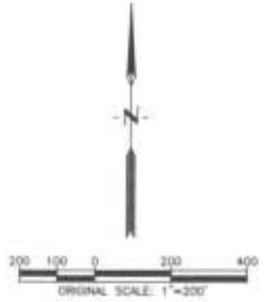
MATCH SEE SHEET 47

MATCH SEE SHEET 50

MATCH SEE SHEET 1

SHEET INDEX





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TOWNSHIP 1 S.
RANGE 67 W.
SECTION N 1/2 1

WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246
PHONE NO. (303) 757-8912
FAX NO. (303) 758-3208

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
48

COMMENTARY ON SHEET 49

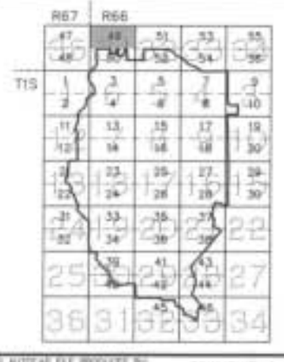
There are no improvements on this sheet.

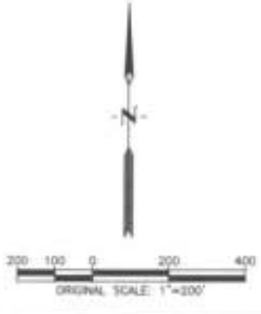
MATCH SEE SHEET 47

MATCH SEE SHEET 51

MATCH SEE SHEET 50

SHEET INDEX





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LAKEWOOD, COLORADO 80232
PHONE: (303) 922-2417 FAX: (303) 922-2868

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RANGE 67 W.
SECTION N. 1/2 1

WRC ENGINEERING, INC.
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
49

COMMENTARY ON SHEET 50

Presented on Sheet 50 are the proposed improvements for Outfall Systems N1, N2, and N3. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

The improvements for Outfall System N1 includes a 3444 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System N2 includes a 1200 foot grass lined channel with a concrete trickle channel.

The improvements for Outfall System N3 includes a 2647 foot grass lined channel with a concrete trickle channel.

The total costs of improvements for the Outfall System on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
50	N01	Channel	$3,105,000.00
50	N02	Channel	$573,000.00
50	N03	Channel	$2,033,000.00

GRASS LINED CHANNEL W/200' R.O.W.

MATCH SEE SHEET 49

REACH N1 SEE PROFILE SHEET 121

GRASS LINED CHANNEL W/125' R.O.W.

REACH N2 SEE PROFILE SHEET 121

ADAMS COUNTY BRIGHTON

136

138

REACH N3 SEE PROFILE SHEET 122

GRASS LINED CHANNEL W/200' R.O.W.

MATCH SEE SHEET 48

128

129

MATCH SEE SHEET 50

MATCH SEE SHEET 52

CHANNEL BEND EROSION PROTECTION

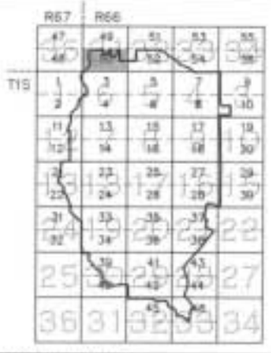
130

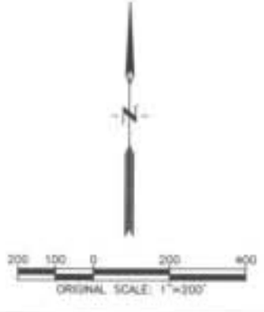
131

MATCH SEE SHEET 3

BRIGHTON ADAMS COUNTY

SHEET INDEX





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- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 50

COMMENTARY ON SHEET 51

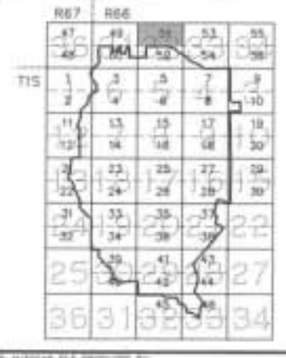
There are no improvements on this sheet.

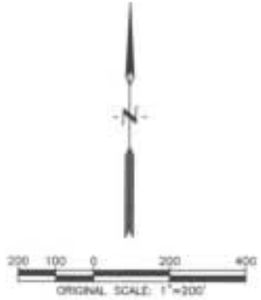
MATCH SEE SHEET 49

MATCH SEE SHEET 53

MATCH SEE SHEET 52

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
- SUB WATERSHED BOUNDARY
- BRIGHTON CITY LIMITS
- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
- CULVERT
- CHANNEL W/R.O.W.
- DETENTION BASIN
- DETENTION BASIN OUTLET

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7. DATUM: VERTICAL = NAVD 1988
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TOWNSHIP 1 S.
RANGE 67 W.
SECTION N. 1/2 1

WRC ENGINEERING, INC.
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DESIGNED	TJC	DATE	1/25/05
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REVISED	APW	DATE	12/2006
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 51

COMMENTARY ON SHEET 52

Presented on Sheet 52 are the proposed improvements for Outfall System N2. The improvements were designed for flood peaks based on future development and a 100-year recurrence period.

The improvements for Outfall System N2 includes a 1900 foot grass lined channel with a concrete trickle channel.

The total costs of improvements for the Outfall System on this sheet are as follows:

Sheet Number	Outfall System Segment	Improvement Description	Improvement Cost
52	N02	Channel	$912,000.00

GRASS LINED CHANNEL
W/150' R.O.W.

REACH N2
SEE PROFILE
SHEET 121

ADAMS COUNTY
BRIGHTON

MATCH SEE SHEET 51

138

133

134

132

131

MATCH SEE SHEET 50

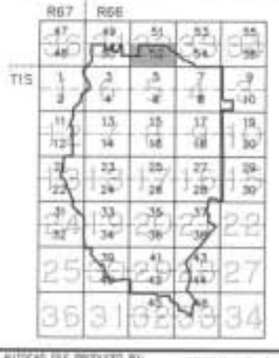
MATCH SEE SHEET 54

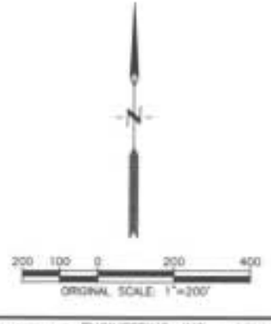
MATCH SEE SHEET 5

ADAMS COUNTY
BRIGHTON

ADAMS COUNTY
BRIGHTON

SHEET INDEX





LEGEND

- WATERSHED BOUNDARY
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- DETENTION BASIN TRIBUTARY AREA

MASTER PLAN FACILITIES

- STORM SEWER
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RANGE 67 W.
SECTION N. 1/2 1

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DESIGNED	TTC	DATE 1/28/05
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CHECKED	ARM	DATE 1/2005
REVISED		DATE
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
52

COMMENTARY ON SHEET 53

There are no improvements on this sheet.

MATCH SEE SHEET 51

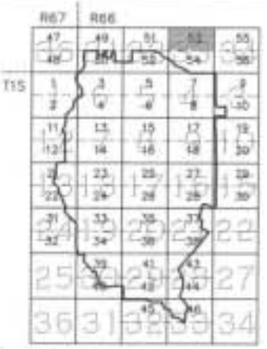
MATCH SEE SHEET 54

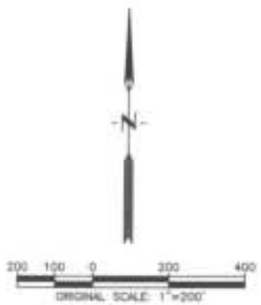
MATCH SEE SHEET 55

ADAMS COUNTY
BRIGHTON

ADAMS COUNTY
BRIGHTON

SHEET INDEX





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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
53

COMMENTARY ON SHEET 54

There are no improvements on this sheet.

MATCH SEE SHEET 53

MATCH SEE SHEET 52

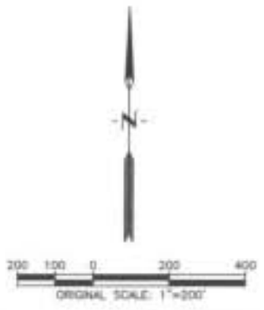
MATCH SEE SHEET 56

135

MATCH SEE SHEET 7

SHEET INDEX





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WRC ENGINEERING, INC.
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FAX NO: (303) 758-3208

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AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PLAN

SHEET
54

COMMENTARY ON SHEET 55

There are no improvements on this sheet.

ADAMS COUNTY
BRIGHTON

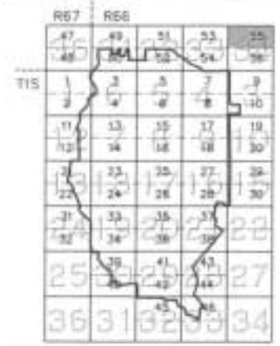
ADAMS COUNTY
BRIGHTON

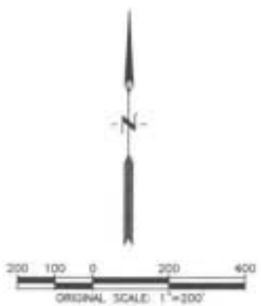
ADAMS COUNTY
BRIGHTON

MATCH SEE SHEET 53

MATCH SEE SHEET 56

SHEET INDEX





LEGEND

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LAKEWOOD, COLORADO 80232
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CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

SHEET 55

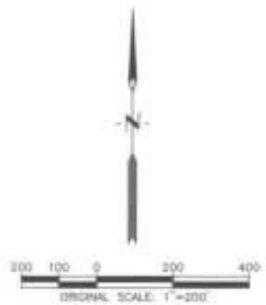
COMMENTARY ON SHEET 56

There are no improvements on this sheet.



SHEET INDEX





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TOWNSHIP 1 S.
RANGE 67 W.
SECTION N. 1/2 1

WRC ENGINEERING, INC.
800 SOUTH CHERRY STREET, SUITE 404
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FAX NO. (303) 758-3208

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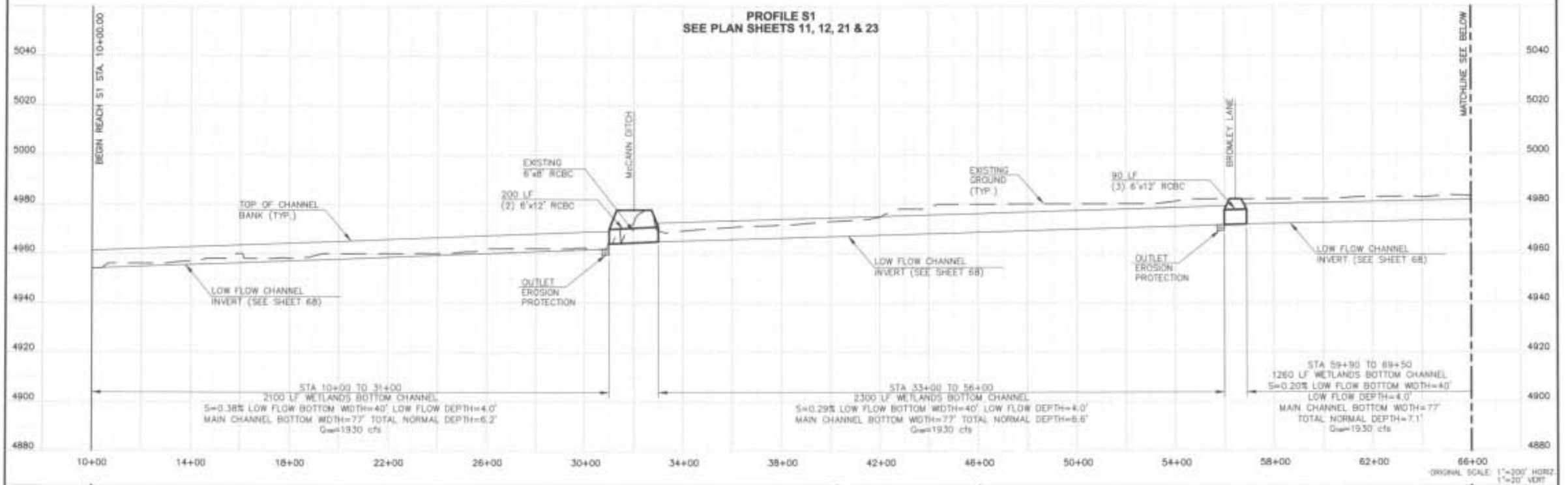
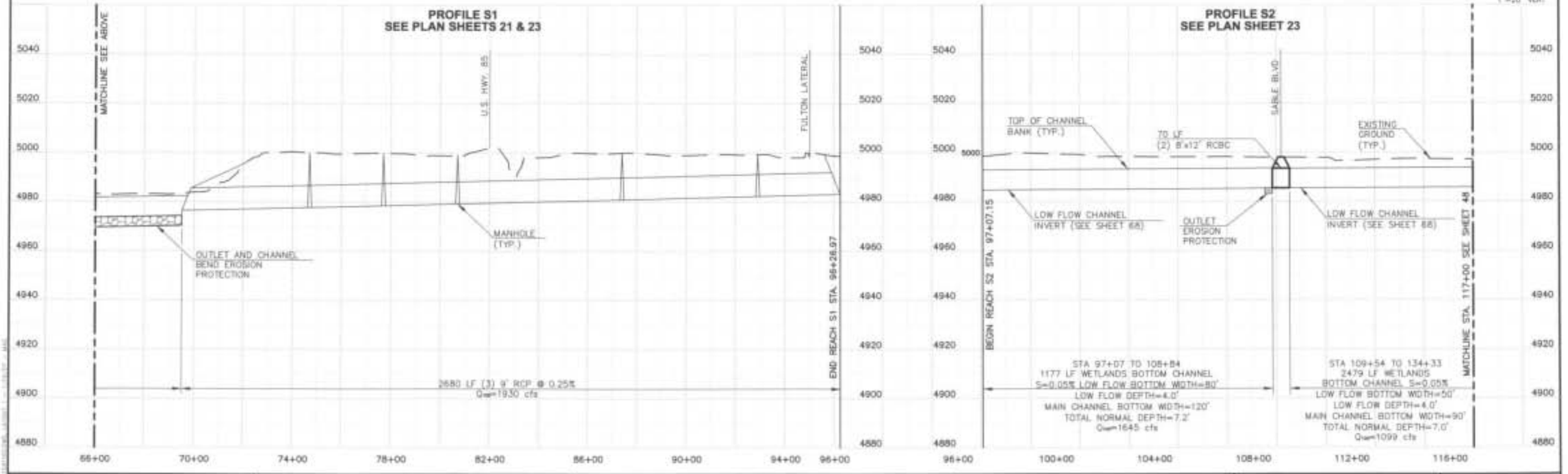
CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY DESIGN PLAN

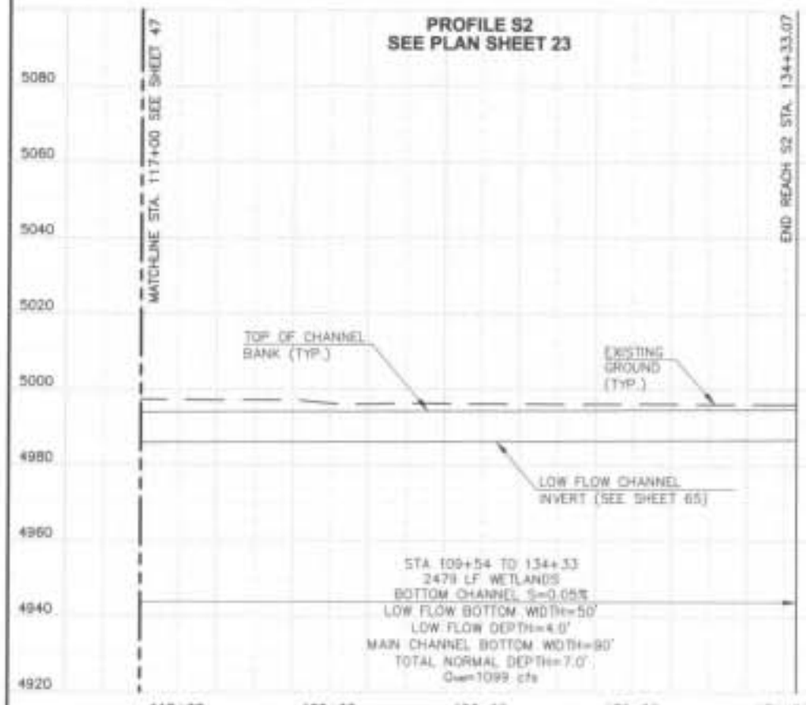
SHEET 56



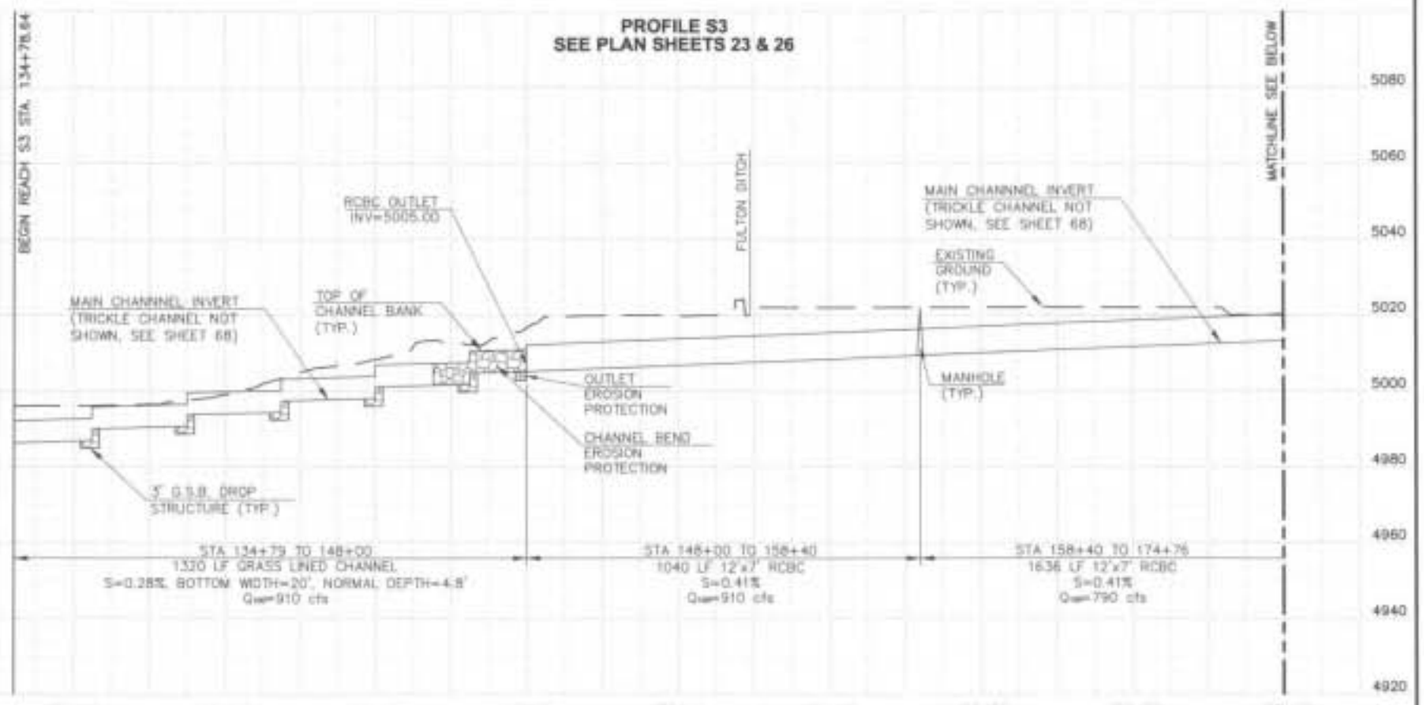


	WRC ENGINEERING, INC. 999 18TH STREET, SUITE 404 DENVER, COLORADO 80202 PHONE NO. (303) 757-8513 FAX NO. (303) 759-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAC DATE 12/20/05 CHECKED DATE REVISED APM DATE 12/2006 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 100

PROFILE S2
SEE PLAN SHEET 23

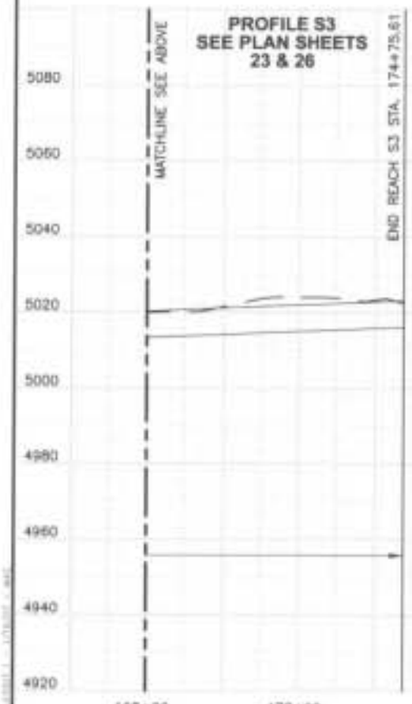


PROFILE S3
SEE PLAN SHEETS 23 & 26

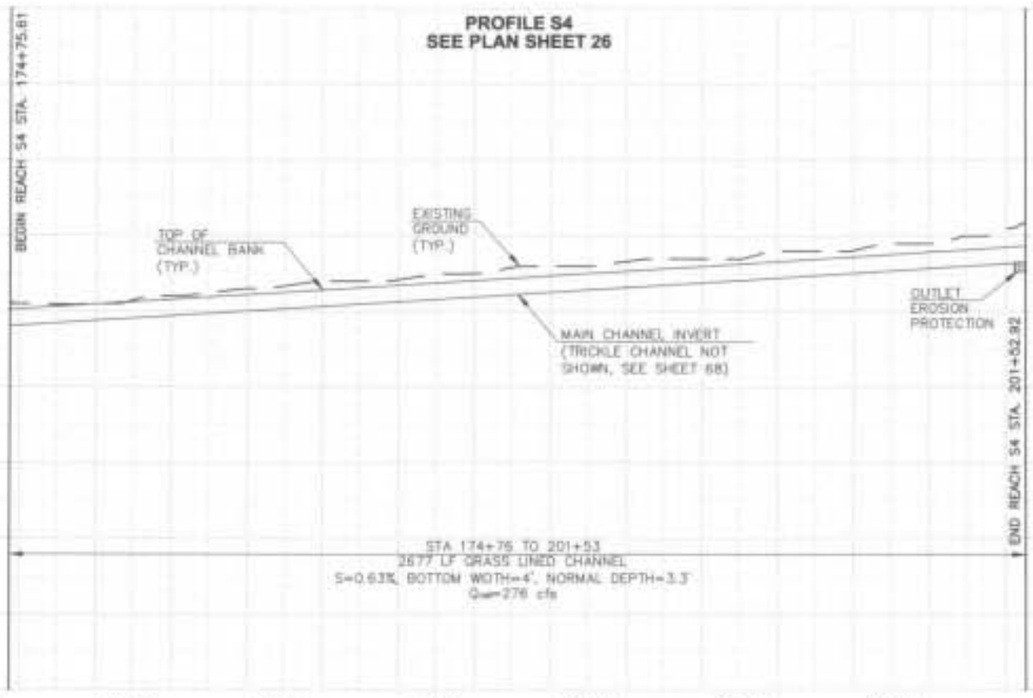


ORIGINAL SCALE: 1"=200' HORIZ
1"=20' VERT

PROFILE S3
SEE PLAN SHEETS 23 & 26



PROFILE S4
SEE PLAN SHEET 26



PROFILE S5
SEE PLAN SHEETS 18 & 25



WRC ENGINEERING, INC.
551 SOUTH CHERRY STREET
SUITE 454
DENVER, COLORADO 80222
PHONE NO. (303) 757-8513
FAX NO. (303) 759-3306

DESIGNED	TIC	DATE 5/28/09
DRAWN	MKS	DATE 5/28/09
CHECKED		DATE
REVISED	AEM	DATE 12/2009
AS-BUILT		DATE

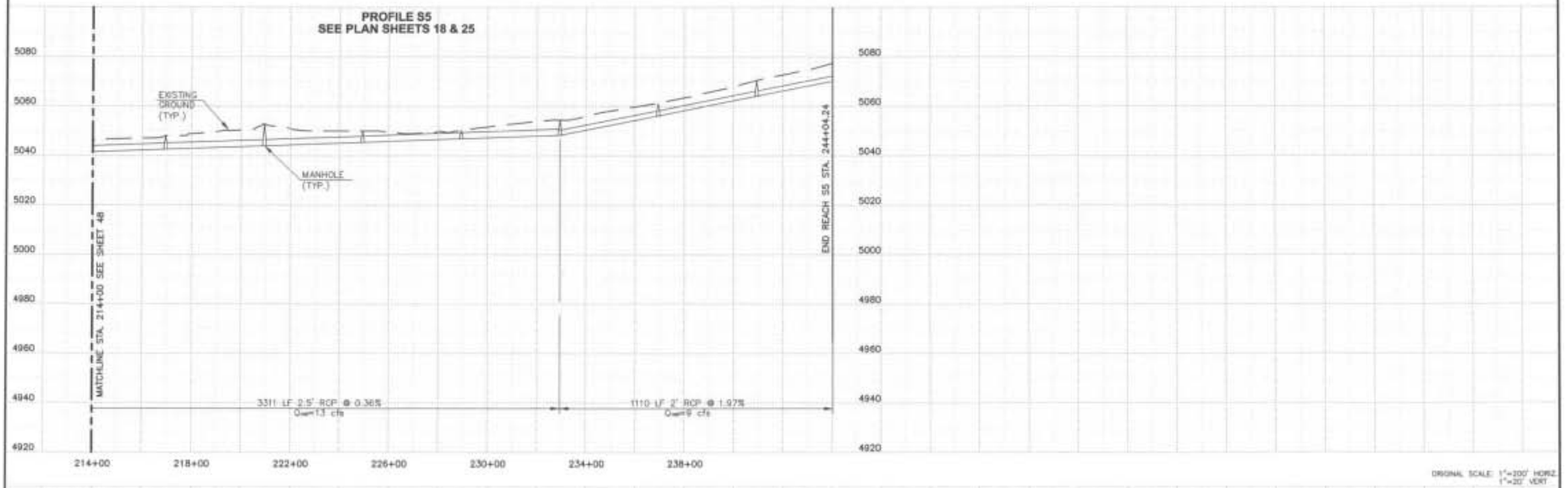
CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

PRELIMINARY
DESIGN PROFILE

SHEET
101

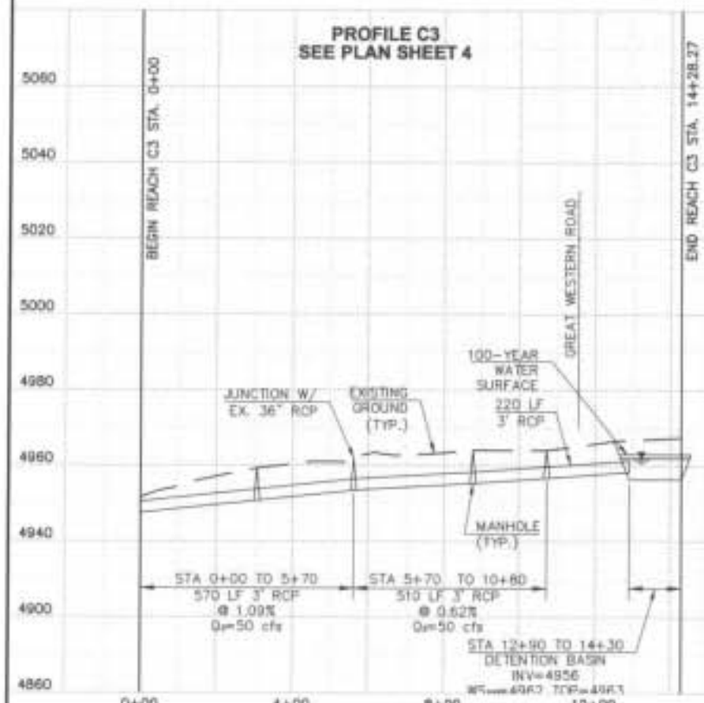
PROFILE S5
SEE PLAN SHEETS 18 & 25



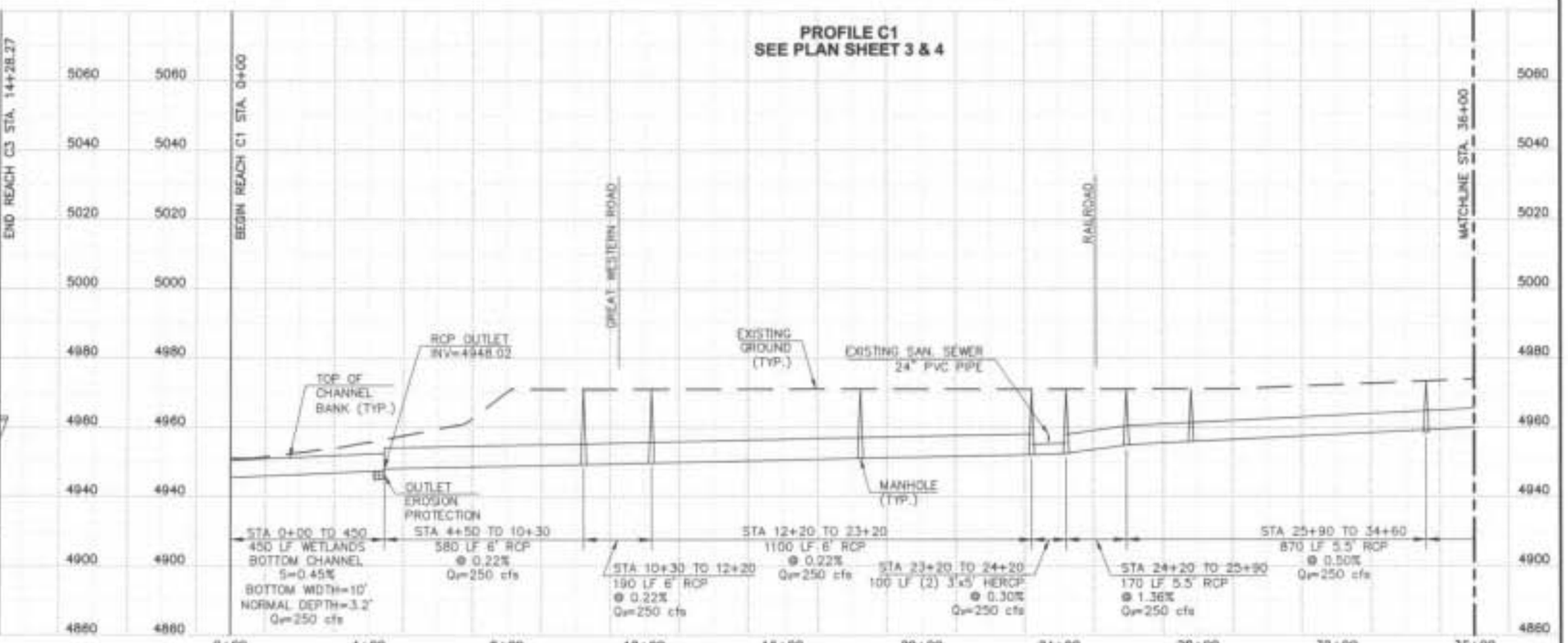
ORIGINAL SCALE: 1"=200' HORIZ.
1"=20' VERT.

WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8913 FAX NO. (303) 756-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED AFM DATE 12/2006 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 102

PROFILE C3
SEE PLAN SHEET 4

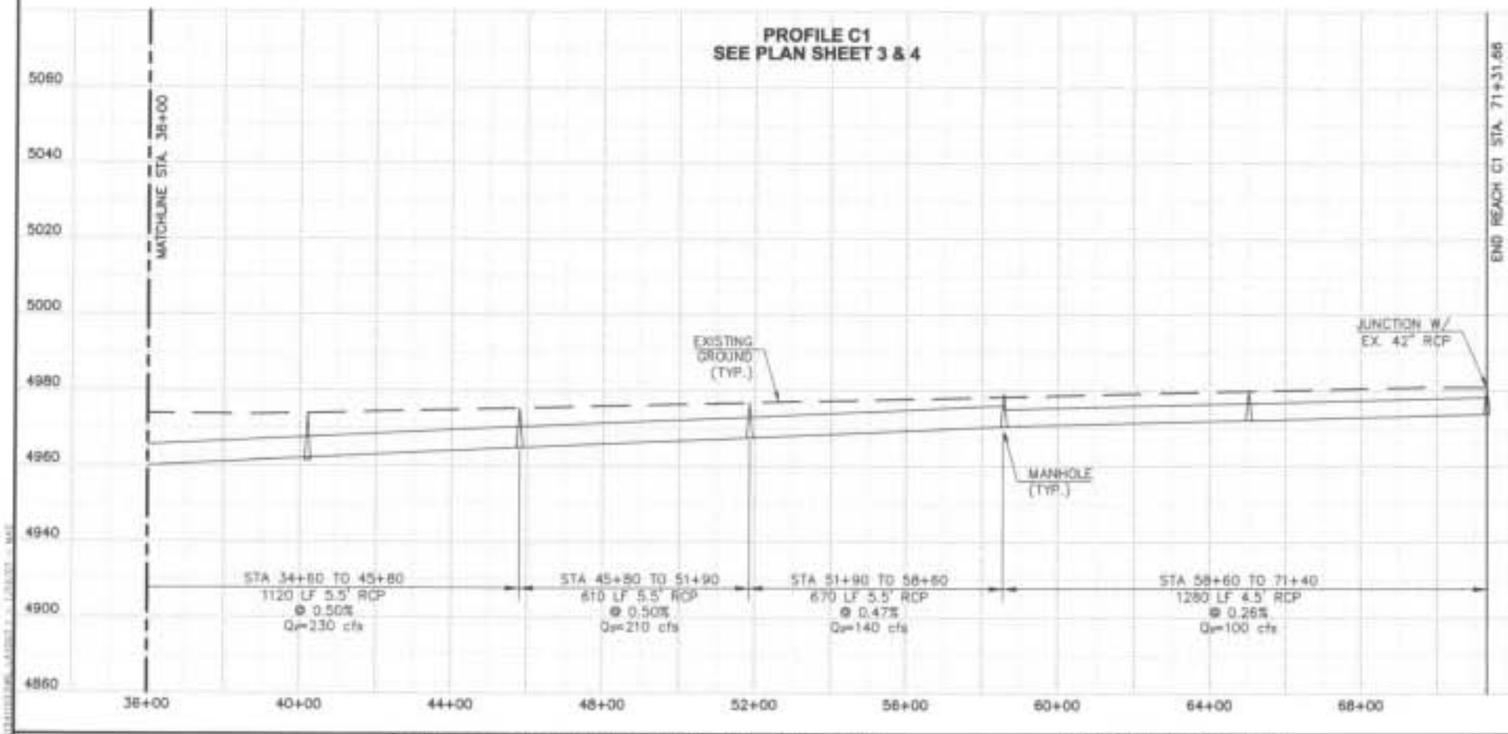


PROFILE C1
SEE PLAN SHEET 3 & 4

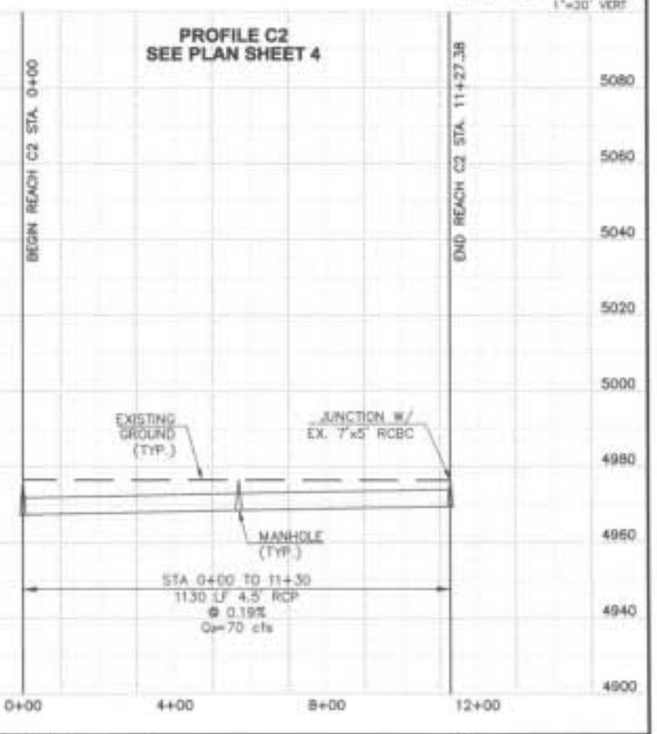


ORIGINAL SCALE: 1"=200' HORIZ. 1"=30' VERT.

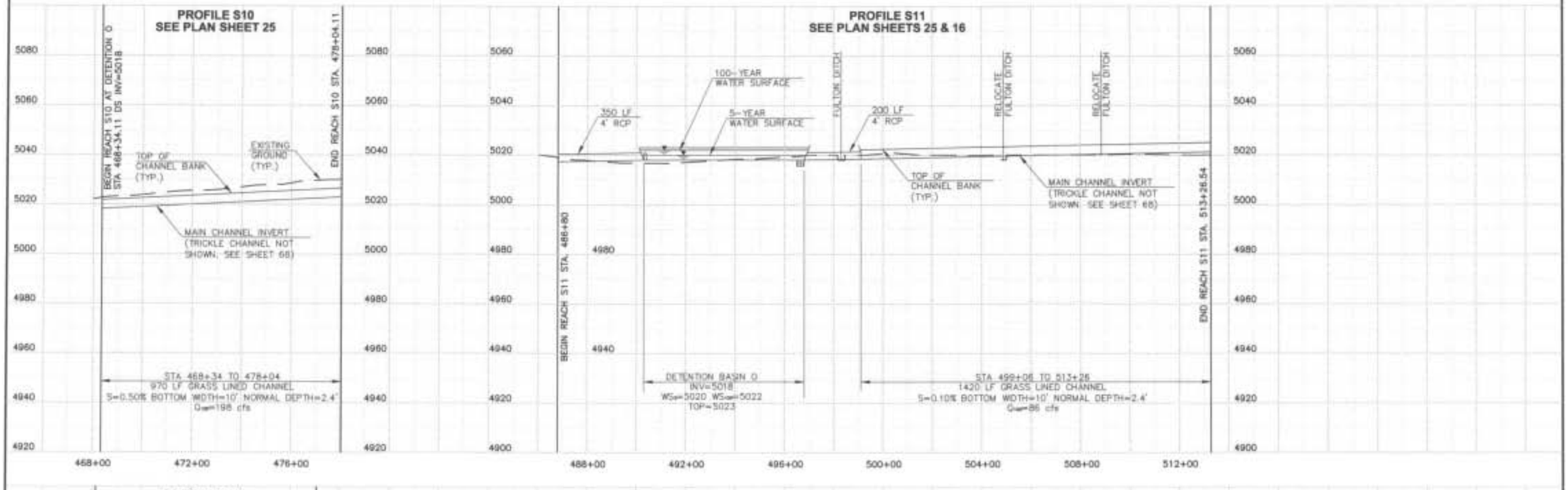
PROFILE C1
SEE PLAN SHEET 3 & 4



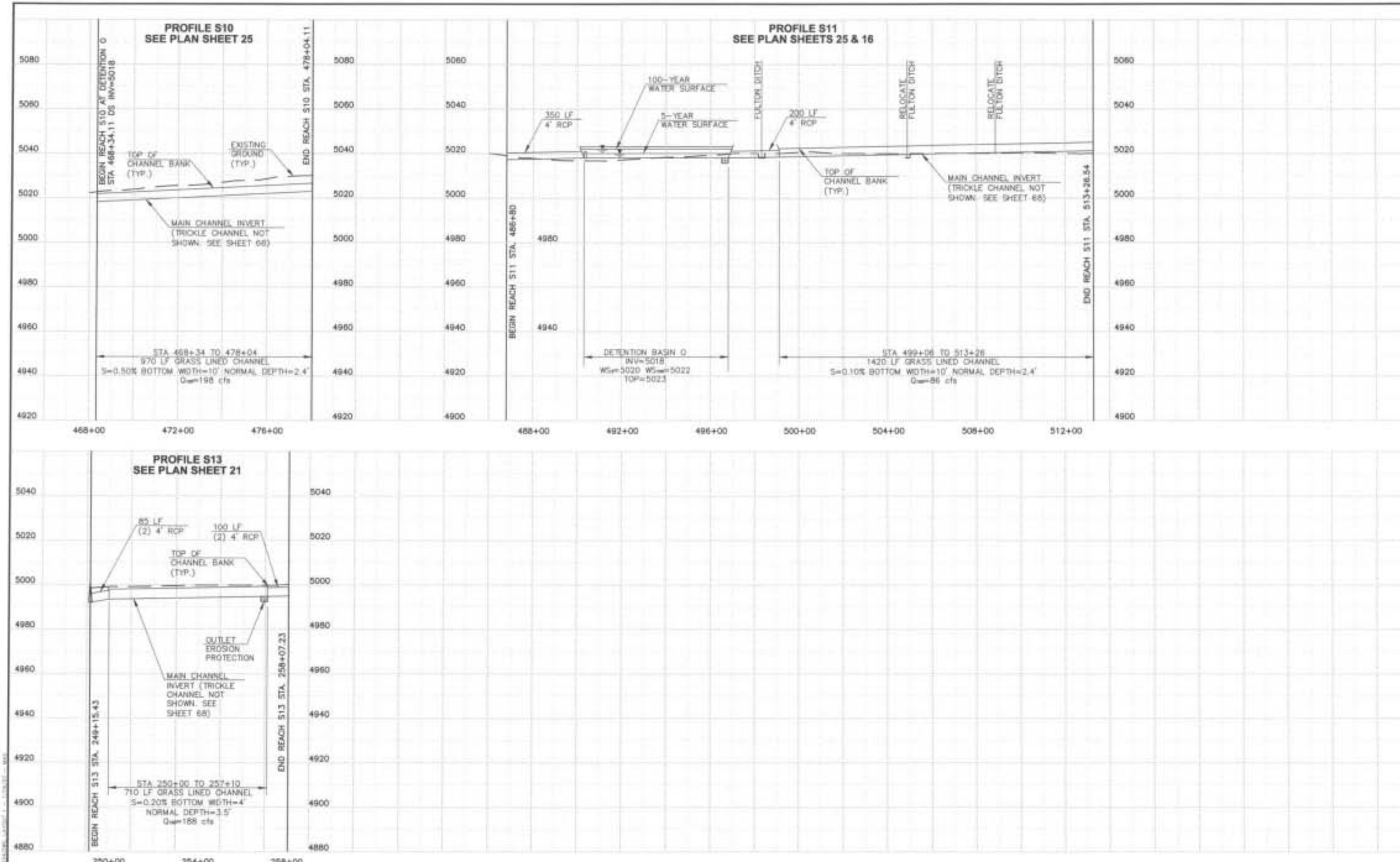
PROFILE C2
SEE PLAN SHEET 4



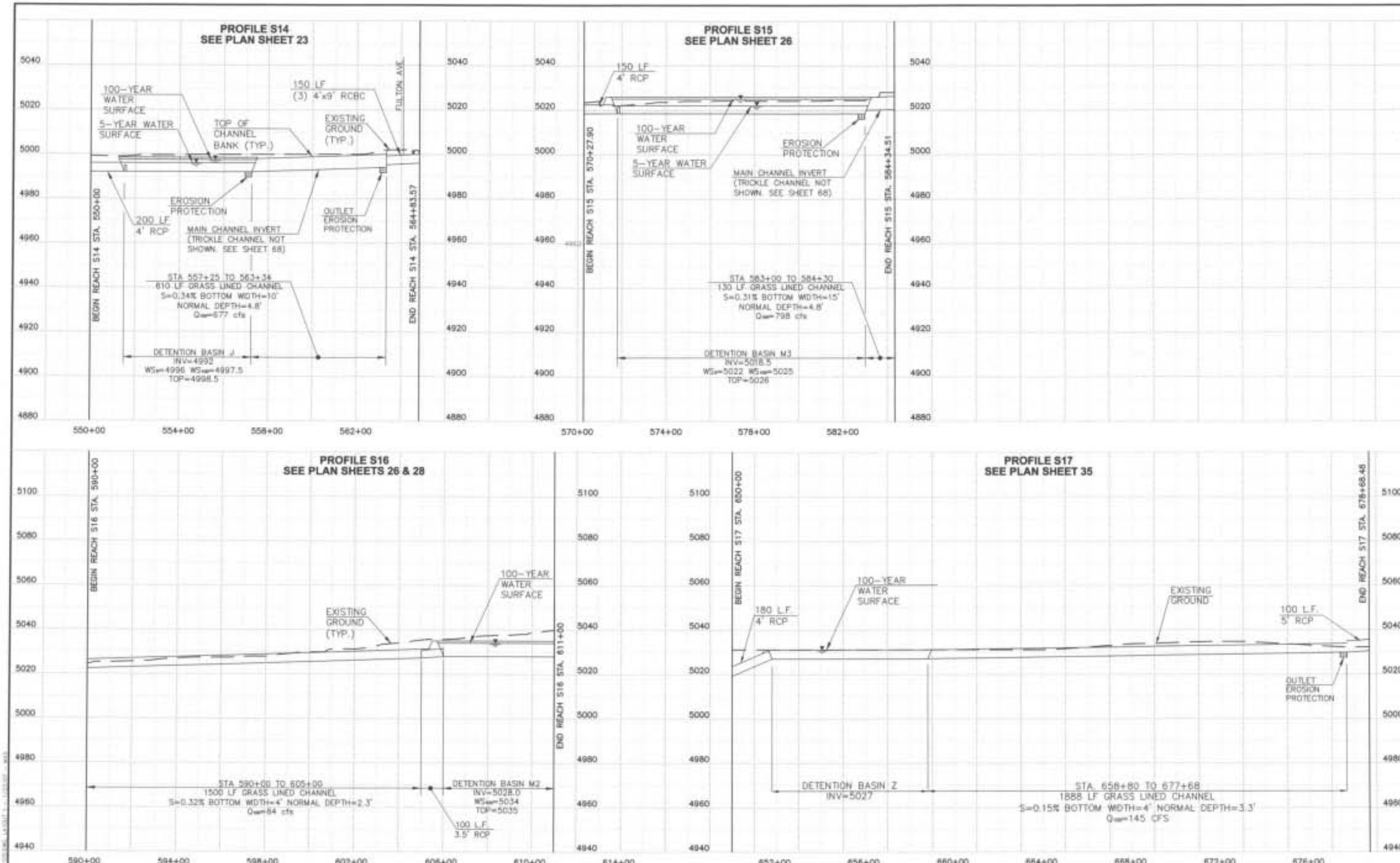
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 756-2209	DESIGNED APM DATE 9/20/05 DRAWN MAS DATE 9/20/05 CHECKED DATE REVISED APM DATE 12/2006 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 103



	WRC ENGINEERING, INC. 999 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 758-3088	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 4/28/05 CHECKED DATE REVISED AEW DATE 12/2009 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 104

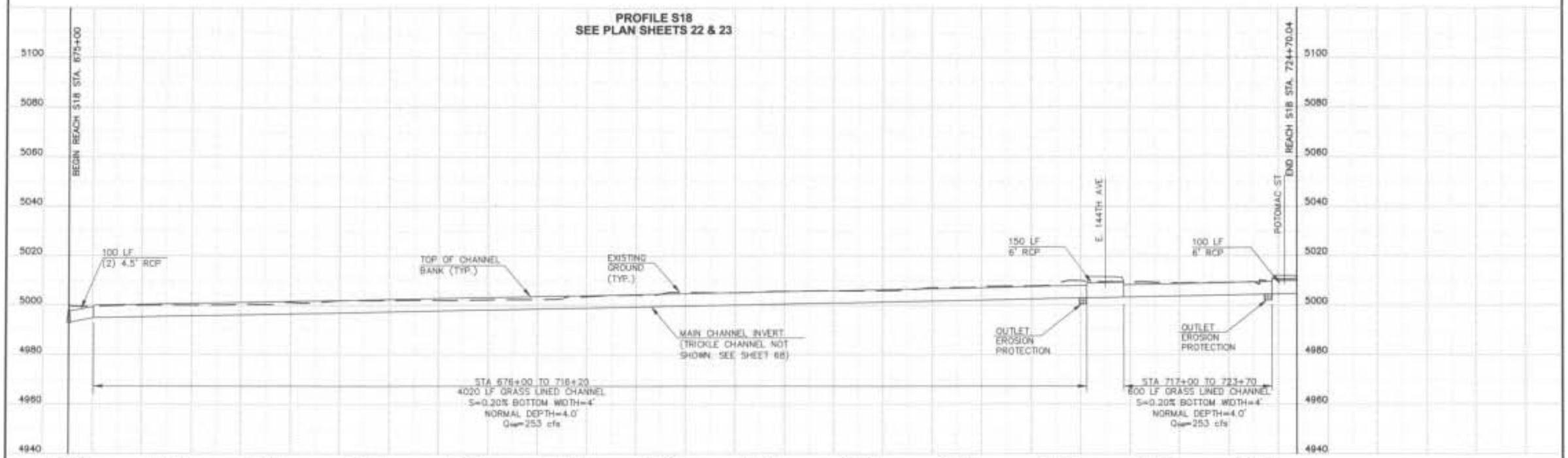


WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8012 FAX NO. (303) 758-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED AFM DATE 12/2009 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 104



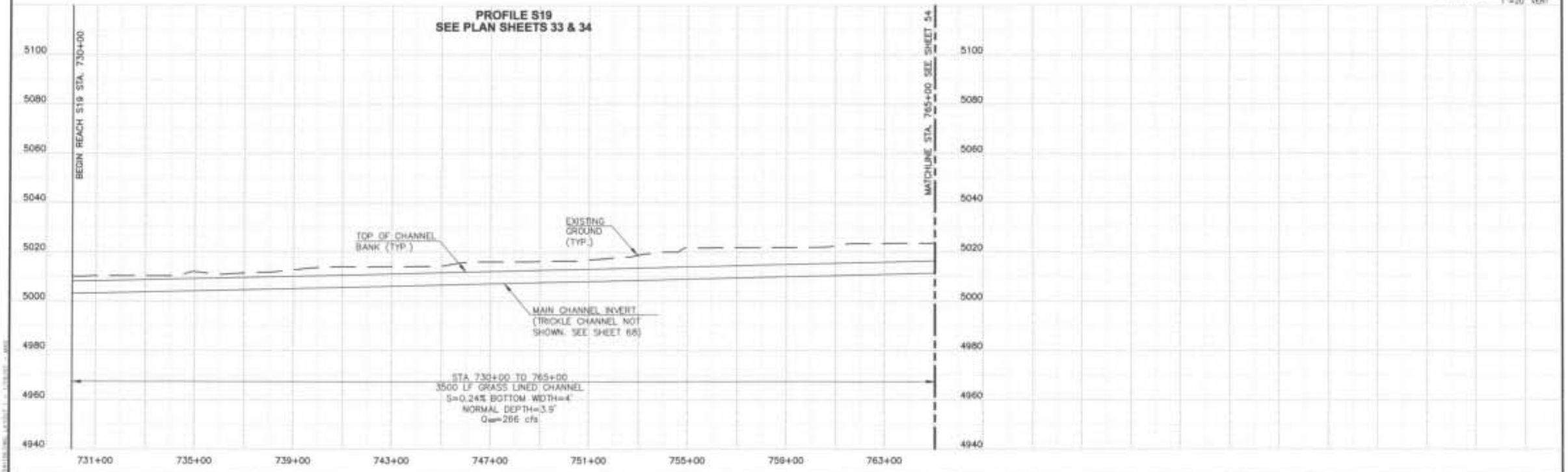
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8013 FAX NO. (303) 758-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED APM DATE 12/2008 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 105

PROFILE S18
SEE PLAN SHEETS 22 & 23

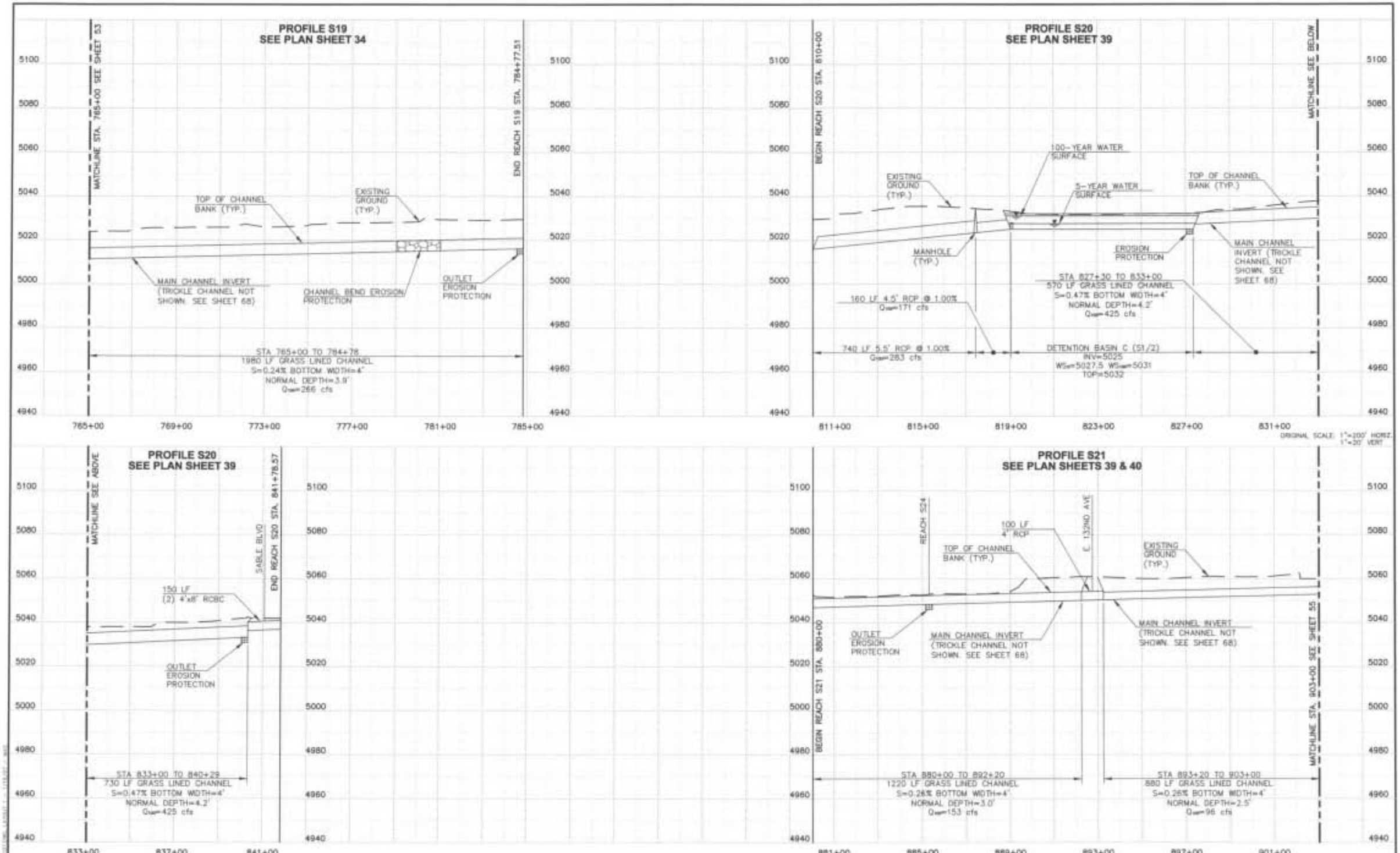


ORIGINAL SCALE: 1"=200' HORIZ
1"=20' VERT

PROFILE S19
SEE PLAN SHEETS 33 & 34

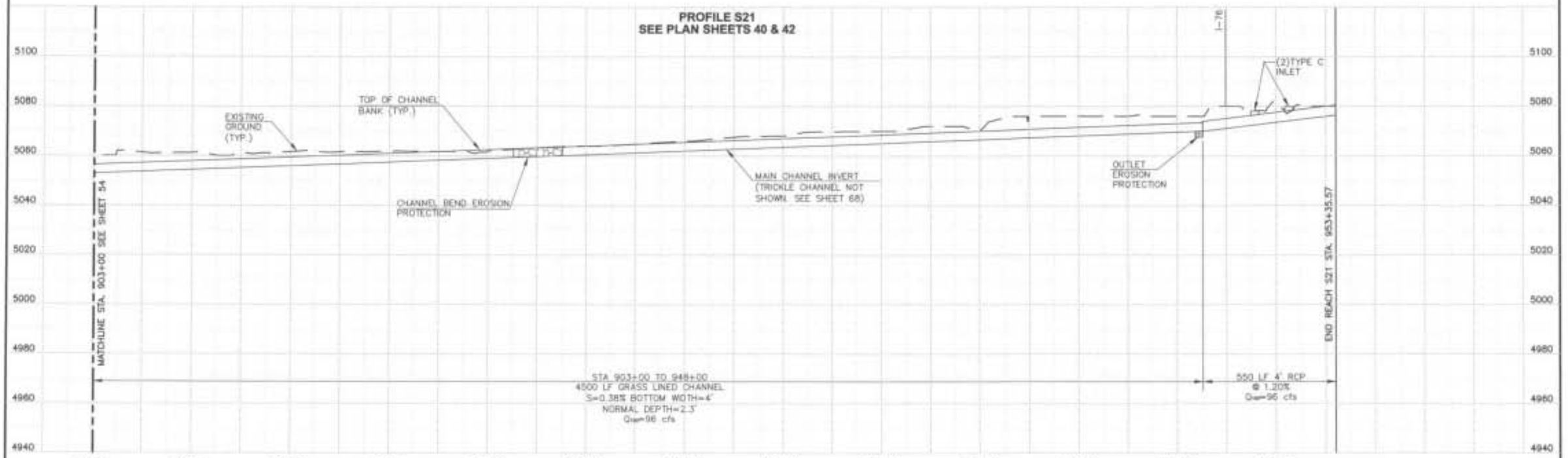


	WRC ENGINEERING, INC. 999 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 758-3268	DESIGNED TTC DATE 3/28/06 DRAWN MAS DATE 12/28/09 CHECKED DATE REVISED AEM DATE 12/2009 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 106



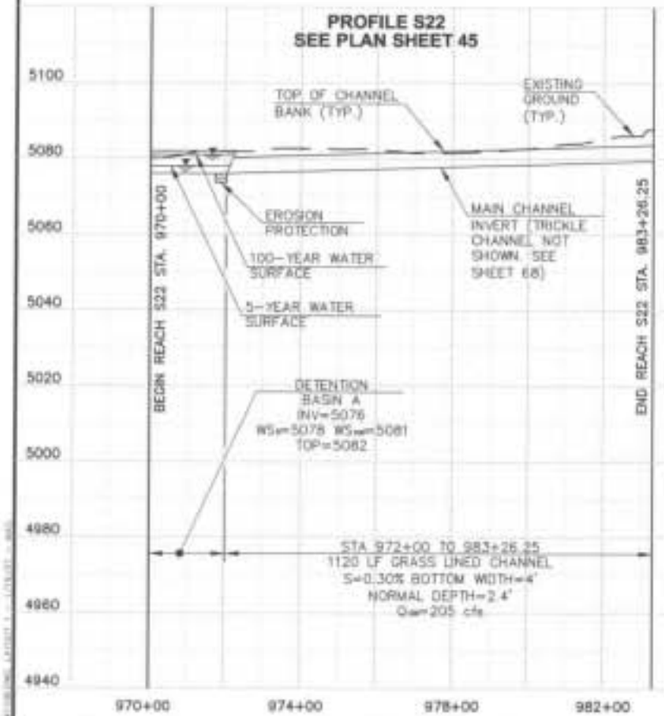
WRC ENGINEERING, INC. 350 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 758-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED APM DATE 12/2009 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 107

PROFILE S21
SEE PLAN SHEETS 40 & 42

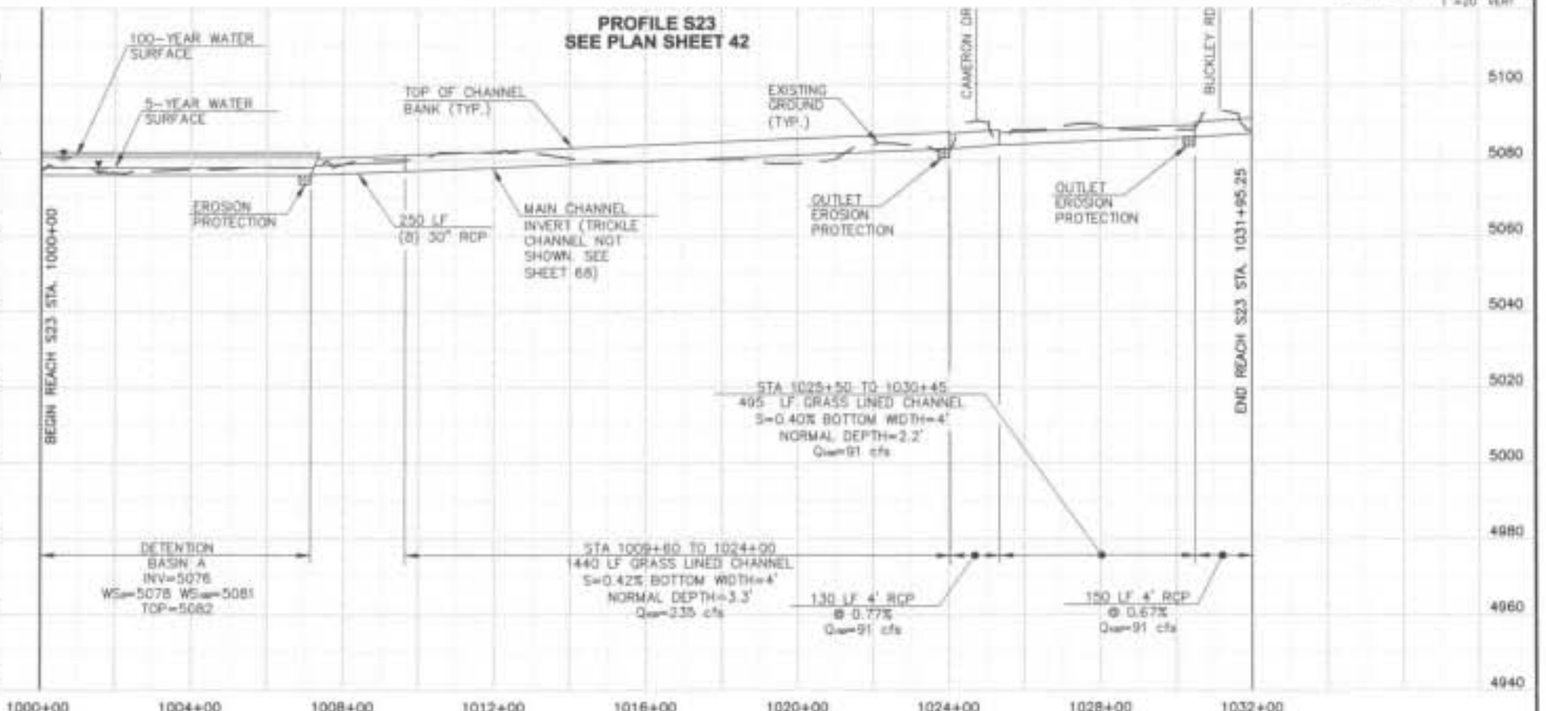


ORIGINAL SCALE: 1"=200' HORIZ.
1"=20' VERT

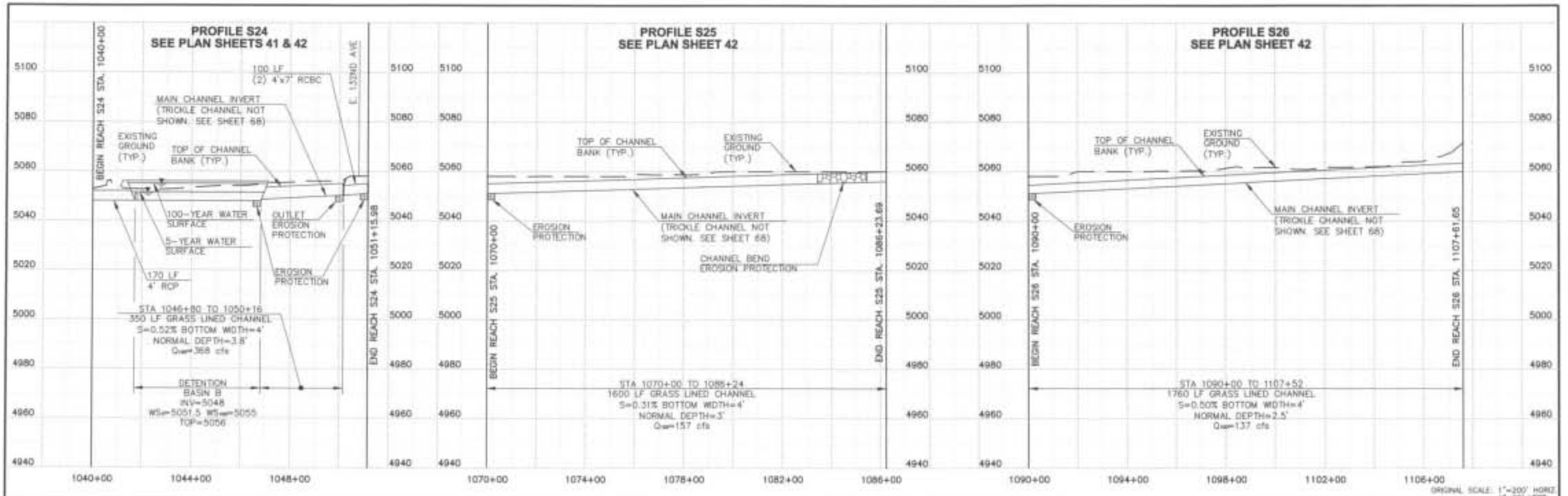
PROFILE S22
SEE PLAN SHEET 45



PROFILE S23
SEE PLAN SHEET 42

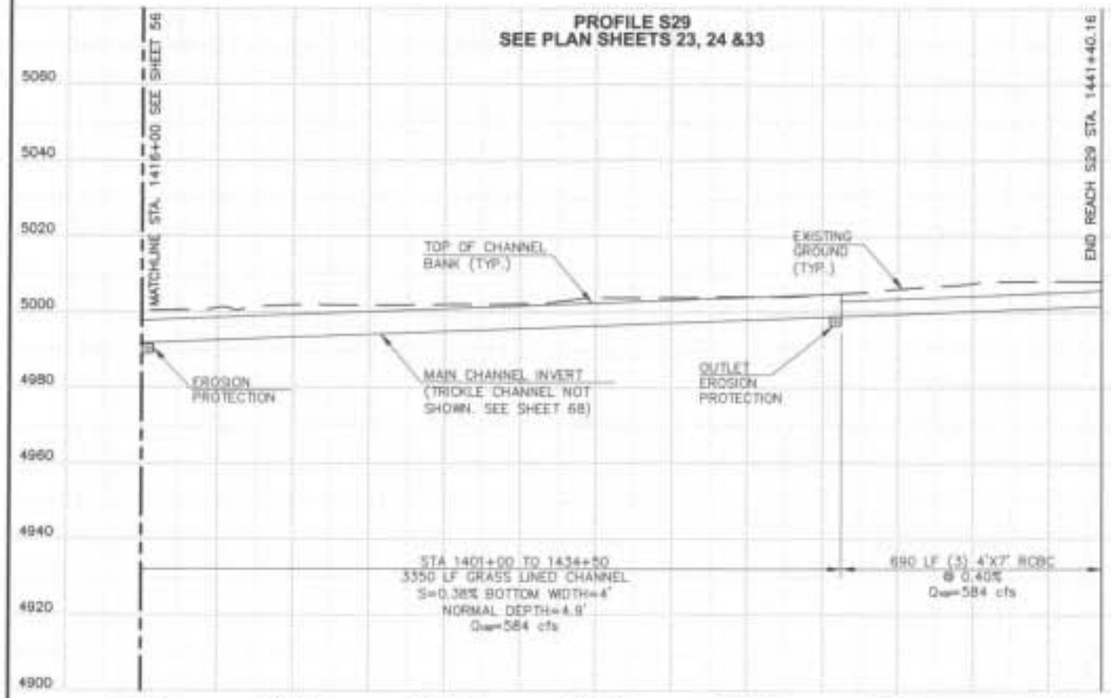


	WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-9313 FAX NO. (303) 756-3238	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED APM DATE 12/2009 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 108

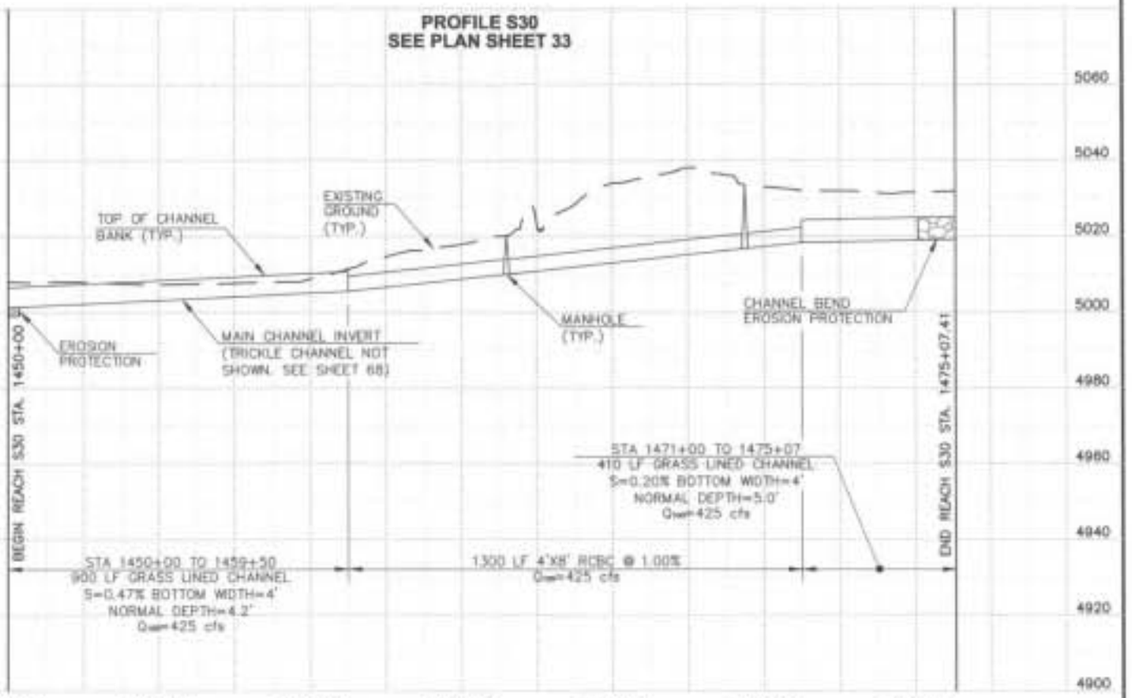


1960D508.dwg	WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-9503 FAX NO. (303) 759-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED AFM DATE 12/2006 REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 109

PROFILE S29
SEE PLAN SHEETS 23, 24 &33

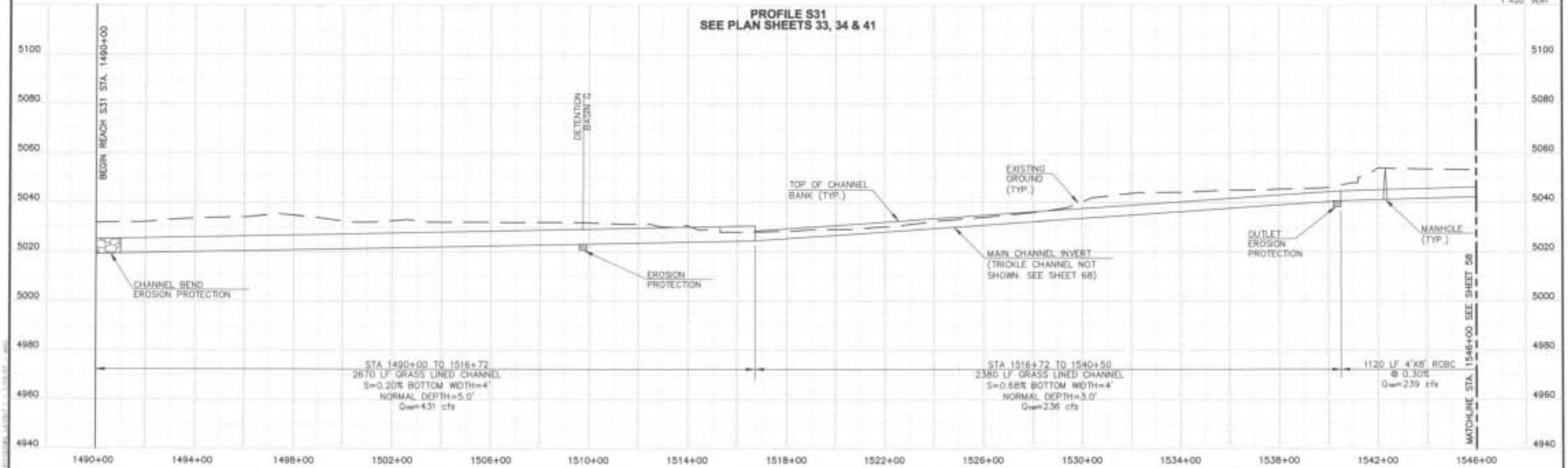


PROFILE S30
SEE PLAN SHEET 33

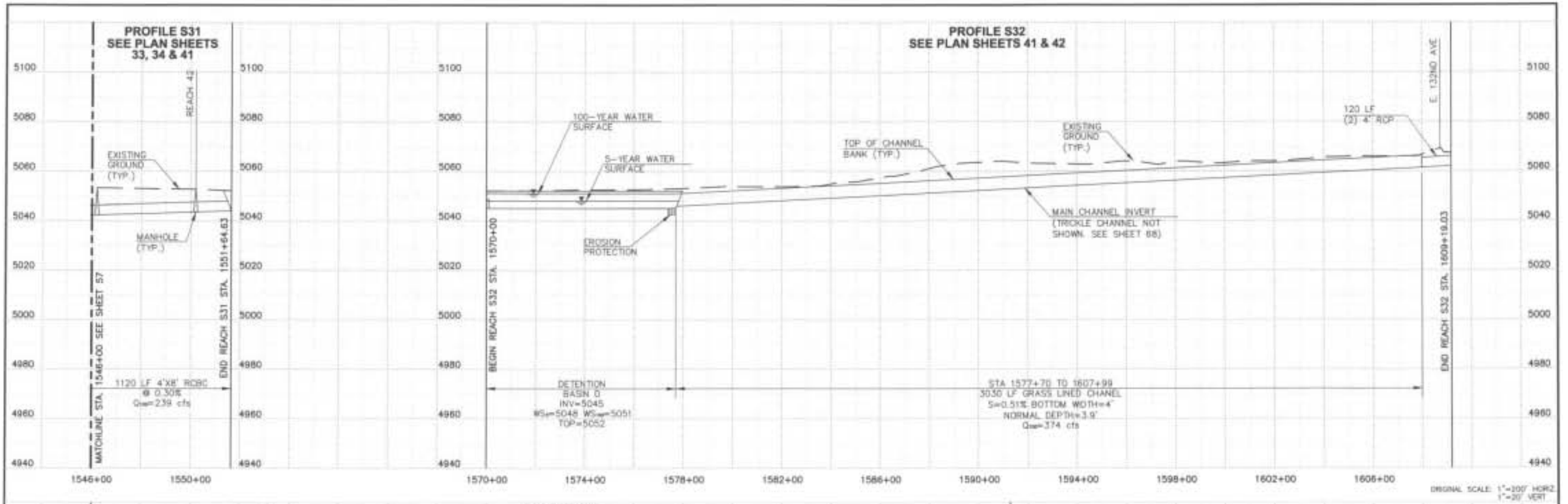


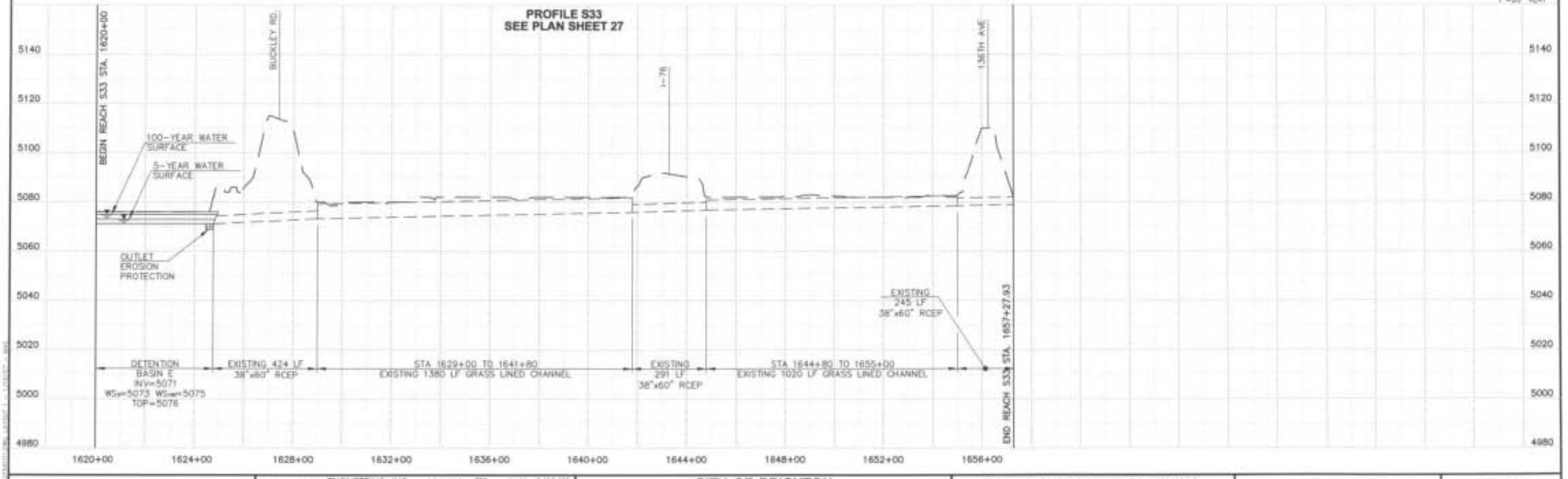
ORIGINAL SCALE: 1"=200' HORIZ
1"=20' VERT

PROFILE S31
SEE PLAN SHEETS 33, 34 & 41

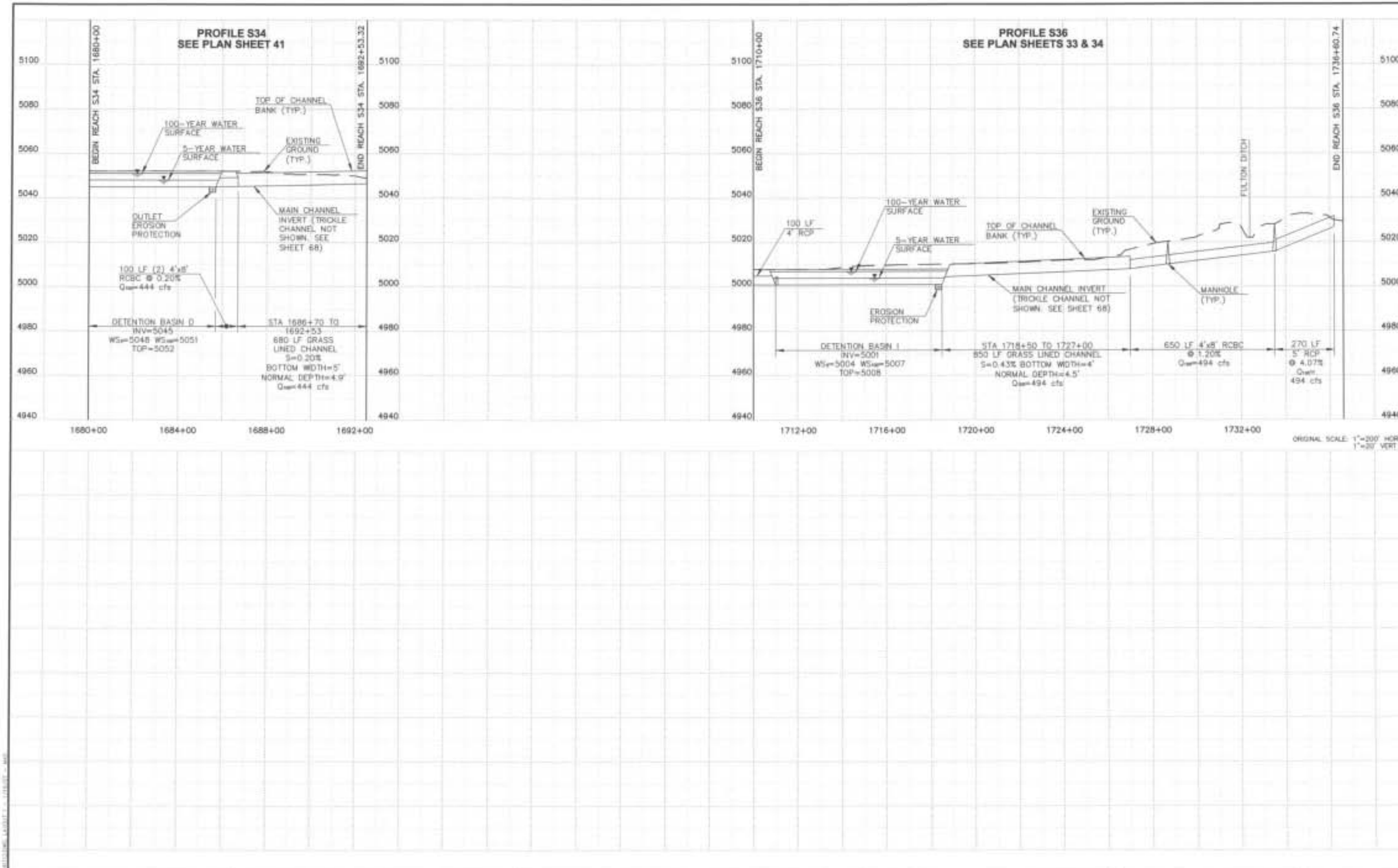


	WRC ENGINEERING, INC. 350 SOUTH DIGBY STREET SUITE 404 DENVER, COLORADO 80232 PHONE NO. (303) 757-8913 FAX NO. (303) 759-5208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED APM DATE 12/2009 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 110

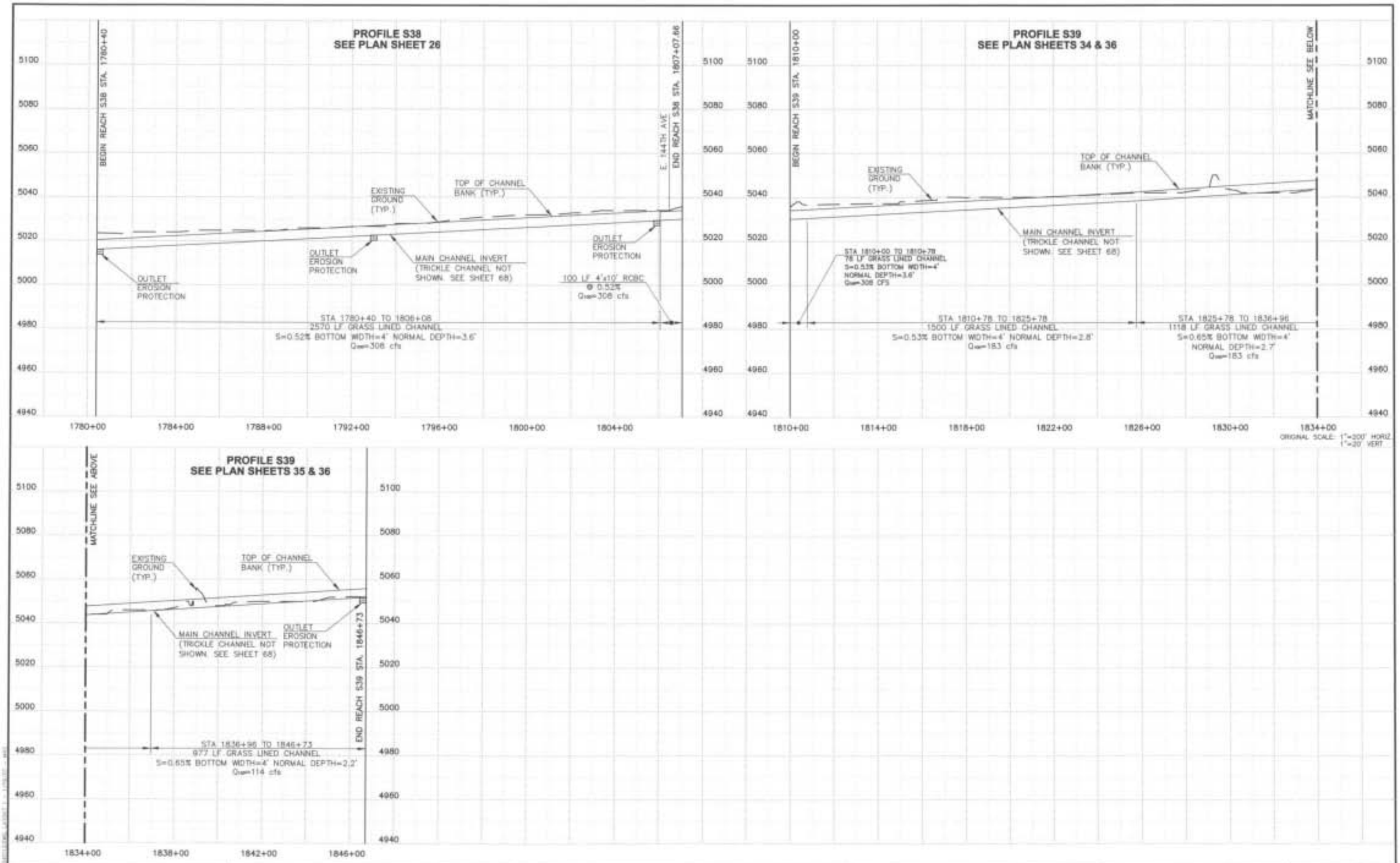




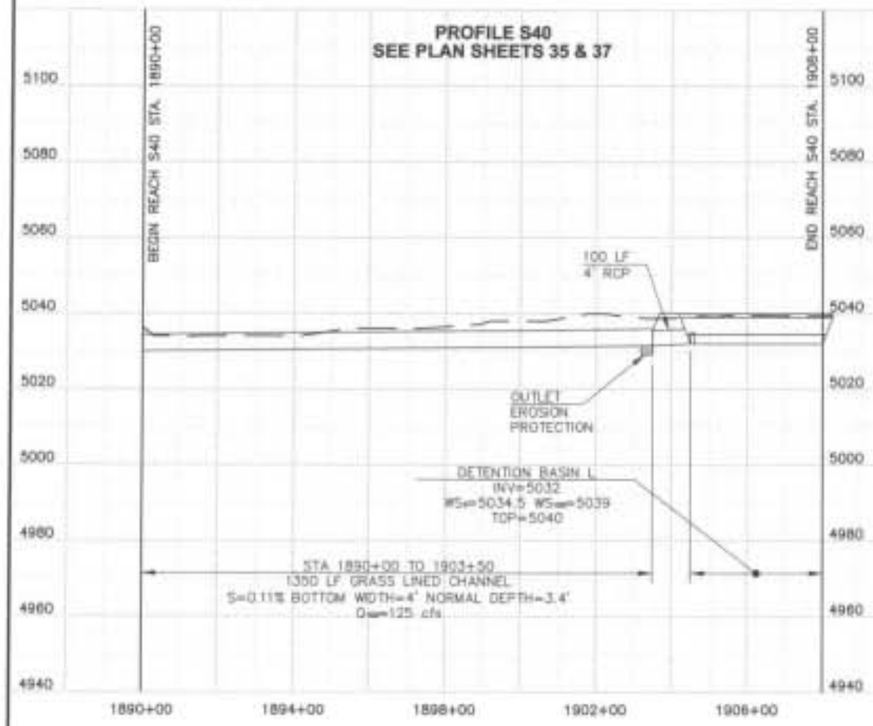
	WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-9513 FAX NO. (303) 759-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 7/28/05 CHECKED DATE REVISED APM DATE 12/2009 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 111

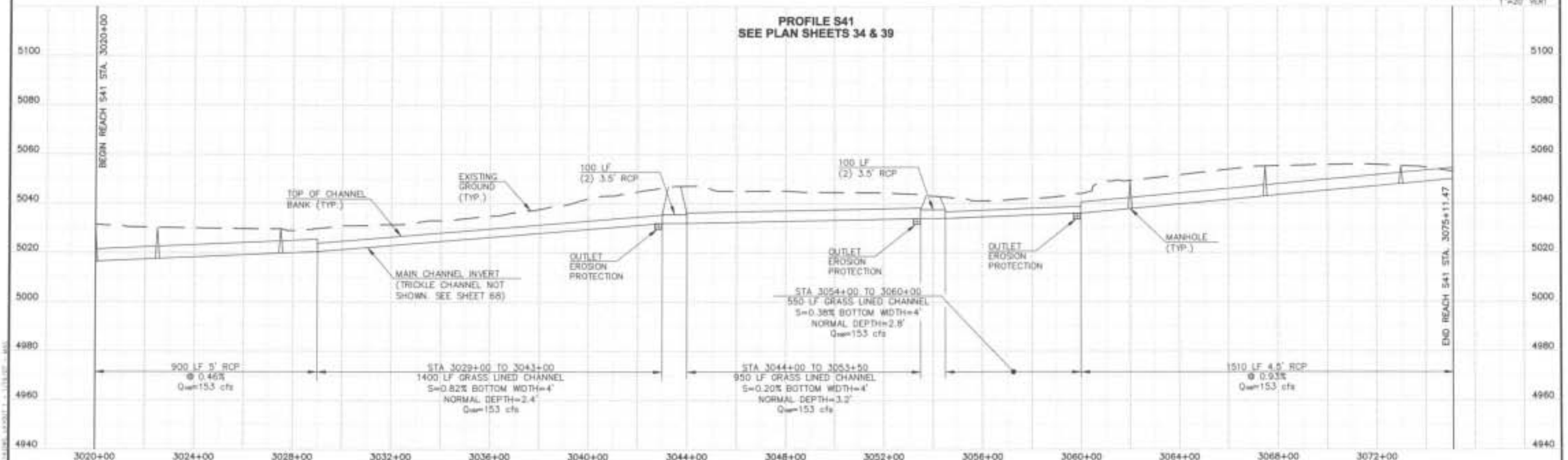


WRC ENGINEERING, INC. 650 SOUTH CHERRY STREET SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 758-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED APM DATE 12/2005 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 112



	WRC ENGINEERING, INC. 650 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 756-3208 DESIGNED TTC DATE 1/28/05 DRAWN MAS DATE 1/28/05 CHECKED DATE REVISED APM DATE 12/2006 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 113





WRC ENGINEERING, INC.
350 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80222
PHONE NO. (303) 757-8513
FAX NO. (303) 756-3508

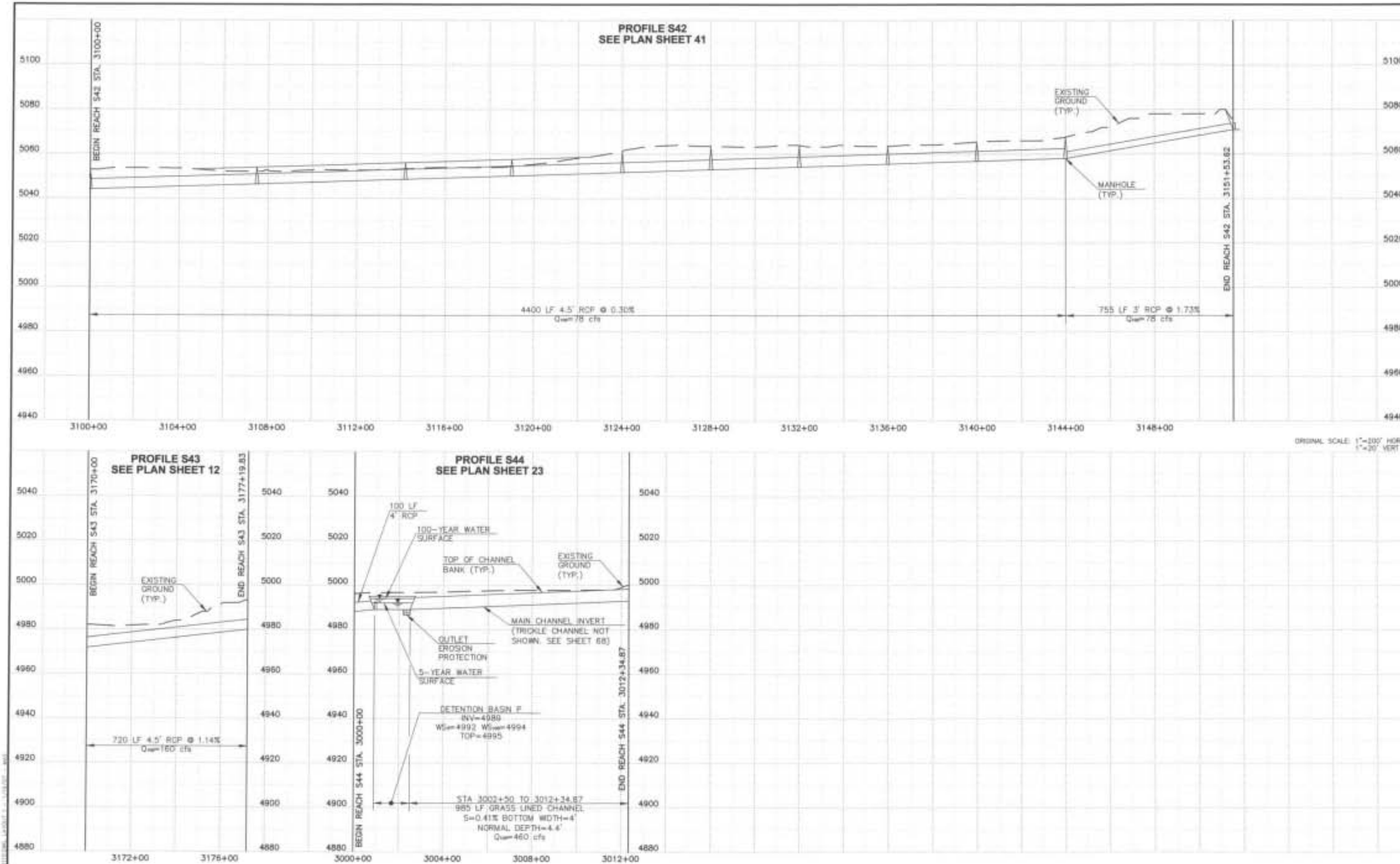
DESIGNED	TTC	DATE	3/28/05
DRAWN	MAS	DATE	3/28/05
CHECKED		DATE	
REVISED	APM	DATE	12/2008
AS-BUILT		DATE	

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

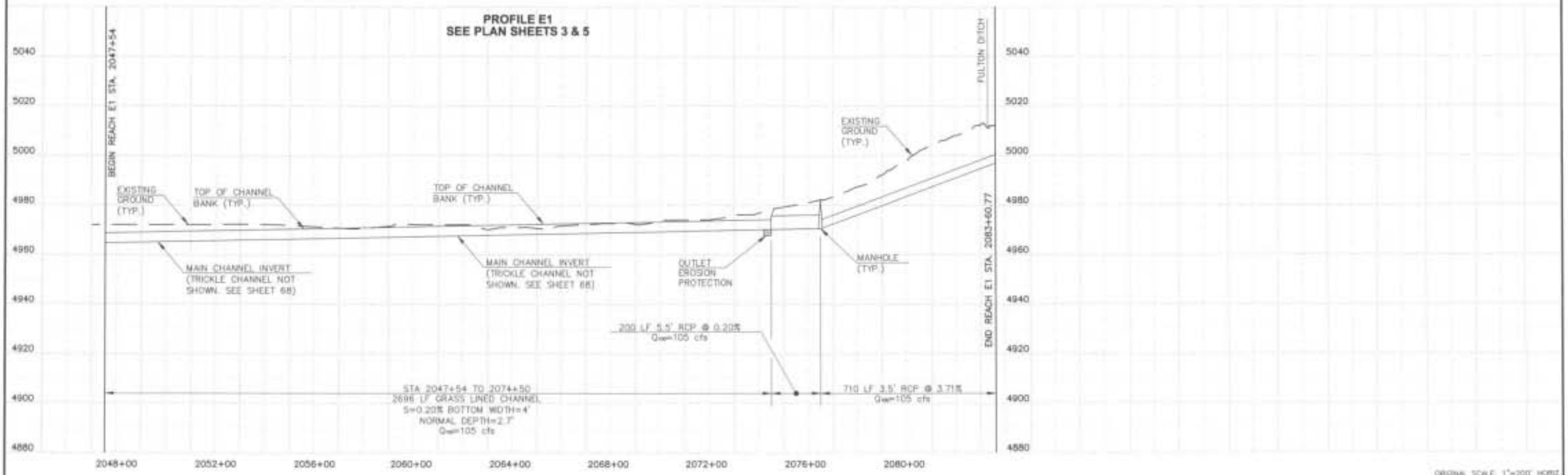
PRELIMINARY
DESIGN PROFILE

SHEET
114



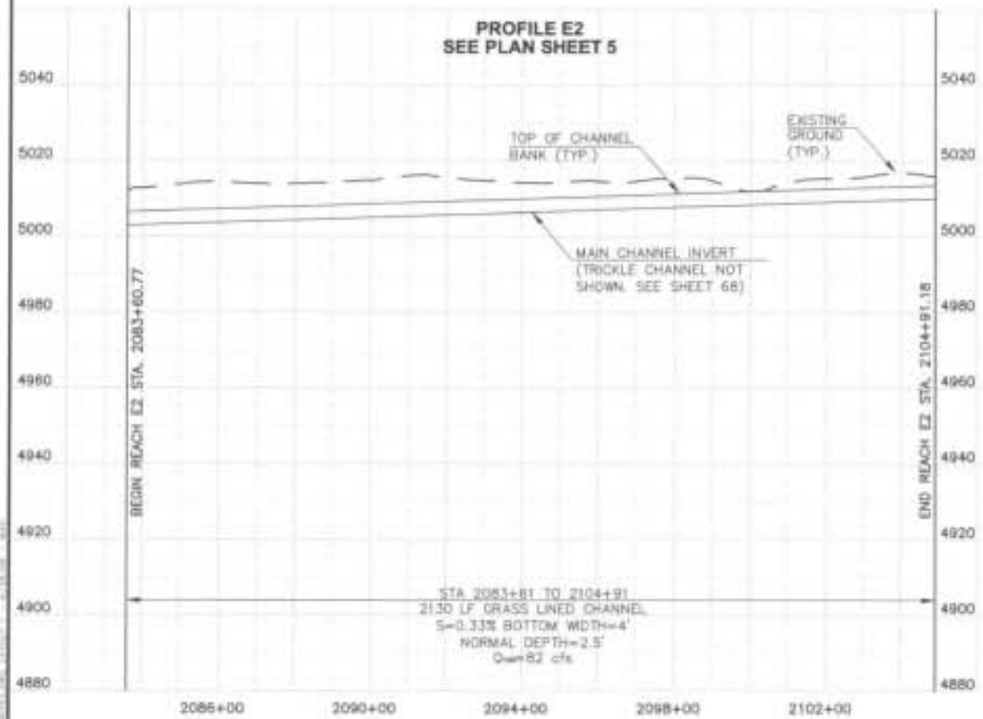
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 758-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED APM DATE 12/2008 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 115

PROFILE E1
SEE PLAN SHEETS 3 & 5

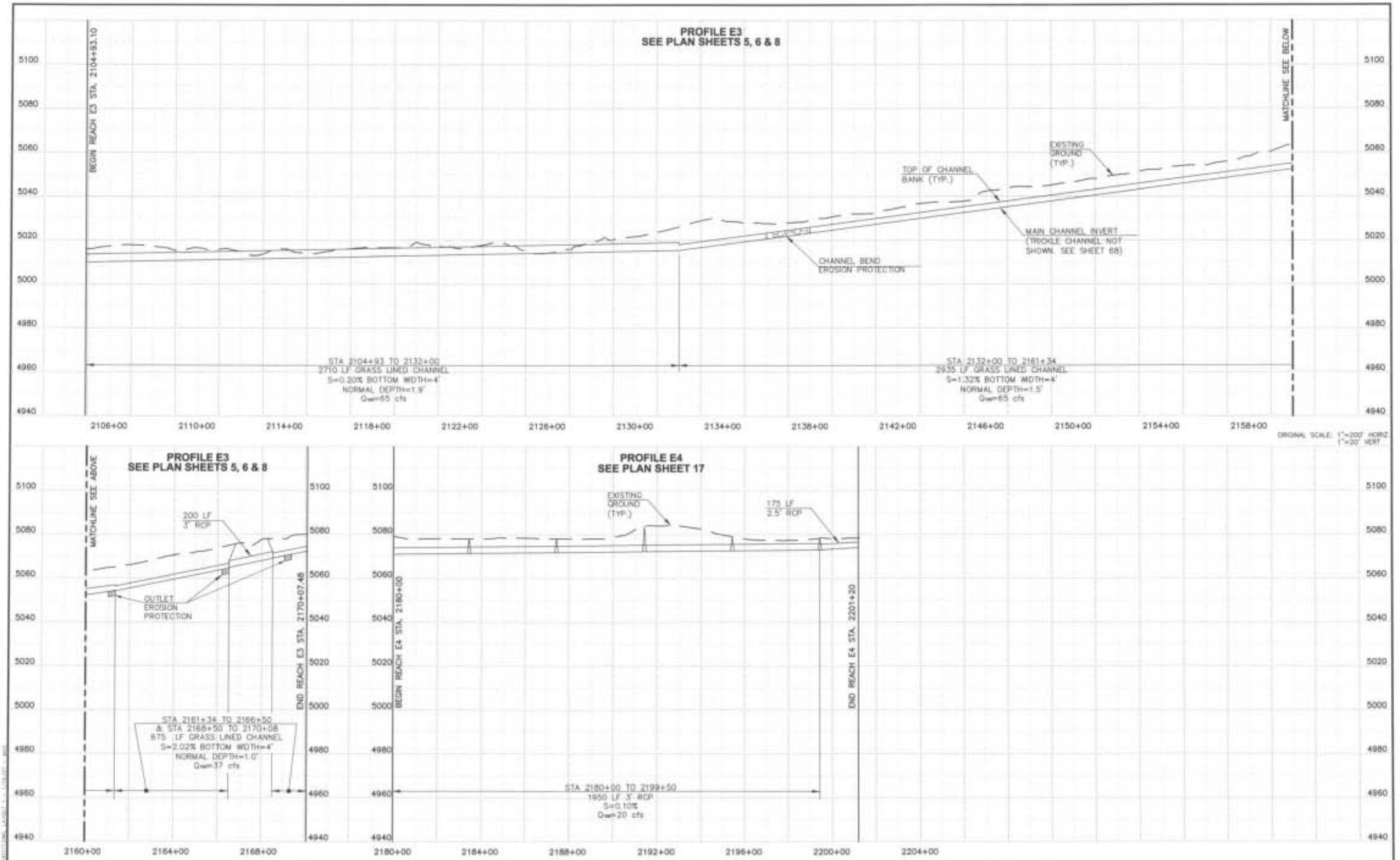


ORIGINAL SCALE: 1"=200' HORIZ
1"=20' VERT

PROFILE E2
SEE PLAN SHEET 5



WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8101 FAX NO. (303) 759-3008	DESIGNED TTC DATE 3/28/05 DRAWN MKB DATE 3/28/05 CHECKED DATE REVISED APM DATE 7/28/05 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET NO. 116



WRC ENGINEERING, INC.
1512 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80222
PHONE NO. (303) 757-8014
FAX NO. (303) 758-2258

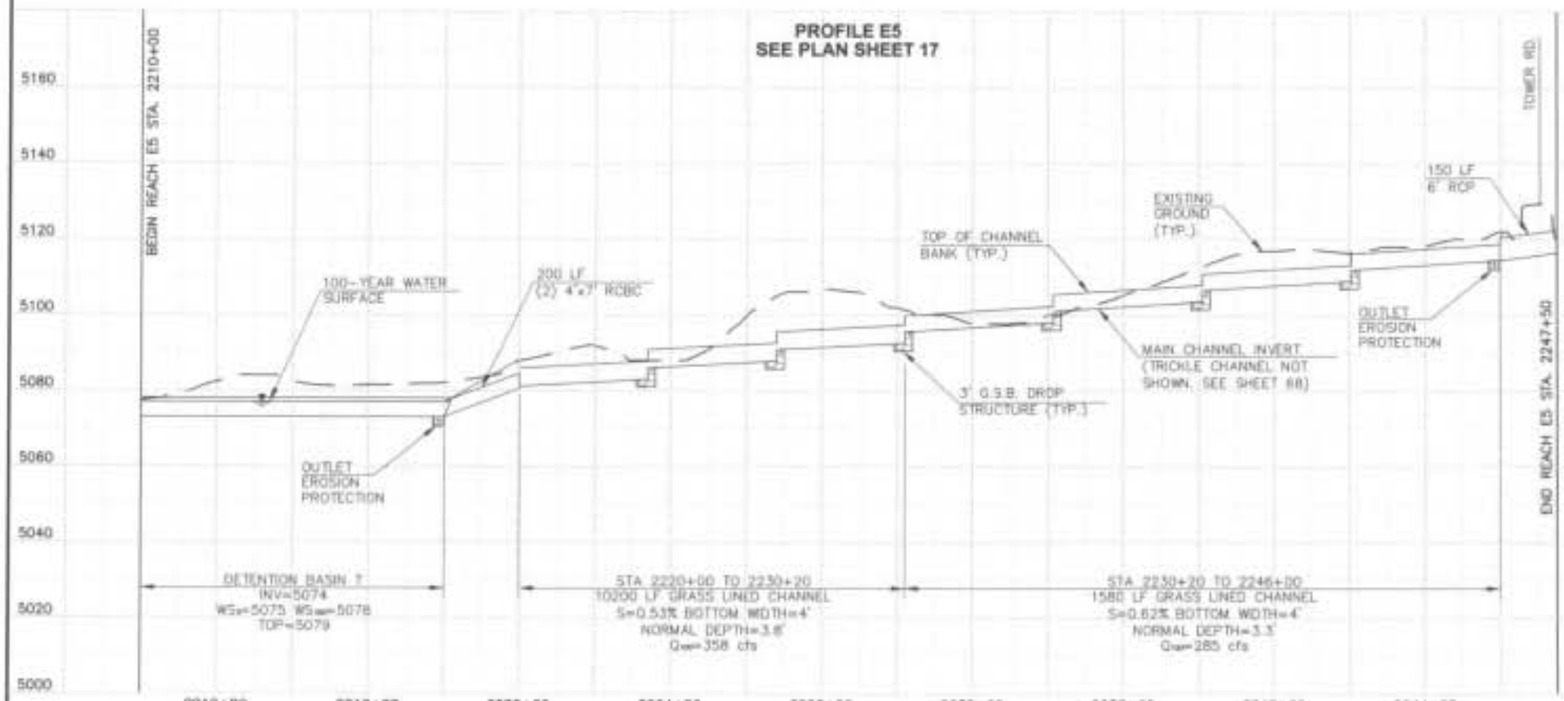
DESIGNED	TTC	DATE	3/28/05
DRAWN	MAS	DATE	7/28/05
CHECKED		DATE	12/2009
REVISED	AFM	DATE	
AS-BUILT		DATE	

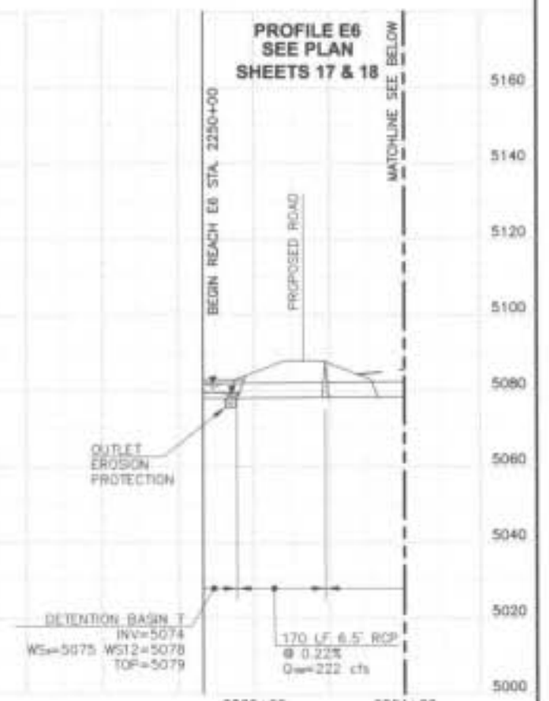
CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

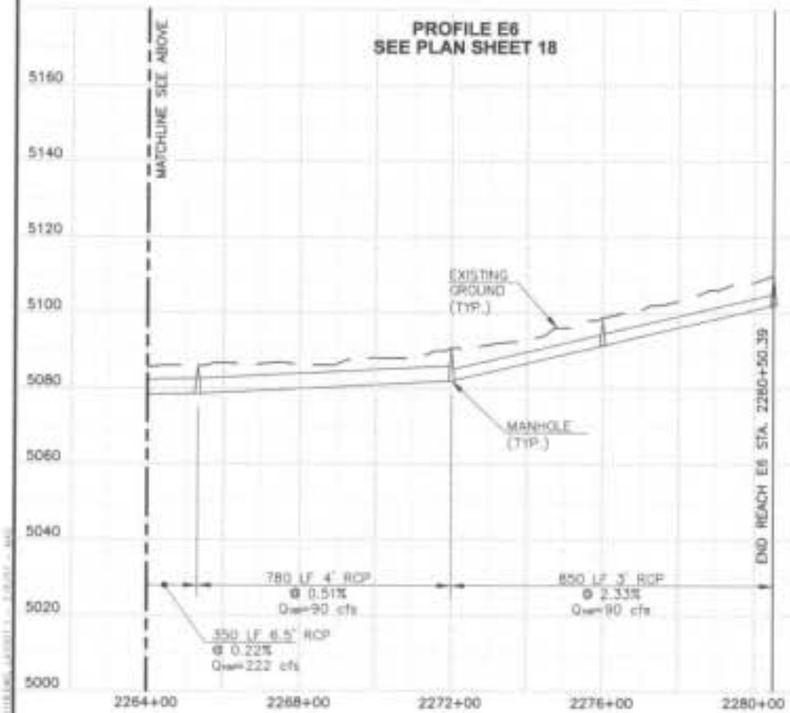
PRELIMINARY
DESIGN PROFILE

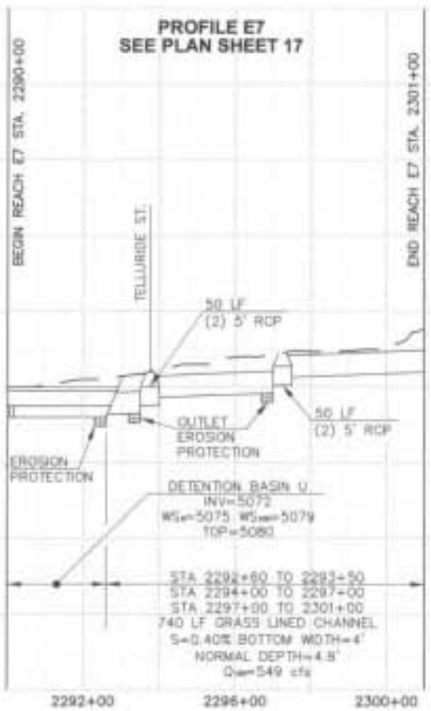
SHEET
117

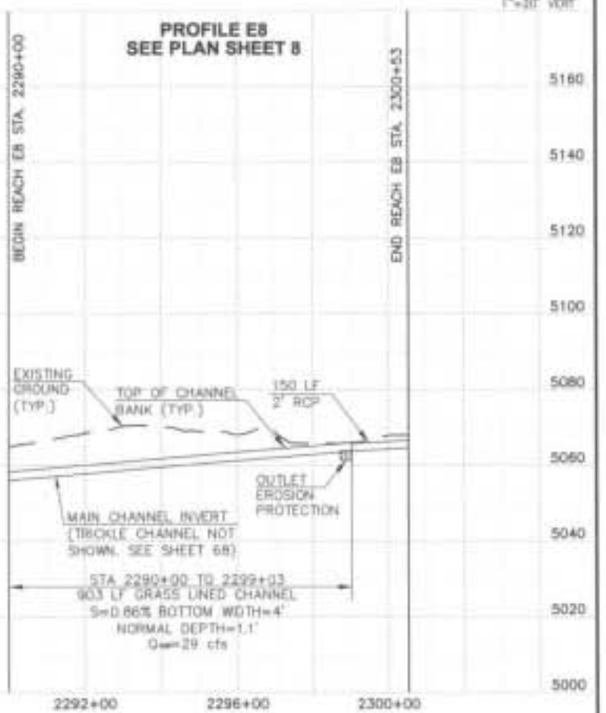




ORIGINAL SCALE: 1"=200' HORIZ. 1"=20' VERT.





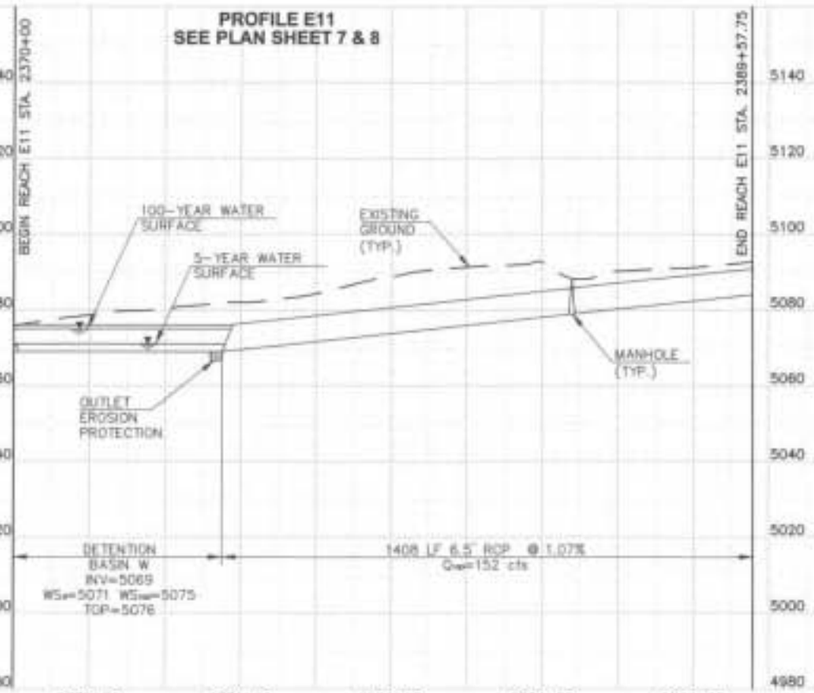


WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 759-3208	DESIGNED TTC DATE 5/28/09 DRAWN MAS DATE 5/28/09 CHECKED APM DATE 12/2009 REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 118

PROFILE E10
SEE PLAN SHEET 8

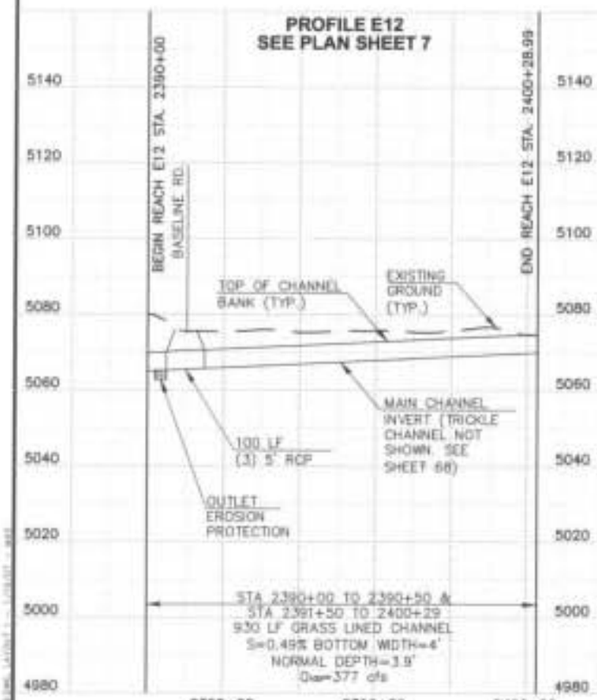


PROFILE E11
SEE PLAN SHEET 7 & 8



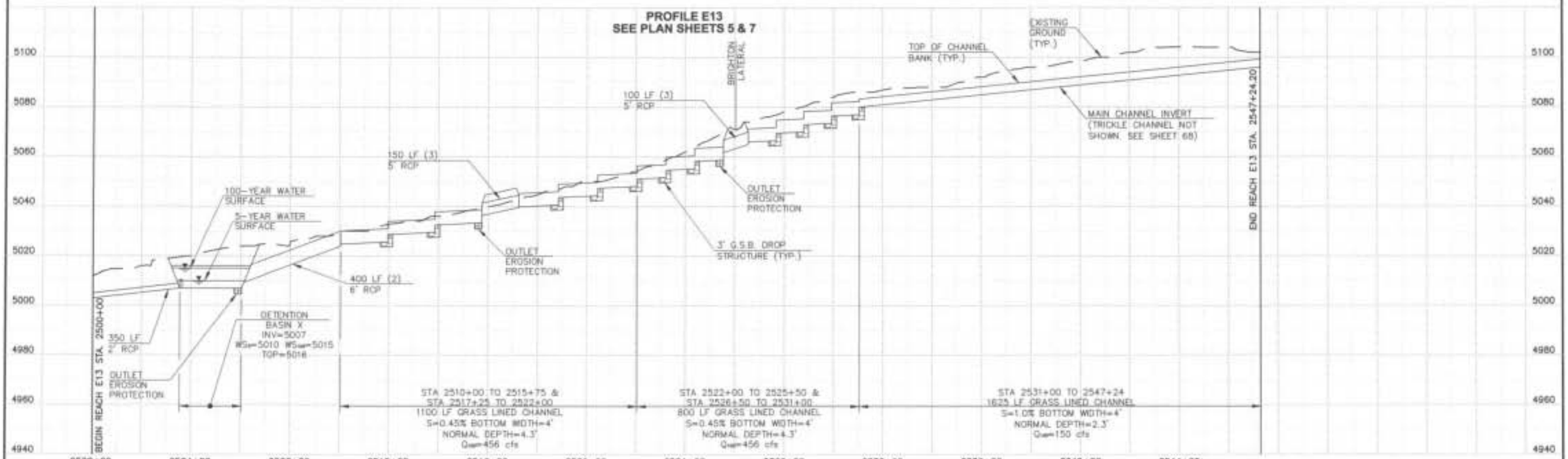
ORIGINAL SCALE: 1"=200' HORIZ.
1"=20' VERT.

PROFILE E12
SEE PLAN SHEET 7



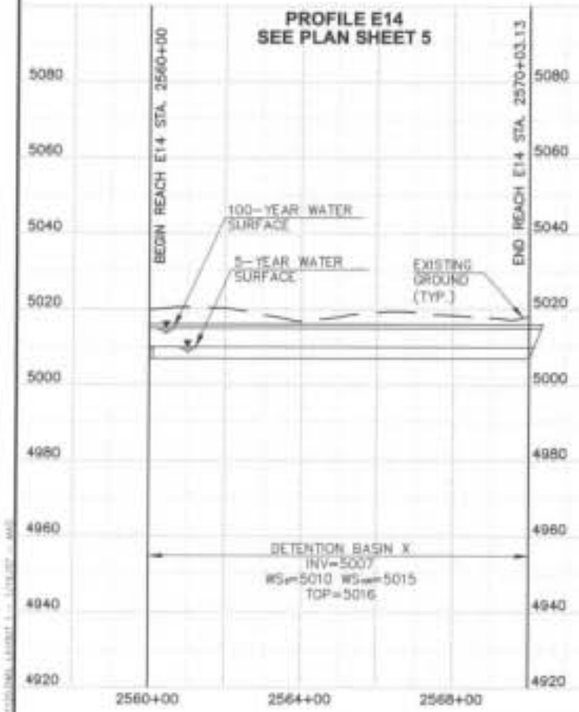
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 759-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 4/28/05 CHECKED DATE REVISED RPM DATE 12/2006 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 119

PROFILE E13
SEE PLAN SHEETS 5 & 7

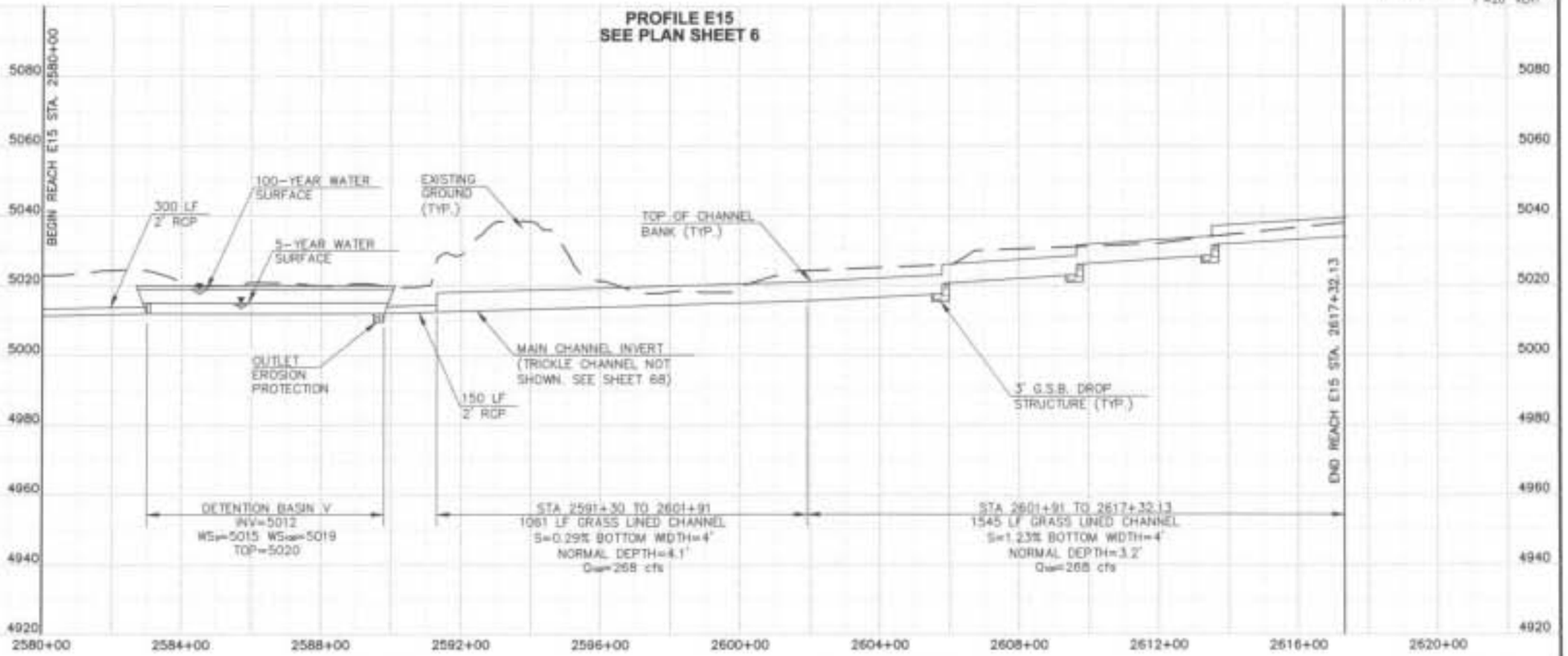


ORIGINAL SCALE: 1"=200' HORIZ. 1"=20' VERT.

PROFILE E14
SEE PLAN SHEET 5

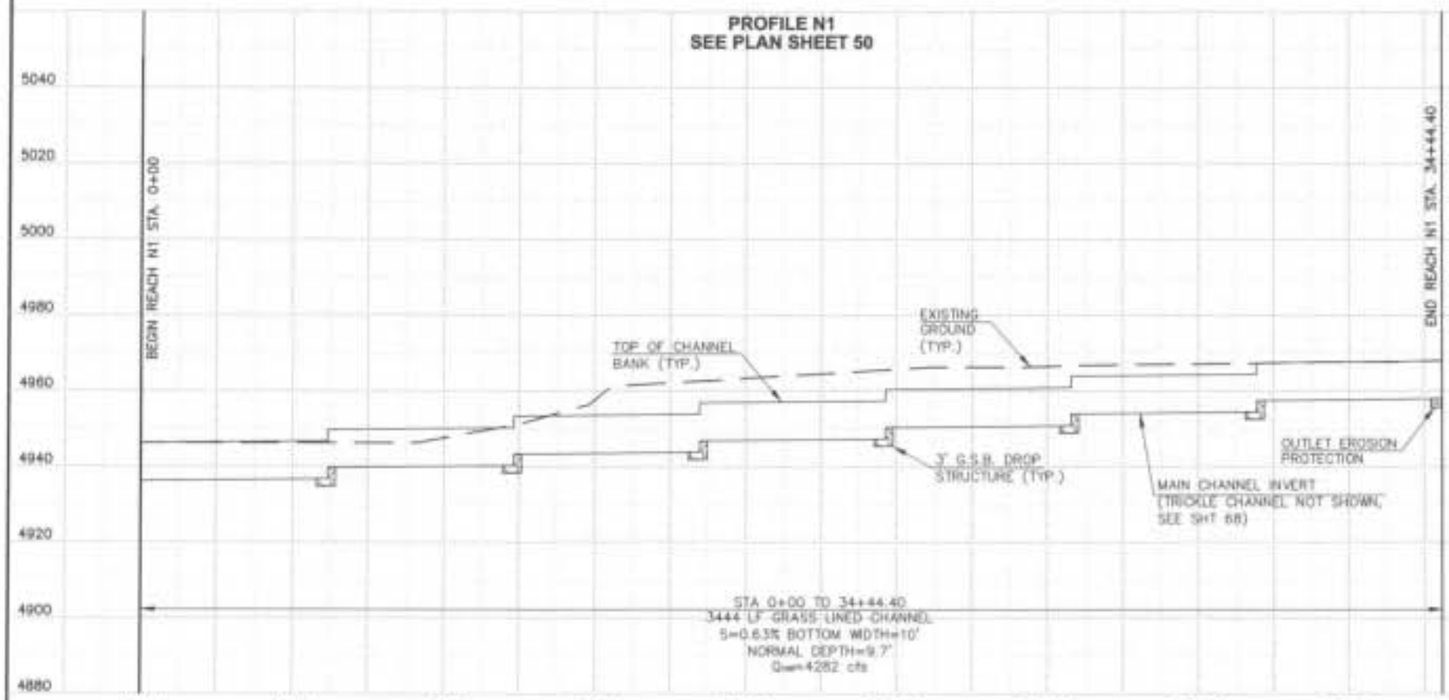


PROFILE E15
SEE PLAN SHEET 6



WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8852 FAX NO. (303) 756-3208	DESIGNED TTC DATE 3/28/05 DRAWN MAS DATE 3/28/05 CHECKED DATE REVISED AFM DATE 12/2005 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	OUTFALL SYSTEMS PLANNING BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER	PRELIMINARY DESIGN PROFILE	SHEET 120

PROFILE N1
SEE PLAN SHEET 50



PROFILE N2
SEE PLAN SHEET 50, 52



WRC ENGINEERING, INC.
350 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80222
PHONE NO. (303) 757-8913
FAX NO. (303) 759-5358

DESIGNED	TTC	DATE	3/28/05
DRAWN	MAS	DATE	12/28/05
CHECKED		DATE	
REVISED	APM	DATE	12/2009
AS-BUILT		DATE	

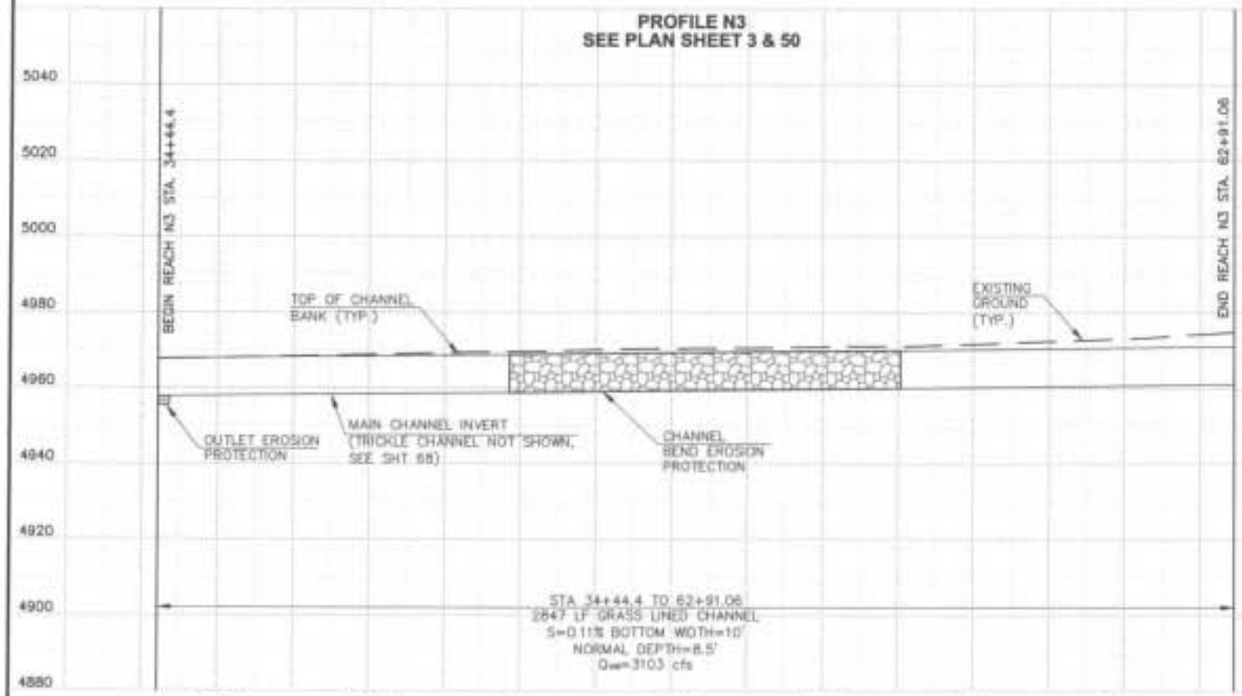
CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

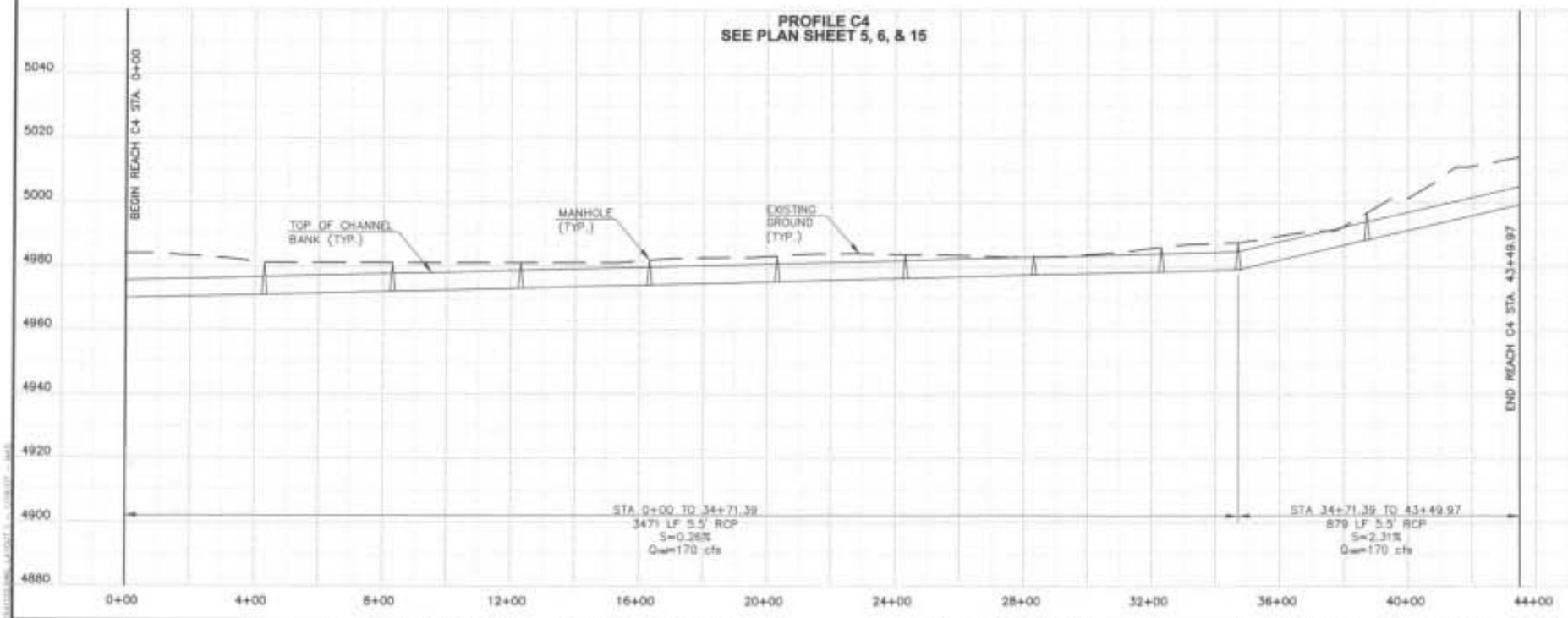
PRELIMINARY
DESIGN PROFILE

SHEET
121

PROFILE N3
SEE PLAN SHEET 3 & 50



PROFILE C4
SEE PLAN SHEET 5, 6, & 15



WRC ENGINEERING, INC.
999 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80222
PHONE NO. (303) 757-8513
FAX NO. (303) 758-3208

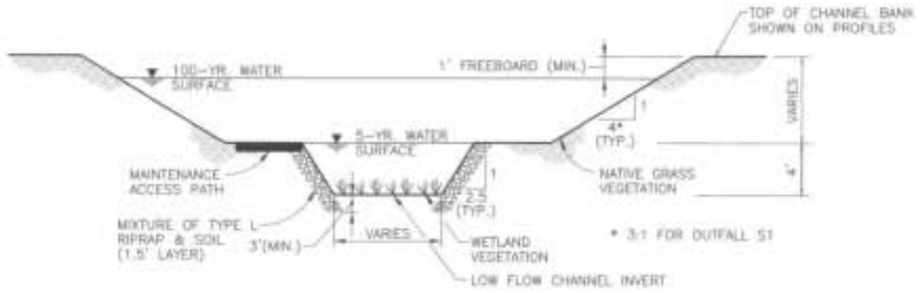
DESIGNED	TTC	DATE 5/28/09
DRAWN	MAS	DATE 5/28/09
CHECKED		DATE
REVISED	APM	DATE 6/2009
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

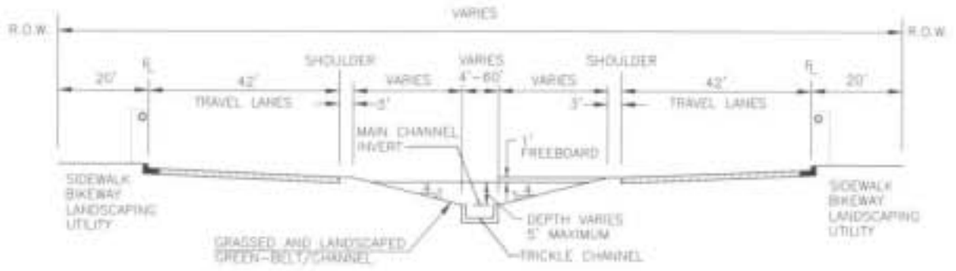
PRELIMINARY
DESIGN PROFILE

SHEET
122



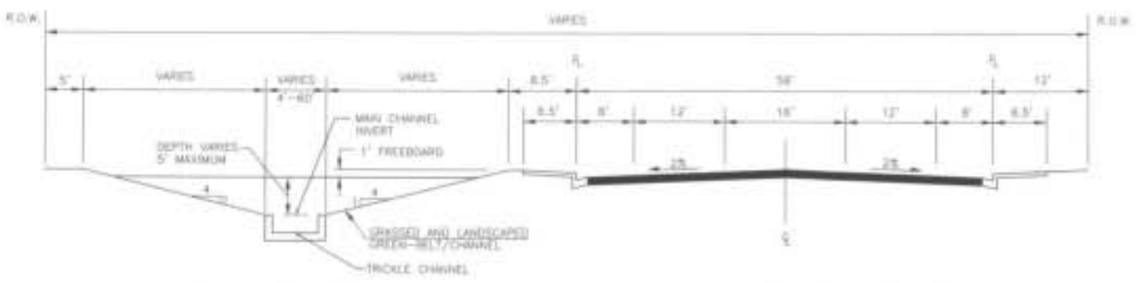
WETLANDS BOTTOM CHANNEL TYPICAL SECTION

N.T.S.



EXAMPLE STREET WITH CENTER GRASSLINED OUTFALL CHANNEL

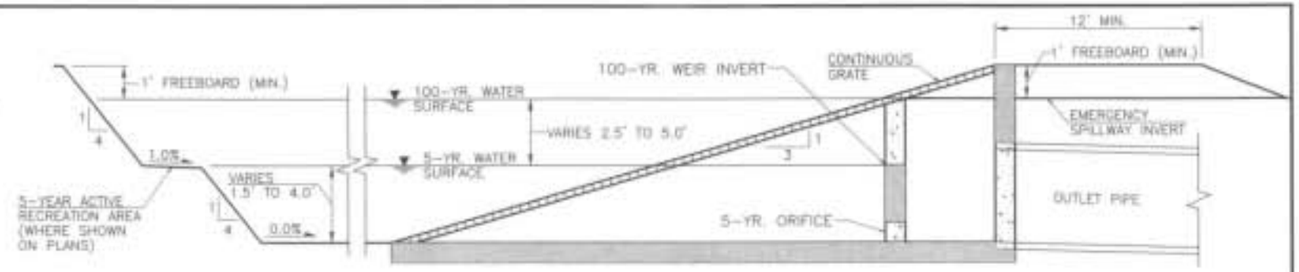
N.T.S.



EXAMPLE STREET WITH ADJACENT GRASSLINED OUTFALL CHANNEL

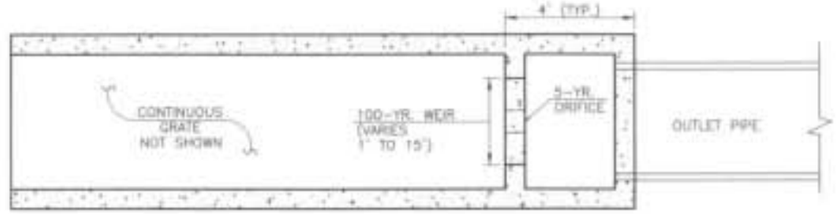
N.T.S.

OUTFALL CHANNELS



BASIN OUTLET PROFILE

N.T.S.



BASIN OUTLET PLAN

N.T.S.

EXAMPLE BASIN OUTLET

DETENTION BASIN	QS (cfs)	Q100 (cfs)	R.O.W. (acre)	VOLS (ac-ft)	VOL100 (ac-ft)	INVERT ELEV. (ft)	WSS ELEV. (ft)	WS100 ELEV. (ft)	TOP ELEV. (ft)	ESTIMATED EXCAVATION (cy)
A	4	90	7.0	9.8	26.5	5076	5078	5081	5082	50000
B	5	93	7.1	12.1	25.9	5048	5051.5	5055	5056	50000
C	9	171	11.9	20.9	49.6	5025	5027.5	5031	5033	90000
D	11	166	10.8	24.8	51.3	5045	5048	5051	5052	100000
E	4	78	Existing	9.4	22.6	5071	5073	5075	5078	50000
F	3.4	69.44	7.73	7.71	18.752	5047	5050	5053	5054	35000
G	7	134.4	10.9	15.85	37.064	5024	5027	5030	5031	70000
I	12	189	12	28	55.3	5001	5004	5007	5008	100000
J	11	118	8.4	24	41.1	4992	4996	4997.5	4998.5	90000
K	28.6	62	Existing	7.26	19.32	5015	5017.5	5021	5022	-
L	20	125	Existing	22.6	39.5	5032	5034.5	5039	5040	-
LUTZ	13	114	Existing	15.5	27.1	-	-	-	-	-
M2	10	64	Existing	7	9.8	-	-	-	-	-
M3	1.4	72	Existing	3.23	26.7	-	-	-	-	-
MV-2	8	84.3	Existing	4.344	6.82	-	-	-	-	-
O	4.6	72	Existing	10.38	17.6	5014	5016	5018	5019	-
P	6	95	10	13.4	28.8	4989	4992	4994	4995	60000
PC1	14.2	54.5	Existing	10.1	16.9	-	-	-	-	-
PC2	27.2	104.6	Existing	6.6	12.3	-	-	-	-	-
PC3	17.7	68	Existing	11.7	21.4	-	-	-	-	-
PC1A	7.4	28.5	Existing	4.9	9.7	-	-	-	-	-
PC2A	13.1	50.3	Existing	2.3	4.6	-	-	-	-	-
PC1B	23.8	91.5	Existing	21.1	33.2	-	-	-	-	-
PRESERVE	4	14.912	Existing	9.05	25.061	-	-	-	-	-
Q	3	40	4.3	7.2	13.1	4989	4991.5	4994	4995	30000
R	37	270	Existing	22.6	31.9	5038	5041	5044	5045	-
S	4	77	Existing	12.6	23.8	4990	4992.5	4995	4996	-
SAFEWAY	1.9	5	Existing	4.26	10.1	5049	5052	5057	5058	-
SC	2.3	8.8	Existing	5.22	14.1	-	-	-	-	-
T	3	19.7	10.4	7.1	27.4	5074	5075	5076	5079	55000
U	6	21	6.9	12.7	34.2	5072	5075	5079	5080	63000
V	1.9	19.2	Existing	4.31	33.4305	5012	5015	5019	5020	-
W	10	15.68	Existing	4.16	23.427	5068	5071	5075	5076	-
X	7	27	6.7	15.7	44.3	5007	5010	5015	5016	80000
Z	3.4	98	6.86	7.81	23.208	5027	5028.7	5031.9	5032.9	44000
TOTALS:			134.4	404.1	903.8					957000

NOTES:
1. DETENTION BASINS 'PC1', 'PC2', AND 'PC3' ARE A PART OF SUBREGIONAL DETENTION SYSTEM 'R'.
2. DETENTION BASINS 'PC1A' AND 'PC2A' ARE A PART OF SUBREGIONAL DETENTION SYSTEM 'M2'.
3. DETENTION BASIN 'PC1B' IS A PART OF SUBREGIONAL DETENTION SYSTEM 'L'.
4. DETENTION BASINS 'SC' (1 POND) AND 'SAFEWAY' (3 PONDS) ARE A PART OF SUBREGIONAL DETENTION SYSTEM 'Y'.
5. DETENTION BASIN 'PRESERVE' (2 PONDS) IS A PART OF SUBREGIONAL DETENTION SYSTEM 'W'.
6. DETENTION BASIN 'MV-2' (3 PONDS) IS A PART OF SUBREGIONAL DETENTION SYSTEM 'E'.

BASIN DESIGN INFORMATION

SUB-REGIONAL DETENTION BASINS

WRC ENGINEERING, INC.
(A DIVISION OF WILSON & COMPANY)
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80246
PHONE NO: (303) 757-8101
FAX NO: (303) 759-3338

DESIGNED	TTC	DATE 1/28/09
DRAWN	MAC	DATE 1/28/09
CHECKED	KPM	DATE 12/2009
REVISED		DATE
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER

OUTFALL SYSTEMS IMPROVEMENT DETAILS

SHEET 200

APPENDIX A

HYDROLOGIC ANALYSIS

FIGURES AND TABLES

TABLE A-1

CUHP SUB-WATERSHED PARAMETERS
EXISTING DEVELOPMENT

Basin ID	Area sq mi	Length mi	Centroid mi	% Imp %	Slope ft/ft	Tc min	Perv Dep storage	Imp Dep storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
1	0.199	1.06	.38	6.2	.0156	na	.35	0.1	4.50	.0018	0.60	B
2	0.087	.38	.19	18.8	.0110	85.7	.35	0.1	4.50	.0018	0.60	B
3	0.100	.64	.27	9.4	.0220	56.2	.35	0.1	4.50	.0018	0.60	B
4	0.140	.19	.09	2.0	.0220	43.4	.35	0.1	4.50	.0018	0.60	B
5	0.186	.45	.15	2.0	.0130	na	.35	0.1	4.50	.0018	0.60	B
6	0.097	.57	.19	2.5	.0130	116.2	.35	0.1	4.50	.0018	0.60	B
7	0.097	.61	.35	14.0	.0110	83.2	.35	0.1	4.50	.0018	0.60	B
8	0.084	.47	.22	2.0	.0180	55.6	.35	0.1	4.50	.0018	0.60	B
9	0.162	.76	.42	2.0	.0154	na	.35	0.1	4.50	.0018	0.60	B
10	0.171	.63	.20	45.2	.0105	na	.35	0.1	4.50	.0018	0.60	B
11	0.065	.30	.20	2.0	.0140	69.9	.35	0.1	4.50	.0018	0.60	B
12	0.193	.64	.34	2.0	.0207	na	.35	0.1	4.50	.0018	0.60	B
13	0.077	.42	.23	2.3	.0170	81.1	.35	0.1	4.50	.0018	0.60	B
14	0.079	.30	.32	2.0	.0310	50.4	.56	0.1	4.50	.0018	0.60	B
15	0.133	.34	.13	5.3	.0230	50.2	.35	0.1	4.50	.0018	0.60	B
16	0.050	.36	.23	8.0	.0200	39.0	.35	0.1	4.50	.0018	0.60	B
17	0.123	.34	.22	4.7	.0230	61.1	.35	0.1	4.50	.0018	0.60	B
18	0.104	.43	.21	8.0	.0128	48.4	.35	0.1	4.50	.0018	0.60	B
19	0.107	.61	.25	2.0	.0126	67.5	.35	0.1	4.50	.0018	0.60	B
20	0.155	.74	.30	2.0	.0190	na	.35	0.1	4.50	.0018	0.60	B
21	0.138	1.14	.31	2.0	.0130	158.8	.35	0.1	4.50	.0018	0.60	B
22	0.064	.27	.07	2.0	.0333	49.4	.35	0.1	4.50	.0018	0.60	B
23	0.160	.57	.28	2.0	.0070	na	.35	0.1	4.50	.0018	0.60	B
24	0.090	.45	.19	2.0	.0200	57.8	.35	0.1	4.50	.0018	0.60	B
25	0.116	.45	.28	2.0	.0170	86.7	.35	0.1	4.50	.0018	0.60	B
26	0.082	.45	.25	2.0	.0200	80.8	.71	0.1	4.50	.0018	0.60	B
27	0.130	.64	.41	2.0	.0100	126.1	.35	0.1	4.50	.0018	0.60	B
28	0.057	.34	.18	2.0	.0110	53.2	.35	0.1	4.50	.0018	0.60	B
29	0.131	.42	.24	6.8	.0140	50.9	.35	0.1	4.50	.0018	0.60	B
30	0.125	.27	.13	2.0	.0100	73.1	.35	0.1	4.50	.0018	0.60	B
31	0.096	.28	.16	2.0	.0100	76.8	.35	0.1	4.50	.0018	0.60	B
32	0.044	.30	.17	43.0	.0210	48.7	.35	0.1	4.50	.0018	0.60	B
33	0.088	.55	.27	31.1	.0100	37.3	.35	0.1	4.50	.0018	0.60	B
34	0.084	.45	.19	16.4	.0200	77.1	.35	0.1	4.50	.0018	0.60	B
35	0.073	.51	.30	39.4	.0084	34.3	.35	0.1	4.50	.0018	0.60	B
36	0.147	.38	.27	68.1	.0150	na	.35	0.1	4.50	.0018	0.60	B
37	0.109	.37	.20	2.0	.0290	59.2	.35	0.1	4.50	.0018	0.60	B
38	0.068	.36	.19	2.0	.0270	46.3	.35	0.1	4.50	.0018	0.60	B
39	0.131	.64	.44	11.3	.0170	74.5	.35	0.1	4.50	.0018	0.60	B
40	0.150	.49	.14	3.6	.0154	na	.35	0.1	4.50	.0018	0.60	B
41	0.104	.52	.30	29.7	.0015	56.1	.35	0.1	4.50	.0018	0.60	B
42	0.113	.38	.32	50.7	.0150	41.4	.35	0.1	4.50	.0018	0.60	B
43	0.056	.45	.23	10.2	.0140	51.3	.35	0.1	4.50	.0018	0.60	B
44	0.207	.45	.20	47.2	.0030	na	.35	0.1	4.50	.0018	0.60	B
45	0.037	.35	.31	29.2	.0069	63.4	.35	0.1	4.50	.0018	0.60	B
46	0.104	.42	.18	43.0	.0100	29.7	.35	0.1	4.50	.0018	0.60	B
47	0.063	.37	.21	2.0	.0031	152.8	.35	0.1	4.50	.0018	0.60	B
48	0.140	.66	.33	39.4	.0070	88.5	.35	0.1	4.50	.0018	0.60	B
49	0.065	.57	.25	43.0	.0150	30.4	.35	0.1	4.50	.0018	0.60	B
50	0.129	.49	.30	2.0	.0100	116.5	.35	0.1	4.50	.0018	0.60	B

TABLE A-1 (CONTINUED)

CUHP SUB-WATERSHED PARAMETERS
EXISTING DEVELOPMENT

Basin ID	Area sq mi	Length mi	Centroid mi	% Imp %	Slope ft/ft	Tc min	Perv Dep storage	Imp Dep storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
51	0.092	.49	.15	48.3	.0020	47.4	.35	0.1	4.50	.0018	0.60	B
52	0.080	.66	.28	47.4	.0015	47.0	.35	0.1	4.50	.0018	0.60	B
53	0.126	.47	.11	45.9	.0027	36.0	.35	0.1	4.50	.0018	0.60	B
54	0.046	.23	.08	8.0	.0200	48.6	.35	0.1	4.50	.0018	0.60	B
55	0.043	.33	.09	2.0	.0025	154.8	.35	0.1	4.50	.0018	0.60	B
56	0.127	.66	.41	48.7	.0020	76.9	.35	0.1	4.50	.0018	0.60	B
57	0.172	.76	.35	49.3	.0020	na	.35	0.1	4.50	.0018	0.60	B
58	0.185	.78	.33	47.5	.0024	na	.35	0.1	4.50	.0018	0.60	B
59	0.128	.74	.28	49.0	.0025	51.2	.35	0.1	4.50	.0018	0.60	B
60	0.116	.59	.29	50.8	.0100	46.5	.35	0.1	4.50	.0018	0.60	B
61	0.091	.47	.19	19.6	.0052	65.7	.35	0.1	4.50	.0018	0.60	B
62	0.166	.66	.24	49.0	.0020	na	.35	0.1	4.50	.0018	0.60	B
63	0.132	.49	.51	35.0	.0023	206.9	.35	0.1	4.50	.0018	0.60	B
64	0.098	.45	.25	2.0	.0070	84.0	.35	0.1	4.50	.0018	0.60	B
66	0.093	.45	.17	67.1	.0075	34.8	.35	0.1	4.50	.0018	0.60	B
67	0.166	.57	.35	37.7	.0040	na	.35	0.1	4.50	.0018	0.60	B
68	0.161	.53	.30	40.6	.0060	na	.35	0.1	4.50	.0018	0.60	B
69	0.085	.49	.24	6.1	.0040	102.1	.35	0.1	4.50	.0018	0.60	B
70	0.096	.45	.14	74.0	.0085	31.3	.35	0.1	4.50	.0018	0.60	B
72	0.038	.37	.16	2.0	.0072	116.5	.35	0.1	4.50	.0018	0.60	B
73	0.182	.55	.42	60.9	.0070	na	.35	0.1	4.50	.0018	0.60	B
74	0.060	.45	.27	43.6	.0028	35.2	.35	0.1	4.50	.0018	0.60	B
75	0.153	.55	.29	47.0	.0026	na	.35	0.1	4.50	.0018	0.60	B
76	0.087	.55	.38	40.4	.0026	115.4	.35	0.1	4.50	.0018	0.60	B
77	0.091	.68	.22	30.4	.0060	179.7	.35	0.1	4.50	.0018	0.60	B
78	0.179	.66	.27	2.0	.0080	na	.35	0.1	4.50	.0018	0.60	B
79	0.133	.45	.27	4.8	.0030	125.5	.35	0.1	4.50	.0018	0.60	B
80	0.155	.55	.21	29.9	.0020	na	.35	0.1	4.50	.0018	0.60	B
81	0.102	.45	.27	2.0	.0030	185.9	.35	0.1	3.00	.0018	0.50	C
82	0.189	.66	.38	2.0	.0020	na	.35	0.1	4.50	.0018	0.60	B
83	0.103	.61	.32	2.0	.0030	238.6	.35	0.1	3.00	.0018	0.50	C
84	0.153	.47	.33	3.4	.0040	na	.35	0.1	4.50	.0018	0.60	B
85	0.136	.49	.22	2.0	.0040	175.0	.35	0.1	4.50	.0018	0.60	B
86	0.135	.59	.32	2.0	.0040	203.5	.35	0.1	4.50	.0018	0.60	B
87	0.130	.57	.34	2.0	.0030	225.5	.35	0.1	4.50	.0018	0.60	B
88	0.197	.49	.33	2.0	.0079	na	.35	0.1	3.00	.0018	0.50	C
89	0.119	.59	.36	2.0	.0030	232.1	.35	0.1	4.50	.0018	0.60	B
90	0.143	.61	.28	5.3	.0060	na	.35	0.1	4.50	.0018	0.60	B
91	0.088	.65	.27	15.0	.0064	65.0	.35	0.1	4.50	.0018	0.60	B
92	0.106	.55	.27	2.0	.0050	147.2	.35	0.1	4.50	.0018	0.60	B
93	0.118	.66	.19	11.1	.0050	160.0	.35	0.1	4.50	.0018	0.60	B
94	0.140	.76	.40	2.0	.0060	186.4	.35	0.1	4.50	.0018	0.60	B
95	0.102	.67	.34	2.0	.0040	166.0	.35	0.1	4.50	.0018	0.60	B
96	0.115	.59	.29	2.0	.0050	183.9	.35	0.1	3.00	.0018	0.50	C
97	0.083	.32	.13	2.0	.0060	104.1	.35	0.1	4.50	.0018	0.60	B
98	0.098	.72	.33	2.0	.0080	177.0	.35	0.1	4.50	.0018	0.60	B
99	0.190	.66	.44	5.8	.0090	na	.35	0.1	4.50	.0018	0.60	B
100	0.194	.63	.38	4.0	.0110	na	.35	0.1	4.50	.0018	0.60	B
101	0.202	.68	.47	3.0	.0140	na	.35	0.1	4.50	.0018	0.60	B
102	0.048	.40	.21	2.0	.0130	87.9	.35	0.1	4.50	.0018	0.60	B

TABLE A-1 (CONTINUED)

CUHP SUB-WATERSHED PARAMETERS
EXISTING DEVELOPMENT

Basin ID	Area sq mi	Length mi	Centroid mi	% Imp %	Slope ft/ft	Tc min	Perv Dep storage	Imp Dep storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
103	0.178	.66	.45	2.9	.0169	na	.35	0.1	4.50	.0018	0.60	B
104	0.095	.38	.19	2.0	.0120	58.6	.35	0.1	4.50	.0018	0.60	B
105	0.150	.47	.19	2.0	.0190	na	.35	0.1	4.50	.0018	0.60	B
106	0.105	.69	.52	2.0	.0140	121.9	.35	0.1	4.50	.0018	0.60	B
107	0.143	.85	.47	2.0	.0090	na	.35	0.1	4.50	.0018	0.60	B
108	0.101	.62	.32	2.0	.0050	108.5	.35	0.1	4.50	.0018	0.60	B
109	0.187	.78	.26	2.0	.0590	na	.35	0.1	4.50	.0018	0.60	B
110	0.098	.49	.23	2.0	.0038	179.1	.35	0.1	4.50	.0018	0.60	B
111	0.167	.61	.33	2.0	.0060	na	.35	0.1	4.50	.0018	0.60	B
112	0.112	.22	.11	2.0	.0080	67.3	.35	0.1	4.50	.0018	0.60	B
113	0.055	.44	.23	2.0	.0043	152.9	.35	0.1	4.50	.0018	0.60	B
114	0.135	.53	.28	4.7	.0041	167.5	.35	0.1	4.50	.0018	0.60	B
115	0.077	.49	.31	2.0	.0040	149.4	.35	0.1	4.50	.0018	0.60	B
116	0.155	.53	.25	2.5	.0010	na	.35	0.1	4.50	.0018	0.60	B
117	0.146	.49	.25	3.5	.0010	na	.35	0.1	4.50	.0018	0.60	B
118	0.136	.57	.31	2.0	.0070	153.6	.35	0.1	4.50	.0018	0.60	B
119	0.116	.51	.20	2.0	.0080	118.6	.35	0.1	4.50	.0018	0.60	B
120	0.078	.47	.16	5.0	.0100	61.9	.35	0.1	4.50	.0018	0.60	B
121	0.101	.34	.14	2.0	.0070	101.9	.35	0.1	4.50	.0018	0.60	B
122	0.129	.31	.33	2.0	.0070	95.4	.35	0.1	3.00	.0018	0.50	C
123	0.158	.68	.38	2.0	.0040	na	.35	0.1	3.00	.0018	0.50	C
124	0.125	.40	.19	2.0	.0060	122.8	.35	0.1	3.00	.0018	0.50	C
125	0.051	.22	.13	2.0	.0070	73.8	.35	0.1	3.00	.0018	0.50	C
126	0.132	.61	.28	2.0	.0080	152.7	.35	0.1	4.50	.0018	0.60	B
127	0.101	.45	.15	2.0	.0080	120.5	.35	0.1	4.50	.0018	0.60	B

TABLE A-2

CUHP SUB-WATERSHED PARAMETERS
FUTURE DEVELOPMENT

Basin ID	Area sq mi	Length mi	Centroid mi	% Imp %	Slope ft/ft	Tc min	Perv Dep storage	Imp Dep storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
1	0.199	1.06	.38	19.1	.0156	na	.35	0.1	4.50	.0018	0.60	B
2	0.087	.38	.19	45.5	.0110	26.6	.35	0.1	4.50	.0018	0.60	B
3	0.100	.64	.27	13.6	.0220	31.2	.35	0.1	4.50	.0018	0.60	B
4	0.140	.19	.09	45.0	.0220	14.2	.35	0.1	4.50	.0018	0.60	B
5	0.186	.45	.15	45.0	.0130	na	.35	0.1	4.50	.0018	0.60	B
6	0.097	.57	.19	37.9	.0130	33.1	.35	0.1	4.50	.0018	0.60	B
7	0.097	.61	.35	53.8	.0110	35.0	.35	0.1	4.50	.0018	0.60	B
8	0.084	.47	.22	45.0	.0180	24.7	.35	0.1	4.50	.0018	0.60	B
9	0.162	.76	.42	45.0	.0154	na	.35	0.1	4.50	.0018	0.60	B
10	0.171	.63	.20	47.6	.0105	na	.35	0.1	4.50	.0018	0.60	B
11	0.065	.30	.20	45.0	.0140	21.2	.35	0.1	4.50	.0018	0.60	B
12	0.193	.64	.34	55.4	.0207	na	.35	0.1	4.50	.0018	0.60	B
13	0.077	.42	.23	42.0	.0170	23.8	.35	0.1	4.50	.0018	0.60	B
14	0.079	.30	.32	41.5	.0310	15.6	.56	0.1	4.50	.0018	0.60	B
15	0.133	.34	.13	14.2	.0230	21.8	.35	0.1	4.50	.0018	0.60	B
16	0.050	.36	.23	8.0	.0200	24.4	.35	0.1	4.50	.0018	0.60	B
17	0.123	.34	.22	28.0	.0230	20.3	.35	0.1	4.50	.0018	0.60	B
18	0.104	.43	.21	8.0	.0128	31.4	.35	0.1	4.50	.0018	0.60	B
19	0.107	.61	.25	19.0	.0126	36.9	.35	0.1	4.50	.0018	0.60	B
20	0.155	.74	.30	45.0	.0190	na	.35	0.1	4.50	.0018	0.60	B
21	0.138	1.14	.31	49.0	.0130	53.5	.35	0.1	4.50	.0018	0.60	B
22	0.064	.27	.07	49.0	.0333	14.8	.35	0.1	4.50	.0018	0.60	B
23	0.160	.57	.28	52.5	.0070	na	.35	0.1	4.50	.0018	0.60	B
24	0.090	.45	.19	45.0	.0200	23.0	.35	0.1	4.50	.0018	0.60	B
25	0.116	.45	.28	43.1	.0170	24.9	.35	0.1	4.50	.0018	0.60	B
26	0.082	.45	.25	42.0	.0200	23.4	.71	0.1	4.50	.0018	0.60	B
27	0.130	.64	.41	45.0	.0100	39.4	.35	0.1	4.50	.0018	0.60	B
28	0.057	.34	.18	45.0	.0110	25.1	.35	0.1	4.50	.0018	0.60	B
29	0.131	.42	.24	43.7	.0140	25.6	.35	0.1	4.50	.0018	0.60	B
30	0.125	.27	.13	45.0	.0100	22.8	.35	0.1	4.50	.0018	0.60	B
31	0.096	.28	.16	81.0	.0100	18.4	.35	0.1	4.50	.0018	0.60	B
32	0.044	.30	.17	43.0	.0210	18.2	.35	0.1	4.50	.0018	0.60	B
33	0.088	.55	.27	47.6	.0100	34.9	.35	0.1	4.50	.0018	0.60	B
34	0.084	.45	.19	43.0	.0200	23.3	.35	0.1	4.50	.0018	0.60	B
35	0.073	.51	.30	39.4	.0084	34.3	.35	0.1	4.50	.0018	0.60	B
36	0.147	.38	.27	74.5	.0150	na	.35	0.1	4.50	.0018	0.60	B
37	0.109	.37	.20	45.0	.0290	17.4	.35	0.1	4.50	.0018	0.60	B
38	0.068	.36	.19	45.0	.0270	17.7	.35	0.1	4.50	.0018	0.60	B
39	0.131	.64	.44	50.0	.0170	30.5	.35	0.1	4.50	.0018	0.60	B
40	0.150	.49	.14	56.0	.0154	na	.35	0.1	4.50	.0018	0.60	B
41	0.104	.52	.30	57.0	.0015	48.6	.35	0.1	4.50	.0018	0.60	B
42	0.113	.38	.32	50.6	.0150	22.7	.35	0.1	4.50	.0018	0.60	B
43	0.056	.45	.23	54.6	.0140	25.3	.35	0.1	4.50	.0018	0.60	B
44	0.207	.45	.20	47.2	.0030	na	.35	0.1	4.50	.0018	0.60	B
45	0.037	.35	.31	42.9	.0069	29.5	.35	0.1	4.50	.0018	0.60	B
46	0.104	.42	.18	40.1	.0100	30.1	.35	0.1	4.50	.0018	0.60	B
47	0.063	.37	.21	45.0	.0031	33.5	.35	0.1	4.50	.0018	0.60	B
48	0.140	.66	.33	41.2	.0070	47.9	.35	0.1	4.50	.0018	0.60	B
49	0.065	.57	.25	43.0	.0150	30.4	.35	0.1	4.50	.0018	0.60	B
50	0.129	.49	.30	45.0	.0100	32.8	.35	0.1	4.50	.0018	0.60	B

TABLE A-2 (CONTINUED)

CUHP SUB-WATERSHED PARAMETERS
FUTURE DEVELOPMENT

Basin ID	Area sq mi	Length mi	Centroid mi	% Imp %	Slope ft/ft	Tc min	Perv Dep storage	Imp Dep storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
51	0.092	.49	.15	48.3	.0020	47.4	.35	0.1	4.50	.0018	0.60	B
52	0.080	.66	.28	47.4	.0015	47.0	.35	0.1	4.50	.0018	0.60	B
53	0.126	.47	.11	46.7	.0027	35.9	.35	0.1	4.50	.0018	0.60	B
54	0.046	.23	.08	8.0	.0200	20.2	.35	0.1	4.50	.0018	0.60	B
55	0.043	.33	.09	45.0	.0025	32.8	.35	0.1	4.50	.0018	0.60	B
56	0.127	.66	.41	48.7	.0020	57.3	.35	0.1	4.50	.0018	0.60	B
57	0.172	.76	.35	49.2	.0020	na	.35	0.1	4.50	.0018	0.60	B
58	0.185	.78	.33	47.5	.0024	na	.35	0.1	4.50	.0018	0.60	B
59	0.128	.74	.28	49.0	.0025	51.2	.35	0.1	4.50	.0018	0.60	B
60	0.116	.59	.29	60.4	.0100	34.7	.35	0.1	4.50	.0018	0.60	B
61	0.091	.47	.19	23.2	.0052	45.5	.35	0.1	4.50	.0018	0.60	B
62	0.166	.66	.24	49.0	.0020	na	.35	0.1	4.50	.0018	0.60	B
63	0.132	.49	.51	74.0	.0023	40.4	.35	0.1	4.50	.0018	0.60	B
64	0.098	.45	.25	20.1	.0070	40.4	.35	0.1	4.50	.0018	0.60	B
66	0.093	.45	.17	69.5	.0075	29.6	.35	0.1	4.50	.0018	0.60	B
67	0.166	.57	.35	77.8	.0040	na	.35	0.1	4.50	.0018	0.60	B
68	0.161	.53	.30	57.1	.0060	na	.35	0.1	4.50	.0018	0.60	B
69	0.085	.49	.24	89.8	.0040	35.1	.35	0.1	4.50	.0018	0.60	B
70	0.096	.45	.14	74.0	.0085	27.6	.35	0.1	4.50	.0018	0.60	B
72	0.038	.37	.16	78.3	.0072	22.2	.35	0.1	4.50	.0018	0.60	B
73	0.182	.55	.42	78.3	.0070	na	.35	0.1	4.50	.0018	0.60	B
74	0.060	.45	.27	43.6	.0028	35.2	.35	0.1	4.50	.0018	0.60	B
75	0.153	.55	.29	47.0	.0026	na	.35	0.1	4.50	.0018	0.60	B
76	0.087	.55	.38	85.1	.0026	36.0	.35	0.1	4.50	.0018	0.60	B
77	0.091	.68	.22	78.5	.0060	46.0	.35	0.1	4.50	.0018	0.60	B
78	0.179	.66	.27	95.0	.0080	na	.35	0.1	4.50	.0018	0.60	B
79	0.133	.45	.27	43.6	.0030	43.7	.35	0.1	4.50	.0018	0.60	B
80	0.155	.55	.21	83.5	.0020	na	.35	0.1	4.50	.0018	0.60	B
81	0.102	.45	.27	80.0	.0030	35.8	.35	0.1	3.00	.0018	0.50	C
82	0.189	.66	.38	80.0	.0020	na	.35	0.1	4.50	.0018	0.60	B
83	0.103	.61	.32	45.0	.0030	52.3	.35	0.1	3.00	.0018	0.50	C
84	0.153	.47	.33	21.0	.0040	na	.35	0.1	4.50	.0018	0.60	B
85	0.136	.49	.22	45.0	.0040	44.0	.35	0.1	4.50	.0018	0.60	B
86	0.135	.59	.32	33.2	.0040	51.9	.35	0.1	4.50	.0018	0.60	B
87	0.130	.57	.34	43.5	.0030	50.4	.35	0.1	4.50	.0018	0.60	B
88	0.197	.49	.33	43.5	.0079	na	.35	0.1	3.00	.0018	0.50	C
89	0.119	.59	.36	60.0	.0030	47.9	.35	0.1	4.50	.0018	0.60	B
90	0.143	.61	.28	37.5	.0060	na	.35	0.1	4.50	.0018	0.60	B
91	0.088	.65	.27	15.0	.0064	49.0	.35	0.1	4.50	.0018	0.60	B
92	0.106	.55	.27	45.0	.0050	46.1	.35	0.1	4.50	.0018	0.60	B
93	0.118	.66	.19	24.0	.0050	56.7	.35	0.1	4.50	.0018	0.60	B
94	0.140	.76	.40	45.0	.0060	43.0	.35	0.1	4.50	.0018	0.60	B
95	0.102	.67	.34	43.1	.0040	54.9	.35	0.1	4.50	.0018	0.60	B
96	0.115	.59	.29	45.0	.0050	48.4	.35	0.1	3.00	.0018	0.50	C
97	0.083	.32	.13	43.1	.0060	31.7	.35	0.1	4.50	.0018	0.60	B
98	0.098	.72	.33	45.0	.0080	47.3	.35	0.1	4.50	.0018	0.60	B
99	0.190	.66	.44	55.4	.0090	na	.35	0.1	4.50	.0018	0.60	B
100	0.194	.63	.38	43.8	.0110	na	.35	0.1	4.50	.0018	0.60	B
101	0.202	.68	.47	38.4	.0140	na	.35	0.1	4.50	.0018	0.60	B
102	0.048	.40	.21	16.5	.0130	29.4	.35	0.1	4.50	.0018	0.60	B

TABLE A-2 (CONTINUED)

CUHP SUB-WATERSHED PARAMETERS
FUTURE DEVELOPMENT

Basin ID	Area sq mi	Length mi	Centroid mi	% Imp %	Slope ft/ft	Tc min	Perv Dep storage	Imp Dep storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
103	0.178	.66	.45	38.2	.0169	na	.35	0.1	4.50	.0018	0.60	B
104	0.095	.38	.19	45.0	.0120	25.7	.35	0.1	4.50	.0018	0.60	B
105	0.150	.47	.19	67.5	.0190	na	.35	0.1	4.50	.0018	0.60	B
106	0.105	.69	.52	95.0	.0140	29.2	.35	0.1	4.50	.0018	0.60	B
107	0.143	.85	.47	70.2	.0090	na	.35	0.1	4.50	.0018	0.60	B
108	0.101	.62	.32	45.0	.0050	50.0	.35	0.1	4.50	.0018	0.60	B
109	0.187	.78	.26	29.8	.0590	na	.35	0.1	4.50	.0018	0.60	B
110	0.098	.49	.23	7.0	.0038	51.0	.35	0.1	4.50	.0018	0.60	B
111	0.167	.61	.33	24.6	.0060	na	.35	0.1	4.50	.0018	0.60	B
112	0.112	.22	.11	45.0	.0080	22.6	.35	0.1	4.50	.0018	0.60	B
113	0.055	.44	.23	45.0	.0043	40.3	.35	0.1	4.50	.0018	0.60	B
114	0.135	.53	.28	13.7	.0041	50.8	.35	0.1	4.50	.0018	0.60	B
115	0.077	.49	.31	42.3	.0040	44.5	.35	0.1	4.50	.0018	0.60	B
116	0.155	.53	.25	37.4	.0010	na	.35	0.1	4.50	.0018	0.60	B
117	0.146	.49	.25	40.1	.0010	na	.35	0.1	4.50	.0018	0.60	B
118	0.136	.57	.31	37.4	.0070	43.6	.35	0.1	4.50	.0018	0.60	B
119	0.116	.51	.20	56.1	.0080	35.3	.35	0.1	4.50	.0018	0.60	B
120	0.078	.47	.16	34.3	.0100	33.5	.35	0.1	4.50	.0018	0.60	B
121	0.101	.34	.14	57.5	.0070	28.3	.35	0.1	4.50	.0018	0.60	B
122	0.129	.31	.33	45.0	.0070	28.9	.35	0.1	3.00	.0018	0.50	C
123	0.158	.68	.38	45.0	.0040	na	.35	0.1	3.00	.0018	0.50	C
124	0.125	.40	.19	45.0	.0060	35.7	.35	0.1	3.00	.0018	0.50	C
125	0.051	.22	.13	80.0	.0070	18.2	.35	0.1	3.00	.0018	0.50	C
126	0.132	.61	.28	52.4	.0080	40.6	.35	0.1	4.50	.0018	0.60	B
127	0.101	.45	.15	42.2	.0080	34.7	.35	0.1	4.50	.0018	0.60	B

TABLE A-3
SWMM ROUTING ELEMENT PARAMETERS (EXISTING DEVELOPMENT)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
363	0		0	1	0.001	0	0	0.001	10
365	0		0	1	0.001	0	0	0.001	10
366	0	PIPE	0.1	1	0.001	0	0	0.001	0.1
367	0		0	1	0.001	0	0	0.001	10
203	303	CHANNEL	0.5	3320	0.02	12	12	0.016	0.5
		OVERFLOW	5	3320	0.02	20	20	0.02	20
304	239		0	1	0.001	0	0	0.001	10
239	303	CHANNEL	0.5	2350	0.015	12	12	0.016	0.5
		OVERFLOW	5	2350	0.015	20	20	0.02	20
303	204		0	1	0.001	0	0	0.001	10
204	339	CHANNEL	0.5	1350	0.018	12	12	0.016	0.5
		OVERFLOW	5	1350	0.018	20	20	0.02	20
339	240		0	1	0.001	0	0	0.001	10
240	340	CHANNEL	0.5	3080	0.013	12	12	0.016	0.5
		OVERFLOW	5	3080	0.013	20	20	0.02	20
172	262		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 362 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 38.3 38.3 38.4 38.3 3000.0 38.3									
362	171	PIPE	3	600	0.005	0	0	0.016	3
171	359	PIPE	3.5	1620	0.005	0	0	0.016	3.5
262	341	CHANNEL	0.5	2170	0.001	12	12	0.016	0.5
		OVERFLOW	10	2170	0.001	20	20	0.02	20
341	241		0	1	0.001	0	0	0.001	10
241	340	CHANNEL	100	1700	0.002	50	50	0.053	10
340	260		0	1	0.001	0	0	0.001	10
260	157	CHANNEL	0.5	1500	0.001	12	12	0.016	0.5
		OVERFLOW	5	1500	0.001	20	20	0.02	20
123	315		0	1	0.001	0	0	0.001	10
315	206	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 1.3 .0 1.9 18.1 2.5 153.4 2.8 250.0 3.1 469.8									
3.6 867.9									
206	133	CHANNEL	100	1180	0.016	50	50	0.053	10
133	306		0	1	0.001	0	0	0.001	10
306	215	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 29.3 .0 31.2 22.6 33.2 191.8 37.1 1084.9									
215	316	CHANNEL	100	450	0.013	50	50	0.053	10
216	316	CHANNEL	0.5	800	0.023	12	12	0.016	0.5
		OVERFLOW	5	800	0.023	20	20	0.02	20
316	218		0	1	0.001	0	0	0.001	10
218	132	CHANNEL	0.5	1500	0.005	12	12	0.016	0.5
		OVERFLOW	5	1500	0.005	20	20	0.02	20
132	332		0	1	0.001	0	0	0.001	10
332	263	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 8.8 .0 11.5 9.3 14.1 78.9 18.3 513.4 22.5 1776.0									
263	318	CHANNEL	100	500	0.012	50	50	0.053	10
318	233		0	1	0.001	0	0	0.001	10
233	300	CHANNEL	0.5	750	0.013	12	12	0.016	0.5
		OVERFLOW	5	750	0.013	20	20	0.02	20

TABLE A-3 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (EXISTING DEVELOPMENT)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
314	214		0	1	0.001	0	0	0.001	10
214	300	CHANNEL	0.5	700	0.014	12	12	0.016	0.5
		OVERFLOW	5	700	0.014	20	20	0.02	20
300	200		0	1	0.001	0	0	0.001	10
200	310	CHANNEL	0.5	2480	0.008	12	12	0.016	0.5
		OVERFLOW	5	2480	0.008	20	20	0.02	20
131	312		0	1	0.001	0	0	0.001	10
312	212	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 3.7 .0 4.9 42.5 6.0 174.9 8.3 726.5 12.9 3366.0									
212	311	CHANNEL	100	1800	0.012	50	50	0.053	10
311	211		0	1	0.001	0	0	0.001	10
211	310	CHANNEL	0.5	3050	0.01	12	12	0.016	0.5
		OVERFLOW	5	3050	0.01	20	20	0.02	20
310	254		0.1	1	0.001	0	0	0.001	10
254	307	CHANNEL	0.5	950	0.007	12	12	0.016	0.5
		OVERFLOW	5	950	0.007	20	20	0.02	20
308	208		0	1	0.001	0	0	0.001	10
208	307	CHANNEL	0.5	2600	0.015	12	12	0.016	0.5
		OVERFLOW	5	2600	0.015	20	20	0.02	20
307	210		0	1	0.001	0	0	0.001	10
210	336	CHANNEL	0.5	2450	0.021	12	12	0.016	0.5
		OVERFLOW	5	2450	0.021	20	20	0.02	20
336	236		0	1	0.001	0	0	0.001	10
236	356	CHANNEL	0.5	1800	0.003	12	12	0.016	0.5
		OVERFLOW	5	1800	0.003	20	20	0.02	20
335	235		0	1	0.001	0	0	0.001	10
235	158	CHANNEL	0.5	2950	0.012	12	12	0.016	0.5
		OVERFLOW	5	2950	0.012	20	20	0.02	20
349	245		0	1	0.001	0	0	0.001	10
245	158	CHANNEL	0.5	1750	0.02	12	12	0.016	0.5
		OVERFLOW	5	1750	0.02	20	20	0.02	20
158	244		0	1	0.001	0	0	0.001	10
244	356	CHANNEL	0.5	2000	0.002	12	12	0.016	0.5
		OVERFLOW	5	2000	0.002	20	20	0.02	20
356	256		0	1	0.001	0	0	0.001	10
256	357	PIPE	1.5	1600	0.001	0	0	0.016	1.5
		OVERFLOW	1	1600	0.001	20	20	0.02	10
277	381	CHANNEL	100	2650	0.003	50	50	0.053	10
381	183		0	1	0.001	0	0	0.001	10
183	179	CHANNEL	100	2700	0.001	50	50	0.053	10
179	276		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 376 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 38.3 38.3 38.4 38.3 3000.0 38.3									
276	380	CHANNEL	0.5	3900	0.001	12	12	0.016	0.5
		OVERFLOW	5	3900	0.001	20	20	0.02	20
380	280		0	1	0.001	0	0	0.001	10
280	389	CHANNEL	0.5	900	0.002	12	12	0.016	0.5
		OVERFLOW	5	900	0.002	20	20	0.02	20
297	146	CHANNEL	100	1650	0.007	50	50	0.053	10
146	145		0	1	0.001	0	0	0.001	10

TABLE A-3 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (EXISTING DEVELOPMENT)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
145	176	CHANNEL	100	1150	0.005	50	50	0.053	10
176	295		0	1	0.001	0	0	0.001	10
295	147	CHANNEL	100	2200	0.005	50	50	0.053	10
296	147	CHANNEL	100	1300	0.002	50	50	0.053	10
147	294		0	1	0.001	0	0	0.001	10
294	117	CHANNEL	100	900	0.007	50	50	0.053	10
117	394		0	1	0.001	0	0	0.001	10
394	290	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 27.5 .0 31.7 38.2 35.9 324.3 44.2 1834.4									
290	390	CHANNEL	100	2900	0.004	50	50	0.053	10
292	138	CHANNEL	0.5	1050	0.002	12	12	0.016	0.5
		OVERFLOW	5	1050	0.002	20	20	0.02	20
138	388		0	1	0.001	0	0	0.001	10
388	270	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 17.2 .0 22.2 11.8 27.1 100.4 31.3 352.3 33.1 565.3									
34.9 761.5 .0 .0									
270	390	CHANNEL	0.5	750	0.011	12	12	0.016	0.5
		OVERFLOW	5	750	0.011	20	20	0.02	20
390	291		0	1	0.001	0	0	0.001	10
291	391	CHANNEL	100	950	0.003	50	50	0.053	10
391	293		0	1	0.001	0	0	0.001	10
293	393	CHANNEL	100	800	0.008	50	50	0.053	10
393	248		0	1	0.001	0	0	0.001	10
248	392	CHANNEL	100	1450	0.001	50	50	0.053	10
392	182		0	1	0.001	0	0	0.001	10
182	162	CHANNEL	100	5030	0.006	50	50	0.053	10
162	186		0	1	0.001	0	0	0.001	10
186	165	CHANNEL	100	2650	0.009	50	50	0.053	10
187	165	CHANNEL	0.5	350	0.003	12	12	0.016	0.5
		OVERFLOW	5	350	0.003	20	20	0.02	20
165	288		0	1	0.001	0	0	0.001	10
288	382	CHANNEL	0.5	2650	0.003	12	12	0.016	0.5
		OVERFLOW	5	2650	0.003	20	20	0.02	20
382	282		0	1	0.001	0	0	0.001	10
282	389	CHANNEL	100	3050	0.002	50	50	0.053	10
389	289		0	1	0.001	0	0	0.001	10
289	383	CHANNEL	0.5	380	0.002	12	12	0.016	0.5
		OVERFLOW	5	380	0.002	20	20	0.02	20
386	286		0	1	0.001	0	0	0.001	10
286	134	CHANNEL	100	470	0.004	50	50	0.053	10
134	358		0	1	0.001	0	0	0.001	10
358	264	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 15.0 .0 18.5 88.8 25.5 502.3 39.4 2841.3									
264	347	CHANNEL	100	1320	0.003	50	50	0.053	10
319	219		0	1	0.001	0	0	0.001	10
219	329	CHANNEL	0.5	1870	0.015	12	12	0.016	0.5
		OVERFLOW	5	1870	0.015	20	20	0.02	20
317	217		0	1	0.001	0	0	0.001	10

TABLE A-3 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (EXISTING DEVELOPMENT)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
217	329	CHANNEL	100	1411	0.02	50	50	0.053	10
329	229		0	1	0.001	0	0	0.001	10
229	343	CHANNEL	0.5	2250	0.017	12	12	0.016	0.5
		OVERFLOW	5	2250	0.017	20	20	0.02	20
343	243		0	1	0.001	0	0	0.001	10
243	347	CHANNEL	0.5	1540	0.004	12	12	0.016	0.5
		OVERFLOW	5	1540	0.004	20	20	0.02	20
220	320	CHANNEL	100	1750	0.008	50	50	0.053	10
320	227		0	1	0.001	0	0	0.001	10
227	327	CHANNEL	100	2450	0.016	50	50	0.053	10
327	230		0	1	0.001	0	0	0.001	10
230	330	CHANNEL	100	1360	0.008	50	50	0.053	10
128	323		0	1	0.001	0	0	0.001	10
323	222	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 4.5 .0 6.2 51.1 8.0 434.0									
222	322	CHANNEL	100	950	0.017	50	50	0.053	10
322	228		0	1	0.001	0	0	0.001	10
228	135	CHANNEL	100	1800	0.01	50	50	0.053	10
135	328		0	1	0.001	0	0	0.001	10
328	226	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 2.0 .0 4.5 26.3 5.7 213.6 7.0 649.2 9.5 1850.4									
226	326	CHANNEL	100	1400	0.014	50	50	0.053	10
326	224		0	1	0.001	0	0	0.001	10
224	330	CHANNEL	100	1450	0.008	50	50	0.053	10
330	221		0	1	0.001	0	0	0.001	10
221	301	CHANNEL	100	1390	0.008	50	50	0.053	10
324	225		0	1	0.001	0	0	0.001	10
225	325	CHANNEL	100	2200	0.016	50	50	0.053	10
325	231		0	1	0.001	0	0	0.001	10
231	331	CHANNEL	100	1350	0.01	50	50	0.053	10
331	284		0	1	0.001	0	0	0.001	10
284	384	CHANNEL	100	2000	0.045	50	50	0.053	10
190	167	CHANNEL	100	3700	0.008	50	50	0.053	10
167	191		0	1	0.001	0	0	0.001	10
191	168	CHANNEL	100	2500	0.005	50	50	0.053	10
379	192		0	1	0.001	0	0	0.001	10
192	168	CHANNEL	100	1050	0.005	50	50	0.053	10
168	193		0	1	0.001	0	0	0.001	10
193	169	CHANNEL	100	550	0.009	50	50	0.053	10
169	194		0	1	0.001	0	0	0.001	10
194	160	CHANNEL	100	1300	0.005	50	50	0.053	10
188	136	CHANNEL	100	2400	0.008	50	50	0.053	10
136	321		0	1	0.001	0	0	0.001	10
321	281	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 12.8 .0 14.0 2.1 15.3 17.4 17.9 98.6									
281	166	CHANNEL	100	2550	0.005	50	50	0.053	10
166	189		0	1	0.001	0	0	0.001	10
189	160	CHANNEL	100	2000	0.006	50	50	0.053	10

TABLE A-3 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (EXISTING DEVELOPMENT)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
160	195		0	1	0.001	0	0	0.001	10
195	384	CHANNEL	100	1250	0.004	50	50	0.053	10
384	223		0	1	0.001	0	0	0.001	10
223	301	CHANNEL	100	600	0.006	50	50	0.053	10
301	285		0	1	0.001	0	0	0.001	10
285	385	CHANNEL	100	1310	0.001	50	50	0.053	10
385	247		0	1	0.001	0	0	0.001	10
247	347	CHANNEL	100	1700	0.003	50	50	0.053	10
347	250		0	1	0.001	0	0	0.001	10
250	350	CHANNEL	0.5	1530	0.013	12	12	0.016	0.5
		OVERFLOW	5	1530	0.013	20	20	0.02	20
163	184		0	1	0.001	0	0	0.001	10
184	164	CHANNEL	100	3150	0.01	50	50	0.053	10
144	164	CHANNEL	100	750	0.027	50	50	0.053	10
164	180		0	1	0.001	0	0	0.001	10
180	159	CHANNEL	100	1400	0.008	50	50	0.053	10
159	298		0	1	0.001	0	0	0.001	10
298	151	CHANNEL	100	3200	0.006	50	50	0.053	10
125	364		0	1	0.001	0	0	0.001	10
364	150	PIPE	0.1	1	0.001	0	0	0.001	0.1

RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW

.0 .0 16.9 .0 20.2 19.1 23.6 162.1 30.4 917.2 48.2 5188.5

150	149	CHANNEL	100	700	0.002	50	50	0.053	10
149	267		0	1	0.001	0	0	0.001	10
267	151	CHANNEL	0.5	650	0.004	12	12	0.016	0.5
		OVERFLOW	5	650	0.004	20	20	0.02	20
151	198		0	1	0.001	0	0	0.001	10
198	355	CHANNEL	100	2900	0.005	50	50	0.053	10
355	199		0	1	0.001	0	0	0.001	10
199	173	CHANNEL	100	1450	0.006	50	50	0.053	10
173	196		0	1	0.001	0	0	0.001	10
196	137	CHANNEL	100	2800	0.001	50	50	0.053	10
137	161		0	1	0.001	0	0	0.001	10
161	181	PIPE	0.1	1	0.001	0	0	0.001	0.1

RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW

.0 .0 126.1 .0 149.6 15.8 173.0 134.2 219.9 759.4 313.6 4295.9

181	175	CHANNEL	100	700	0.004	50	50	0.053	10
175	197		0	1	0.001	0	0	0.001	10
197	387	CHANNEL	100	3000	0.003	50	50	0.053	10
387	287		0	1	0.001	0	0	0.001	10
287	350	CHANNEL	100	2540	0.011	50	50	0.053	10
232	334	CHANNEL	100	1150	0.012	50	50	0.053	10
334	234		0	1	0.001	0	0	0.001	10
234	348	CHANNEL	0.5	2310	0.013	12	12	0.016	0.5
		OVERFLOW	5	2310	0.013	20	20	0.02	20
348	246		0	1	0.001	0	0	0.001	10
246	346	CHANNEL	100	340	0.009	50	50	0.053	10
119	333		0	1	0.001	0	0	0.001	10
333	141	PIPE	0.1	1	0.001	0	0	0.001	0.1

RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW

.0 .0 .0 3.5 2.7 4.2 10.3 4.8 16.6 5.0 16.6 3000.0

TABLE A-3 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (EXISTING DEVELOPMENT)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
141	249	PIPE	1.5	2600	0.009	0	0	0.016	1.5
346	120	PIPE	0.1	1	0.001	0	0	0.001	0.1

RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW

.0 .0 .3 6.5 5.3 14.6 10.3 19.5 11.6 85.8 12.9 392.5

15.5 2125.6

120	255		0	1	0.001	0	0	0.001	10

DIVERSION TO GUTTER NUMBER 249 - TOTAL Q VS DIVERTED Q IN CFS

.0 .0 55.0 55.0 55.1 55.0 300.0 55.0

350	283		0	1	0.001	0	0	0.001	10
283	383	CHANNEL	0.5	780	0.001	12	12	0.016	0.5
		OVERFLOW	5	780	0.001	20	20	0.02	20
383	255		0	1	0.001	0	0	0.001	10
255	353	CHANNEL	0.5	2500	0.002	12	12	0.016	0.5
		OVERFLOW	5	2500	0.002	20	20	0.02	20
353	253		0	1	0.001	0	0	0.001	10

DIVERSION TO GUTTER NUMBER 397 - TOTAL Q VS DIVERTED Q IN CFS

.0 .0 40.4 40.4 40.5 40.4 500.0 40.4

253	351	CHANNEL	0.5	800	0.003	12	12	0.016	0.5
		OVERFLOW	5	800	0.003	20	20	0.02	20
351	251		0	1	0.001	0	0	0.001	10
251	357	CHANNEL	0.5	2670	0.001	12	12	0.016	0.5
		OVERFLOW	5	2670	0.001	20	20	0.02	20
275	374	CHANNEL	0.5	1170	0.001	12	12	0.016	0.5
		OVERFLOW	5	1170	0.001	20	20	0.02	20
374	274		0	1	0.001	0	0	0.001	10
274	352	PIPE	2	2300	0.002	0	0	0.016	2
		OVERFLOW	1	2300	0.002	20	20	0.02	10
352	252		0	1	0.001	0	0	0.001	10

DIVERSION TO GUTTER NUMBER 399 - TOTAL Q VS DIVERTED Q IN CFS

.0 .0 13.0 13.0 13.1 13.0 271.0 13.0

252	357	CHANNEL	0.5	1570	0.001	12	12	0.016	0.5
		OVERFLOW	5	1570	0.001	20	20	0.02	20
357	257		0	1	0.001	0	0	0.001	10
257	127	PIPE	2	2500	0.005	0	0	0.016	2
		OVERFLOW	1	2500	0.005	20	20	0.02	10
127	126		0	1	0.001	0	0	0.001	10

DIVERSION TO GUTTER NUMBER 344 - TOTAL Q VS DIVERTED Q IN CFS

.0 .0 11.6 11.6 11.7 11.6 3000.0 11.6

344	354	PIPE	2	400	0.004	0	0	0.016	2
126	118	CHANNEL	100	1500	0.005	50	50	0.053	20
359	259		0	1	0.001	0	0	0.001	10
259	118	PIPE	3.5	1750	0.007	0	0	0.016	3.5
		OVERFLOW	5	1750	0.007	20	0	0.02	20
118	361		0	1	0.001	0	0	0.001	10
361	261	PIPE	0.1	1	0.001	0	0	0.001	0.1

RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW

.0 .0 10.6 .0 21.5 8.8 47.7 10.5 60.2 12.0 61.9 255.3

64.4 997.9 65.9 1575.5 66.5 2110.4 67.7 2770.3 68.5 3413.0 69.4 4720.2

70.2 5376.4 70.6 6000.3

261	157	PIPE	2	700	0.01	0	0	0.016	2
		OVERFLOW	100	700	0.01	50	50	0.02	30

TABLE A-3 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (EXISTING DEVELOPMENT)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Side Slopes Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
360	265		0	1	0.001	0	0	0.001	10
265	157	CHANNEL	0.5	600	0.002	12	12	0.016	0.5
		OVERFLOW	5	600	0.002	20	20	0.02	20
354	258		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 398 - TOTAL Q VS DIVERTED Q IN CFS									
0 0 26.0 26.0 26.1 26.0 329.0 26.0									
258	157	CHANNEL	0.5	2330	0.003	12	12	0.016	0.5
		OVERFLOW	5	2330	0.003	20	20	0.02	20
157	0		0	1	0.001	0	0	0.001	10
279	377	CHANNEL	100	2500	0.002	50	50	0.053	10
377	278		0	1	0.001	0	0	0.001	10
278	378	CHANNEL	0.5	850	0.016	12	12	0.016	0.5
		OVERFLOW	5	850	0.016	20	20	0.02	20
378	273		0	1	0.001	0	0	0.001	10
273	373	CHANNEL	10	1900	0.006	1.2	1.2	0.053	4.5
		OVERFLOW	100	1900	0.006	50	50	0.053	10
373	272		0	1	0.001	0	0	0.001	10
272	371	CHANNEL	100	670	0.003	50	50	0.053	10
371	271		0	1	0.001	0	0	0.001	10
271	372	CHANNEL	100	2200	0.005	50	50	0.053	10
207	305	CHANNEL	100	1920	0.015	50	50	0.053	10
129	302		0	1	0.001	0	0	0.001	10
302	202	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 0 11.4 .0 13.3 12.3 15.2 104.6 19.1 591.8									
202	313	CHANNEL	100	1500	0.017	50	50	0.053	10
313	213		0	1	0.001	0	0	0.001	10
213	305	CHANNEL	100	1600	0.012	50	50	0.053	10
205	305	CHANNEL	100	1450	0.012	50	50	0.053	10
305	209		0	1	0.001	0	0	0.001	10
209	309	CHANNEL	100	3970	0.016	50	50	0.053	10
309	201		0	1	0.001	0	0	0.001	10
201	342	CHANNEL	0.5	2570	0.012	12	12	0.016	0.5
		OVERFLOW	5	2570	0.012	20	20	0.02	20
337	237		0	1	0.001	0	0	0.001	10
237	342	CHANNEL	100	850	0.038	50	50	0.053	10
342	242		0	1	0.001	0	0	0.001	10
242	124	CHANNEL	0.5	1150	0.01	12	12	0.016	0.5
		OVERFLOW	5	1150	0.01	20	20	0.02	20
338	238		0	1	0.001	0	0	0.001	10
238	124	CHANNEL	100	960	0.044	50	50	0.053	10
124	345		0	1	0.001	0	0	0.001	10
345	341	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 6.4 .0 7.9 5.1 9.3 122.0 12.2 690.4 13.7 1447.2									
15.1 2113.8 15.1 2113.8 18.0 3905.4									
370	139		0	1	0.001	0	0	0.001	10
139	140	CHANNEL	100	1500	0.005	50	50	0.053	10
140	268		0	1	0.001	0	0	0.001	10
268	368	CHANNEL	0.5	1150	0.003	12	12	0.016	0.5
		OVERFLOW	5	1150	0.003	20	20	0.02	20

TABLE A-3 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (EXISTING DEVELOPMENT)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Side Slopes Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
368	269		0	1	0.001	0	0	0.001	10
269	369	CHANNEL	0.5	1000	0.006	12	12	0.016	0.5
		OVERFLOW	5	1000	0.006	20	20	0.02	20
376	156	PIPE	3.5	2780	0.002	0	0	0.016	3.5
		OVERFLOW	1	2780	0.002	20	20	0.02	10
249	143	PIPE	5	2400	0.001	0	0	0.016	5
143	142		0	1	0.001	0	0	0.001	10
142	375	PIPE	3.5	2700	0.005	0	0	0.016	3.5
397	375	PIPE	4	1520	0.001	0	0	0.016	4
375	275		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 396 - TOTAL Q VS DIVERTED Q IN CFS									
0 .0 86.2 86.2 86.3 86.2 500.0 86.2									
177	156	PIPE	5.5	1350	0.001	0	0	0.016	5.5
		OVERFLOW	1	1350	0.001	20	20	0.02	10
156	178		0	1	0.001	0	0	0.001	10
178	373	PIPE	6	2600	0.003	0	0	0.016	6
		OVERFLOW	1	2600	0.003	20	20	0.02	10
398	154	PIPE	3	2410	0.002	0	0	0.016	3
399	154	PIPE	2	2000	0.005	0	0	0.016	2
154	174		0	1	0.001	0	0	0.001	10
174	0	PIPE	3	2200	0.005	0	0	0.016	3
		OVERFLOW	1	2200	0.005	20	20	0.02	10
396	177		0	1	0.001	0	0	0.001	10

TABLE A-4
SWMM ROUTING ELEMENT PARAMETERS (FUTURE DEVELOPMENT WITH CLOSED BASINS)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
363	0		0	1	0.001	0	0	0.001	10
365	0		0	1	0.001	0	0	0.001	10
366	0	PIPE	0.1	1	0.001	0	0	0.001	0.1
367	0		0	1	0.001	0	0	0.001	10
203	303	CHANNEL	0.5	3320	0.02	12	12	0.016	0.5
		OVERFLOW	5	3320	0.02	20	20	0.02	20
304	239		0	1	0.001	0	0	0.001	10
239	303	CHANNEL	0.5	2350	0.015	12	12	0.016	0.5
		OVERFLOW	5	2350	0.015	20	20	0.02	20
303	204		0	1	0.001	0	0	0.001	10
204	339	CHANNEL	0.5	1350	0.018	12	12	0.016	0.5
		OVERFLOW	5	1350	0.018	20	20	0.02	20
339	240		0	1	0.001	0	0	0.001	10
240	340	CHANNEL	0.5	3080	0.013	12	12	0.016	0.5
		OVERFLOW	5	3080	0.013	20	20	0.02	20
172	262		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 362 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 38.3 38.3 38.4 38.3 3000.0 38.3									
362	171	PIPE	3	600	0.005	0	0	0.016	3
171	359	PIPE	3.5	1620	0.005	0	0	0.016	3.5
262	341	CHANNEL	0.5	2170	0.001	12	12	0.016	0.5
		OVERFLOW	10	2170	0.001	20	20	0.02	20
341	241		0	1	0.001	0	0	0.001	10
241	340	CHANNEL	10	1700	0.002	4	4	0.053	30
340	260		0	1	0.001	0	0	0.001	10
260	157	CHANNEL	0.5	1500	0.001	12	12	0.016	0.5
		OVERFLOW	5	1500	0.001	20	20	0.02	20
123	315		0	1	0.001	0	0	0.001	10
315	206	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 1.3 .0 1.9 18.1 2.5 153.4 2.8 250.0 3.1 469.8									
3.6 867.9									
206	133	CHANNEL	10	1180	0.016	4	4	0.053	10
133	306		0	1	0.001	0	0	0.001	10
306	215	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 29.3 .0 31.2 22.6 33.2 191.8 37.1 1084.9									
215	316	CHANNEL	10	450	0.013	4	4	0.053	10
216	316	CHANNEL	0.5	800	0.023	12	12	0.016	0.5
		OVERFLOW	5	800	0.023	20	20	0.02	20
316	218		0	1	0.001	0	0	0.001	10
218	132	CHANNEL	0.5	1500	0.005	12	12	0.016	0.5
		OVERFLOW	5	1500	0.005	20	20	0.02	20
132	332		0	1	0.001	0	0	0.001	10
332	263	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 8.8 .0 11.5 9.3 14.1 78.9 18.3 513.4 22.5 1776.0									
263	318	CHANNEL	10	500	0.012	4	4	0.053	10
318	233		0	1	0.001	0	0	0.001	10
233	300	CHANNEL	0.5	750	0.013	12	12	0.016	0.5
		OVERFLOW	5	750	0.013	20	20	0.02	20

TABLE A-4 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (FUTURE DEVELOPMENT WITH CLOSED BASINS)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
314	214		0	1	0.001	0	0	0.001	10
214	300	CHANNEL	0.5	700	0.014	12	12	0.016	0.5
		OVERFLOW	5	700	0.014	20	20	0.02	20
300	200		0	1	0.001	0	0	0.001	10
200	310	CHANNEL	0.5	2480	0.008	12	12	0.016	0.5
		OVERFLOW	5	2480	0.008	20	20	0.02	20
131	312		0	1	0.001	0	0	0.001	10
312	212	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 3.7 .0 4.9 42.5 6.0 174.9 8.3 726.5 12.9 3366.0									
212	311	CHANNEL	10	1800	0.012	4	4	0.053	10
311	211		0	1	0.001	0	0	0.001	10
211	310	CHANNEL	0.5	3050	0.01	12	12	0.016	0.5
		OVERFLOW	5	3050	0.01	20	20	0.02	20
310	254		0.1	1	0.001	0	0	0.001	10
254	307	CHANNEL	0.5	950	0.007	12	12	0.016	0.5
		OVERFLOW	5	950	0.007	20	20	0.02	20
308	208		0	1	0.001	0	0	0.001	10
208	307	CHANNEL	0.5	2600	0.015	12	12	0.016	0.5
		OVERFLOW	5	2600	0.015	20	20	0.02	20
307	210		0	1	0.001	0	0	0.001	10
210	336	CHANNEL	0.5	2450	0.021	12	12	0.016	0.5
		OVERFLOW	5	2450	0.021	20	20	0.02	20
336	236		0	1	0.001	0	0	0.001	10
236	356	CHANNEL	0.5	1800	0.003	12	12	0.016	0.5
		OVERFLOW	5	1800	0.003	20	20	0.02	20
335	235		0	1	0.001	0	0	0.001	10
235	158	CHANNEL	0.5	2950	0.012	12	12	0.016	0.5
		OVERFLOW	5	2950	0.012	20	20	0.02	20
349	245		0	1	0.001	0	0	0.001	10
245	158	CHANNEL	0.5	1750	0.02	12	12	0.016	0.5
		OVERFLOW	5	1750	0.02	20	20	0.02	20
158	244		0	1	0.001	0	0	0.001	10
244	356	CHANNEL	0.5	2000	0.002	12	12	0.016	0.5
		OVERFLOW	5	2000	0.002	20	20	0.02	20
356	256		0	1	0.001	0	0	0.001	10
256	357	PIPE	1.5	1600	0.001	0	0	0.016	1.5
		OVERFLOW	1	1600	0.001	20	20	0.02	10
277	381	CHANNEL	10	2650	0.003	4	4	0.053	10
381	183		0	1	0.001	0	0	0.001	10
183	179	CHANNEL	10	2700	0.001	4	4	0.053	10
179	276		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 376 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 38.3 38.3 38.4 38.3 3000.0 38.3									
276	380	CHANNEL	0.5	3900	0.001	12	12	0.016	0.5
		OVERFLOW	5	3900	0.001	20	20	0.02	20
380	280		0	1	0.001	0	0	0.001	10
280	389	CHANNEL	0.5	900	0.002	12	12	0.016	0.5
		OVERFLOW	5	900	0.002	20	20	0.02	20
297	146	CHANNEL	10	1650	0.007	4	4	0.053	10
146	145		0	1	0.001	0	0	0.001	10

TABLE A-4 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (FUTURE DEVELOPMENT WITH CLOSED BASINS)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
145	176	CHANNEL	10	1150	0.005	4	4	0.053	10
176	295		0	1	0.001	0	0	0.001	10
295	147	CHANNEL	10	2200	0.005	4	4	0.053	10
296	147	CHANNEL	10	1300	0.002	4	4	0.053	10
147	294		0	1	0.001	0	0	0.001	10
294	117	CHANNEL	10	900	0.007	4	4	0.053	10
117	394		0	1	0.001	0	0	0.001	10
394	290	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 27.5 .0 31.7 38.2 35.9 324.3 44.2 1834.4									
290	390	CHANNEL	10	2900	0.004	4	4	0.053	10
292	138	CHANNEL	0.5	1050	0.002	12	12	0.016	0.5
		OVERFLOW	5	1050	0.002	20	20	0.02	20
138	388		0	1	0.001	0	0	0.001	10
388	270	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 17.2 .0 22.2 11.8 27.1 100.4 31.3 352.3 33.1 565.3									
34.9 761.5 .0 .0									
270	390	CHANNEL	0.5	750	0.011	12	12	0.016	0.5
		OVERFLOW	5	750	0.011	20	20	0.02	20
390	291		0	1	0.001	0	0	0.001	10
291	391	CHANNEL	10	950	0.003	4	4	0.053	10
391	293		0	1	0.001	0	0	0.001	10
293	393	CHANNEL	10	800	0.008	4	4	0.053	10
393	248		0	1	0.001	0	0	0.001	10
248	392	CHANNEL	10	1450	0.001	4	4	0.053	10
392	182		0	1	0.001	0	0	0.001	10
182	162	CHANNEL	10	5030	0.006	4	4	0.053	10
162	186		0	1	0.001	0	0	0.001	10
186	165	CHANNEL	10	2650	0.009	4	4	0.053	10
187	165	CHANNEL	0.5	350	0.003	12	12	0.016	0.5
		OVERFLOW	5	350	0.003	20	20	0.02	20
165	288		0	1	0.001	0	0	0.001	10
288	382	CHANNEL	0.5	2650	0.003	12	12	0.016	0.5
		OVERFLOW	5	2650	0.003	20	20	0.02	20
382	282		0	1	0.001	0	0	0.001	10
282	389	CHANNEL	10	3050	0.002	4	4	0.053	30
389	289		0	1	0.001	0	0	0.001	10
289	383	CHANNEL	0.5	380	0.002	12	12	0.016	0.5
		OVERFLOW	5	380	0.002	20	20	0.02	20
386	286		0	1	0.001	0	0	0.001	10
286	134	CHANNEL	10	470	0.004	4	4	0.053	10
134	358		0	1	0.001	0	0	0.001	10
358	264	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 15.0 .0 18.5 88.8 25.5 502.3 39.4 2841.3									
264	347	CHANNEL	10	1320	0.003	4	4	0.053	10
319	219		0	1	0.001	0	0	0.001	10
219	329	CHANNEL	0.5	1870	0.015	12	12	0.016	0.5
		OVERFLOW	5	1870	0.015	20	20	0.02	20
317	217		0	1	0.001	0	0	0.001	10

TABLE A-4 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (FUTURE DEVELOPMENT WITH CLOSED BASINS)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
217	329	CHANNEL	10	1411	0.02	4	4	0.053	10
329	229		0	1	0.001	0	0	0.001	10
229	343	CHANNEL	0.5	2250	0.017	12	12	0.016	0.5
		OVERFLOW	5	2250	0.017	20	20	0.02	20
343	243		0	1	0.001	0	0	0.001	10
243	347	CHANNEL	0.5	1540	0.004	12	12	0.016	0.5
		OVERFLOW	5	1540	0.004	20	20	0.02	20
220	320	CHANNEL	10	1750	0.008	4	4	0.053	10
320	227		0	1	0.001	0	0	0.001	10
227	327	CHANNEL	10	2450	0.016	4	4	0.053	10
327	230		0	1	0.001	0	0	0.001	10
230	330	CHANNEL	10	1360	0.008	4	4	0.053	10
128	323		0	1	0.001	0	0	0.001	10
323	222	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 4.5 .0 6.2 51.1 8.0 434.0									
222	322	CHANNEL	10	950	0.017	4	4	0.053	10
322	228		0	1	0.001	0	0	0.001	10
228	135	CHANNEL	10	1800	0.01	4	4	0.053	10
135	328		0	1	0.001	0	0	0.001	10
328	226	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 2.0 .0 4.5 26.3 5.7 213.6 7.0 649.2 9.5 1850.4									
226	326	CHANNEL	10	1400	0.014	4	4	0.053	10
326	224		0	1	0.001	0	0	0.001	10
224	330	CHANNEL	10	1450	0.008	4	4	0.053	10
330	221		0	1	0.001	0	0	0.001	10
221	301	CHANNEL	10	1390	0.008	4	4	0.053	10
324	225		0	1	0.001	0	0	0.001	10
225	325	CHANNEL	10	2200	0.016	4	4	0.053	10
325	231		0	1	0.001	0	0	0.001	10
231	331	CHANNEL	10	1350	0.01	4	4	0.053	10
331	284		0	1	0.001	0	0	0.001	10
284	384	CHANNEL	10	2000	0.045	4	4	0.053	10
190	167	CHANNEL	10	3700	0.008	4	4	0.053	10
167	191		0	1	0.001	0	0	0.001	10
191	168	CHANNEL	10	2500	0.005	4	4	0.053	10
379	192		0	1	0.001	0	0	0.001	10
192	168	CHANNEL	10	1050	0.005	4	4	0.053	10
168	193		0	1	0.001	0	0	0.001	10
193	169	CHANNEL	10	550	0.009	4	4	0.053	10
169	194		0	1	0.001	0	0	0.001	10
194	160	CHANNEL	10	1300	0.005	4	4	0.053	10
188	136	CHANNEL	10	2400	0.008	4	4	0.053	10
136	321		0	1	0.001	0	0	0.001	10
321	281	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 12.8 .0 14.0 2.1 15.3 17.4 17.9 98.6									
281	166	CHANNEL	10	2550	0.005	4	4	0.053	10
166	189		0	1	0.001	0	0	0.001	10
189	160	CHANNEL	10	2000	0.006	4	4	0.053	10

TABLE A-4 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (FUTURE DEVELOPMENT WITH CLOSED BASINS)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
160	195		0	1	0.001	0	0	0.001	10
195	384	CHANNEL	10	1250	0.004	4	4	0.053	30
384	223		0	1	0.001	0	0	0.001	10
223	301	CHANNEL	10	600	0.006	4	4	0.053	30
301	285		0	1	0.001	0	0	0.001	10
285	385	CHANNEL	10	1310	0.001	4	4	0.053	30
385	247		0	1	0.001	0	0	0.001	10
247	347	CHANNEL	10	1700	0.003	4	4	0.053	30
347	250		0	1	0.001	0	0	0.001	10
250	350	CHANNEL	0.5	1530	0.013	12	12	0.016	0.5
		OVERFLOW	5	1530	0.013	20	20	0.02	20
163	184		0	1	0.001	0	0	0.001	10
184	164	CHANNEL	10	3150	0.01	4	4	0.053	10
144	164	CHANNEL	10	750	0.027	4	4	0.053	10
164	180		0	1	0.001	0	0	0.001	10
180	159	CHANNEL	10	1400	0.008	4	4	0.053	10
159	298		0	1	0.001	0	0	0.001	10
298	151	CHANNEL	10	3200	0.006	4	4	0.053	10
125	364		0	1	0.001	0	0	0.001	10
364	150	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 16.9 .0 20.2 19.1 23.6 162.1 30.4 917.2 48.2 5188.5									
150	149	CHANNEL	10	700	0.002	4	4	0.053	10
149	267		0	1	0.001	0	0	0.001	10
267	151	CHANNEL	0.5	650	0.004	12	12	0.016	0.5
		OVERFLOW	5	650	0.004	20	20	0.02	20
151	198		0	1	0.001	0	0	0.001	10
198	355	CHANNEL	10	2900	0.005	4	4	0.053	10
355	199		0	1	0.001	0	0	0.001	10
199	173	CHANNEL	10	1450	0.006	4	4	0.053	10
173	196		0	1	0.001	0	0	0.001	10
196	137	CHANNEL	10	2800	0.001	4	4	0.053	30
137	161		0	1	0.001	0	0	0.001	10
161	181	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 126.1 .0 149.6 15.8 173.0 134.2 219.9 759.4 313.6 4295.9									
181	175	CHANNEL	10	700	0.004	4	4	0.053	10
175	197		0	1	0.001	0	0	0.001	10
197	387	CHANNEL	10	3000	0.003	4	4	0.053	10
387	287		0	1	0.001	0	0	0.001	10
287	350	CHANNEL	10	2540	0.011	4	4	0.053	10
232	334	CHANNEL	10	1150	0.012	4	4	0.053	10
334	234		0	1	0.001	0	0	0.001	10
234	348	CHANNEL	0.5	2310	0.013	12	12	0.016	0.5
		OVERFLOW	5	2310	0.013	20	20	0.02	20
348	246		0	1	0.001	0	0	0.001	10
246	346	CHANNEL	10	340	0.009	4	4	0.053	10
119	333		0	1	0.001	0	0	0.001	10
333	141	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
0 0 0 3.5 2.7 4.2 10.3 4.8 16.6 5.0 16.6 3000.0									

TABLE A-4 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (FUTURE DEVELOPMENT WITH CLOSED BASINS)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
141	249	PIPE	1.5	2600	0.009	0	0	0.016	1.5
346	120	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 .3 6.5 5.3 14.6 10.3 19.5 11.6 85.8 12.9 392.5 15.5 2125.6									
120	255		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 249 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 55.0 55.0 55.1 55.0 300.0 55.0									
350	283		0	1	0.001	0	0	0.001	10
283	383	CHANNEL	0.5	780	0.001	12	12	0.016	0.5
		OVERFLOW	5	780	0.001	20	20	0.02	20
383	255		0	1	0.001	0	0	0.001	10
255	353	CHANNEL	0.5	2500	0.002	12	12	0.016	0.5
		OVERFLOW	5	2500	0.002	20	20	0.02	20
353	253		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 397 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 40.4 40.4 40.5 40.4 500.0 40.4									
253	351	CHANNEL	0.5	800	0.003	12	12	0.016	0.5
		OVERFLOW	5	800	0.003	20	20	0.02	20
351	251		0	1	0.001	0	0	0.001	10
251	357	CHANNEL	0.5	2670	0.001	12	12	0.016	0.5
		OVERFLOW	5	2670	0.001	20	20	0.02	20
275	374	CHANNEL	0.5	1170	0.001	12	12	0.016	0.5
		OVERFLOW	5	1170	0.001	20	20	0.02	20
374	274		0	1	0.001	0	0	0.001	10
274	352	PIPE	2	2300	0.002	0	0	0.016	2
		OVERFLOW	1	2300	0.002	20	20	0.02	10
352	252		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 399 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 13.0 13.0 13.1 13.0 271.0 13.0									
252	357	CHANNEL	0.5	1570	0.001	12	12	0.016	0.5
		OVERFLOW	5	1570	0.001	20	20	0.02	20
357	257		0	1	0.001	0	0	0.001	10
257	127	PIPE	2	2500	0.005	0	0	0.016	2
		OVERFLOW	1	2500	0.005	20	20	0.02	10
127	126		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 344 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 11.6 11.6 11.7 11.6 3000.0 11.6									
344	354	PIPE	2	400	0.004	0	0	0.016	2
126	118	CHANNEL	10	1500	0.005	4	4	0.053	20
359	259		0	1	0.001	0	0	0.001	10
259	118	PIPE	3.5	1750	0.007	0	0	0.016	3.5
		OVERFLOW	5	1750	0.007	20	0	0.02	20
118	361		0	1	0.001	0	0	0.001	10
361	261	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 10.6 .0 21.5 8.8 47.7 10.5 60.2 12.0 61.9 255.3 64.4 997.9 65.9 1575.5 66.5 2110.4 67.7 2770.3 68.5 3413.0 69.4 4720.2 70.2 5376.4 70.6 6000.3									
261	157	PIPE	2	700	0.01	0	0	0.016	2
		OVERFLOW	10	700	0.01	4	4	0.02	30

TABLE A-4 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (FUTURE DEVELOPMENT WITH CLOSED BASINS)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
360	265		0	1	0.001	0	0	0.001	10
265	157	CHANNEL	0.5	600	0.002	12	12	0.016	0.5
		OVERFLOW	5	600	0.002	20	20	0.02	20
354	258		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 398 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 26.0 26.0 26.1 26.0 329.0 26.0									
258	157	CHANNEL	0.5	2330	0.003	12	12	0.016	0.5
		OVERFLOW	5	2330	0.003	20	20	0.02	20
157	0		0	1	0.001	0	0	0.001	10
279	377	CHANNEL	10	2500	0.002	4	4	0.053	10
377	278		0	1	0.001	0	0	0.001	10
278	378	CHANNEL	0.5	850	0.016	12	12	0.016	0.5
		OVERFLOW	5	850	0.016	20	20	0.02	20
378	273		0	1	0.001	0	0	0.001	10
273	373	CHANNEL	10	1900	0.006	1.2	1.2	0.053	4.5
		OVERFLOW	100	1900	0.006	50	50	0.053	10
373	272		0	1	0.001	0	0	0.001	10
272	371	CHANNEL	10	670	0.003	4	4	0.053	30
371	271		0	1	0.001	0	0	0.001	10
271	372	CHANNEL	10	2200	0.005	4	4	0.053	10
207	305	CHANNEL	10	1920	0.015	4	4	0.053	10
129	302		0	1	0.001	0	0	0.001	10
302	202	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 11.4 .0 13.3 12.3 15.2 104.6 19.1 591.8									
202	313	CHANNEL	10	1500	0.017	4	4	0.053	10
313	213		0	1	0.001	0	0	0.001	10
213	305	CHANNEL	10	1600	0.012	4	4	0.053	10
205	305	CHANNEL	10	1450	0.012	4	4	0.053	10
305	209		0	1	0.001	0	0	0.001	10
209	309	CHANNEL	10	3970	0.016	4	4	0.053	10
309	201		0	1	0.001	0	0	0.001	10
201	342	CHANNEL	0.5	2570	0.012	12	12	0.016	0.5
		OVERFLOW	5	2570	0.012	20	20	0.02	20
337	237		0	1	0.001	0	0	0.001	10
237	342	CHANNEL	10	850	0.038	4	4	0.053	10
342	242		0	1	0.001	0	0	0.001	10
242	124	CHANNEL	0.5	1150	0.01	12	12	0.016	0.5
		OVERFLOW	5	1150	0.01	20	20	0.02	20
338	238		0	1	0.001	0	0	0.001	10
238	124	CHANNEL	10	960	0.044	4	4	0.053	10
124	345		0	1	0.001	0	0	0.001	10
345	341	PIPE	0.1	1	0.001	0	0	0.001	0.1
RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW									
.0 .0 6.4 0 7.9 5.1 9.3 122.0 12.2 690.4 13.7 1447.2									
15.1 2113.8 15.1 2113.8 18.0 3905.4									
370	139		0	1	0.001	0	0	0.001	10
139	140	CHANNEL	10	1500	0.005	4	4	0.053	10
140	268		0	1	0.001	0	0	0.001	10
268	368	CHANNEL	0.5	1150	0.003	12	12	0.016	0.5
		OVERFLOW	5	1150	0.003	20	20	0.02	20

TABLE A-4 (CONTINUED)
SWMM ROUTING ELEMENT PARAMETERS (FUTURE DEVELOPMENT WITH CLOSED BASINS)

Conveyance ID From	To		Width or Diam. (ft)	Length (ft)	Invert Slope (ft/ft)	Side Slopes Horiz. L	Vert. R	Manning's N	Overbank/ Surcharge Depth (FT)
368	269		0	1	0.001	0	0	0.001	10
269	369	CHANNEL	0.5	1000	0.006	12	12	0.016	0.5
		OVERFLOW	5	1000	0.006	20	20	0.02	20
376	156	PIPE	3.5	2780	0.002	0	0	0.016	3.5
		OVERFLOW	1	2780	0.002	20	20	0.02	10
249	143	PIPE	5	2400	0.001	0	0	0.016	5
143	142		0	1	0.001	0	0	0.001	10
142	375	PIPE	3.5	2700	0.005	0	0	0.016	3.5
397	375	PIPE	4	1520	0.001	0	0	0.016	4
375	275		0	1	0.001	0	0	0.001	10
DIVERSION TO GUTTER NUMBER 396 - TOTAL Q VS DIVERTED Q IN CFS									
.0 .0 86.2 86.2 86.3 86.2 500.0 86.2									
177	156	PIPE	5.5	1350	0.001	0	0	0.016	5.5
		OVERFLOW	1	1350	0.001	20	20	0.02	10
156	178		0	1	0.001	0	0	0.001	10
178	373	PIPE	6	2600	0.003	0	0	0.016	6
		OVERFLOW	1	2600	0.003	20	20	0.02	10
398	154	PIPE	3	2410	0.002	0	0	0.016	3
399	154	PIPE	2	2000	0.005	0	0	0.016	2
154	174		0	1	0.001	0	0	0.001	10
174	0	PIPE	3	2200	0.005	0	0	0.016	3
		OVERFLOW	1	2200	0.005	20	20	0.02	10
396	177		0	1	0.001	0	0	0.001	10

TABLE A-5
BRIGHTON PEAK FLOW SUMMARY

SWMM Conv. Elnt		EXISTING DEVELOPMENT Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITH CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITHOUT CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
117		0	13	28	96	140	84	178	241	506	651	84	178	241	506	651
118		181	443	639	1489	2067	892	1913	2612	5808	7727	1163	2472	3401	7460	9857
119		16	36	48	97	121	27	50	63	115	142	27	50	63	115	142
120		12	17	42	194	285	15	30	83	377	589	15	30	83	377	589
123		3	26	42	106	137	14	51	73	166	212	14	51	73	166	212
124		37	94	142	389	545	234	483	646	1347	1717	239	497	668	1408	1800
125		0	7	13	37	50	35	65	83	154	190	35	65	83	154	190
126		140	364	544	1341	1894	860	1834	2515	5644	7506	1133	2404	3304	7296	9655
127		253	528	726	1642	2184	877	1854	2543	5688	7585	1152	2429	3324	7317	9693
128		0	24	39	105	138	86	149	193	340	406	86	149	193	340	406
129		5	15	21	48	61	31	58	74	135	166	31	58	74	135	166
131		2	33	53	143	188	121	207	267	459	549	121	207	267	459	549
132		5	28	45	119	157	7	39	61	156	205	37	121	177	424	549
133		0	8	17	88	133	24	49	72	248	329	35	92	129	283	358
134		0	7	13	41	58	34	70	92	183	230	34	70	92	183	230
135		0	9	15	47	83	40	76	100	300	430	105	198	255	477	593
136		0	8	17	65	96	90	162	206	371	457	90	162	206	371	457
137		1	17	32	128	196	182	381	519	1131	1498	200	418	570	1231	1628
138		0	10	17	49	67	36	68	87	167	208	36	68	87	167	208
139		17	29	37	69	89	46	73	90	153	186	46	73	90	153	186
140		58	115	148	278	346	121	208	257	442	541	121	208	257	442	541
141	(1)	4	4	4	4	5	4	4	4	5	5	4	4	4	5	5
142	(1)	15	21	43	59	60	18	32	59	60	60	18	32	59	60	60
143	(1)	15	21	44	59	60	18	32	59	60	60	18	32	59	60	60
144		0	4	8	26	37	3	17	27	69	90	3	17	27	69	90
145		0	8	18	66	97	37	85	117	255	327	37	85	117	255	327
146		0	12	24	83	120	40	91	124	264	337	40	91	124	264	337
147		0	14	28	97	143	85	180	242	511	656	85	180	242	511	656
149		0	4	6	17	22	27	40	48	76	91	50	87	111	205	254
150		0	0	0	0	0	0	0	0	0	0	31	59	76	146	182
151		4	33	55	165	236	164	311	408	821	1050	185	354	468	961	1225
154	(1)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
156	(1)	82	102	108	124	125	117	124	124	124	124	117	124	124	124	124
157		72	191	608	2255	2927	1037	2591	3594	7479	9722	1366	2949	4054	8893	11850
158		32	63	81	160	201	32	63	81	160	201	32	63	81	160	201
159		0	22	44	134	223	78	179	245	519	661	78	179	245	519	661
160		0	23	48	177	260	225	413	536	1043	1306	270	505	654	1279	1609
161		0	0	0	0	0	0	0	0	4	59	200	418	570	1231	1628
162		4	35	54	133	175	112	208	264	530	700	121	269	381	818	1092
163		0	9	15	43	57	23	43	55	104	129	23	43	55	104	129
164		2	40	66	173	228	53	129	177	378	478	53	129	177	378	478
165		5	47	74	193	269	173	337	435	847	1078	173	339	444	942	1263
166		0	23	39	108	144	181	275	329	512	608	209	338	417	723	889
167		2	25	42	114	152	62	128	168	329	410	62	128	168	329	410
168		0	16	33	118	173	99	200	266	540	686	99	200	266	540	686
169		0	21	43	148	214	106	231	311	653	831	106	231	311	653	831
171	(1)	38	38	38	38	38	38	38	38	38	38	38	38	38	38	38
172		70	126	160	284	348	70	126	160	284	348	70	126	160	284	348
173		0	29	58	197	287	221	444	593	1250	1604	238	480	642	1356	1752

TABLE A-5 (CONTINUED)
BRIGHTON PEAK FLOW SUMMARY

SWMM Conv. Elnt		EXISTING DEVELOPMENT Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITH CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITHOUT CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
174	(1)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
175		0	16	27	75	100	37	75	99	190	234	213	446	611	1324	1754
176		0	11	23	85	125	55	119	162	346	441	55	119	162	346	441
177	(1)	78	86	86	86	86	82	86	86	86	86	82	86	86	86	86
178	(1)	80	101	108	124	124	114	124	124	124	124	114	124	124	124	124
179		9	17	23	46	59	68	106	129	225	277	68	106	129	225	277
180		0	13	27	102	149	44	114	161	359	460	44	114	161	359	460
181		0	0	0	0	0	0	0	0	4	59	200	416	568	1233	1630
182		0	6	13	48	72	42	98	138	315	421	104	232	325	713	950
183		0	2	5	15	22	38	62	76	133	167	38	62	76	133	167
184		0	2	4	16	24	16	31	41	83	107	16	31	41	83	107
186		0	12	24	75	109	91	182	243	520	688	120	265	375	808	1078
187		2	16	23	55	71	40	77	98	172	211	40	77	98	172	211
188		0	5	12	47	71	84	145	182	315	387	84	145	182	315	387
189		0	8	16	57	84	140	216	260	430	519	177	295	368	665	821
190		0	1	4	15	24	17	35	46	98	125	17	35	46	98	125
191		0	5	12	47	71	43	93	127	276	355	43	93	127	276	355
192		0	12	23	79	113	65	126	163	309	384	65	126	163	309	384
193		0	15	32	114	167	98	201	267	543	689	98	201	267	543	689
194		0	16	33	122	180	97	214	294	632	809	97	214	294	632	809
195		0	19	41	156	232	211	395	511	1012	1275	255	485	631	1252	1583
196		0	14	32	128	193	169	351	478	1039	1372	187	388	529	1146	1512
197		0	2	6	22	33	19	43	59	129	168	197	417	574	1247	1655
198		0	12	27	108	162	125	255	344	736	952	149	302	406	866	1117
199		0	14	31	124	187	153	314	424	914	1185	174	358	480	1035	1340
200		1	14	24	74	103	26	55	75	159	207	50	153	226	540	697
201		1	23	48	186	278	138	306	421	910	1165	149	328	448	980	1258
202		0	0	0	0	0	0	0	0	0	0	26	50	65	124	154
203		3	16	25	66	87	7	28	42	105	136	7	28	42	105	136
204		3	40	66	182	242	62	133	177	355	448	62	133	177	355	448
205		2	21	40	135	188	31	103	150	336	429	31	103	150	336	429
206		0	2	10	55	86	0	12	34	140	191	11	45	67	159	205
207		1	6	11	30	42	29	51	65	121	150	29	51	65	121	150
208		0	11	19	55	74	26	49	64	122	151	26	49	64	122	151
209		1	15	33	131	198	99	231	318	697	896	114	257	355	776	996
210		69	142	192	399	511	128	250	330	725	967	206	435	590	1265	1609
211		0	6	11	61	105	19	68	112	318	429	97	178	227	430	535
212		0	0	0	44	77	14	55	95	282	376	92	164	213	387	474
213		0	3	6	21	31	20	40	54	107	134	42	84	110	219	275
214		0	9	15	47	66	31	57	72	134	172	32	63	82	156	172
215		0	0	0	0	0	0	0	0	0	0	35	93	130	281	357
216		2	11	17	42	55	2	15	22	54	70	2	15	22	54	70
217		0	8	16	54	77	25	62	88	188	237	25	62	88	188	237
218		2	9	15	40	53	2	12	19	49	65	33	98	141	318	408
219		0	13	23	64	86	11	35	50	113	145	11	35	50	113	145
220		0	4	7	26	38	29	54	69	133	166	29	54	69	133	166
221		0	12	28	115	190	129	255	337	747	1071	211	415	548	1111	1391
222		0	0	0	35	66	0	24	42	204	312	82	147	188	331	404
223		0	25	57	231	346	310	585	766	1533	1935	351	672	875	1766	2235

TABLE A-5 (CONTINUED)
BRIGHTON PEAK FLOW SUMMARY

SWMM Conv. Elnt		EXISTING DEVELOPMENT Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITH CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITHOUT CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
224		0	2	4	32	70	21	38	73	306	458	106	208	271	536	660
225		0	3	7	27	40	25	48	63	125	156	25	48	63	125	156
226		0	0	0	30	67	4	25	65	276	401	96	185	240	452	563
227		0	7	15	58	86	59	116	152	304	383	59	116	152	304	383
228		0	2	5	35	66	22	43	55	239	352	87	165	213	397	493
229		4	38	65	194	265	75	172	235	488	616	75	172	235	488	616
230		0	10	21	81	121	87	171	224	446	561	87	171	224	446	561
231		0	7	15	57	84	54	108	142	280	351	54	108	142	280	351
232		5	9	12	25	33	14	28	36	70	87	14	28	36	70	87
233		1	8	13	31	42	2	13	20	49	63	38	128	194	468	606
234		7	18	27	65	88	37	73	97	189	236	37	73	97	189	236
235		15	30	39	79	100	15	30	39	79	100	15	30	39	79	100
236		135	242	312	600	759	181	324	418	857	1117	234	475	642	1359	1735
237		0	10	19	62	87	48	92	118	213	263	48	92	118	213	263
238		0	6	12	40	56	28	54	70	127	157	28	54	70	127	157
239		1	25	43	121	161	59	113	147	274	340	59	113	147	274	340
240		7	53	88	247	331	95	192	255	508	640	95	192	255	508	640
241		5	33	81	308	461	145	425	617	1447	1888	162	452	649	1520	1984
242		34	82	121	327	461	205	429	577	1212	1549	210	444	600	1275	1632
243		5	45	77	225	310	88	195	264	546	690	88	195	264	546	690
244		26	52	69	142	180	26	52	69	142	180	26	52	69	142	180
245		18	34	45	85	105	18	34	45	85	105	18	34	45	85	105
246		22	50	69	152	199	68	132	172	334	416	68	132	172	334	416
247		0	26	67	287	452	397	776	1030	2196	2900	511	1001	1326	2734	3496
248		1	11	22	69	100	36	91	129	297	388	106	237	332	729	974
249	(1)	15	21	44	59	60	18	32	59	60	60	18	32	59	60	60
250		5	48	82	300	470	455	905	1209	2583	3411	593	1182	1576	3303	4247
251		18	113	198	661	992	733	1507	2034	4534	6028	970	2012	2739	5971	7850
252		12	51	85	234	318	12	54	86	239	322	12	54	86	239	322
253		5	98	178	640	971	758	1550	2082	4648	6134	997	2058	2786	6092	7998
254		78	152	199	381	479	114	219	286	619	838	186	399	545	1166	1485
255		21	108	180	630	933	785	1565	2081	4591	6046	1025	2075	2788	6063	7938
256		203	385	505	1012	1285	260	486	634	1310	1694	311	623	835	1752	2244
257		253	528	726	1642	2184	877	1854	2543	5688	7585	1152	2429	3324	7317	9693
258		36	78	105	217	275	36	78	105	217	275	36	78	105	217	275
259		70	90	105	168	200	70	90	105	168	200	70	90	105	168	200
260		10	77	132	453	679	187	542	790	1871	2487	203	568	821	1929	2563
261		9	107	485	1678	2068	890	2139	2847	5827	7714	1164	2473	3399	7457	9863
262		12	46	70	168	221	12	46	70	168	221	12	46	70	168	221
263		0	0	0	3	24	0	0	0	3	28	37	120	178	421	544
264		0	0	0	0	0	0	0	0	7	45	28	60	80	168	213
265		32	56	72	131	161	48	79	98	169	205	48	79	98	169	205
267		0	3	6	16	22	25	38	46	74	88	49	86	110	204	252
268		53	106	138	267	334	113	194	242	425	522	113	194	242	425	522
269		51	110	146	294	370	165	269	335	575	696	165	269	335	575	696
270		0	0	0	0	0	0	0	0	0	2	36	67	87	166	208
271		65	111	140	229	267	253	337	386	600	710	262	370	436	720	869
272		102	158	191	333	407	274	383	443	670	784	282	408	486	788	944
273		3	20	36	94	124	97	138	166	284	357	107	170	211	383	476

TABLE A-5 (CONTINUED)
BRIGHTON PEAK FLOW SUMMARY

SWMM Conv. Elnt	EXISTING DEVELOPMENT Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITH CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITHOUT CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
274	11	42	69	193	259	11	44	71	197	263	11	44	71	197	263
275	0	34	61	169	225	0	37	63	172	227	0	37	63	172	227
276	0	0	0	3	13	19	51	72	150	197	19	51	72	150	197
277	0	1	3	9	13	15	24	29	50	62	15	24	29	50	62
278	5	11	16	39	54	55	93	116	216	270	55	93	116	216	270
279	0	2	5	18	26	19	39	51	108	139	19	39	51	108	139
280	26	60	83	172	217	140	211	254	399	476	140	211	254	399	476
281	0	0	0	0	3	0	0	0	39	86	57	106	139	275	347
282	1	29	57	176	256	222	428	557	1110	1429	223	432	564	1136	1489
283	5	56	98	341	534	505	1016	1356	2917	3845	754	1530	2047	4363	5686
284	0	9	20	77	115	110	191	243	449	557	110	191	243	449	557
285	0	30	70	297	468	398	773	1020	2133	2811	515	1004	1329	2708	3441
286	0	5	9	30	42	21	46	61	124	157	21	46	61	124	157
287	0	4	9	35	52	39	81	110	236	305	206	436	603	1303	1736
288	4	42	71	190	266	155	310	405	818	1054	156	314	441	936	1254
289	26	65	90	211	310	309	576	742	1460	1878	309	578	746	1478	1918
290	0	0	0	0	8	0	0	0	172	302	71	153	208	447	586
291	0	8	16	53	76	34	72	97	195	313	102	219	300	645	852
292	0	7	12	34	46	24	45	58	110	138	24	45	58	110	138
293	3	16	28	85	120	38	90	123	260	335	104	229	316	690	917
294	0	13	28	96	140	84	178	241	506	651	84	178	241	506	651
295	0	7	16	63	93	46	103	142	311	404	46	103	142	311	404
296	0	4	8	20	28	23	46	59	112	140	23	46	59	112	140
297	0	7	14	51	75	17	46	65	148	191	17	46	65	148	191
298	0	7	18	74	113	53	130	183	423	552	53	130	183	423	552
300	1	17	27	78	107	34	70	92	183	235	54	165	241	567	727
301	0	36	84	345	536	440	836	1103	2238	2887	561	1086	1417	2877	3626
302	0	0	0	0	0	0	0	0	0	0	31	58	74	135	166
303	3	40	67	184	244	64	135	183	367	461	64	135	183	367	461
304	1	30	49	128	166	70	132	172	307	377	70	132	172	307	377
305	3	58	101	308	422	141	314	422	865	1084	148	336	450	927	1167
306	0	0	0	0	0	0	0	0	0	0	35	92	129	283	359
307	78	156	209	416	526	135	261	343	735	983	212	447	606	1282	1636
308	0	13	22	58	76	31	58	74	134	165	31	58	74	134	165
309	1	24	48	187	280	145	322	439	940	1200	154	339	464	1003	1283
310	82	154	204	383	469	116	224	288	626	848	186	399	543	1160	1477
311	0	8	13	62	107	25	74	123	362	478	115	211	272	494	607
312	0	0	4	97	152	15	69	118	344	436	121	207	267	459	549
313	0	9	14	39	52	26	51	65	120	149	48	93	120	232	289
314	0	9	15	47	66	33	59	75	140	179	34	67	87	160	179
315	0	5	16	99	133	0	13	40	152	204	14	51	73	166	212
316	2	11	17	42	55	3	15	22	54	70	37	107	151	333	425
317	2	20	32	83	109	31	74	101	202	253	31	74	101	202	253
318	2	9	13	32	42	2	13	20	49	63	39	130	194	463	600
319	0	15	25	66	87	13	38	53	117	148	13	38	53	117	148
320	0	25	41	109	144	73	141	179	334	415	73	141	179	334	415
321	0	0	0	0	12	0	0	0	48	104	90	162	206	371	457
322	0	11	18	47	93	33	60	78	275	408	111	201	254	450	553
323	0	0	0	44	103	0	25	43	223	320	86	149	193	340	406

TABLE A-5 (CONTINUED)
BRIGHTON PEAK FLOW SUMMARY

SWMM Conv. Elnt		EXISTING DEVELOPMENT Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITH CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITHOUT CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
324		0	14	23	61	80	34	64	81	147	182	34	64	81	147	182
325		0	14	24	75	108	59	116	153	294	366	59	116	153	294	366
326		0	6	10	38	82	27	49	76	330	488	117	224	289	562	688
327		0	14	27	97	142	93	180	235	460	574	93	180	235	460	574
328		0	0	1	44	83	5	25	67	301	424	105	198	255	477	593
329		4	40	67	196	266	81	183	249	506	635	81	183	249	506	635
330		0	17	31	123	196	135	266	349	761	1079	219	429	562	1137	1419
331		0	12	24	87	127	117	199	251	457	566	117	199	251	457	566
332		0	0	0	4	28	0	0	0	3	28	37	121	177	424	549
333	(1)	4	4	4	4	5	4	4	4	5	5	4	4	4	5	5
334		7	18	27	66	89	42	83	108	203	252	42	83	108	203	252
335		18	36	47	89	109	18	36	47	89	109	18	36	47	89	109
336		161	271	346	641	804	198	349	447	877	1136	242	491	663	1402	1786
337		0	17	28	75	99	50	93	122	221	269	50	93	122	221	269
338		0	12	20	53	69	30	55	72	131	159	30	55	72	131	159
339		8	58	95	256	339	109	217	283	546	685	109	217	283	546	685
340		11	82	139	456	683	195	569	825	1958	2576	212	591	857	2012	2648
341		25	77	137	562	792	180	515	739	1639	2137	198	540	765	1693	2175
342		35	82	122	328	462	205	429	579	1220	1554	210	443	598	1268	1624
343		6	47	80	229	312	97	210	283	573	721	97	210	283	573	721
344	(1)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
345		0	45	106	384	542	153	427	605	1350	1806	172	452	632	1404	1843
346		12	17	42	194	285	15	30	83	377	589	15	30	83	377	589
347		5	49	83	300	470	456	910	1214	2597	3416	592	1185	1583	3322	4262
348		24	52	72	155	202	68	133	174	337	420	68	133	174	337	420
349		19	37	47	88	108	19	37	47	88	108	19	37	47	88	108
350		5	57	100	342	534	509	1018	1367	2914	3839	757	1530	2061	4389	5708
351		27	124	211	690	1041	770	1576	2116	4714	6221	1008	2082	2817	6158	8085
352		30	72	108	268	354	30	74	110	272	357	30	74	110	272	357
353		46	138	219	683	1012	801	1596	2122	4679	6157	1039	2103	2826	6146	8049
354		75	128	161	282	341	75	128	161	282	341	75	128	161	282	341
355		2	28	47	137	198	159	322	433	929	1200	179	365	489	1049	1352
356		244	446	572	1087	1369	295	536	690	1355	1749	332	652	871	1820	2322
357		273	552	748	1661	2196	886	1868	2562	5710	7625	1161	2445	3348	7384	9749
358		0	0	0	0	0	0	0	0	10	48	34	70	92	183	230
359		71	97	113	175	207	71	97	113	175	207	71	97	113	175	207
360		33	58	73	133	164	50	82	102	174	212	50	82	102	174	212
361		9	108	473	1496	2067	848	2112	2695	5913	7727	1163	2472	3401	7460	9857
362	(1)	39	39	39	39	39	39	39	39	39	39	39	39	39	39	39
363		7	15	20	41	53	66	102	123	200	238	66	102	123	200	238
364		0	0	0	0	0	0	0	0	0	0	35	65	83	154	190
365		0	11	18	50	67	11	33	46	100	126	11	33	46	100	126
366		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
367		45	92	121	231	285	140	210	258	404	470	140	210	258	404	470
368		53	114	151	300	377	170	278	339	576	700	170	278	339	576	700
369		51	110	146	294	370	165	269	335	575	696	165	269	335	575	696
370		54	84	101	163	197	59	92	112	179	213	59	92	112	179	213
371		102	158	191	333	407	274	383	443	670	784	282	408	486	788	944
372		65	111	140	229	267	253	337	386	600	710	262	370	436	720	869

TABLE A-5 (CONTINUED)
BRIGHTON PEAK FLOW SUMMARY

SWMM Conv. Elnt		EXISTING DEVELOPMENT Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITH CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT WITHOUT CLOSED BASINS Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
373		139	233	284	462	559	275	393	457	684	805	285	410	491	789	944
374		16	61	95	239	311	16	65	97	243	315	16	65	97	243	315
375		80	135	170	292	352	87	142	173	295	355	87	142	173	295	355
376	(1)	8	17	22	38	38	38	38	38	38	38	38	38	38	38	38
377		5	11	16	39	54	55	93	116	215	270	55	93	116	215	270
378		5	30	49	134	179	232	336	399	593	688	232	336	399	593	688
379		3	29	47	123	162	75	144	182	331	411	75	144	182	331	411
380		29	66	89	179	223	155	228	277	426	496	155	228	277	426	496
381		0	9	14	34	46	65	101	121	195	233	65	101	121	195	233
382		9	92	147	384	523	300	541	682	1277	1605	300	541	683	1282	1612
383		27	115	187	526	787	808	1603	2122	4431	5814	1049	2111	2821	5911	7705
384		2	25	59	234	350	310	591	773	1530	1931	353	670	883	1769	2238
385		0	32	74	314	493	421	818	1079	2249	2962	538	1049	1388	2837	3606
386		0	7	12	35	48	22	47	62	125	156	22	47	62	125	156
387		0	7	13	45	65	44	90	120	251	320	210	443	611	1320	1761
388		0	0	0	0	0	0	0	0	0	2	36	68	87	167	208
389		26	65	90	211	310	309	577	742	1464	1878	309	577	745	1476	1918
390		3	22	35	89	116	42	86	112	214	317	103	221	302	650	861
391		5	19	32	94	133	40	93	127	265	336	105	229	317	690	917
392		1	14	26	86	125	58	132	182	404	523	115	256	359	784	1044
393		4	23	40	116	162	50	121	166	354	451	111	247	343	757	1008
394		0	0	0	0	87	0	0	0	214	387	84	178	241	506	651
396	(1)	80	86	86	86	86	86	86	86	86	86	86	86	86	86	86
397	(1)	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
398	(1)	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
399	(1)	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13

(1) Flows restricted by pipe capacity with overflow diverted to other conveyance elements

TABLE A-6
SUB-WATERSHED FLOW SUMMARY

Sub-Watershed Designation	EXISTING DEVELOPMENT					FUTURE DEVELOPMENT				
	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
1	12	84	130	305	395	43	134	183	373	478
2	5	11	17	48	61	31	58	74	135	166
3	4	19	29	69	89	9	35	51	117	150
4	1	30	49	128	166	70	132	172	307	377
5	2	46	74	193	251	104	199	254	447	554
6	0	8	14	38	51	24	49	65	124	153
7	4	15	22	52	67	35	61	76	135	165
8	0	13	22	58	76	31	58	74	134	165
9	0	21	35	95	126	63	119	151	274	339
10	82	153	201	366	443	89	162	212	378	458
11	0	8	13	36	47	25	47	59	108	133
12	2	33	53	143	188	121	207	267	459	549
13	0	9	14	39	52	26	51	65	120	149
14	0	9	15	47	66	33	59	75	140	179
15	3	27	42	106	137	14	51	73	166	212
16	2	11	17	42	55	3	15	22	54	70
17	2	20	32	83	109	31	74	101	202	253
18	4	22	34	82	105	6	32	48	117	150
19	0	15	25	66	87	13	38	53	117	148
20	0	25	40	108	142	68	125	166	304	367
21	0	9	15	44	60	35	62	78	144	177
22	0	11	18	46	61	33	60	78	137	167
23	0	24	39	105	138	86	149	193	340	406
24	0	14	23	61	80	34	64	81	147	182
25	0	13	22	60	79	41	79	101	186	230
26	0	6	10	29	42	27	49	61	109	138
27	0	10	18	50	67	37	68	87	162	200
28	0	9	14	38	50	20	37	48	87	107
29	4	27	42	103	133	47	90	116	212	262
30	0	16	27	74	98	48	92	116	210	261
31	0	12	19	53	70	84	124	151	234	271
32	9	17	22	41	51	17	33	43	79	97
33	16	38	51	97	121	27	50	63	115	142
34	5	15	21	49	62	30	57	73	134	166
35	18	38	49	89	109	18	36	47	89	109
36	125	199	244	387	470	138	213	257	397	482
37	0	17	28	75	99	50	93	122	221	269
38	0	12	20	53	69	30	55	72	131	159
39	5	22	33	78	100	49	87	111	198	241
40	3	39	61	155	202	111	194	240	412	491
41	14	32	43	86	109	32	55	68	120	147
42	35	65	82	139	170	50	90	113	199	245
43	2	11	16	38	50	24	42	53	92	112
44	100	181	239	432	520	100	181	239	432	520
45	4	9	12	24	30	10	20	26	48	59
46	33	67	86	151	185	30	60	78	147	181
47	0	3	6	16	22	15	29	37	68	85
48	18	37	48	93	118	31	60	78	148	184
49	19	39	51	88	108	19	37	47	88	108
50	0	11	19	53	71	40	75	97	178	218

TABLE A-6 (CONTINUED)
SUB-WATERSHED FLOW SUMMARY

Sub-Watershed Designation	EXISTING DEVELOPMENT					FUTURE DEVELOPMENT				
	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
51	24	44	56	99	123	24	42	54	99	123
52	20	37	48	85	105	20	36	45	85	105
53	38	73	94	166	205	39	72	91	167	207
54	2	9	13	32	42	2	13	20	49	63
55	0	3	5	14	20	14	27	35	64	79
56	24	44	55	101	125	29	52	67	124	154
57	61	109	137	247	306	60	108	136	247	305
58	64	116	150	271	329	64	116	150	271	329
59	33	61	77	137	169	33	59	74	137	169
60	33	60	76	133	164	50	82	102	174	212
61	7	20	28	62	80	11	29	40	85	107
62	70	126	160	284	348	70	126	160	284	348
63	7	15	21	41	53	66	102	123	200	238
64	0	11	18	50	67	11	33	46	100	126
66	44	75	91	144	173	50	79	97	158	188
67	45	92	121	231	285	140	210	258	404	470
68	55	110	141	261	325	96	162	209	358	425
69	0	9	14	36	47	57	83	98	150	178
70	54	94	114	163	197	59	92	112	179	213
72	0	3	6	17	22	27	40	48	76	91
73	111	185	228	385	460	165	247	302	471	549
74	16	32	41	72	90	16	30	38	72	90
75	61	113	144	258	318	61	113	144	258	318
76	9	17	23	44	57	54	80	95	148	175
77	5	10	14	29	38	43	65	78	127	152
78	0	26	44	118	155	217	311	367	531	616
79	0	12	19	51	68	34	63	81	153	188
80	29	66	89	179	223	155	228	276	421	489
81	0	9	13	31	41	61	93	111	173	206
82	0	18	30	85	112	149	222	266	414	492
83	0	7	11	25	34	25	47	60	107	132
84	2	21	34	91	120	16	43	60	132	169
85	0	8	14	40	55	36	66	84	157	193
86	0	7	12	35	48	22	47	62	125	156
87	0	6	10	31	42	29	55	71	135	168
88	7	46	67	150	194	87	171	219	383	460
89	0	5	9	27	37	41	67	83	144	176
90	3	22	35	89	116	42	86	112	214	266
91	5	17	25	57	74	6	22	32	72	91
92	0	7	12	35	47	26	48	61	115	143
93	2	10	15	37	49	13	32	45	96	121
94	0	7	13	37	50	35	65	83	154	190
95	0	6	11	30	41	21	39	51	97	120
96	1	10	15	36	47	30	56	71	128	157
97	0	7	13	35	47	24	46	60	112	137
98	0	5	9	27	37	23	43	55	104	129
99	4	26	42	109	143	99	171	212	362	444
100	3	29	47	123	162	75	144	182	331	411
101	2	27	45	121	160	61	124	161	305	378
102	0	5	8	21	28	5	17	25	56	71

TABLE A-6 (CONTINUED)
SUB-WATERSHED FLOW SUMMARY

Sub-Watershed Designation	EXISTING DEVELOPMENT Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	FUTURE DEVELOPMENT Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)
103	2	25	42	111	146	55	111	144	273	340
104	0	15	24	64	85	34	65	83	151	186
105	2	35	56	147	191	133	213	259	423	501
106	0	8	14	40	54	84	122	144	214	249
107	0	15	25	68	91	97	153	185	297	359
108	0	9	15	43	57	23	43	55	104	129
109	2	40	65	172	223	52	117	160	317	395
110	0	6	10	30	41	3	18	28	70	91
111	0	22	36	98	130	22	55	76	161	205
112	0	16	26	70	92	40	78	100	185	228
113	0	3	6	16	22	14	26	33	61	75
114	0	9	15	41	55	9	33	49	112	143
115	0	5	8	24	32	17	33	43	81	100
116	0	16	27	75	100	37	75	99	190	234
117	1	16	27	73	96	41	81	105	199	245
118	0	9	16	45	61	29	58	76	149	185
119	0	10	17	46	62	45	77	95	167	203
120	1	12	19	48	63	17	36	48	93	116
121	0	9	16	45	59	46	77	97	166	200
122	3	20	30	69	90	48	94	118	206	251
123	4	25	37	86	112	58	113	143	249	303
124	2	16	23	54	71	41	77	96	171	210
125	0	9	13	29	37	25	37	44	71	85
126	0	9	15	44	59	43	75	95	170	207
127	0	8	14	39	52	28	53	69	128	159



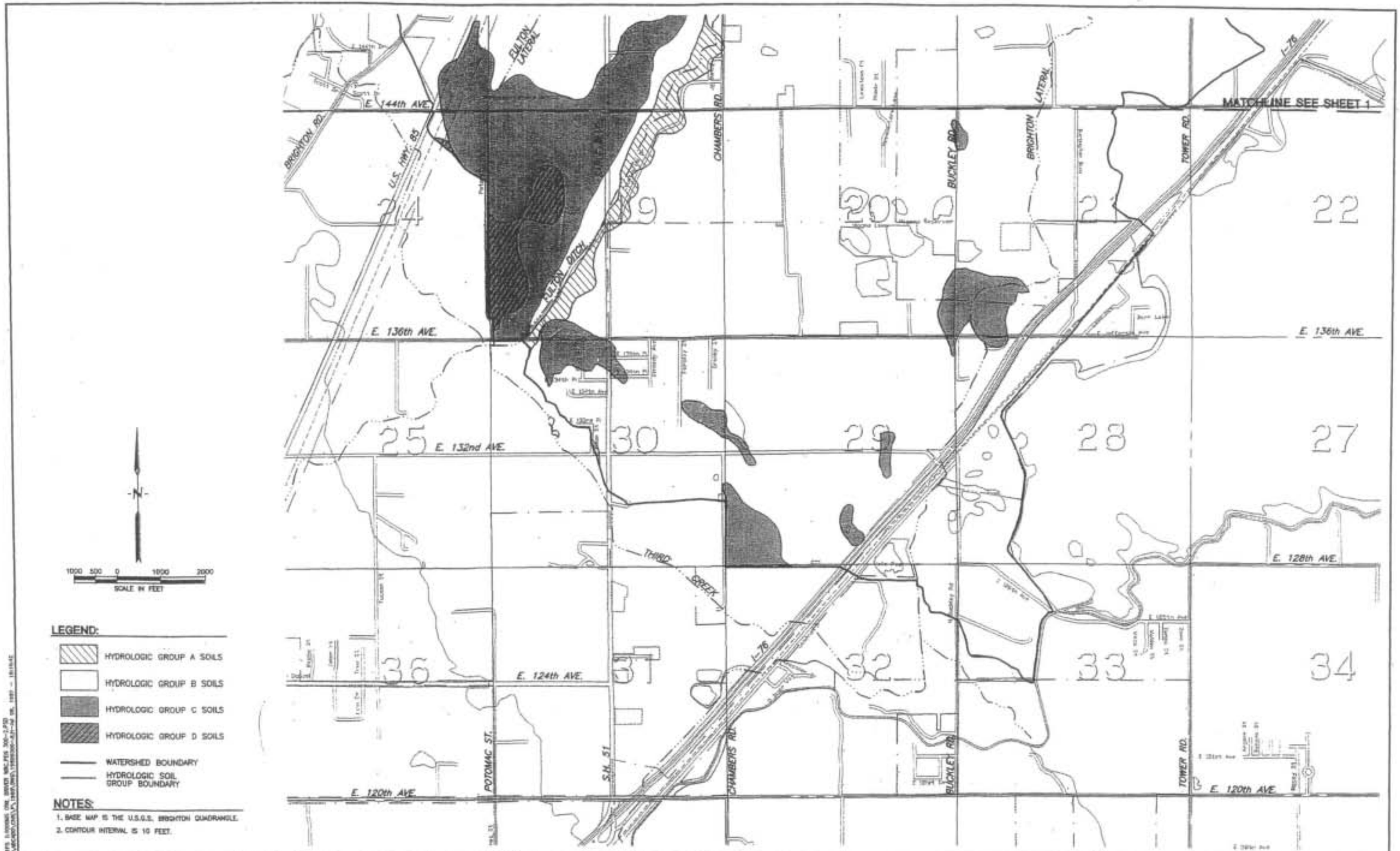
LEGEND:

- HYDROLOGIC GROUP A SOILS
- HYDROLOGIC GROUP B SOILS
- HYDROLOGIC GROUP C SOILS
- HYDROLOGIC GROUP D SOILS
- WATERSHED BOUNDARY
- HYDROLOGIC SOIL GROUP BOUNDARY

NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.

WRC ENGINEERING, INC. 800 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8013 FAX NO: (303) 758-3208	DESIGNED: DPK DATE: 06-17-96 DRAWN: E.M. DATE: 06-17-96 CHECKED: DATE: REVISED: DATE: AS-BUILT: DATE:	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	HYDROLOGIC SOILS GROUP MAP SHEET 1 OF 2	FIGURE A-1



WRC ENGINEERING, INC.
950 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80222
PHONE NO. (303) 757-8101
FAX NO. (303) 759-3284

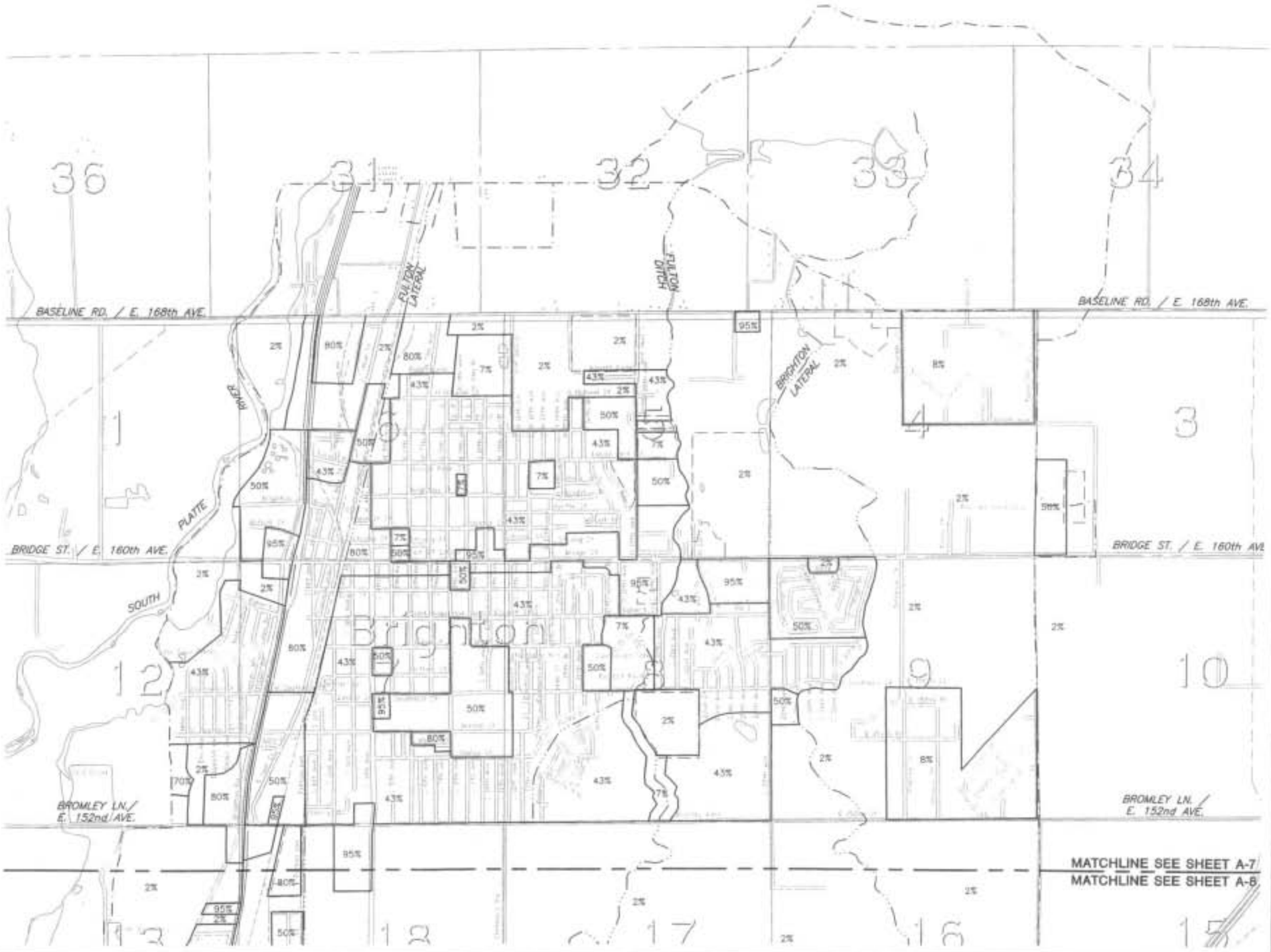
DESIGNED DPK DATE 08-17-94
DRAWN PJM DATE 08-17-94
CHECKED DATE
REVISED DATE
AS-BUILT DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

HYDROLOGIC SOILS GROUP MAP
SHEET 2 OF 2

FIGURE
A-2



N

1000 500 0 1000 2000
SCALE IN FEET

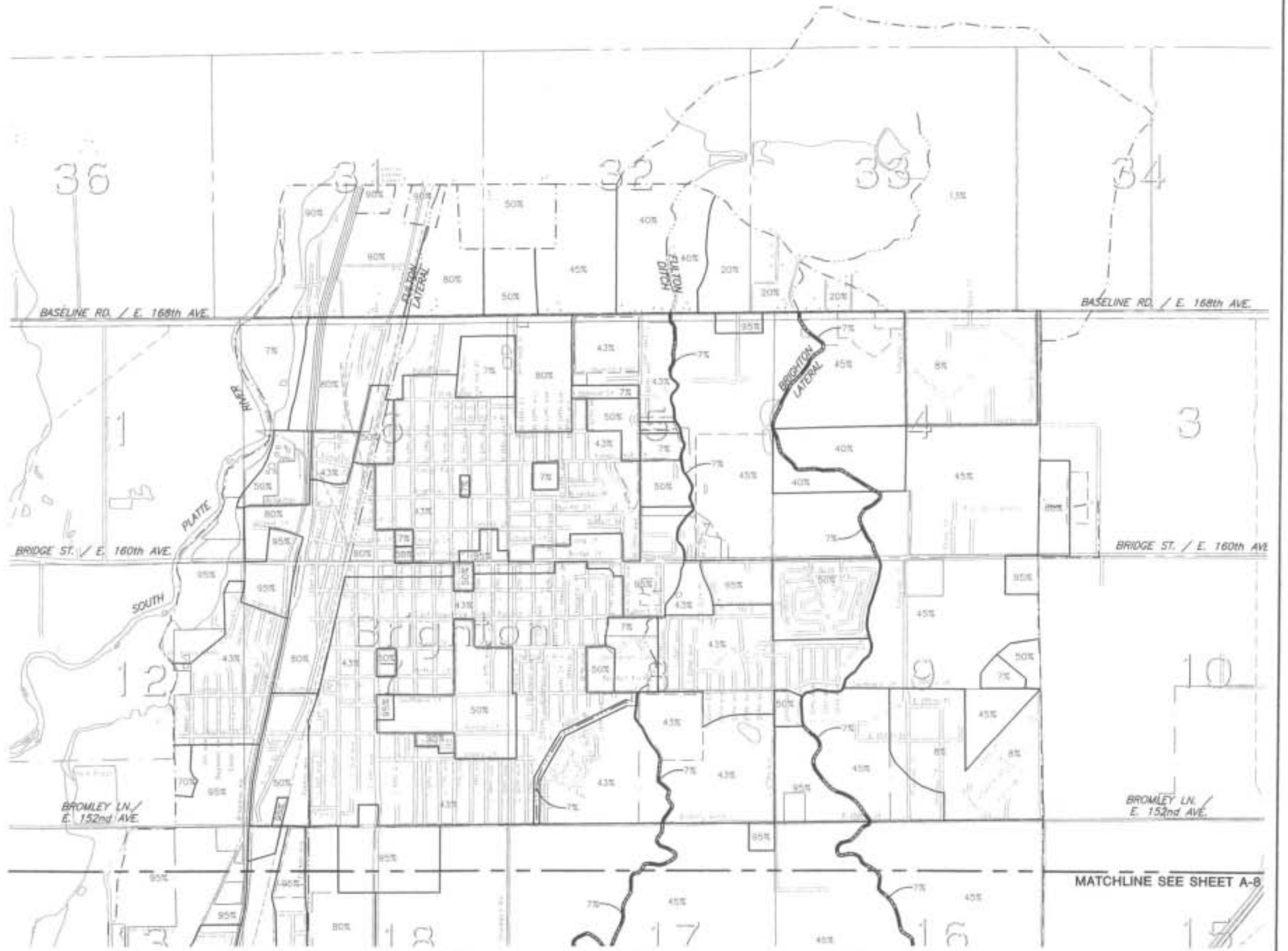
LEGEND:

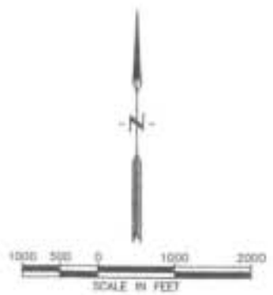
95%	COMMERCIAL, OFFICE
80%	INDUSTRIAL DISTRICT
50%	SCHOOLS & PUBLIC LAND
43%-15% 8%-5%	SINGLE FAMILY HOMES
7%	PARKS & OPEN SPACES
2%	AGRICULTURAL
	WATERSHED BOUNDARY

NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.

WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 758-3206	DESIGNED TTC DATE 3/28/05 DRAWN MKS DATE 6/28/05 CHECKED DATE REVISED APM DATE 7/19/06 AS-BUILT DATE	CITY OF BRIGHTON URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	EXISTING WATERSHED IMPERVIOUSNESS MAP SHEET 2 OF 2	DWG. NO. A-5

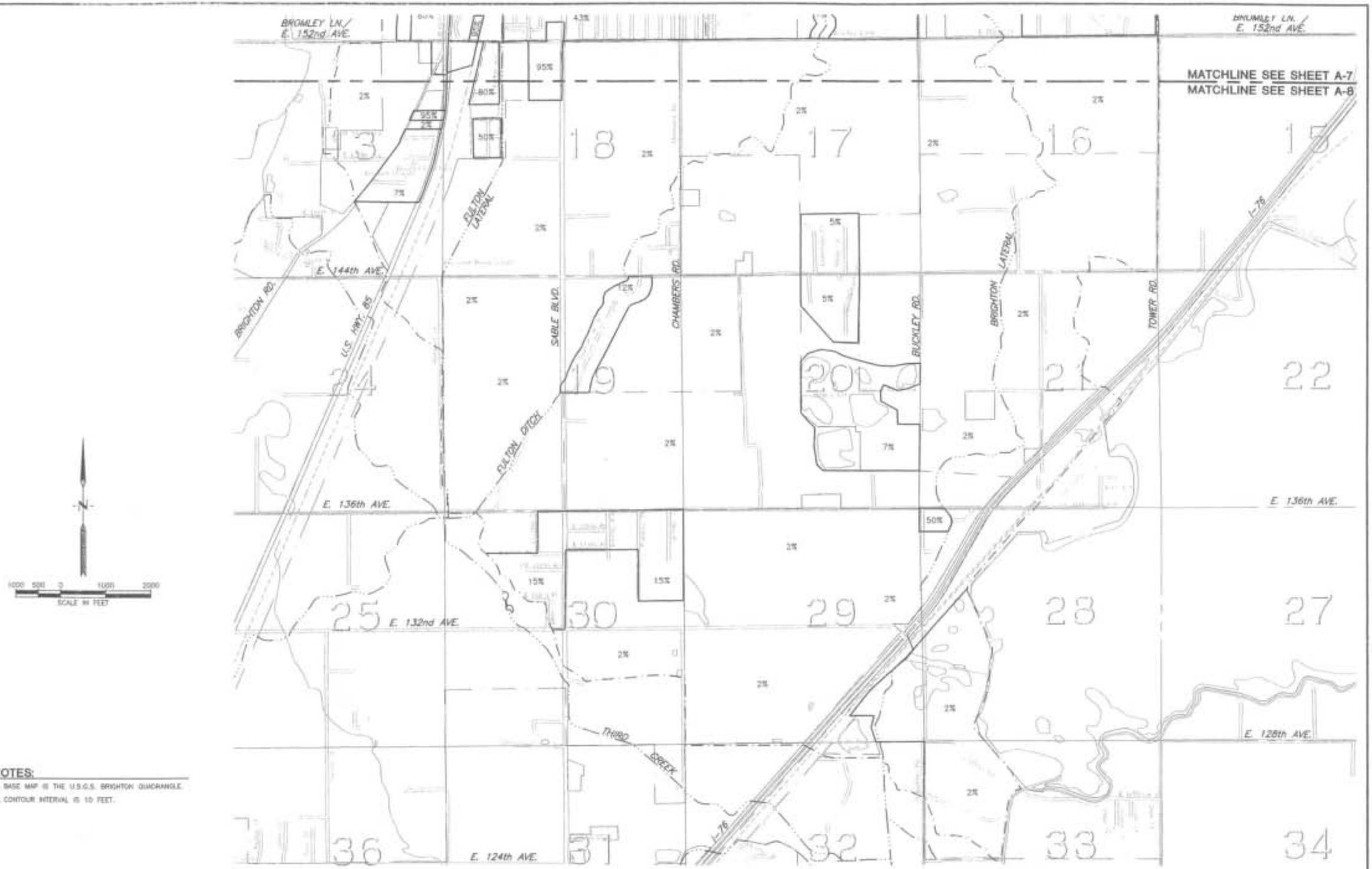




NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.

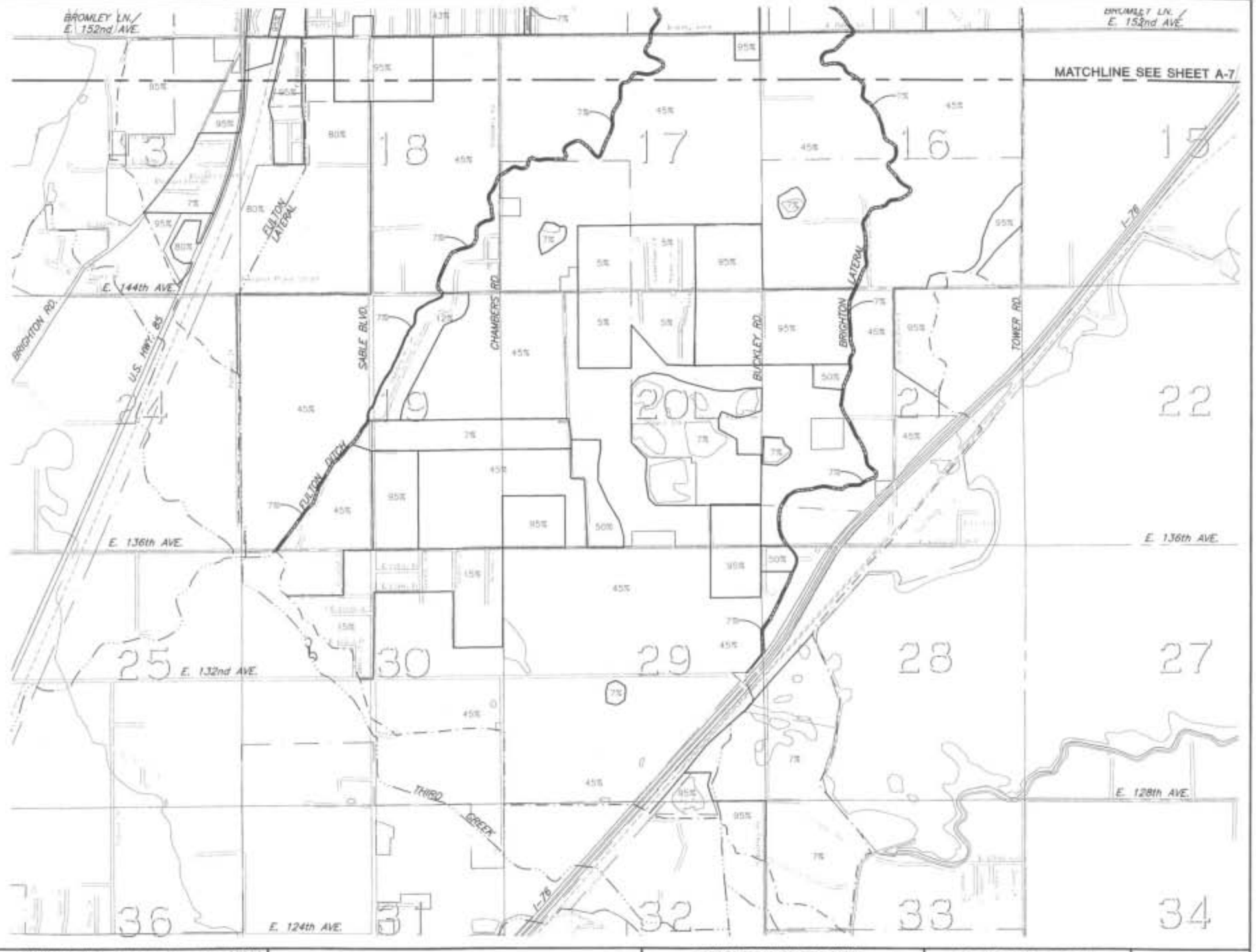
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404, DENVER, COLORADO 80222, PHONE NO: (303) 757-6913, FAX NO: (303) 759-3208	DESIGNED TTC DATE 1/28/05 DRAWN MAB DATE 1/28/05 CHECKED — DATE — REVISED APM DATE 2/24/05 AS-BUILT — DATE —	CITY OF BRIGHTON URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FUTURE WATERSHED IMPERVIOUSNESS MAP SHEET 1 OF 2	DWG. NO. A-7



NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.

	WRC ENGINEERING, INC. 1604 COLORADO BOULEVARD, SUITE 434 DENVER, COLORADO 80222 PHONE NO. (303) 757-8013 FAX NO. (303) 759-3310	DESIGNED TTC DATE 5/28/05 DRAWN MAS DATE 5/28/05 CHECKED ____ DATE ____ REVISED APM DATE 7/24/06 AS-BUILT ____ DATE ____	CITY OF BRIGHTON URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	EXISTING WATERSHED IMPERVIOUSNESS MAP SHEET 2 OF 2	DWG. NO. A-6



NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.

WRC ENGINEERING, INC.
350 SOUTH CHERRY STREET
SUITE 404
DENVER, COLORADO 80222
PHONE NO: (303) 757-8812
FAX NO: (303) 758-3998

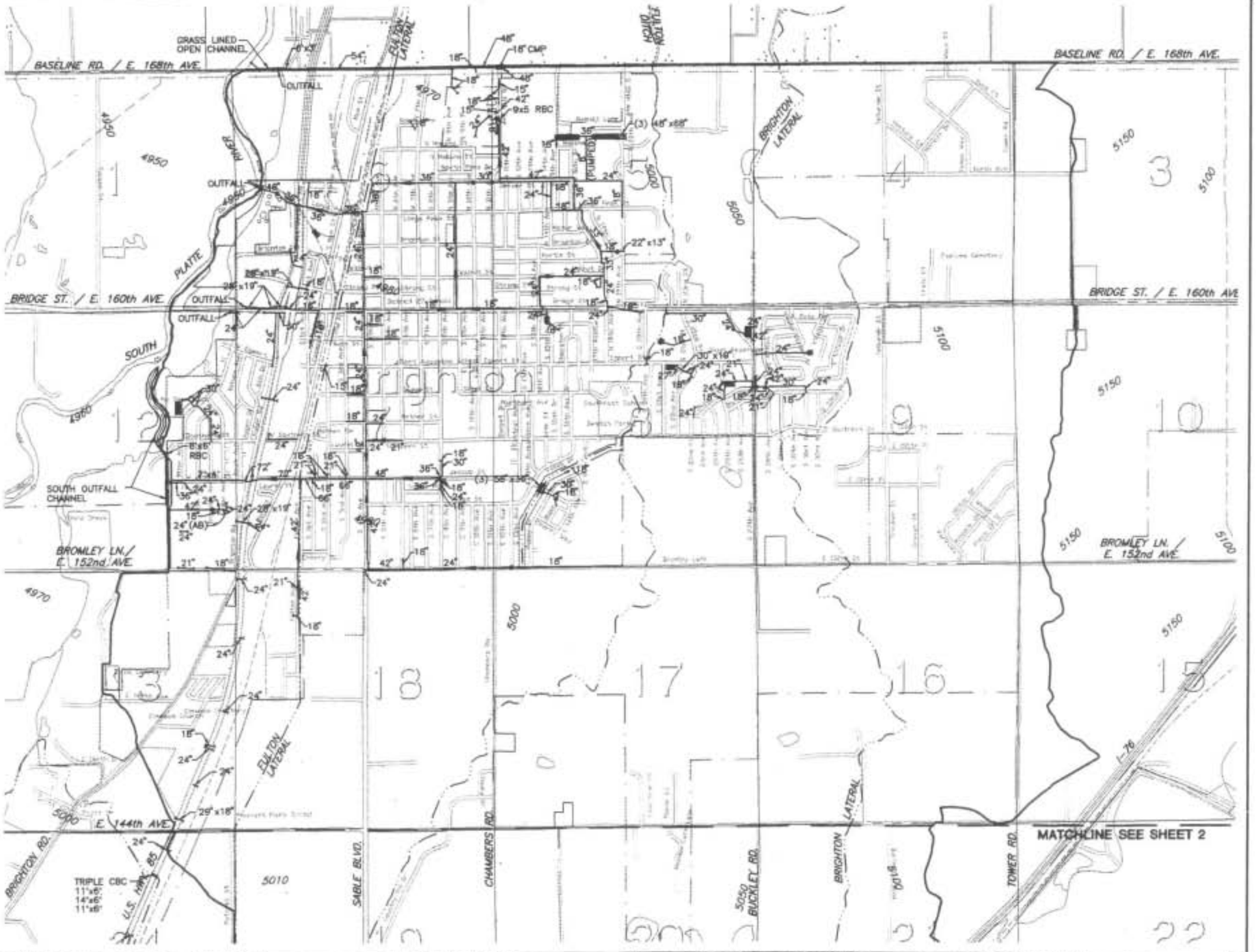
DESIGNED	TJC	DATE	3/28/08
DRAWN	MAS	DATE	3/28/08
CHECKED		DATE	
REVISED	AFM	DATE	4/24/09
AS-BUILT		DATE	

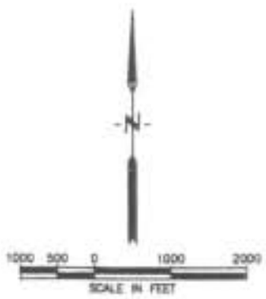
CITY OF BRIGHTON
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

FUTURE WATERSHED
IMPERVIOUSNESS MAP
SHEET 2 OF 2

DWG. NO.
A-8





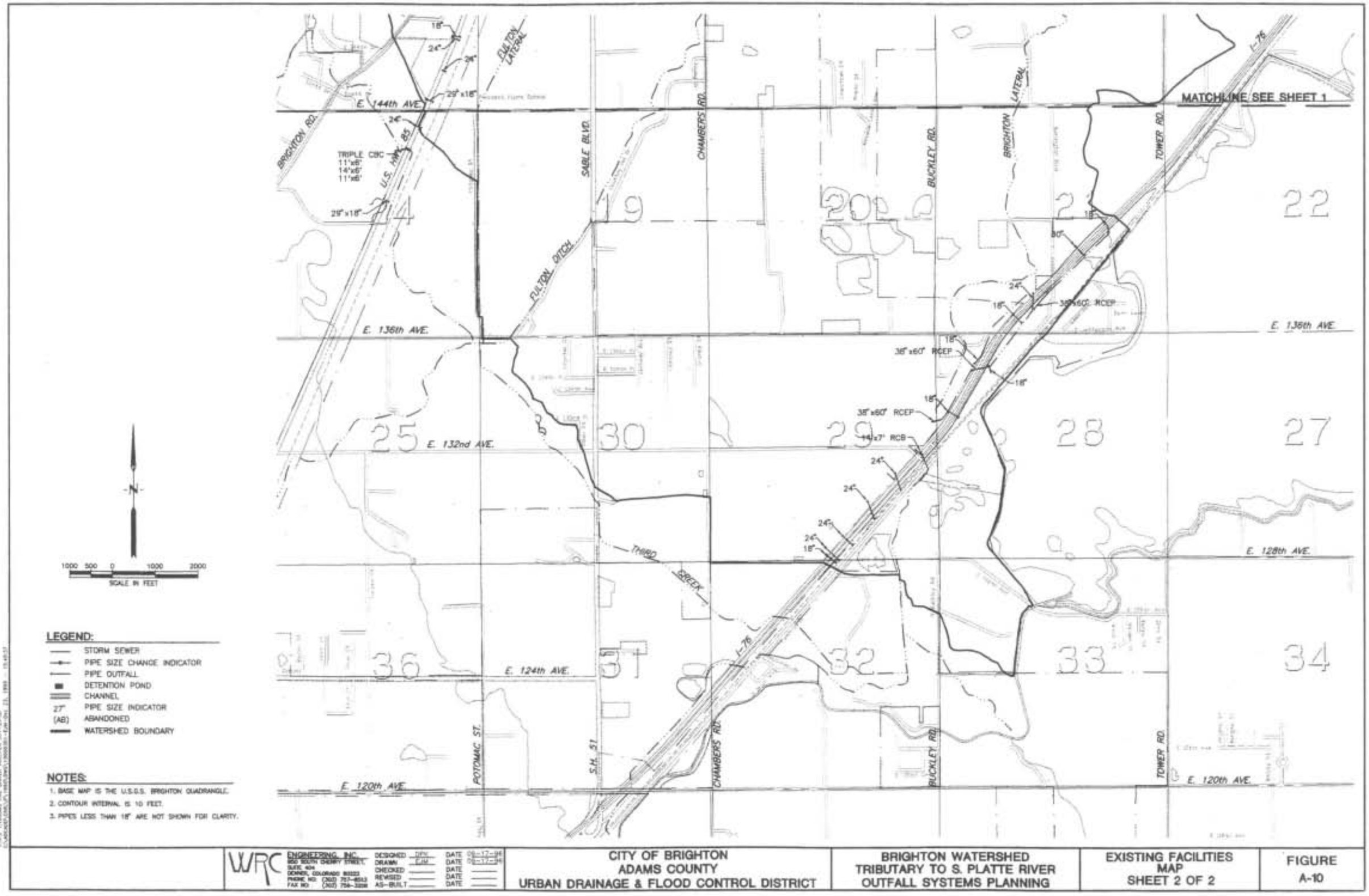
LEGEND:

- STORM SEWER
- PIPE SIZE CHANGE INDICATOR
- PIPE OUTFALL
- DETENTION POND
- CHANNEL
- 27" PIPE SIZE INDICATOR
- (AB) ABANDONED
- WATERSHED BOUNDARY

NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.
3. PIPES LESS THAN 18" ARE NOT SHOWN FOR CLARITY.

WRC ENGINEERING, INC. 850 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 756-3206	DESIGNED DPK DATE 09-17-96 DRAWN EJM DATE 09-17-96 CHECKED DATE REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	EXISTING FACILITIES MAP SHEET 1 OF 2	FIGURE A-9



LEGEND:

- STORM SEWER
- PIPE SIZE CHANGE INDICATOR
- PIPE OUTFALL
- DETENTION POND
- CHANNEL
- 27" PIPE SIZE INDICATOR
- (AB) ABANDONED
- WATERSHED BOUNDARY

NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.
3. PIPES LESS THAN 18" ARE NOT SHOWN FOR CLARITY.

WRC ENGINEERING, INC.
600 SOUTH CHERRY STREET, SUITE 404
DENVER, COLORADO 80222
PHONE NO: (303) 757-8513
FAX NO: (303) 758-3288

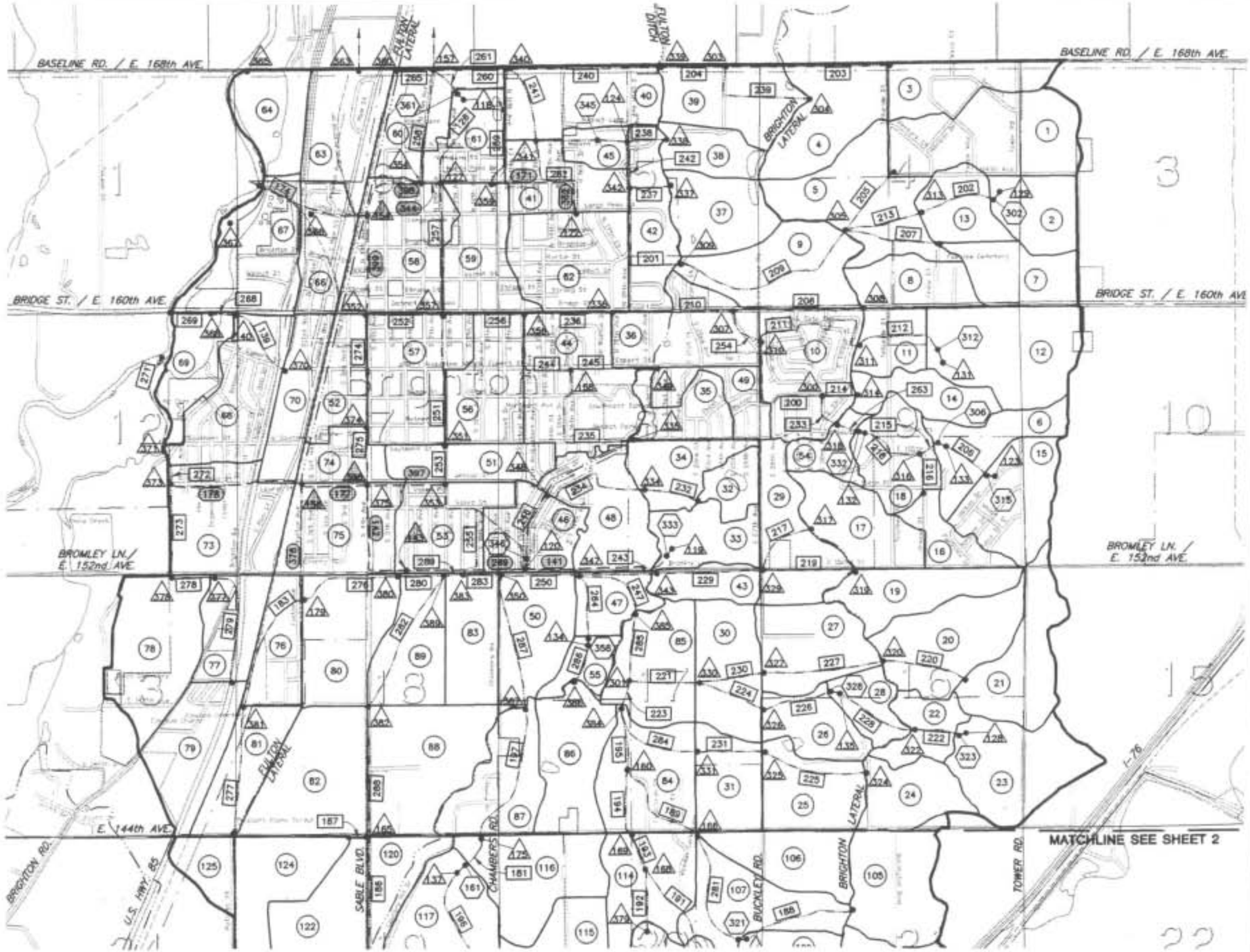
DESIGNED	DPK	DATE 06-17-94
DRAWN	EJM	DATE 06-17-94
CHECKED		DATE
REVISED		DATE
AS-BUILT		DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

EXISTING FACILITIES
MAP
SHEET 2 OF 2

FIGURE
A-10



1000 500 0 1000 2000
SCALE IN FEET

LEGEND:

- (25) SUB-WATERSHED DESIGNATION
- ● MODELLED OUTFLOW LOCATION
- △6 DESIGN POINT
- [2] CONVEYANCE ELEMENT
- (123) EXISTING DETENTION POND/CLOSED BASIN
- (111) DIVERSION ELEMENT
- WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY
- ROUTING PATH & SUB-WATERSHED DRAINAGEWAYS
- DIVERSION PATH

NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.

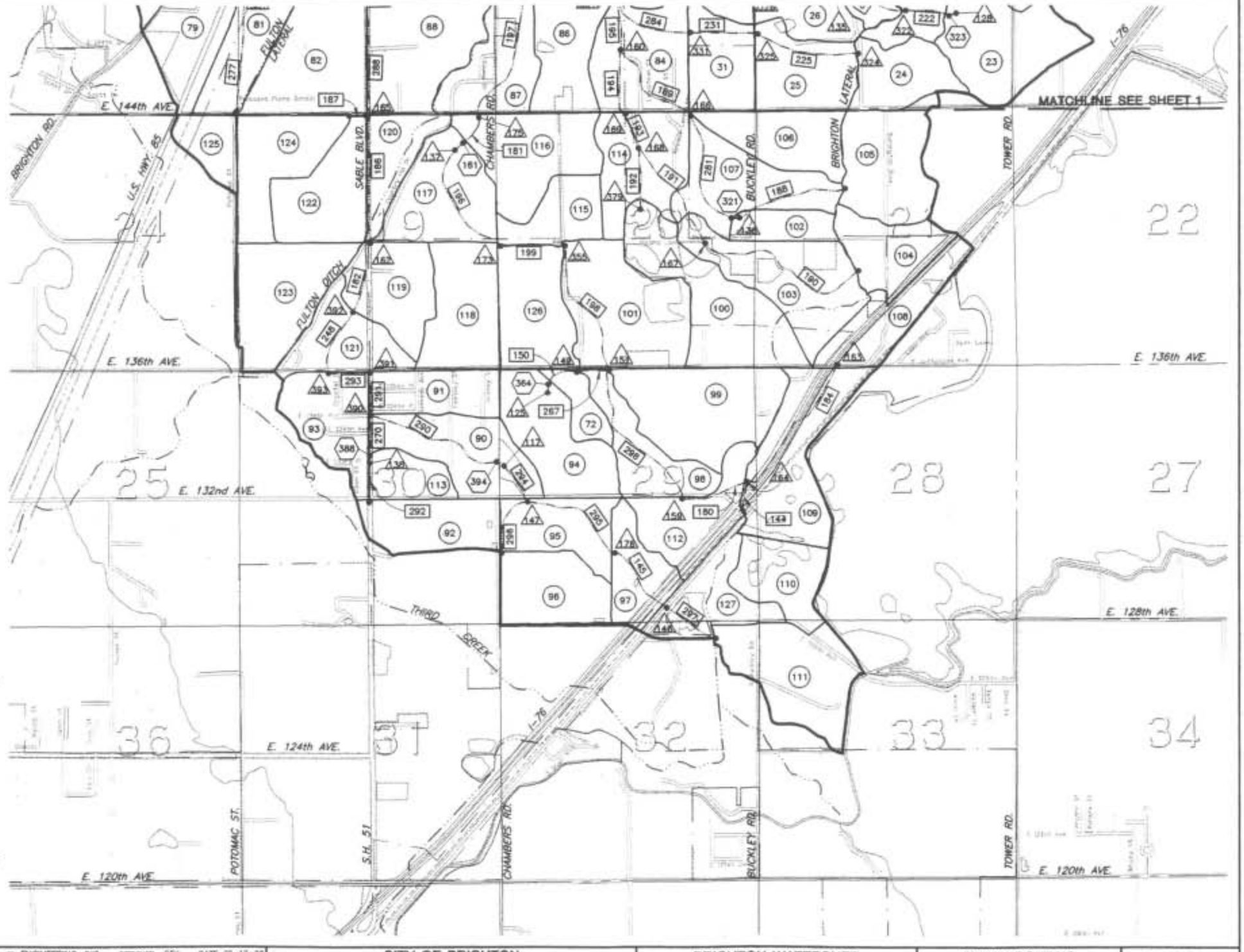
WRC ENGINEERING, INC.
DESIGNED DPK DATE 09-17-96
DRAWN DATE 10-08-96
CHECKED DATE
REVISED DATE
AS-BUILT DATE

CITY OF BRIGHTON
ADAMS COUNTY
URBAN DRAINAGE & FLOOD CONTROL DISTRICT

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

SWMM ROUTING
ELEMENTS MAP
SHEET 1 OF 2

FIGURE
A-11



1000 500 0 1000 2000
SCALE IN FEET

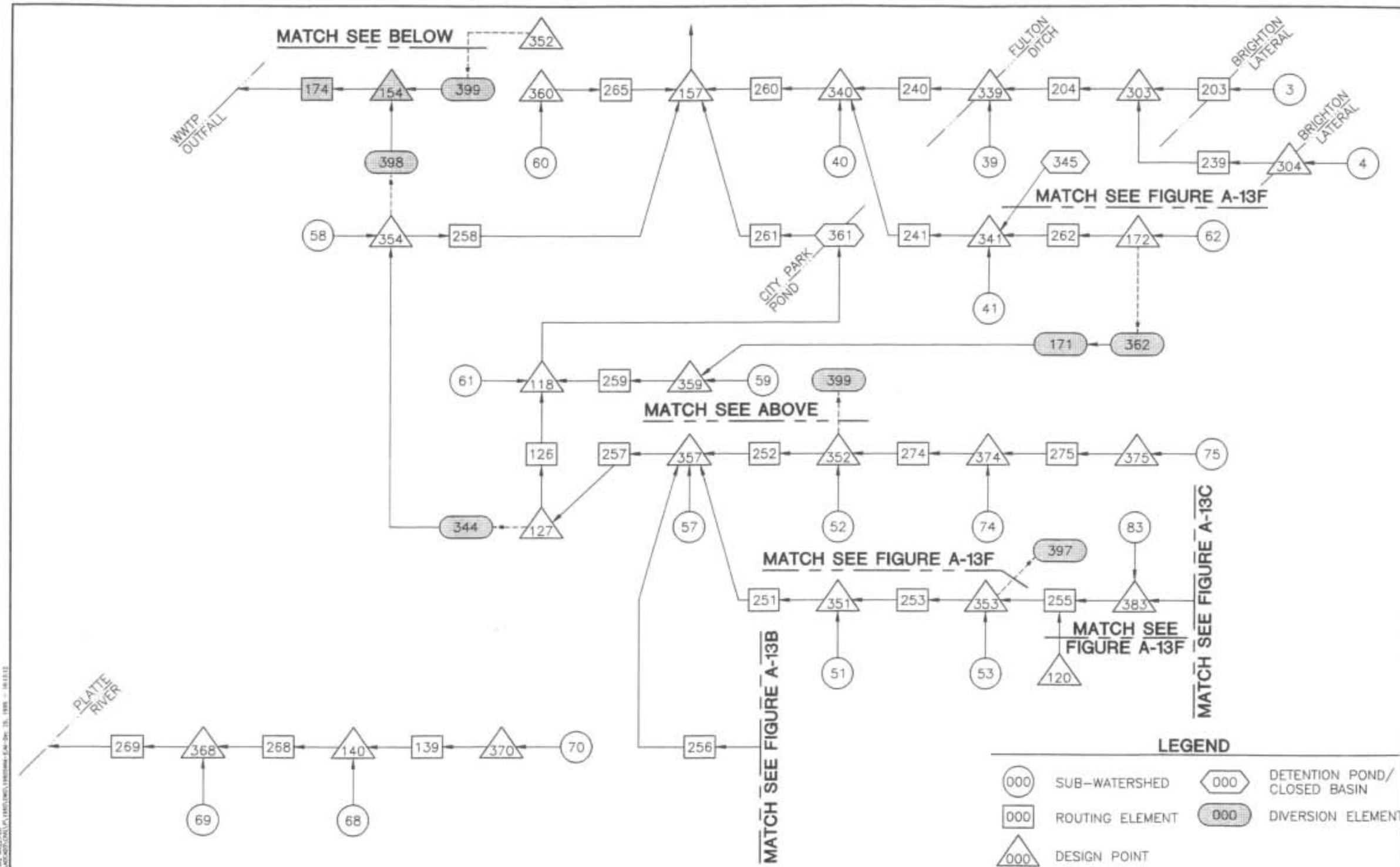
LEGEND:

- (25) SUB-WATERSHED DESIGNATION
- ● MODELLED OUTFLOW LOCATION
- △6 DESIGN POINT
- [2] CONVEYANCE ELEMENT
- ⟨123⟩ EXISTING DETENTION POND/CLOSED BASIN
- (111) DIVERSION ELEMENT
- WATERSHED BOUNDARY
- SUB-WATERSHED BOUNDARY
- ROUTING PATH & SUB-WATERSHED DRAINAGEWAYS
- DIVERSION PATH

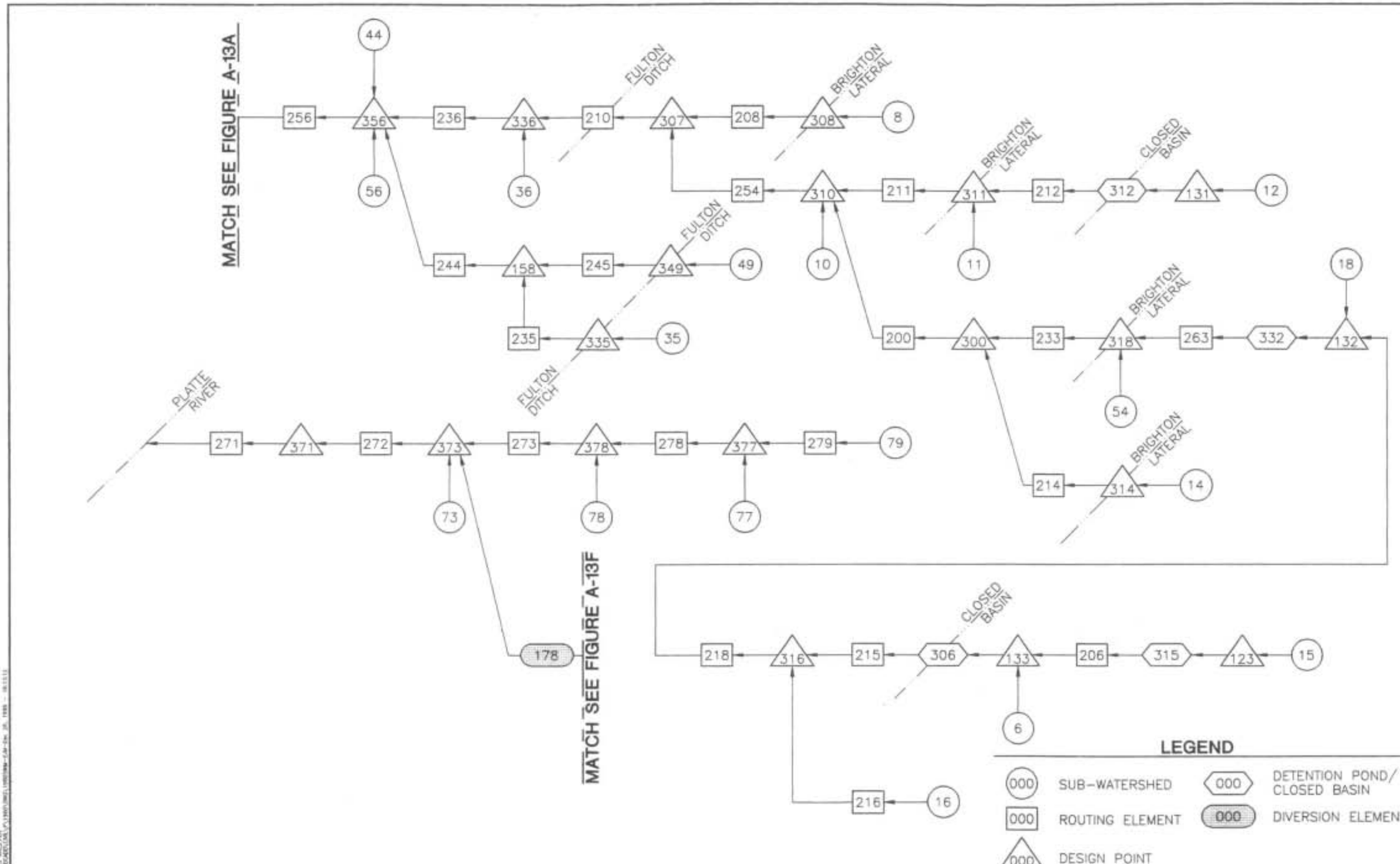
NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.

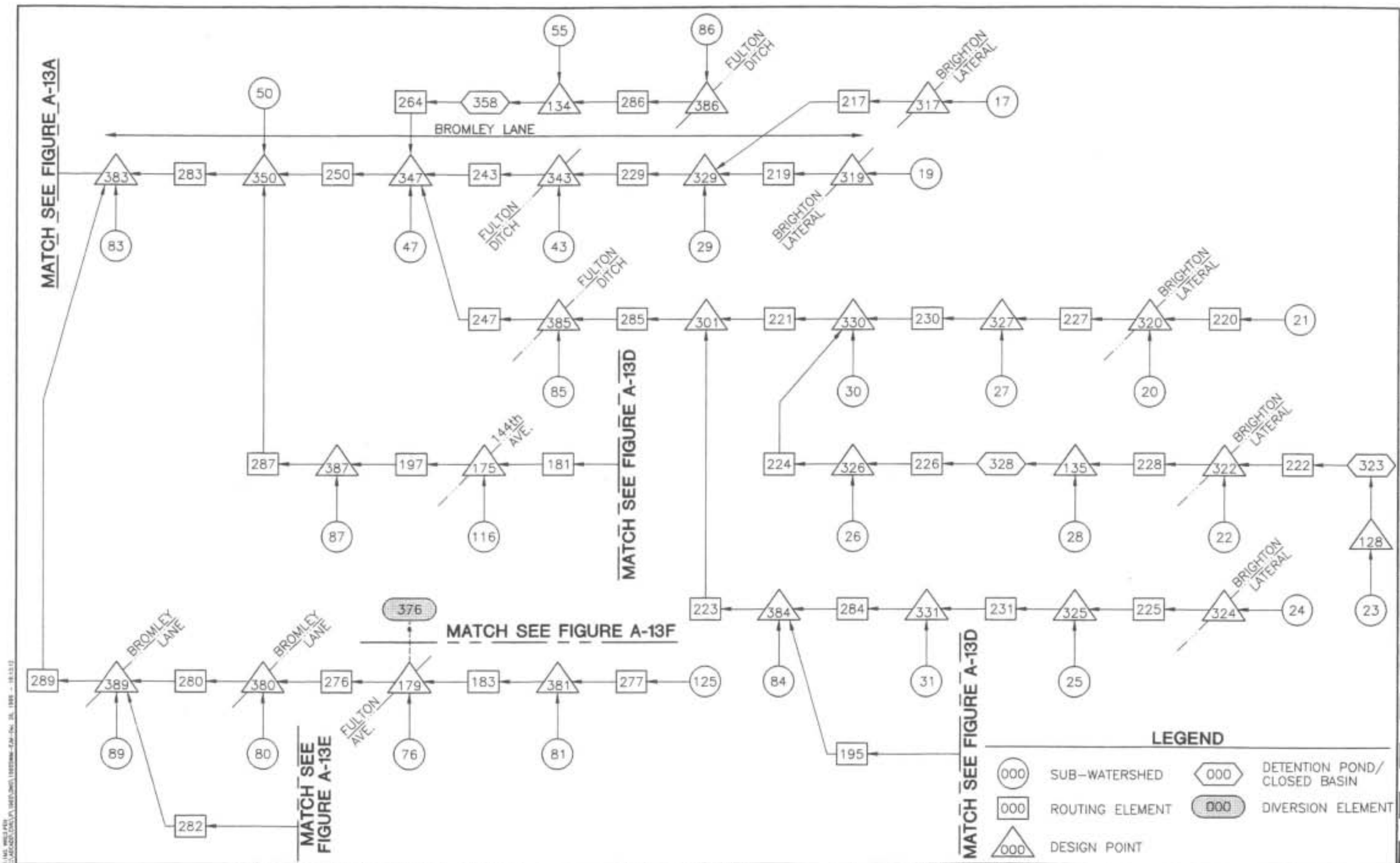
WRC ENGINEERING, INC. 850 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 758-3208	DESIGNED DPK DATE 09-17-96 DRAWN EJM DATE 10-08-96 CHECKED DATE REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	SWMM ROUTING ELEMENTS MAP SHEET 2 OF 2	FIGURE A-12



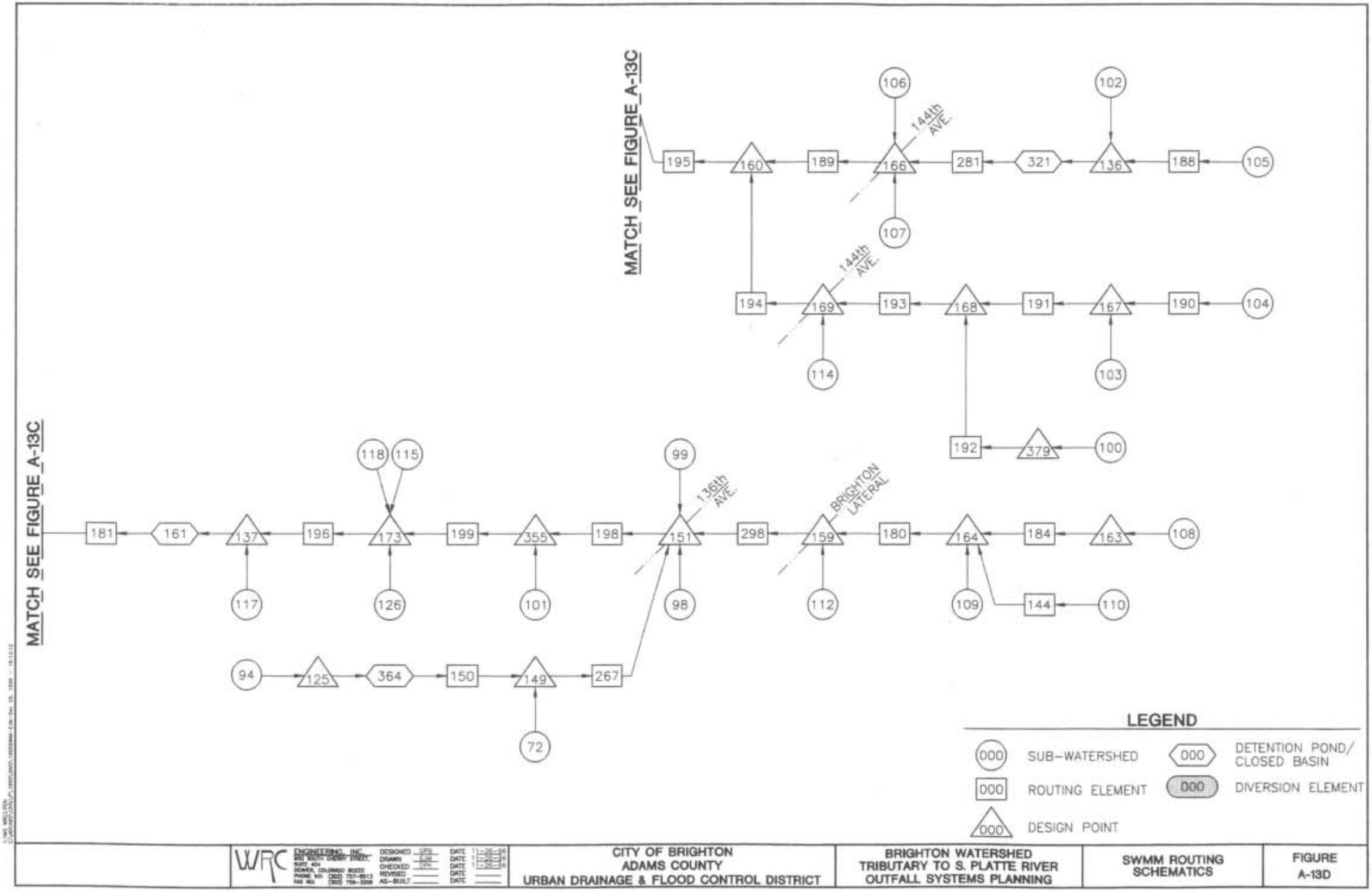
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 756-3208	DESIGNED GPB DRAWN EJM CHECKED DPK REVISED AS-BUILT	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	SWMM ROUTING SCHEMATICS	FIGURE A-13A



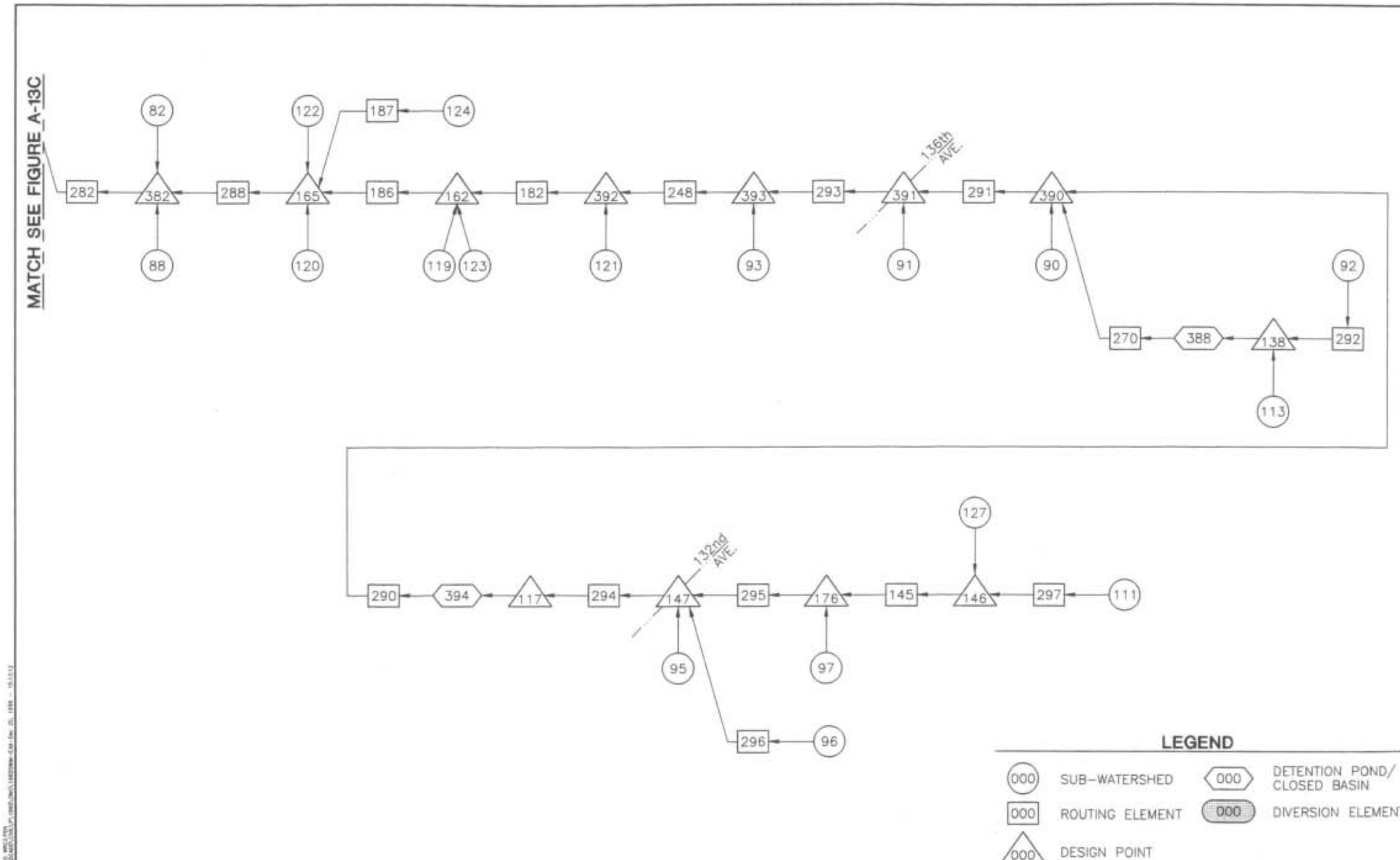
WRC ENGINEERING, INC.	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	SWMM ROUTING SCHEMATICS	FIGURE A-13B



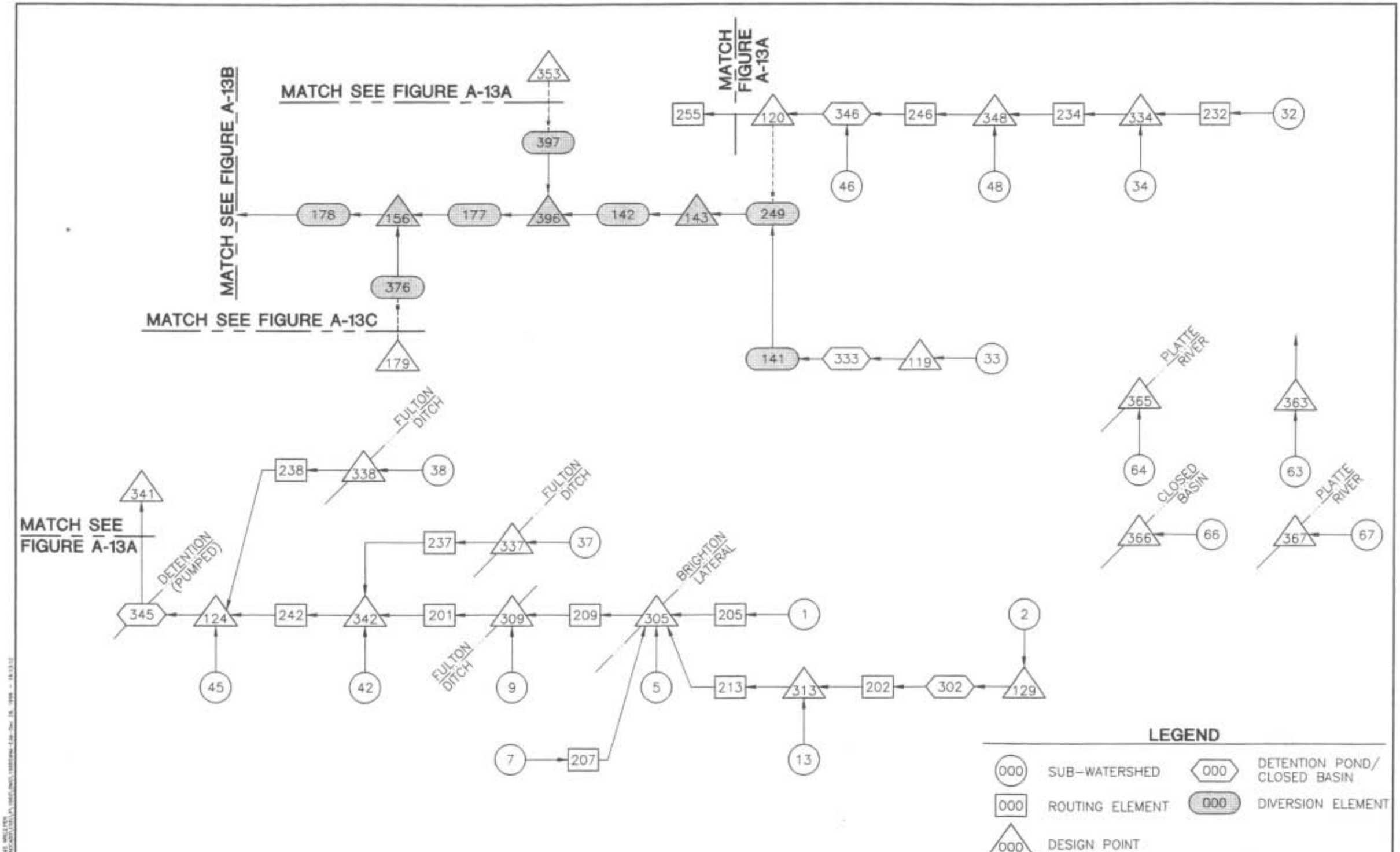
WRC ENGINEERING, INC.	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	SWMM ROUTING SCHEMATICS	FIGURE A-13C



WRC ENGINEERING, INC. 1900 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 759-3208	DESIGNED GPS DATE 11-26-96 DRAWN EJM DATE 11-26-96 CHECKED DPK DATE 11-26-96 REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	SWMM ROUTING SCHEMATICS	FIGURE A-13D



WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-6013 FAX NO: (303) 758-3288	DESIGNED GPB DATE 11-26-96 DRAWN EJM DATE 11-26-96 CHECKED SPK DATE 11-26-96 REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	SWMM ROUTING SCHEMATICS	FIGURE A-13E



WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 758-3208	DESIGNED GPB DRAWN EJM CHECKED TPH REVISED AS-BUILT	DATE 11-26-96 DATE 11-26-96 DATE 11-26-96 DATE DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	SWMM ROUTING SCHEMATICS	FIGURE A-13F

APPENDIX B

ALTERNATIVES DEVELOPMENT AND SELECTION FIGURES AND TABLES

TABLE B-1
SUB-REGIONAL DETENTION POND COST ESTIMATE - SOUTH AREA

Pond Designation	SWMM Element Number	Estimated Volume (af)	Estimated Land Requirement (ac)	Estimated Construction Cost (1)	Construction Contingencies and Engineering (2)	Assigned Land Value (3)	Total Estimated Cost
A	10	10.6	6.7	$173,379	$86,689	$197,185	$457,254
B	394	21	12.4	$316,437	$158,219	$365,942	$840,597
C	11	47.5	26.6	$679,654	$339,827	$783,139	$1,802,620
D	14	48.5	27.2	$693,342	$346,671	$798,703	$1,838,716
E	13	19.1	11.4	$290,338	$145,169	$335,472	$770,979
F	21	36.7	20.9	$531,757	$265,878	$614,393	$1,412,028
G	15	32.4	18.6	$472,830	$236,415	$546,802	$1,256,048
H	16	18.3	11.0	$279,346	$139,673	$322,605	$741,623
I	18	53	29.5	$754,927	$377,464	$868,636	$2,001,027
J	19	37.3	21.2	$539,977	$269,988	$623,804	$1,433,769
K	20	29.7	17.1	$435,815	$217,907	$504,211	$1,157,934
L	22	41.8	23.6	$601,613	$300,807	$694,239	$1,596,659
M	48	44.3	24.9	$635,846	$317,923	$733,270	$1,687,039
N	24	31.7	18.2	$463,235	$231,618	$535,772	$1,230,625
O	25	20.4	12.1	$308,197	$154,098	$356,333	$818,628
P	17	32.5	18.7	$474,201	$237,101	$548,377	$1,259,679
Q	12	32	18.4	$467,347	$233,674	$540,500	$1,241,521
R	26	33	18.9	$481,054	$240,527	$556,250	$1,277,832
S	23	33.5	19.2	$487,907	$243,954	$564,119	$1,295,980
Total		623.3	356.8	$9,087,204	$4,543,602	$10,489,752	$24,120,557

TABLE B-2
SUB-REGIONAL DETENTION POND COST ESTIMATE - EAST AREA
ALTERNATIVES No. 1E AND 2E

Pond Designation	SWMM Element Number	Estimated Volume (af)	Estimated Land Requirement (ac)	Estimated Construction Cost (1)	Construction Contingencies and Engineering (2)	Assigned Land Value (3)	Total Estimated Cost
Alternative No. 1E							
T	27	35.9	20.5	$520,796	$260,398	$601,838	$1,383,032
U	28	30.9	17.8	$452,268	$226,134	$523,156	$1,201,558
V	64	28.3	16.4	$416,616	$208,308	$482,075	$1,107,000
W	51	52.2	29.1	$743,980	$371,990	$856,216	$1,972,186
X	52	29.4	17.0	$431,701	$215,851	$499,471	$1,147,023
Total (Alternative No. 1E)		176.7	100.8	$2,565,361	$1,282,681	$2,962,756	$6,810,798
Alternative No. 2E							
T	27	44.7	25.2	$641,322	$320,661	$739,509	$1,701,493
U	28	36.9	21.0	$534,497	$267,248	$617,530	$1,419,276
V	64	34.7	19.8	$504,353	$252,176	$582,989	$1,339,518
W	51	63.9	35.3	$904,038	$452,019	$1,037,413	$2,393,470
X	52	35.9	20.5	$520,796	$260,398	$601,838	$1,383,032
Total (Alternative No. 2E)		216.1	121.7	$3,105,005	$1,552,503	$3,579,281	$8,236,789

Notes: (1) Estimated Construction Cost includes excavation, seeding and mulching, and $25,000 for spillway.
(2) Construction Contingencies and Engineering includes: 25% for contingencies; 10% for engineering; 10% for legal and administration; and 5% for contractor mobilization.
(3) Assigned Land Value includes: 25% for contingencies; 10% for legal and administration.

TABLE B-3
ALTERNATIVE No.1S
CONVEYANCE ELEMENT COST ESTIMATE - SOUTH AREA

SWMM Element Number	Flow Rate (cfs)	Conveyance Description: Conveyance Type	Length (ft)	slope (ft/ft)	Diam (in) or BW (ft)	unit cost ($/lf) (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Est. R.O.W. Req. (ft)	Est. Land Req. (ac) (3)	Assigned Land Value (4)	Total Estimated Cost
30	111	channel	1250	0.004	4	25	$31,221	$15,611	40	1.1	$33,750	$80,582
31	137	channel	7400	0.002	7	28	$206,924	$103,462	40	6.8	$199,800	$510,185
32	234	channel	7100	0.004	4	21	$148,576	$74,288	45	7.3	$215,663	$438,527
33	259	channel	4100	0.006	8	20	$81,130	$40,565	45	4.2	$124,538	$246,232
34	92	pipe	3820	0.008	48	125	$477,500	$238,750	0	0.0	$0	$716,250
35	378	channel	2660	0.003	10	32	$85,464	$42,732	50	3.1	$89,775	$217,971
36	470	channel	2450	0.003	9	37	$91,740	$45,870	55	3.1	$90,956	$228,566
37	1590	channel	2670	0.001	85	155	$413,086	$206,543	135	8.3	$243,304	$862,933
38	1971	channel	2500	0.001	107	188	$469,199	$234,599	160	9.2	$270,000	$973,798
39	280	channel	1350	0.002	4	31	$41,774	$20,887	50	1.5	$45,563	$108,223
40	595	channel	1620	0.015	4	25	$41,021	$20,510	45	1.7	$49,208	$110,738
41	119	pipe	3700	0.006	54	150	$555,000	$277,500	0	0.0	$0	$832,500
42	417	RCBC	2625	0.01	6(w)x5(h)	351	$920,370	$460,185	25	1.5	$44,297	$1,424,852
43	302	channel	3220	0.014	4	16	$52,359	$26,180	40	3.0	$86,940	$165,479
44	120	channel	1350	0.005	4	12	$16,707	$8,353	35	1.1	$31,894	$56,954
45	245	pipe	2670	0.008	66	175	$467,250	$233,625	0	0.0	$0	$700,875
46	795	channel	860	0.002	23	65	$55,577	$27,788	75	1.5	$43,538	$126,903
47	940	RCBC	2440	0.011	11(w)x5(h)	499	$1,216,988	$608,494	35	2.0	$57,645	$1,883,126
50	236	pipe	1670	0.008	66	175	$292,250	$146,125	0	0.0	$0	$438,375
53	173	pipe	600	0.01	60	163	$97,800	$48,900	0	0.0	$0	$146,700
54	116	channel	750	0.005	10	12	$9,307	$4,653	35	0.6	$17,719	$31,679
55	282	channel	2600	0.004	7	24	$61,642	$30,821	45	2.7	$78,975	$171,438
56	639	channel	1300	0.003	11	47	$60,511	$30,256	60	1.8	$52,650	$143,417
57	196	pipe	1400	0.005	66	175	$245,000	$122,500	0	0.0	$0	$367,500
58	175	channel	2700	0.003	7	19	$50,903	$25,451	40	2.5	$72,900	$149,254
66	468	channel	760	0.004	11	34	$25,920	$12,960	55	1.0	$28,215	$67,096
181	291	channel	700	0.004	4	25	$17,725	$8,862	45	0.7	$21,263	$47,850
186	430	RCBC	2650	0.009	7(w)x5(h)	380	$1,007,654	$503,827	25	1.5	$44,719	$1,556,200
192	165	channel	1050	0.005	4	16	$16,893	$8,446	40	1.0	$28,350	$53,689
193	165	channel	550	0.009	4	16	$8,848	$4,424	40	0.5	$14,850	$28,123
194	137	channel	1300	0.005	6	13	$17,506	$8,753	35	1.0	$30,713	$56,972
196	118	RCBC	2800	0.001	6(w)x5(h)	351	$981,728	$490,864	25	1.6	$47,250	$1,519,843
199	341	channel	1450	0.006	7	24	$34,080	$17,040	45	1.5	$44,044	$95,164
217	237	pipe	1411	0.02	60	163	$229,993	$114,997	0	0.0	$0	$344,990
219	145	channel	1870	0.015	4	12	$22,688	$11,344	35	1.5	$44,179	$78,211
220	166	pipe	1750	0.008	60	163	$285,250	$142,625	0	0.0	$0	$427,875
221	239	pipe	1390	0.008	66	175	$243,250	$121,625	0	0.0	$0	$364,875
222	404	RCBC	950	0.017	5(w)x5(h)	321	$304,938	$152,469	25	0.5	$16,031	$473,439
225	156	pipe	2200	0.016	54	150	$330,000	$165,000	0	0.0	$0	$495,000
226	563	RCBC	1400	0.014	7(w)x5(h)	380	$532,346	$266,173	25	0.8	$23,625	$822,144
227	383	RCBC	2450	0.016	5(w)x5(h)	321	$786,420	$393,210	25	1.4	$41,344	$1,220,973

TABLE B-3 (CONTINUED)
ALTERNATIVE No.1S
CONVEYANCE ELEMENT COST ESTIMATE - SOUTH AREA

SWMM Element Number	Flow Rate (cfs)	Conveyance Description: Conveyance Type	Length (ft)	slope (ft/ft)	Diam (in) or BW (ft)	unit cost ($/lf) (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Est. R.O.W. Req. (ft)	Est. Land Req. (ac) (3)	Assigned Land Value (4)	Total Estimated Cost
228	493	RCBC	1800	0.01	7(w)x5(h)	380	$684,444	$342,222	25	1.0	$30,375	$1,057,042
229	616	channel	2250	0.017	4	25	$56,973	$28,487	45	2.3	$68,344	$153,803
231	351	RCBC	1350	0.01	6(w)x5(h)	351	$473,333	$236,667	25	0.8	$22,781	$732,781
248	231	RCBC	1400	0.004	6(w)x5(h)	351	$490,864	$245,432	25	0.8	$23,625	$759,921
267	540	channel	750	0.005	7	35	$25,893	$12,946	55	0.9	$27,844	$66,683
270	208	channel	750	0.011	4	16	$12,066	$6,033	40	0.7	$20,250	$38,349
277	231	RCBC	2650	0.003	6(w)x5(h)	351	$929,136	$464,568	25	1.5	$44,719	$1,438,422
278	150	channel	850	0.016	4	12	$10,313	$5,156	35	0.7	$20,081	$35,550
279	177	RCBC	2500	0.002	6(w)x5(h)	351	$876,543	$438,272	25	1.4	$42,188	$1,357,002
283	2115	channel	2100	0.01	50	79	$166,604	$83,302	90	4.3	$127,575	$377,482
284	539	RCBC	1340	0.005	10(w)x5(h)	469	$628,642	$314,321	25	0.8	$22,613	$965,575
288	157	channel	2650	0.003	6	18	$46,470	$23,235	40	2.4	$71,550	$141,256
290	237	channel	2900	0.004	10	21	$61,997	$30,998	45	3.0	$88,088	$181,082
291	415	channel	950	0.003	4	37	$35,265	$17,633	55	1.2	$35,269	$88,166
293	502	channel	800	0.008	6	28	$22,275	$11,138	50	0.9	$27,000	$60,413
294	347	RCBC	900	0.007	6(w)x5(h)	351	$315,556	$157,778	25	0.5	$15,188	$488,521
295	97	pipe	2850	0.004	54	150	$427,500	$213,750	0	0.0	$0	$641,250
296	140	channel	1300	0.002	7	19	$24,174	$12,087	40	1.2	$35,100	$71,361
297	53	pipe	1650	0.007	42	100	$165,000	$82,500	0	0.0	$0	$247,500
298	157	pipe	3200	0.006	60	163	$521,600	$260,800	0	0.0	$0	$782,400
Totals Alternative No.1S							$17,009,187	$8,504,594		100.5	$2,956,281	$28,470,062

Notes: (1) Channel unit cost includes excavation and seeding and mulching for the estimated right-of-way width
(2) Construction Contingencies and Engineering includes: 25% for contingencies; 10% for engineering; 10% for legal and administration; and 5% for contractor mobilization
(3) Pipes were assumed to be located in dedicated street right-of-way and installed prior to street construction
(4) Assigned Land Value includes: 25% for contingencies; 10% for legal and administration

TABLE B-4
ALTERNATIVE No.2S
CONVEYANCE ELEMENT COST ESTIMATE - SOUTH AREA

SWMM Element Number	Flow Rate (cfs)	Conveyance Description: Conveyance Type	Length (ft)	slope (ft/ft)	Diam (in) or BW (ft)	unit cost ($/lf) (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Est. R.O.W. Req. (ft)	Est. Land Req. (ac) (3)	Assigned Land Value (4)	Total Estimated Cost
30	111	channel	1250	0.004	4	25	$31,221	$15,611	40	1.1	$33,750	$80,582
31	137	channel	7400	0.002	7	28	$206,924	$103,462	40	6.8	$199,800	$510,185
32	234	channel	7100	0.004	4	21	$148,576	$74,288	45	7.3	$215,663	$438,527
33	259	channel	4100	0.006	8	20	$81,130	$40,565	45	4.2	$124,538	$246,232
34	92	pipe	3820	0.008	48	125	$477,500	$238,750	0	0.0	$0	$716,250
35	378	channel	2660	0.003	10	32	$85,464	$42,732	50	3.1	$89,775	$217,971
36	470	channel	2450	0.003	9	37	$91,740	$45,870	55	3.1	$90,956	$228,566
37	1590	RCBC	2670	0.001	24(w)x6(h)	910	$2,429,700	$1,214,850	60	3.7	$108,135	$3,752,685
38	1971	RCBC	2500	0.001	24(w)x6(h)	910	$2,275,000	$1,137,500	60	3.4	$101,250	$3,513,750
39	280	channel	1350	0.002	4	31	$41,774	$20,887	50	1.5	$45,563	$108,223
40	595	channel	1620	0.015	4	25	$41,021	$20,510	45	1.7	$49,208	$110,738
41	119	pipe	3700	0.006	54	150	$555,000	$277,500	0	0.0	$0	$832,500
42	417	RCBC	2625	0.01	6(w)x5(h)	351	$920,370	$460,185	25	1.5	$44,297	$1,424,852
43	302	channel	3220	0.014	4	16	$52,359	$26,180	40	3.0	$86,940	$165,479
44	120	channel	1350	0.005	4	12	$16,707	$8,353	35	1.1	$31,894	$56,954
45	245	pipe	2670	0.008	66	175	$467,250	$233,625	0	0.0	$0	$700,875
46	795	channel	860	0.002	23	65	$55,577	$27,788	75	1.5	$43,538	$126,903
47	940	RCBC	2440	0.011	11(w)x5(h)	499	$1,216,988	$608,494	35	2.0	$57,645	$1,883,126
50	236	pipe	1670	0.008	66	175	$292,250	$146,125	0	0.0	$0	$438,375
53	173	pipe	600	0.01	60	163	$97,800	$48,900	0	0.0	$0	$146,700
54	116	channel	750	0.005	10	12	$9,307	$4,653	35	0.6	$17,719	$31,679
55	282	channel	2600	0.004	7	24	$61,642	$30,821	45	2.7	$78,975	$171,438
56	639	channel	1300	0.003	11	47	$60,511	$30,256	60	1.8	$52,630	$143,417
57	196	pipe	1400	0.005	66	175	$245,000	$122,500	0	0.0	$0	$367,500
58	175	channel	2700	0.003	7	19	$50,903	$25,451	40	2.5	$72,900	$149,254
66	468	channel	760	0.004	11	34	$25,920	$12,960	55	1.0	$28,215	$67,096
181	291	channel	700	0.004	4	25	$17,725	$8,862	45	0.7	$21,263	$47,850
186	430	RCBC	2650	0.009	7(w)x5(h)	380	$1,007,654	$503,827	25	1.5	$44,719	$1,556,200
192	165	channel	1050	0.005	4	16	$16,893	$8,446	40	1.0	$28,350	$53,689
193	165	channel	550	0.009	4	16	$8,848	$4,424	40	0.5	$14,850	$28,123
194	137	channel	1300	0.005	6	13	$17,506	$8,753	35	1.0	$30,713	$56,972
196	118	RCBC	2800	0.001	6(w)x5(h)	351	$981,728	$490,864	25	1.6	$47,250	$1,519,843
199	341	channel	1450	0.006	7	24	$34,080	$17,040	45	1.5	$44,044	$95,164
217	237	pipe	1411	0.02	60	163	$229,993	$114,997	0	0.0	$0	$344,990
219	145	channel	1870	0.015	4	12	$22,688	$11,344	35	1.5	$44,179	$78,211
220	166	pipe	1750	0.008	60	163	$285,250	$142,625	0	0.0	$0	$427,875
221	239	pipe	1390	0.008	66	175	$243,250	$121,625	0	0.0	$0	$364,875
222	404	RCBC	950	0.017	5(w)x5(h)	321	$304,938	$152,469	25	0.5	$16,031	$473,439
225	156	pipe	2200	0.016	54	150	$330,000	$165,000	0	0.0	$0	$495,000
226	563	RCBC	1400	0.014	7(w)x5(h)	380	$532,346	$266,173	25	0.8	$23,625	$822,144
227	383	RCBC	2450	0.016	5(w)x5(h)	321	$786,420	$393,210	25	1.4	$41,344	$1,220,973

TABLE B-4 (CONTINUED)
ALTERNATIVE No.2S
CONVEYANCE ELEMENT COST ESTIMATE - SOUTH AREA

SWMM Element Number	Flow Rate (cfs)	Conveyance Description: Conveyance Type	Length (ft)	slope (ft/ft)	Diam (in) or BW (ft)	unit cost ($/lf) (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Est. R.O.W. Req. (ft)	Est. Land Req. (ac) (3)	Assigned Land Value (4)	Total Estimated Cost
228	493	RCBC	1800	0.01	7(w)x5(h)	380	$684,444	$342,222	25	1.0	$30,375	$1,057,042
229	616	channel	2250	0.017	4	25	$56,973	$28,487	45	2.3	$68,344	$153,803
231	351	RCBC	1350	0.01	6(w)x5(h)	351	$473,333	$236,667	25	0.8	$22,781	$732,781
248	231	RCBC	1400	0.004	6(w)x5(h)	351	$490,864	$245,432	25	0.8	$23,625	$759,921
267	540	channel	750	0.005	7	35	$25,893	$12,946	55	0.9	$27,844	$66,683
270	208	channel	750	0.011	4	16	$12,066	$6,033	40	0.7	$20,250	$38,349
277	231	RCBC	2650	0.003	6(w)x5(h)	351	$929,136	$464,568	25	1.5	$44,719	$1,438,422
278	150	channel	850	0.016	4	12	$10,313	$5,156	35	0.7	$20,081	$35,550
279	177	RCBC	2500	0.002	6(w)x5(h)	351	$876,543	$438,272	25	1.4	$42,188	$1,357,002
283	2115	channel	2100	0.01	50	79	$166,604	$83,302	90	4.3	$127,575	$377,482
284	539	RCBC	1340	0.005	10(w)x5(h)	469	$628,642	$314,321	25	0.8	$22,613	$965,575
288	157	channel	2650	0.003	6	18	$46,470	$23,235	40	2.4	$71,550	$141,256
290	237	channel	2900	0.004	10	21	$61,997	$30,998	45	3.0	$88,088	$181,082
291	415	channel	950	0.003	4	37	$35,265	$17,633	55	1.2	$35,269	$88,166
293	502	channel	800	0.008	6	28	$22,275	$11,138	50	0.9	$27,000	$60,413
294	347	RCBC	900	0.007	6(w)x5(h)	351	$315,556	$157,778	25	0.5	$15,188	$488,521
295	97	pipe	2850	0.004	54	150	$427,500	$213,750	0	0.0	$0	$641,250
296	140	channel	1300	0.002	7	19	$24,174	$12,087	40	1.2	$35,100	$71,361
297	53	pipe	1650	0.007	42	100	$165,000	$82,500	0	0.0	$0	$247,500
298	157	pipe	3200	0.006	60	163	$521,600	$260,800	0	0.0	$0	$782,400
Totals Alternative No.2S							$20,831,603	$10,415,801		90.2	$2,652,362	$33,899,766

Notes: (1) Channel unit cost includes excavation and seeding and mulching for the estimated right-of-way width
(2) Construction Contingencies and Engineering includes: 25% for contingencies; 10% for engineering; 10% for legal and administration; and 5% for contractor mobilization
(3) Pipes were assumed to be located in dedicated street right-of-way and installed prior to street construction
(4) Assigned Land Value includes: 25% for contingencies; 10% for legal and administration

TABLE B-5
ALTERNATIVE No.3S
CONVEYANCE ELEMENT COST ESTIMATE - SOUTH AREA

SWMM Element Number	Flow Rate (cfs)	Conveyance Description: Conveyance Type	Length (ft)	slope (ft/ft)	Diam (in) or BW (ft)	unit cost ($/lf) (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Est. R.O.W. Req. (ft)	Est. Land Req. (ac) (3)	Assigned Land Value (4)	Total Estimated Cost
30	111	channel	1250	0.004	4	25	$51,221	$15,611	40	1.1	$33,750	$80,582
31	137	channel	7400	0.002	7	28	$206,924	$103,462	40	6.8	$199,800	$510,185
32	234	channel	7100	0.004	4	21	$148,576	$74,288	45	7.3	$215,663	$438,527
33	259	channel	4100	0.006	8	20	$81,130	$40,565	45	4.2	$124,538	$246,232
34	92	pipe	3820	0.008	48	125	$477,500	$238,750	0	0.0	$0	$716,250
35	378	channel	2660	0.003	10	32	$85,464	$42,732	50	3.1	$89,775	$217,971
36	470	channel	2450	0.003	9	37	$91,740	$45,870	55	3.1	$90,956	$228,566
37	1590	RCBC	2670	0.001	14(w)x6(h)	610	$1,628,700	$814,350	50	3.1	$90,113	$2,533,163
38	1971	RCBC	2500	0.001	14(w)x6(h)	610	$1,525,000	$762,500	50	2.9	$84,375	$2,371,875
39	280	channel	1350	0.002	4	31	$41,774	$20,887	50	1.5	$45,563	$108,223
40	595	channel	1620	0.015	4	25	$41,021	$20,510	45	1.7	$49,208	$110,738
41	119	pipe	3700	0.006	54	150	$555,000	$277,500	0	0.0	$0	$832,500
42	417	RCBC	2625	0.01	6(w)x5(h)	351	$920,370	$460,185	25	1.5	$44,297	$1,424,852
43	302	channel	3220	0.014	4	16	$52,359	$26,180	40	3.0	$86,940	$165,479
44	120	channel	1350	0.005	4	12	$16,707	$8,353	35	1.1	$31,894	$56,954
45	245	pipe	2670	0.008	66	175	$467,250	$233,625	0	0.0	$0	$700,875
46	795	channel	860	0.002	23	65	$55,577	$27,788	75	1.5	$43,538	$126,903
47	940	RCBC	2440	0.011	11(w)x5(h)	499	$1,216,988	$608,494	35	2.0	$57,645	$1,883,126
50	236	pipe	1670	0.008	66	175	$292,250	$146,125	0	0.0	$0	$438,375
53	173	pipe	600	0.01	60	163	$97,800	$48,900	0	0.0	$0	$146,700
54	116	channel	750	0.005	10	12	$9,307	$4,653	35	0.6	$17,719	$31,679
55	282	channel	2600	0.004	7	24	$61,642	$30,821	45	2.7	$78,975	$171,438
56	639	channel	1300	0.003	11	47	$60,511	$30,256	60	1.8	$52,650	$143,417
57	196	pipe	1400	0.005	66	175	$245,000	$122,500	0	0.0	$0	$367,500
58	175	channel	2700	0.003	7	19	$50,903	$25,451	40	2.5	$72,900	$149,254
66	468	channel	760	0.004	11	34	$25,920	$12,960	55	1.0	$28,215	$67,096
181	291	channel	700	0.004	4	25	$17,725	$8,862	45	0.7	$21,263	$47,850
186	430	RCBC	2650	0.009	7(w)x5(h)	380	$1,007,654	$503,827	25	1.5	$44,719	$1,556,200
192	165	channel	1050	0.005	4	16	$16,893	$8,446	40	1.0	$28,350	$53,689
193	165	channel	550	0.009	4	16	$8,848	$4,424	40	0.5	$14,850	$28,123
194	137	channel	1300	0.005	6	13	$17,506	$8,753	35	1.0	$30,713	$56,972
196	118	RCBC	2800	0.001	6(w)x5(h)	351	$981,728	$490,864	25	1.6	$47,250	$1,519,843
199	341	channel	1450	0.006	7	24	$34,080	$17,040	45	1.5	$44,044	$95,164
217	237	pipe	1411	0.02	60	163	$229,993	$114,997	0	0.0	$0	$344,990
219	145	channel	1870	0.015	4	12	$22,688	$11,344	35	1.5	$44,179	$78,211
220	166	pipe	1750	0.008	60	163	$285,250	$142,625	0	0.0	$0	$427,875
221	239	pipe	1390	0.008	66	175	$243,250	$121,625	0	0.0	$0	$364,875
222	404	RCBC	950	0.017	5(w)x5(h)	321	$304,938	$152,469	25	0.5	$16,031	$473,439
225	156	pipe	2200	0.016	54	150	$330,000	$165,000	0	0.0	$0	$495,000
226	563	RCBC	1400	0.014	7(w)x5(h)	380	$532,346	$266,173	25	0.8	$23,625	$822,144
227	383	RCBC	2450	0.016	5(w)x5(h)	321	$786,420	$393,210	25	1.4	$41,344	$1,220,973

TABLE B-5 (CONTINUED)
ALTERNATIVE No.3S
CONVEYANCE ELEMENT COST ESTIMATE - SOUTH AREA

SWMM Element Number	Flow Rate (cfs)	Conveyance Description: Conveyance Type	Length (ft)	slope (ft/ft)	Diam (in) or BW (ft)	unit cost ($/lf) (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Est. R.O.W. Req. (ft)	Est. Land Req. (ac) (3)	Assigned Land Value (4)	Total Estimated Cost
228	493	RCBC	1800	0.01	7(w)x5(h)	380	$684,444	$342,222	25	1.0	$30,375	$1,057,042
229	616	channel	2250	0.017	4	25	$56,973	$28,487	45	2.3	$68,344	$153,803
231	351	RCBC	1350	0.01	6(w)x5(h)	351	$473,333	$236,667	25	0.8	$22,781	$732,781
248	231	RCBC	1400	0.004	6(w)x5(h)	351	$490,864	$245,432	25	0.8	$23,625	$759,921
267	540	channel	750	0.005	7	35	$25,893	$12,946	55	0.9	$27,844	$66,683
270	208	channel	750	0.011	4	16	$12,066	$6,033	40	0.7	$20,250	$38,349
277	231	RCBC	2650	0.003	6(w)x5(h)	351	$929,136	$464,568	25	1.5	$44,719	$1,438,422
278	150	channel	850	0.016	4	12	$10,313	$5,156	35	0.7	$20,081	$35,550
279	177	RCBC	2500	0.002	6(w)x5(h)	351	$876,543	$438,272	25	1.4	$42,188	$1,357,002
283	2115	channel	2100	0.01	50	79	$166,604	$83,302	90	4.3	$127,575	$377,482
284	539	RCBC	1340	0.005	10(w)x5(h)	469	$628,642	$314,321	25	0.8	$22,613	$965,575
288	157	channel	2650	0.003	6	18	$46,470	$23,235	40	2.4	$71,550	$141,256
290	237	channel	2900	0.004	10	21	$61,997	$30,998	45	3.0	$88,088	$181,082
291	415	channel	950	0.003	4	37	$35,265	$17,633	55	1.2	$35,269	$88,166
293	502	channel	800	0.008	6	28	$22,275	$11,138	50	0.9	$27,000	$60,413
294	347	RCBC	900	0.007	6(w)x5(h)	351	$315,556	$157,778	25	0.5	$15,188	$488,521
295	97	pipe	2850	0.004	54	150	$427,500	$213,750	0	0.0	$0	$641,250
296	140	channel	1300	0.002	7	19	$24,174	$12,087	40	1.2	$35,100	$71,361
297	53	pipe	1650	0.007	42	100	$165,000	$82,500	0	0.0	$0	$247,500
298	157	pipe	3200	0.006	60	163	$521,600	$260,800	0	0.0	$0	$782,400
Totals Alternative No.3S							$19,280,603	$9,640,301		89.0	$2,617,464	$31,538,368

Notes: (1) Channel unit cost includes excavation and seeding and mulching for the estimated right-of-way width.
(2) Construction Contingencies and Engineering includes: 25% for contingencies; 10% for engineering; 10% for legal and administration; and 5% for contractor mobilization.
(3) Pipes were assumed to be located in dedicated street right-of-way and installed prior to street construction.
(4) Assigned Land Value includes: 25% for contingencies; 10% for legal and administration.

TABLE B-6
ALTERNATIVE No. 1E
CONVEYANCE ELEMENT COST ESTIMATE - EAST AREA

SWMM Element Number	Flow Rate (cfs)	Conveyance Description: Conveyance Type	Length (ft)	slope (ft/ft)	Diam (in) or BW (ft)	unit cost ($/lf) (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Est. R.O.W. Req. (ft)	Est. Land Req. (ac) (3)	Assigned Land Value (4)	Total Estimated Cost
59	149	RCBC	1950	0.001	7(w)x5(h)	380	$741,481	$370,741	25	1.1	$32,906	$1,145,128
60	251	channel	1300	0.009	4	20	$26,331	$13,166	40	1.2	$35,100	$74,597
62	443	RCBC	4950	0.008	7(w)x5(h)	380	$1,882,222	$941,111	25	2.8	$83,531	$2,906,865
63	522	RCBC	2350	0.001	17(w)x5(h)	677	$1,589,877	$794,938	35	1.9	$55,519	$2,440,334
65	285	channel	1500	0.003	4	31	$46,415	$23,208	50	1.7	$50,625	$120,248
67	239	RCBC	1650	0.001	10(w)x5(h)	469	$774,074	$387,037	25	0.9	$27,844	$1,188,955
68	405	channel	2040	0.023	4	20	$41,320	$20,660	40	1.9	$55,080	$117,060
69	163	pipe	700	0.019	54	150	$105,000	$52,500	0	0.0	$0	$157,500
70	429	channel	1450	0.012	4	25	$36,716	$18,358	45	1.5	$44,044	$99,118
71	199	channel	1450	0.012	4	16	$23,328	$11,664	40	1.3	$39,150	$74,142
72	336	RCBC	1500	0.017	5(w)x5(h)	321	$481,481	$240,741	25	0.9	$25,313	$747,535
76	570	channel	4000	0.008	8	30	$121,538	$60,769	50	4.6	$135,000	$317,307
76	570	RCBC	4500	0.008	8(w)x6(h)	420	$1,890,000	$945,000	0	0.0	$0	$2,835,000
202	154	pipe	1500	0.017	54	150	$225,000	$112,500	0	0.0	$0	$337,500
203	144	channel	2070	0.016	4	12	$25,115	$12,557	35	1.7	$48,904	$86,576
208	166	channel	3900	0.017	4	12	$47,317	$23,659	35	3.1	$92,138	$163,114
209	200	pipe	3970	0.016	54	150	$595,500	$297,750	0	0.0	$0	$893,250
212	474	channel	1800	0.012	4	25	$45,579	$22,789	45	1.9	$54,675	$123,043
213	435	RCBC	1600	0.015	6(w)x5(h)	351	$560,988	$280,494	25	0.9	$27,000	$868,481
216	70	pipe	800	0.023	36	85	$68,000	$34,000	0	0.0	$0	$102,000
218	65	pipe	1500	0.005	48	125	$187,500	$93,750	0	0.0	$0	$281,250
Totals Alternative No. 1E							$9,327,282	$4,663,641		27.4	$806,828	$14,797,751

Notes: (1) Channel unit cost includes excavation and seeding and mulching for the estimated right-of-way width.
(2) Construction Contingencies and Engineering includes: 25% for contingencies; 10% for engineering; 10% for legal and administration; and 5% for contractor mobilization.
(3) Pipes were assumed to be located in dedicated street right-of-way and installed prior to street construction.
(4) Assigned Land Value includes: 25% for contingencies; 10% for legal and administration.

TABLE B-7
ALTERNATIVE No. 2E
CONVEYANCE ELEMENT COST ESTIMATE - EAST AREA

SWMM Element Number	Flow Rate (cfs)	Conveyance Description: Conveyance Type	Length (ft)	slope (ft/ft)	Diam (in) or BW (ft)	unit cost ($/lf) (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Est. R.O.W. Req. (ft)	Est. Land Req. (ac) (3)	Assigned Land Value (4)	Total Estimated Cost
59	31	pipe	1950	0.001	48	125	$243,750	$121,875	0	0.0	$0	$365,625
60	52	channel	1300	0.009	4	6	$7,838	$3,919	25	0.7	$21,938	$33,694
62	92	pipe	4950	0.008	48	125	$618,750	$309,375	0	0.0	$0	$928,125
63	112	RCBC	2350	0.001	6(w)x5(h)	351	$823,951	$411,975	20	1.1	$31,725	$1,267,651
65	285	channel	1500	0.003	4	31	$46,415	$23,208	50	1.7	$50,625	$120,248
67	239	RCBC	1650	0.001	10(w)x5(h)	469	$774,074	$387,037	25	0.9	$27,844	$1,188,955
68	405	channel	2040	0.023	4	20	$41,320	$20,660	40	1.9	$55,080	$117,060
69	163	pipe	700	0.019	54	150	$105,000	$52,500	0	0.0	$0	$157,500
70	429	channel	1450	0.012	4	25	$36,716	$18,358	45	1.5	$44,044	$99,118
71	199	channel	1450	0.012	4	16	$23,328	$11,664	40	1.3	$39,150	$74,142
72	336	RCBC	1500	0.017	5(w)x5(h)	321	$481,481	$240,741	20	0.7	$20,250	$742,472
76	134	channel	4000	0.008	9	12	$46,767	$23,384	35	3.2	$94,500	$164,651
76	134	pipe	4500	0.008	54	150	$675,000	$337,500	0	0.0	$0	$1,012,500
202	154	pipe	1500	0.017	54	150	$225,000	$112,500	0	0.0	$0	$337,500
203	144	channel	2070	0.016	4	12	$25,115	$12,557	35	1.7	$48,904	$86,576
208	166	channel	3900	0.017	4	12	$47,317	$23,659	35	3.1	$92,138	$163,114
209	40	pipe	3970	0.016	30	80	$317,600	$158,800	0	0.0	$0	$476,400
212	474	channel	1800	0.012	4	25	$45,579	$22,789	45	1.9	$54,675	$123,043
213	435	RCBC	1600	0.015	6(w)x5(h)	351	$560,988	$280,494	20	0.7	$21,600	$863,081
216	70	pipe	800	0.023	36	85	$68,000	$34,000	0	0.0	$0	$102,000
218	65	pipe	1500	0.005	48	125	$187,500	$93,750	0	0.0	$0	$281,250
Totals Alternative 2E							$5,401,489	$2,700,744		20.5	$602,471	$8,704,704

Notes: (1) Channel unit cost includes excavation and seeding and mulching for the estimated right-of-way width.
(2) Construction Contingencies and Engineering includes: 25% for contingencies; 10% for engineering; 10% for legal and administration; and 5% for contractor mobilization.
(3) Pipes were assumed to be located in dedicated street right-of-way and installed prior to street construction.
(4) Assigned Land Value includes: 25% for contingencies; 10% for legal and administration.

TABLE B-8
STREET CROSSINGS COST ESTIMATE - SOUTH AREA

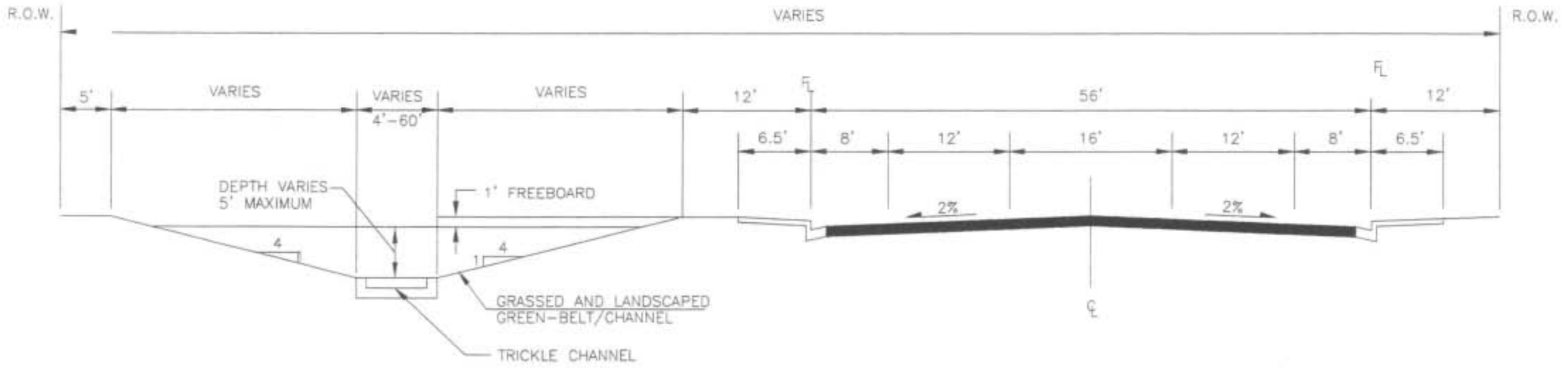
Location	SWMM Element No.	Flow Rate (cfs)	Culvert Description: Type	W	x	H	Length (ft)	Unit Cost ($/lineal ft)	Wingwall Cost (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Total Estimated Cost
Alternatives No. 1S, 2S, & 3S												
128th Ave. & Chambers Rd.	31	137	RCBC	5	x	5	100	320	$24,000	$56,000	$28,000	$84,000
132th Ave. & Chambers Rd.	31	137	RCBC	5	x	5	100	320	$24,000	$56,000	$28,000	$84,000
133th Ave. & Chambers Rd.	394	107	RCP		(2)	36	100	170	$24,000	$41,000	$20,500	$61,500
140th Ave. & Chambers Rd.	35	378	RCBC	12	x	5	100	530	$24,000	$77,000	$38,500	$115,500
144th Ave. & Chambers Rd.	36	470	RCBC	15	x	5	100	620	$24,000	$86,000	$43,000	$129,000
148th Ave. & Chambers Rd.	20	125	RCP		(1)	60	100	163	$24,000	$40,300	$20,150	$60,450
150th Ave. & Chambers Rd.	47	940	RCBC	30	x	5	100	1060	$40,000	$146,000	$73,000	$219,000
Bromley Ln & Chambers Rd.	12	111	RCP		(1)	60	100	163	$24,000	$40,300	$20,150	$60,450
134th Ave. & Sable Blvd.	50	236	RCBC	8	x	5	100	410	$24,000	$65,000	$32,500	$97,500
144th Ave. & Sable Blvd.	288	157	RCBC	5	x	5	100	320	$24,000	$56,000	$28,000	$84,000
148th Ave. & Sable Blvd.	19	123	RCP		(1)	60	100	163	$24,000	$40,300	$20,150	$60,450
150th Ave. & Sable Blvd.	38	1971	RCBC	24	x	6	100	910	$80,000	$171,000	$85,500	$256,500
136th Ave. & Potomac St.	32	234	RCBC	8	x	5	100	410	$24,000	$65,000	$32,500	$97,500
144th Ave. & Potomac St.	277	231	RCBC	8	x	5	100	410	$24,000	$65,000	$32,500	$97,500
Future street crossing	295	97	RCP		(1)	60	100	163	$24,000	$40,300	$20,150	$60,450
Future street crossing	33	259	RCBC	8	x	5	100	410	$24,000	$65,000	$32,500	$97,500
Future street crossing	55	282	RCBC	9	x	5	100	440	$24,000	$68,000	$34,000	$102,000
Future street crossing	45	245	RCBC	11	x	5	100	500	$24,000	$74,000	$37,000	$111,000
Future street crossing	57	196	RCBC	6	x	5	100	350	$24,000	$59,000	$29,500	$88,500
Frontage & Buckley Rd.	184	107	RCP		(1)	60	100	163	$24,000	$40,300	$20,150	$60,450
140th & Buckley Rd.	53	173	RCBC	6	x	5	100	350	$24,000	$59,000	$29,500	$88,500
144th & Buckley Rd.	43	302	RCBC	10	x	5	100	470	$24,000	$71,000	$35,500	$106,500
146th & Buckley Rd.	231	351	RCBC	11	x	5	100	500	$24,000	$74,000	$37,000	$111,000
148th & Buckley Rd.	45	245	RCBC	8	x	5	100	410	$24,000	$65,000	$32,500	$97,500
Bromley Ln. & Buckley Rd.	217	237	RCBC	8	x	5	100	410	$24,000	$65,000	$32,500	$97,500
Future street crossing	220	166	RCBC	6	x	5	100	350	$24,000	$59,000	$29,500	$88,500
Future street crossing	222	404	RCBC	13	x	5	100	560	$24,000	$80,000	$40,000	$120,000
Railroad	38	1971								$325,000	$162,500	$487,500
SH 85	38	1971								$450,000	$225,000	$675,000
Total Crossing Costs (Alternatives No. 1S, 2S, & 3S)										$2,599,500	$1,299,750	$3,899,250

Notes: (1) Estimated cost of wingwalls includes riprap and filter material
(2) Construction Contingencies and Engineering includes: 25% for contingencies; 10% for engineering; 10% for legal and administration; and 5% for contractor mobilization.

TABLE B-9
STREET CROSSINGS COST ESTIMATE - EAST AREA
ALTERNATIVES No. 1E AND 2E

Location	SWMM Element No.	Flow Rate (cfs)	Culvert Description Type	W (ft)	x	H (ft)	Length (ft)	Unit Cost ($/lineal ft)	Wingwall Cost (1)	Estimated Construction Cost	Construction Contingencies & Engineering (2)	Total Estimated Cost
Alternative No. 1E												
156th Ave. & Truckee	72	336	RCBC	11	x	5	100	500	$24,000	$74,000	$37,000	$111,000
Bridge St. & Telluride	60	251	RCBC	8	x	5	100	410	$24,000	$65,000	$32,500	$97,500
20th & Baseline	76	570	RCBC	16	x	5	100	650	$40,000	$105,000	$52,500	$157,500
Railroad	76	134	RCP		(2)	66				$100,000	$50,000	$150,000
SH 85	76	134	RCP		(2)	66				$250,000	$125,000	$375,000
Total Crossing Costs (Alternative No. 1E)										$594,000	$297,000	$891,000
Alternative No. 2E												
156th Ave. & Truckee	72	336	RCBC	11	x	5	100	500	$24,000	$74,000	$37,000	$111,000
Bridge St. & Telluride	60	52	RCP		(1)	36	100	85	$24,000	$32,500	$16,250	$48,750
20th & Baseline	76	134	RCBC	5	x	5	100	320	$24,000	$56,000	$28,000	$84,000
Railroad	76	134	RCP		(1)	54				$50,000	$25,000	$75,000
SH 85	76	134	RCP		(1)	54				$165,000	$82,500	$247,500
Total Crossing Costs (Alternative No. 2E)										$377,500	$188,750	$566,250

Notes: (1) Estimated cost of wingwalls includes riprap and filter material
(2) Construction Contingencies and Engineering includes: 25% for contingencies; 10% for engineering; 10% for legal and administration; and 5% for contractor mobilization



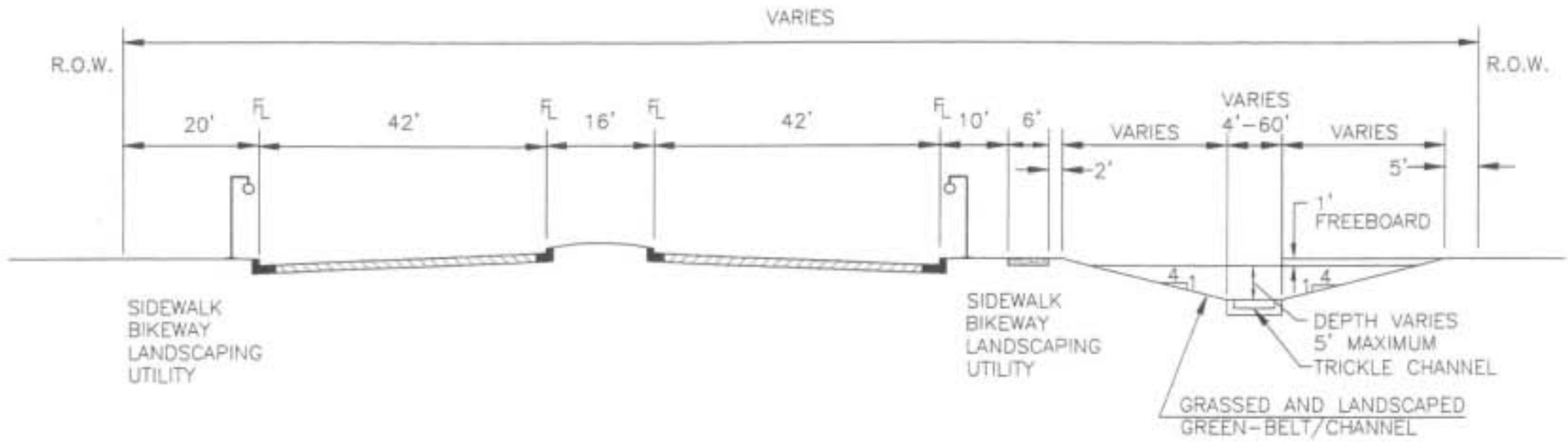
TYPICAL COMMERCIAL COLLECTOR (PARKWAY)

WITH ROADSIDE CHANNEL

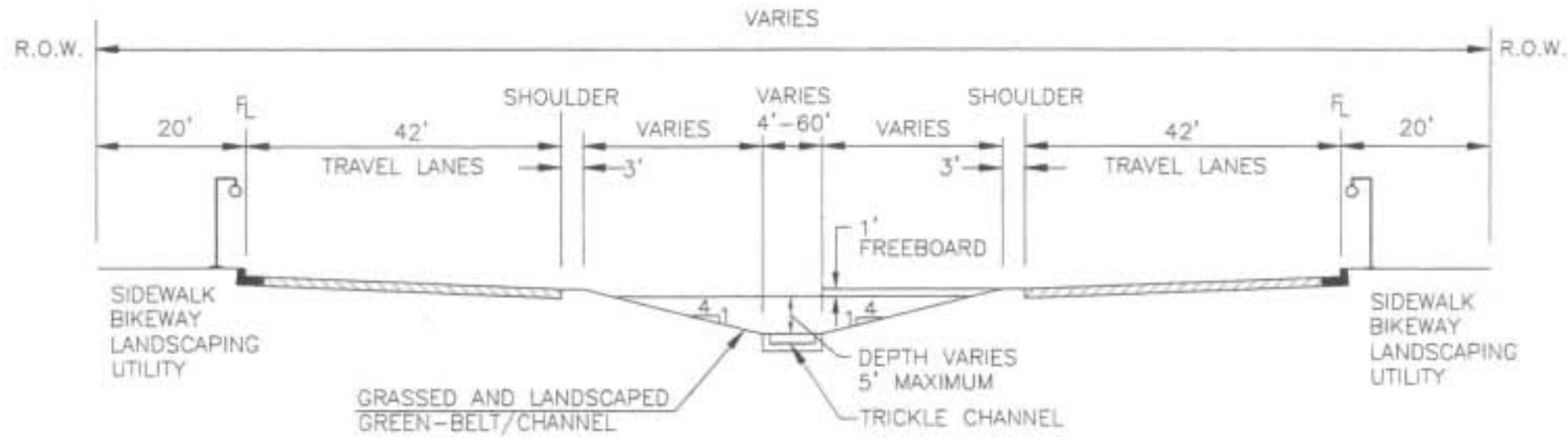
1960, 19600700.DWG 12-03-08 1:10MS WRC2.PCP JLH

WRC ENGINEERING, INC. DENVER, COLORADO	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	TYPICAL STREET CROSS SECTION	FIGURE B-1

OPTION A



OPTION B



PRINCIPAL ARTERIAL (PARKWAY) WITH ROADSIDE CHANNEL

WRC ENGINEERING, INC.
DENVER, COLORADO

BRIGHTON WATERSHED
TRIBUTARY TO S. PLATTE RIVER
OUTFALL SYSTEMS PLANNING

TYPICAL STREET
CROSS SECTION

FIGURE
B-2

APPENDIX C

MEETING MINUTES

CITY OF BRIGHTON

OUTFALL SYSTEMS PLANNING

SUB-REGIONAL DETENTION FACILITY IMPLEMENTATION GUIDELINES

The purpose of the Master Plan is to preliminarily locate and size the required sub-regional detention facilities and to size the downstream collection facilities based upon these preliminary sub-regional detention facilities and locations.

Minor adjustments in size and location of the sub-regional detention facilities can be accommodated as long as the master plan design criteria (i.e. 5-year extended detention, 100-year restricted release rates) and the hydrologic/hydraulic function of the entire master planned drainage system are maintained.

For example, a sub-regional detention facility may be moved upstream or downstream if the following guidelines are addressed:

1. Pond size must be adjusted for the increase/decrease in tributary area.

2. The new location must not interfere with the outfall system from upstream sub-regional detention facilities.

3. The Master Plan flow rates downstream of the new location must be maintained or reduced. This should be checked using the master plan hydrologic model.

4. The new location/plan should not result in a proliferation of additional sub-regional detention facilities.

Tributary basin boundaries can be adjusted as long as the above guidelines are followed. However, a logical reason must exist for said change. Also, as facilities are implemented, some changes will not be possible in order to avoid retro-fitting of previously constructed facilities.

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Since most of the sub-regional detention facilities are "off-line" of the collector system, their location may be adjusted from one side of the road to another as long as all hydraulic functions are maintained.

For the design of the detention facility itself, adjustments in the size of the minor and major storm storage areas can be accommodated but the overall facility size will change. For example, if a large manicured , active use park is desired, the facility and size may need to be increased in order to minimize the frequency of inundation of the active use area. In contract, it may be desirable in another area to use the facility as open space (no active recreation). In this example, the facility and size may be reduced but will have a larger area that may be frequently inudated with runoff.

The end result of any of these changes should be functionally equivalent system that:

- Minimizes maintenance requirements (less facilities is better)
- Minimizes land required (less facilities is better)
- Maintains public ownership or control (i.e. pertinent drainage easement) of sub-regional detention facilities.

WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

PHASE-B PRELIMINARY DESIGN
IMPLEMENTATION MEETING WITH CITY OF BRIGHTON STAFF

JULY 9, 1998

The progress meeting for Phase-B of the above referenced project was held on July 9, 1998 at the offices of the City of Brighton. Attending the meeting were:

Charlie Kiepe	City of Brighton
Tony Huerta	City of Brighton
Scott Bernhart	City of Brighton
Ken Manpin	City of Brighton
Dirk Rickwine	City of Brighton
John Bramble	City of Brighton
Terry Benton	City of Brighton
Clint Blackhurst	City of Brighton
Joe Gerdom	City of Brighton
Ben Urbonas	UD&FCD
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.

A summary of the items discussed is as follows:

1. WRC prepared and distributed a handout titled "Sub-Regional Detention Facility Implementation Guidelines".

2. John Doerfer presented and discussed the Master Plan concept.

3. The estimated Right-of-Way needs for the 14 square miles of drainage area is as follows:

Basins South	-	357 acres
Basins East	-	122 acres
Channels South	-	101 acres
Channels East	-	21 acres
Total		600 Acres ±

4. Provide an equation in the Master Plan for sizing sub-regional/on-site detention basins.

5. Optional sub-regional basin sittings were discussed which could be accommodated after the Master Plan is adopted within the implementation guidelines.

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WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

PHASE-B PRELIMINARY DESIGN
FOURTH MEETING

MAY 21, 1998

The fourth progress meeting for Phase-B of the above referenced project was held on May 21, 1998 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Ben Urbonas	UD&FCD
Charlie Kiepe	City of Brighton
Tim McCandless	City of Brighton
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.

A summary of the items discussed is as follows:

1. The draft South Outfall Channel design was presented and discussed. WRC was requested to cost out and consider concrete channel from Fulton Street to Railroad.

2. Brighton is looking at widening Sable to provide commercial area access off of U.S. 85.

3. Look at providing slope on upper bench area of sub-regional basins for drainage purposes.

4. Basins could be lined to provide permanent pool but then would not function for infiltration purposes (water supply).

5. Redlines of the sub-regional basins were performed at the meeting for revision of WRC's draft designs.

6. Phasing suggested as follows:

   a) Conveyance segments (logical units and rank)
   b) Critical basins
   c) Tie conveyance needs to basin timing
   d) Remaining basins tied to development timing

7. WRC to refine the storage volume computation method.

8. Next meeting scheduled for June 3, 1998.

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WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

PHASE-B PRELIMINARY DESIGN
FIFTH MEETING

JUNE 3, 1998

The fifth progress meeting for Phase-B of the above referenced project was held on June 3, 1998 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Ben Urbonas	UD&FCD
Charlie Kiepe	City of Brighton
Tony Huerta	City of Brighton
Scott Bernhart	City of Brighton
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.

A summary of the items discussed is as follows:

1. Shrink the overbank areas to reduce the ROW required for all basins.

2. Current land dedication for parks is about 6 acres per 270 homes.

3. Look at 3' drop from basin bottom to bottom of south Outfall channel if possible.

4. Recommend 0.1 cfs/Acre for on-site detention requirement.

5. Use existing North Outfall if possible to convey flows east of Fulton Ditch.

6. Delete match lines; use "See Sheet ____" instead.

7. Use 3:1 side slope on South Outfall channel from South Platte to Upstream of Fulton Street..

8. Draft report expected around 1st of July.

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WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

PHASE-B PRELIMINARY DESIGN
SECOND MEETING

MARCH 13, 1998

The second progress meeting for Phase-B of the above referenced project was held on March 13, 1998 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Ben Urbonas	UD&FCD
Charlie Kiepe	City of Brighton
Tim McCandless	City of Brighton
Besharah Najjar	Adams County
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.

A summary of the items discussed is as follows:

1. Cost out (3) 9' diameter RCPs with improved inlet instead of a box near the south Outfall at U.S. 85 and railroad.

2. Upstream of Fulton Street, look at a grass-lined channel or a hexagonal section vs rectangular. Compare cost of rectangular concrete channel vs hexagonal concrete channel. Use 1.5:1 minimum concrete channel side slopes (may be deeper than rectangular because of savings in steel reinforcement).

3. Consolidate sub-regional ponds U and T, use 4' average depth, and squeeze detention into 13 acre parcel.

4. Discussed use of Brighton Lateral for conveyance out of U and T to Baseline Road.

5. Next meeting scheduled for May 1, 1998.

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WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

PHASE-B PRELIMINARY DESIGN
THIRD MEETING

MAY 1, 1998

The third progress meeting for Phase-B of the above referenced project was held on May 1, 1998 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Ben Urbonas	UD&FCD
Tim McCandless	City of Brighton
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.

A summary of the items discussed is as follows:

1. No changes will be made now for possible future comprehensive plan changes.

2. If density in future is higher, more on-site storage is needed. Include sizing method in Master Plan.

3. Possibly use retention ponds in east area initially to facilitate implementation. Concerns raised as to method of sizing; if they become permanent? Cost of maintenance?

4. Next project meeting scheduled for May 21, 1998.

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WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

PHASE-B PRELIMINARY DESIGN
INITIAL MEETING

JANUARY 26, 1998

The initial progress meeting for Phase-B of the above referenced project was held on January 26, 1998 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Ben Urbonas	UD&FCD
Blair Renfro	City of Brighton
Charlie Kiepe	City of Brighton
Besharah Najjar	Adams County
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.

A summary of the items discussed is as follows:

1. Brighton is planning to purchase 100' R.O.W. up to Sable. They also plan to purchase remaining R.O.W. up to 4th by end of year.

2. Brighton let the contract for HKS 24" pipe to 6th Street.

3. RCBC addition proposed at McCann Ditch.

4. Redi-Mix is purchasing 75 acres near South Outfall at McCann Ditch. City has plans to purchase old gravel pit.

5. McCann Ditch will be piped around existing gravel pit north of Bromley.

6. WRC proposes that the South Outfall elevation at Bromley be lowered to accommodate RCBC. Bromley proposed to be 95' wide.

7. Sanitary sewer proposed on north side of R.O.W. under railroad (28' deep).

8. Sanitary sewer R.O.W. cost $175,000 for 1.23 acres (D/S of U.S.85)
   Kestler property (50'x110') for $20,000
   U/S property estimated at $1.08/Sq. Ft.
   Through industrial property $1.25/Sq. Ft.

9. R.O.W. map for South Outfall to be provided by Brighton.

10. Brighton to provide current City Boundary Map.

11. Brighton needs to put MDCIA citation in Drainage Criteria and Sub-division Regulations.

12. Adequate assurance agreement may be needed for sub-regional detention basins.

13. Brighton to find out status of parks/recreation planning.

14. No recreational access to be provided under U.S. 85/RR with this plan.

15. The next progress meeting will be March 13, 1998.

WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

NINTH PROGRESS MEETING
APRIL 2, 1997, 9 A.M.

The ninth progress meeting for the above referenced project was held on April 2, 1997, at the office of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Ivan Grein	Brighton Lateral
Ben Urbonas	UD&FCD
Cecil King	Fulton Ditch/Brighton Lateral
Tim McCandless	City of Brighton
Besharah Najjar	Adams County
John Doerfer	UD&FCD
Alan J. Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.

The following items were discussed:

1. Conveyance system alternatives were reviewed. Alternatives description and preliminary cost estimates are attached.

2. Alternatives will include culvert crossings at arterial and collector streets. Additional crossings will be the responsibility of the property owners and developers.

3. Alternatives that increase the 100-year runoff above the 100-year historic runoff rates into the City will not be included as a viable alternative in the alternatives evaluation and report.

4. Alternatives that include additional detention (i.e. 0.10 cfs/tributary acre release rate) should be considered for the area east of the City.

5. Costs estimates will include all costs associated with crossing the highway and railroad.

Please advise the undersigned if there are any additional items or corrections to these minutes.

Very truly yours,

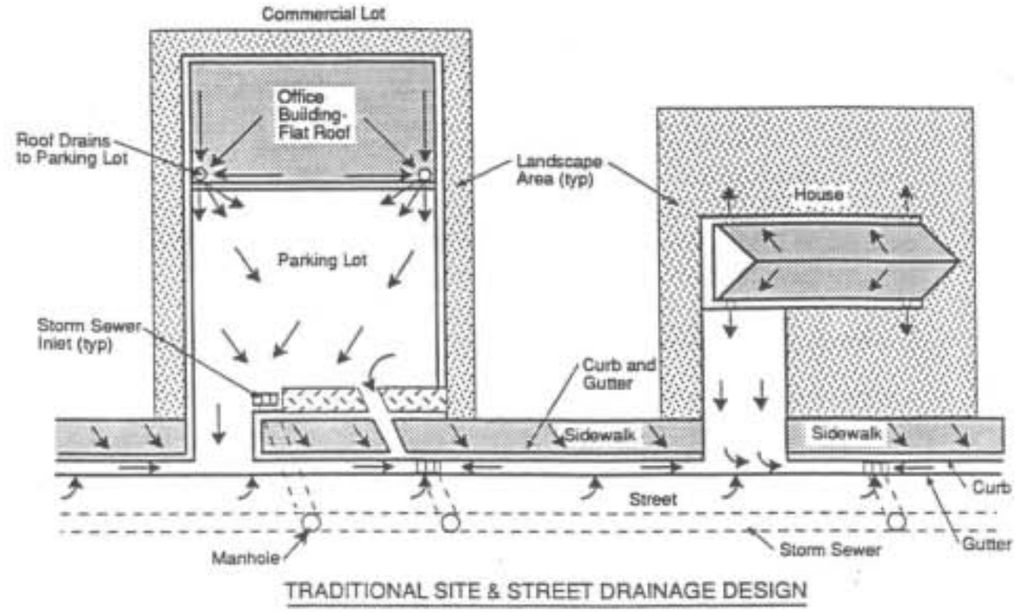
WRC ENGINEERING, INC.

David P. Krickbaum, P.E.
Project Engineer

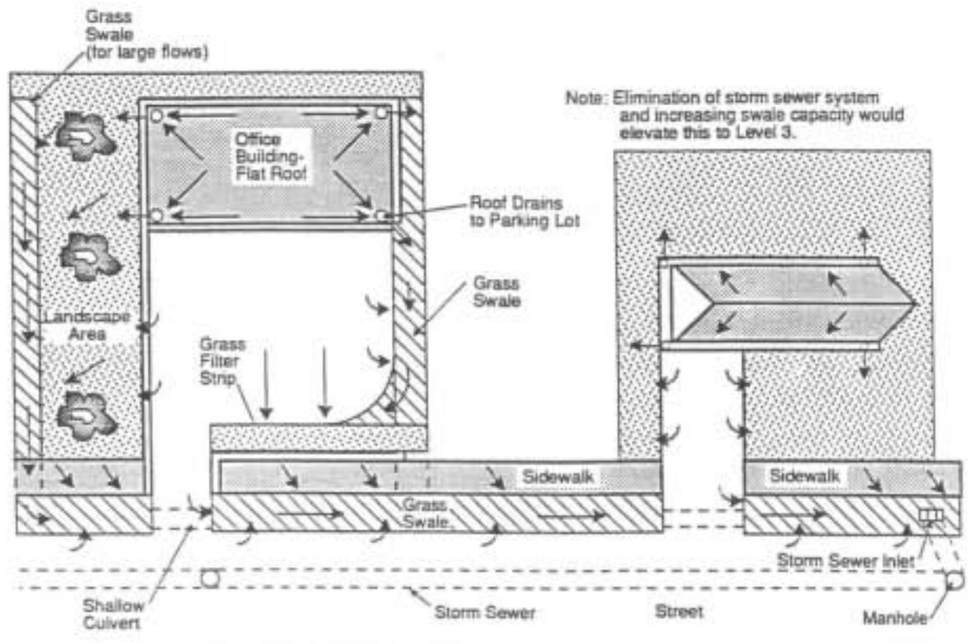
DPK/mag

Attachment

cc: All Attendees
Mr. James Holladay
Mr. Greg Fabisiak/South Adams County Water & Sanitation District
Mr. Max Dodson
Ms. Sarah Johnson
Mr. Tim Carey
Mr. Greg Gerlich
Mr. Rich Anderson
Ms. Nickole Stoner
Mr. Hal Simpson
Mr. David Hoden
Mr. George McDonald
Henderson Water Company
Mr. Steve McQuilkin
Mr. Garth Englund



TRADITIONAL SITE & STREET DRAINAGE DESIGN



MINIMIZING DIRECTLY CONNECTED IMPERVIOUS AREAS (LEVEL 2 PRACTICES SHOWN)

FIGURE 2-2. EXAMPLES OF MINIMIZING DIRECTLY CONNECTED IMPERVIOUS AREAS

CITY OF BRIGHTON
OUTFALL SYSTEMS PLAN

DRAFT

SUB-REGIONAL DETENTION POND SIZING CRITERIA

STORM FREQUENCY	ALLOWABLE RELEASE RATE	REQUIRED STORAGE VOLUME	TOTAL APPROXIMATE DRAIN TIME	APPROXIMATE REQUIRED LAND AREA
Water Quality	Water Quality Criteria	Water Quality Criteria	40 hours	----
5- Year	0.03 cfs/Ac	0.12 AF/Imp. Ac.	48 hours	---
100 -Year	0.10 cfs/Ac	0.36 AF/Imp. Ac (Residential 0.15 AF/Ac)	72 hours	10 percent of Tributary Area

WRC ENGINEERING, INC.

MEETING MINUTES
OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

EIGHTH PROGRESS MEETING
FEBRUARY 19, 1997, 9 A.M.

The eighth progress meeting for the above referenced project was held on February 19, 1997, at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Cecil King	Fulton Ditch/Brighton Lateral
John Case	Brighton Lateral
Ivan Grein	Brighton Lateral
Tim McCandless	City of Brighton
Besharah Najjar	Adams County
Ben Urbonas	UD&FCD
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.

The following items were discussed:

1. The City's direction is to evaluate alternatives that provide sub-regional 5-year extended detention, roadside ditches along arterial and collector streets and curb, gutter and storm sewer in residential areas.

2. A schematic plan identifying pond locations and outfall alignments was presented. A draft sub-regional detention pond criteria was presented (copy attached). The land area required to provide 100-year extended detention ponds was considered to be excessive. Therefore, detention ponds will be evaluated with a 100-year overflow that has a capacity of 0.50 cfs/acre of tributary area.

3. The alternatives report will identify costs and impacts of each alternative.

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4. Pipe and channel alternatives will be shown for the south outfall. The outfall will be sized for two alternative design flows: a) 5-year runoff form the master planned system; or b) the difference between the 100-year existing runoff and the 100-year future runoff. Both of these alternatives will not reduce the flooding potential from 100-year events to less than it is currently.

The next progress meeting will be on April 2, 1997, 9:00 A.M. at Urban Drainage and Flood Control District.

Please advise the undersigned if there are any additional items or corrections to these minutes.

Very truly yours,
WRC ENGINEERING, INC.

David P. Krickbaum, P.E.
Project Engineer

DPK/jlb
cc: All attendees
Mr. James Holladay
Mr. Greg Fabisiak
Mr. Max Dodson
Mr. Sarah Johnson
Mr. Tim Carey
Mr. Greg Gerlich
Mr. Rick Anderson
Ms. Nickole Stoner
Mr. Hal Simpson
Mr. David Hoden
Mr. George McDonald
Henderson Water Company
Mr. Steve McQuilkin

WRC ENGINEERING, INC.

MEETING MINUTES
OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

SEVENTH PROGRESS MEETING
JANUARY 28, 1997, 1:30 P.M.

The seventh progress meeting for the above referenced project was held on January 28, 1997 at the City of Brighton offices. Attending the meeting were:

Besharah Najjar	Adams County
Darren Duncan	Adams County
John Bramble	City of Brighton
C. Kiepe	City of Brighton
Tim McCandless	City of Brighton
Bill Timmons	Ready Mix Concrete
Ivan Grein	Brighton Lateral
Cecil King	Fulton Ditch/Brighton Lateral
Ben Urbonas	UD&FCD
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.
Andy Andrews	WRC Engineering, Inc.

The following items were discussed:

1. The alternatives proposed to be presented at the City Council work session on February 10, 1997, were discussed. A description of the eight alternatives discussed is attached.

2. A discussion regarding the cost of right-of-way acquisition was held. WRC is currently using $1.00 per square foot for right-of-way acquisition. It was agreed that $0.50 per square foot is a more reasonable value.

Please advise the undersigned if there are any additional items or corrections to these minutes.

Very truly yours,
WRC ENGINEERING, INC.

David P. Krickbaum, P.E.
Project Engineer

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OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED TRIBUTARY
TO
SOUTH PLATTE RIVER
ALTERNATIVES DESCRIPTION

ALTERNATIVE 1 - Diversion without MDCIA

Storm runoff from newly developed areas is captured by a network of storm sewers or channels. Captured runoff for the 2-and 5-year is prevented from entering the City by diversions along Bromley Lane and Baseline Road. 2- and 5-year runoff will be conveyed in storm sewers. These storm sewers have a minimal effect in reducing the 100-year runoff entering the City. 100-year runoff will be conveyed in channels. Preliminary costs for this alternative wee estimated to the 2-, 5- and 100-year storms.

ALTERNATIVE 2 - Diversion with MDCIA

Storm runoff is captured in the same manner as Alternative 1. However, storm water drainage practices for newly developed areas will help reduce the peak runoff quantities. These practices are collectively referred to as MDCIA (Minimized Directly Connected Impervious Area) and are intended to be an important over traditional drainage methods. A conceptual drawing comparing MDCIA to traditional drainage practices is attached. Alternative 2 will include the 3rd level of MDCIA for the newly developed areas. Preliminary costs for this alternative were estimated for the 2, 5, and 100-year storms.

ALTERNATIVE 3 - On-Site 100-year Detention with MDCIA

In this alternative, each future development will provide detention capacity for the 100-year storm. In addition to 100-year storm storage capacity, the newly developed areas will also have level 3 MDCIA. Preliminary costs for this alternative were based on the 100-year storm.

ALTERNATIVE 4 - On-Site 5-year Detention with MDCIA

Like Alternative 3, the drainage basins in newly developed areas will each have detention storage and MDCIA level 3. However, these detentions will be sized to provide extended detention for the 5-year storm instead standard detention of the 100-year storm. Preliminary costs for this alternative were based on 5-year detention facilities and 100-year conveyance facilities.

ALTERNATIVE 5 - Sub-regional 100-year Detention without MDCIA

This alternative evaluates the effect of sub-regional detention. Unlike the previous two alternatives, runoff for 200-600 acre sub-watersheds will be consolidated into a single detention pond. Thus, much fewer ponds will be constructed (approximately 24 ponds). This alternative assumes traditional drainage practices. Preliminary costs were based on the 100-year storm.

ALTERNATIVE 6 - Sub-regional 100-year Detention with MDCIA

This alternative is the same as Alternative 5 except the pond sizes and outflow rates are slightly different. The difference is due to the addition of extended detention for the 5-year flows. Preliminary costs were based on the 100-year storm.

ALTERNATIVE 8 - Sub-regional 100-year Detention with 5-year Extended Detention and MDCIA

This alternative is the same as Alternative 7 except MDCIA level 3 is used instead of traditional drainage practices. Preliminary costs were based on the 100-year storm.

WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

SIXTH PROGRESS MEETING
JANUARY 7, 1997, 9 A.M.

The sixth progress meeting for the above referenced project was held on January 7, 1997 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Garth Englund	CDOT
Ben Urbonas	UD&FCD
Bill Timmons	Ready Mix Concrete
Tim McCandless	City of Brighton
Besharah Najjar	Adams County
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.
Andy Andrews	WRC Engineering, Inc.

The following items were discussed:

1. The hydrology report was reviewed. Ben Urbonas requested that models be run with a 0.4-inch rainfall depth. 0.4-inches is the average annual rainfall depth for the Denver area and is what the typical resident experiences. The additional run will be submitted as an addendum to the hydrology report.

2. Bill Timmons said that the current mining plan shows the existing gravel operation being expanded and ultimately creating a large lake at the west end of Bromely Lane. Possible uses for the future lake include water supply, recreation and augmentation. If Bromley Lane does not continue west, past the future lake, the public right-of-way would not be available for drainage improvements.

3. Alternatives were presented that would reduce the future developed runoff that would flow into the City. The alternatives include:

   A. Full conveyance of the 100-year runoff in open channels. Estimated cost of excavation and right-of-way acquisition for this alternative is $30,000,000. The cost of channel drop structures, highway and railroad crossings will increase the cost significantly.

   B. Full conveyance of the 2-year and 5-year runoff in pipes. The estimated cost of these alternatives is $30,600,000 and $49,900,000 respectively. It was noted that with these alternatives significant runoff will flow into town during larger storm events.

   C. 100-year on-site detention in accordance with the criteria manual. With this alternative, the 100-year flow entering the City is approximately 3.5 times the historic 100-year flow rate.

   D. 100-year sub-regional detention with 0.1 cfs per acre and 0.5 cfs per acre release rates. This alternative with a 0.10 cfs/acre release rate starts to approximate the historic 100-year flow rates into the City.

   WRC will continue to evaluate alternatives for further discussion at the next meeting. The alternatives will be evaluated for the minor and major storm events.

4. The work session with the Brighton City Council is scheduled for February 10, 1997.

5. The next progress meeting will be on January 28, 1997 at 1:30 P.M. in Brighton. There will be no meeting on January 21, 1997.

Please advise the undersigned if there are any additional items or corrections to these minutes.

Very truly yours,
WRC ENGINEERING, INC.

David P. Krickbaum, P.E.
Project Engineer

DPK/jlb
cc: All attendees
Mr. James Holladay
Mr. Greg Fabisiak/South Adams County Water and Sanitation District
Mr. Max Dodson
Ms. Sarah Johnson
Mr. Tim Carey
Mr. Greg Gerlich
Mr. Rick Anderson
Ms. Nickole Stoner
Mr. Hal Simpson
Mr. David Hoden
Mr. George McDonald
Henderson Water Company
Mr. Steve McQuilkin

WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

FIFTH PROGRESS MEETING
DECEMBER 7, 1996, 9 A.M.

The fifth progress meeting for the above referenced project was held on December 7, 1996 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Ben Urbonas	UD&FCD
Cecil King	Brighton Lateral/Fulton Ditch
Ivan Grein	Brighton Lateral
Tim McCandless	City of Brighton
Besharah Najjar	Adams County
John Akolt	Burlington Ditch
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.

The following items were discussed:

1. The existing 15-inch storm sewer in Bromley Lane is for discharges from the City's reverse osmosis plant. The detention pond for Bromley Creek, Filing N°. 1 currently discharges into the existing Bromley Lane storm sewer. This connection is temporary. In the future it is intended for the detention pond to discharge to the Jessup Street Outfall.

2. The draft results of the hydrology model were reviewed. The model includes diversions for the Jessup Street Outfall, the 11th Avenue into the City park detention pond and the outfall along Denver Street, Longs Peak Street and North 4th Avenue. The model includes the large regional detention ponds in the City park, Bromley Creek, Filing N°. 1 and the HKS Channel. The smaller ponds will have a minor effect in the modeling and have not been included. The closed basins that exist in the undeveloped portions of the watershed are included in the model. For this baseline model it is assumed that the stormwater flows across the irrigation ditches and is not intercepted by the ditches.

   A draft summary of flow rates at select design points was presented for the existing conditions, future conditions with closed basins and future conditions without closed basins. The draft flow summary showed that the closed basins had little affect on the 100-year peak runoff rates. It was agreed that the hydrology report will include all three scenarios.

3. Alternatives that will be considered include:

   A. Full conveyance of storm runoff with no detention. This will result in large channels or pipes. Implementation of the proposed improvements would be difficult if development occurs in the upper parts of the watershed before downstream facilities are constructed. A question was raised as to the effects of increased flow to the South Platte River on the South Platte River peak flows.

   B. Detention criteria that would require on-site detention, sub-regional detention or regional detention. The ponds could provide for extended detention of the minor storm events, extended detention for all storm events or could be designed in accordance with the County's criteria. The design criteria established for detention ponds will affect the size of needed conveyance facilities.

   C. Policy alternatives such as requirements to minimize directly connected impervious areas and providing additional open space by purchasing development rights.

4. Diversion of storm runoff into Third Creek is an alternative that should be considered. The legal ramifications of transbasin diversions will need to be identified.

5. The work session with the Brighton City Council will be January 27, 1997.

6. The schedule for future meetings was revised:

   6th Progress Meeting - January 7, 1997

   7th Progress Meeting - January 21, 1997

   8th Progress Meeting - February 6, 1997

The meetings will be at 9 A.M. at UD&FCD. There will be no meeting on January 28 and February 18, 1997.

Please advise the undersigned if there are any additional items or corrections to these minutes.

Very truly yours,
WRC ENGINEERING, INC.

David P. Krickbaum, P.E.
Project Engineer

DPK/jlb
cc: All attendees
Mr. James Holladay
Mr. Greg Fabisiak/South Adams County Water and Sanitation District
Mr. Max Dodson
Ms. Sarah Johnson
Mr. Tim Carey
Mr. Greg Gerlich
Mr. Rick Anderson
Ms. Nickole Stoner
Mr. Hal Simpson
Mr. David Hoden
Mr. George McDonald
Henderson Water Company
Mr. Steve McQuilkin
Mr. Garth Englund

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WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

FOURTH PROGRESS MEETING
NOVEMBER 26, 1996, 9 A.M.

The fourth progress meeting for the above referenced project was held on November 26, 1996 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Margy Sadler	Brighton Lateral
Cecil King	Brighton Lateral/Fulton Ditch
John Case	Brighton Lateral
Ivan Grein	Brighton Lateral
Tim McCandless	City of Brighton
Besharah Najjar	Adams County
John Doerfer	UD&FCD
Andy Andrews	WRC Engineering, Inc.
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.

The following items were discussed:

1. The City has annexed land north of the Study Area. According to Ivan Grein the annexed area drains into the Brighton Lateral. Since the area is outside the study limits, it will not be analyzed as part of this project. However, it is important to know that the annexed area drains into the ditch. If alternatives are evaluated that would convey storm runoff in the ditch, the amount of surface runoff that drains into the Brighton Lateral north of the City must be quantified to determine the available ditch capacity and increases needed to carry both ditch and runoff flows.

2. In the fall of 1995, McLaughlin prepared drainage studies in the Mountain View area. Tim McCandless will call McLaughlin to determine if copies of the report and models are available.

3. A review of the hydrologic modeling was presented. Before the models are finalized, flow splits and the closed basins will be incorporated. A table comparing unit-area peak flows (in cfs/acre) for similar watersheds was handed out. The CUHP models prepared by WRC show a lower runoff rate than those prepared by McLaughlin in 1991. It appears that the differences are due to the use of a different hydrologic soil group and 1-hour rainfall depth. The WRC models use a group B soil, which is more previous than the group C used in the McLaughlin models. The WRC models use the 1-hour point rainfall depth in the Adams County criteria. The McLaughlin models use the total depth of the 2-hour design storm as the 1-hour rainfall depth which, because it is a higher rainfall depth than considered appropriate by WRC and UD&FCD, would over estimate runoff.

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4. A draft hydrology report will be sent to the project sponsors for review before the next progress meeting. A copy will also be sent to Ivan Grein.

5. The effect of a high ground water table and irrigation on the soil infiltration capacity during storms will have to be evaluated. Ivan Grein said that at his farm the ground water is approximately 18-inches below grade in the summer and 4-feet below grade in the winter.

6. WRC will meet with UD&FCD to discuss: the time of concentration calculations versus CUHP lag times; closed basin modeling; flow splits and alternatives modeling.

7. Ivan Grein presented a drainage alternative for consideration. It would include enlarging and lining the Brighton lateral from 144th Avenue north to a large detention pond located ¼ to ½ mile north of Baseline Road. Conveyance from the pond west to the South Platte River would be needed. If the ditch company agreed to accept the storm runoff an agreement would be needed to address increased maintenance of the ditch and to protect the ditch company from liability.

8. Alternatives were presented based on detention for a sample, developed sub-watershed. It was demonstrated that the peak runoff rate could be reduced if extended detentions were used. If extended detention is included in the Outfall Systems Plan, a design volume and release criteria would be needed. The cost of land acquisitions for extended detention basins and the cost of an outfall storm sewer system from the detention basins will have to be evaluated.

9. **The next progress meeting will be December 17, 1996, 9:00 A.M., at UD&FCD.**

Please advise the undersigned if there are any additional items or corrections to these minutes.

Very truly yours,

WRC ENGINEERING, INC.

David P. Krickbaum, P.E.
Project Manager

DPK/jlb

cc: All attendees
Mr. James Holladay
Mr. Greg Fabisiak/South Adams County Water and Sanitation District
Mr. Max Dodson
Ms. Sarah Johnson
Mr. Tim Carey
Mr. Greg Gerlich
Mr. Rick Anderson
Ms. Nickole Stoner
Mr. Hal Simpson
Mr. David Hoden
Mr. George McDonald
Henderson Water Company
Mr. Steve McQuilkin
Mr. John Akolt
Mr. Garth Englund

11. Ben Urbonas would like to schedule a work session with the City about the 1st of February to discuss conceptual alternatives. The session needs to be in a format that the council members can relate to and make decisions. Tim McCandless said that it should be coordinated through Jim Holladay at the City.

12. If WRC develops alternatives that divert runoff to 3rd Creek we need to be aware that: the existing crossings under the highway and railroad are small; 3rd Creek is not well defined in areas; and there is no money available to construct the proposed 3rd Creek improvements. WRC will review the 3rd Creek hydrograph to determine if diverting a portion of the Brighton watershed to 3rd Creek will increase the peak flow in 3rd Creek.

13. Tim McCandless said that the City is not receptive to discharging storm runoff into the City's existing ponds, west of the highway.

14. The ditch companies are concerned about storm ditches being parallel to the irrigation ditches due to seepage, bank stability and wetness. Options would be to locate storm ditches further upstream or to line the irrigation ditches.

15. Groundwater is 3-feet below grade in the vicinity of north of Bromley Lane in between the Fulton Ditch and Brighton Lateral. Shallow ground water was also evident along Bromley during construction of a City pipeline. The pipeline was backfilled with gravel. Clay cutoff walls were constructed across the trench. The pipe trench has acted as groundwater interceptor. As a result the City has seen the water level drop in its wells.

16. The City has prepared groundwater studies. Ben Urbonas requested copies of the studies.

17. According to Cecil King and John Care, Ivan Grein's lake is 13-feet deep and fills with groundwater in the winter.

18. Tim McCandless said that developers have proposed to install drains on the downstream side of the ditches to lower the groundwater. They proposed connecting the drains to the North Outfall. Ben Urbonas said that would fill the North Outfall with groundwater and suggested that other alternatives be explored.

19. The Burlington ditch loses approximately 2% - 3% per mile or 10 cfs through the study area. The capacity of the ditch is 60 cfs, and 80 cfs during runoff. John Care does not think the Fulton Ditch has the same seepage problems as the Burlington Ditch.

20. Tim McCandless provided additional information to WRC on ponds owned by the City. The location of City Park, Bromley Park, and Little Pond were identified.

21. **Next meeting will be November 26, 1996, 9:00 A.M. at the UD&FCD offices.**

Please advise the undersigned if thre are any additonal items or corrections to these minutes.

Very truly yours,

WRC ENGINEERING, INC.

David P. Krickbaum, P.E.
Project Manager

DPK/jlb

cc: All attendees
Mr. Greg Fabisiak/South Adams County Water and Sanitation District
Mr. Max Dodson
Ms. Sarah Johnson
Mr. Tim Carey
Mr. Greg Gerlich
Mr. Rick Anderson
Ms. Nickole Stoner
Mr. Hal Simpson
Mr. David Hoden
Mr. George McDonald
Henderson Water Company
Mr. Steve McQuilkin
Mr. John Akolt
Mr. Besharah Najjar
Mr. Garth Englund

WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED TRIBUTARY TO SOUTH PLATTE RIVER

THIRD PROGRESS MEETING NOVEMBER 5, 1996, 9:00 A.M.

The third progress meeting for the above referenced project was held on November 5, 1996 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Cecil King	Brighton Lateral/Fulton Ditch
John Care	Brighton Lateral/Burlington
Tim McCandless	City of Brighton
Ben Urbonas	UD&FCD
John Doerfer	UD&FCD
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.

The following items were discussed:

1. The sub-watershed, existing facilities, hydrological soils group, existing and future impervious maps will be sent to the UD&FCD, City and County no later than Friday, November 8, 1996, for final review. If WRC does not receive any comments by November 15, 1996, we will assume that the maps are acceptable and will proceed with the hydrology.

2. John Doerfer reported that the mapping that has been checked meets the specifications for accuracy. Final maps are being prepared.

3. It was agreed that the rainfall distribution for watersheds less than 5 square miles will be used in the hydrologic modeling.

4. John Care reported that Item 1-G of the previous meeting minutes was inaccurate. Surface runoff does not flow into the Brighton Lateral from the Montview area. However, surface runoff does flow into the ditch north and south of Montview.

5. A discussion was held regarding the City's current criteria for approving detention ponds in new developments. Tim McCandless said that if no outfall exists the City requires detention of the 24 hour, 100-year event with 1 cfs release rate. Ben Urbonas said releases of this volume to downstream facilities would reduce available capacity of the system and suggested that the City should be very conservative when approving new developments until the Outfall Systems Plan is adopted. He recommended that the 100-year storm be retained with a minimal release rate (over 72 hour period) until specific guidelines are provided in the outfall systems plan.

6. Alternatives that WRC will be considering include: A few large regional detention basins, a mix of large and small detention basins serving 2-3 watersheds designed in accordance with the County's criteria and designed for extended detention times; on-site detention ponds; minimizing directly-connected imperviousness through use of swales and roadside ditches, and use of retention basins. Depending on hydrology, it may be necessary to allow street flooding. The advantage, disadvantage and Right-of-Way requirements for regional ponds will be discussed in the alternatives report.

7. Ben Urbonas emphasized that non-traditional alternatives be considered. Level 1 and 2 disconnected impervious areas will reduce the peak flow for minor storm events and improve water quality.

8. The roadside ditch alternative will take into account the variable ditch section that will be needed. Consideration will be given to placing the ditch in the center of the right-of-way and along the sides of the street. This would require that drainage criteria be adopted specifying a wider street ROW for the ditch in new development areas. Ben Urbonas suggested that a rendering would be helpful when presenting this alternative to the public.

9. The County Judicial building drains to Beebe Draw.

10. Tim McCandless said that there is blow sand along the fence line near 160th and Southern Street. The sand deposits could affect the contours provided by the mapper and sub-watershed delineation. Ben Urbonas said that if WRC needs additional spot elevations to determine flow directions, the mapper can provide the information.

WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER

OCTOBER 22, 1996

A meeting for the above referenced project was held on October 22, 1996 at the Adams County offices to discuss existing and most probable future land uses. Attending the meeting were:

Nicki Stoner	Adams County
Marv Falconburg	City of Brighton
Tim McCandless	City of Brighton
John Doerfer	UD&FCD
Ben Urbonas	UD&FCD
Darren Duncan	Adams County
Besharah Najjar	Adams County
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.

The following items were discussed:

1. Ben Urbonas requested that WRC verify the existing imperviousness in the vicinity of the railroad. 95% imperviousness, as shown on the draft maps, seems too high for the existing conditions observed.

2. Ben Urbonas explained that it is important to develop a conservative projection of the anticipated development. If the projection is too optimistic in estimating the amount of future open space, drainage facilities recommended in the study will be undersized. This would result in the need for additional money to upgrade drainage facilities or greater development controls in the future.

3. Alan Leak requested that the City provide specific goals for the percentage of residential, open space and commercial land uses they project for a typical square mile of future development.

4. Marv Falconburg said that the City can provide a good projection of future development for areas adjoining the City. The outlying areas will be more difficult. The City's current zoning map was reviewed. Alan Leak requested a copy of the map.

5. A discussion was held regarding the future open space corridors along the irrigation ditches. Marv Falconburg estimated that there is an average 40-feet wide corridor along the ditches in existing developments. Ben Urbonas proposed that for this study we assume a corridor width equal to the ditch width plus 30-feet for green belt areas. The meeting participates agreed.

6. Nicki Stoner said that the commercial areas shown on the most probable future imperviousness map are reasonable. She said that the future interchanges are planned along I-76 at 136th and 144th Avenues and suggested that commercial land uses be added in these areas.

7. Adams County is revising it's Comprehensive Land Use Plan. It should be available in March or April, 1997.

8. The County is preparing an open space plan which should be started in mid-November.

Please advise the undersigned if there are any additional items or corrections to these minutes.

Very truly yours,

WRC ENGINEERING, INC.

David P. Krickbaum, P.E.
Project Engineer

DPK/jlb

A. Sub-watershed delineations have been completed on the 1" = 200' scale maps provided by UD&FCD.
B. The field inventory has been started. Samples of the structure inventory sheets were available for review during the meeting.
C. Copies of the existing facilities, hydrologic soils group, existing imperviousness and most probable future imperviousness maps were available for review.
D. It is important that the existing and most probable future imperviousness maps be finalized so that the hydrologic modeling can begin. David will mail copies of the maps to UD&FCD, the City of Brighton and Adams County for review. A meeting will be scheduled the week of October 21st to discuss and finalize these maps.

5. Additional information needed includes:

A. Location and design reports of publicly maintained detention ponds.
B. Hydrologic models used for the 1991 Drainage Outfall Systems Planning prepared by McLaughlin Water Engineers.
C. Drainage capital improvement projects planned through 1997. (Ben Urbonas identified a storm sewer segment that will extend west from the HKS channel as a project scheduled for construction in 1997).
D. Drainage studies for pending development approval.
E. 1974 Brighton Basin Master Drainage Plan (John Doerfer provided a copy of the study after the meeting).

6. A copy of the project schedule presented at the initial progress meeting was reviewed. The project duration is 15 months. An updated schedule will be provided at the next meeting.

7. Future meetings were scheduled for:

November 5, 1996
November 26, 1996
December 17, 1996
January 7, 1997
January 28, 1997
February 18, 1997
The meetings will be at 9:00 A.M. at the UD&FCD offices.

8. Other Discussions

A. Andy Andrews asked if anybody knew what Thornton's intent was when they claimed the gravel pits for water storage. John Akolt thinks they are claiming the pits for augmentation purposes even though the City does not own them yet.
B. Ben Urbonas explained that urban runoff is low in total nitrogen, high in phosphates and nitrogen. This is supported by testing completed for the Denver Metro storm water quality permits.
C. Fulton Ditch has had an agreement with the City to accept a prescribed quantity of storm runoff in town and to discharge the runoff north of town. The runoff is being put into the ditch in Town but is not being removed.

Please advise the undersigned if there are any additional items or corrections to these minutes.

Respectfully submitted,

WRC ENGINEERING, INC.

David P. Krickbaum

David P. Krickbaum, P.E.
Project Engineer

DPK/jlb

cc: All attendees
Mr. Greg Fabisiak/South Adams County Water and Sanitation District
Mr. Max Dodson
Ms. Sarah Johnson
Mr. Tim Carey
Mr. Greg Gerlich
Mr. Rick Anderson
Ms. Nickole Stoner
Mr. Hal Simpson
Mr. David Hoden
Mr. George McDonald
Henderson Water Company

WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED TRIBUTARY TO SOUTH PLATTE RIVER

SECOND PROGRESS MEETING
OCTOBER 15, 1996, 9:00 A.M.

The second progress meeting for the above referenced project was held on October 15, 1996 at the offices of Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Steve McQuilkin	E-470 Authority
Cecil King	Brighton Lateral/Fulton Ditch
Ivan Grein	Brighton Lateral/Burlington
John Akolt	FRICO/Burlington/Brighton Lateral
Besharah Najjar	Adams County
Garth Englund	CDOT Hydraulic Section
Tim McCandless	City of Brighton
Lysle Dirrim	Fulton Irrigation Ditch
Ben Urbonas	UD&FCD
John Doerfer	UD&FCD
Andy Andrews	WRC Engineering, Inc.
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.

The following items were discussed:

1. Each of the entities present were asked to identify the items they thought to be critical to the project.

   A. John Akolt
   - Recognizes the need to pass historic flow in the ditches. The 2- and 5-year urban developed flows are a concern.
   - Water quality/nutrient loading
   - Total increased flow into the South Platte River and the impact to facilities downstream of Denver.
   - Ditch companies will consider conveying storm runoff if capacity is available and if there is some place to remove the runoff from the ditch downstream.
   - Ditch companies are willing to work toward common solutions.

   B. E-470 Authority
   - The project is funded to 120th Avenue
   - Future alignment approximately follows Third Creek.
   - Even though E-470 is largely located outside the study area, they want to be involved.

   C. Fulton Ditch
   - Has the same concerns expressed by John Akolt
   - Presently, urban runoff from east of the ditch drains into the ditch.
   - The ditch has overtopped several times north of the City.
   - An 18-inch pipe drains into the ditch south of Bridge Street.
   - The Fulton Lateral has no excess capacity.
   - There is no Fulton Ditch wasteway at Third Creek.

   D. City of Brighton
   - The center of Town is flat
   - At 13th and Bridge flooding occurs during minor events.
   - The City needs funding for drainage improvements.
   - There are serious problems with the ditches.

   E. Adams County
   - Sees the outfall systems plan as a guide for the area left as unincorporated.

   F. CDOT
   - Not aware of any problems along Highway 85.
   - High groundwater was encountered during construction of the I-76 Improvements.
   - Wetlands mitigation is located at 132nd Avenue and Buckly Road.

   G. Brighton Lateral
   - The ditch overtops at Bromely Lane.
   - Lack of City maintenance at the culverts are a problem
   - Coarse soils upstream of the ditch help to minimize runoff, they are not aware of surface runoff flowing into the ditch.
   - There is no return flow to the river from the ditch
   - The ditch overtopped at 160th and Bridge Street one time this year, at no time the year before and many times in previous years. Ben requested records of ditch overflow documenting the location and frequency of overtopping.

2. Alan Leak explained that project should proceed with an open format and open discussions. Items that WRC will be looking at include:

   A. Stormwater and irrigation water interface
   B. Phasing and funding of drainage improvements
   C. Implementation of the outfall system plan with the scattered growth pattern that is anticipated.
   D. Potential use of the gravel pits to detain storm runoff and improve water quality and the municipalities plans to use the pits for raw water storage.
   E. Drainage improvements for the minor storm event.

3. John Doerfer presented the status of the mapping. 1" = 200' scale maps have been provided to WRC for most of the study area. AutoCadd files were sent to the surveyors for checking last Friday. The final AutoCadd maps should be ready in about 2 weeks. John will provide the preliminary files to WRC so the hydrologic modelling can be continued.

4. David Krickbaum summarized the work completed to-date.

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WRC ENGINEERING, INC.

MEETING MINUTES

OUTFALL SYSTEMS PLANNING FOR BRIGHTON WATERSHED
TRIBUTARY TO SOUTH PLATTE RIVER
INITIAL PROJECT MEETING

The initial project meeting for the above referenced project was held on August 27, 1996, at the offices of the Urban Drainage and Flood Control District (UD&FCD). Attending the meeting were:

Daren Duncan	Adams County
Ben Urbonas	UD&FCD
John Doerfer	UD&FCD
Andy Andrews	WRC Engineering, Inc.
Alan Leak	WRC Engineering, Inc.
David Krickbaum	WRC Engineering, Inc.

The following items were discussed:

1. The next progress meeting will be **9:00 a.m., October 15, 1996, at UD&FCD**. Meetings are also scheduled on November 5 and 26, 1996 at 9:00 a.m. The location of the November meetings will be determined later.

2. Entities/parties that are suggested to be invited to attend the progress meetings include:

   Colorado Department of Transportation
   Colorado Department of Public Health and Environment
   Colorado Division of Wildlife
   Army Corps of Engineers
   E-470 Authority
   Environmental Protection Agency
   State Engineer's Office
   South Adams County Water and Sanitation District
   Gravel pit owners
   Railroad companies
   Adams County Parks Department
   Adams County Planning Department
   Irrigation Ditch Companies

   WRC will solicit input from the City of Brighton to determine if other developers, special districts or City departments are to be included or if any of the above should not be included at this time. When the list of participants is finalized, WRC will prepare an invitation letter for the next meeting to be mailed by the UD&FCD. Also, the City's input on public participation/input is being sought.

3. According to Daren, ditch companies have said that they will not accept urban runoff. Irrigation water and storm runoff need to be kept separate. Mr. Andrews noted that there are places where irrigation water drains into the City's storm sewer system. In these cases it may not be possible to separate the irrigation and storm flows. We will need to identify those areas and recognize that there may be base irrigation flows in the storm sewer during a rainfall event.

4. A project schedule was distributed and based upon WRC receiving final mapping on October 1, 1996. The actual schedule will depend on receipt of the final mapping. Draft mapping should be available in 2 weeks. WRC can start the sub-basin boundary delineation with the draft mapping. WRC requested a set of contact prints when the draft mapping is delivered.

5. Adams County will provide their transportation plan, comprehensive/land use plan, open space plan and assessors maps. WRC will obtain similar information from the City of Brighton.

CONSULTING ENGINEERS
950 SOUTH CHERRY STREET • SUITE 404 • DENVER, COLORADO 80222 • (303) 757-8513 • FAX (303) 758-3208

APPENDIX D

CITY COUNCIIL WORK SESSION

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED TRIBUTARY
TO SOUTH PLATTE RIVER

CITY COUNCIL WORK SESSION
FEBRUARY 10, 1997

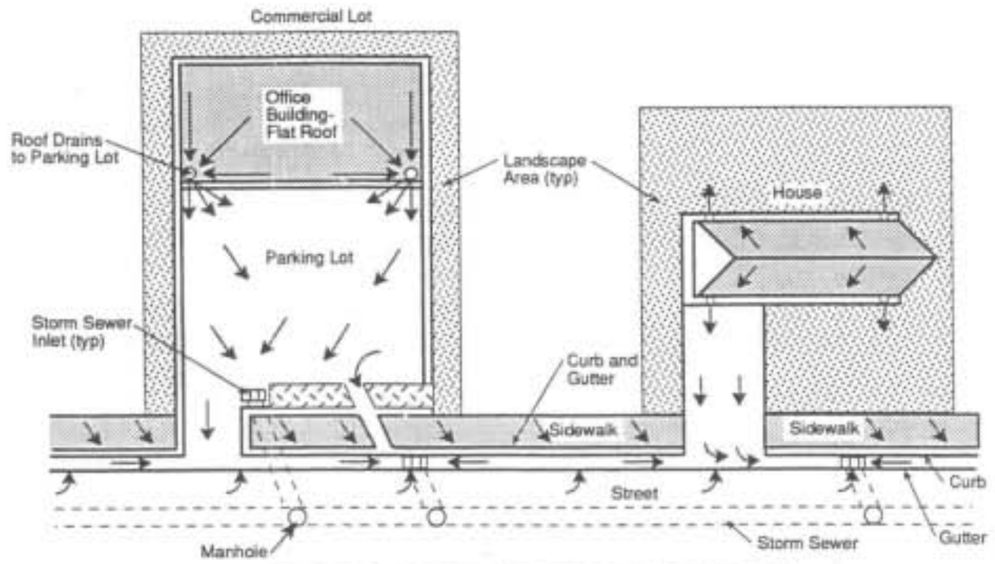
AGENDA

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED
CITY COUNCIL WORK SESSION

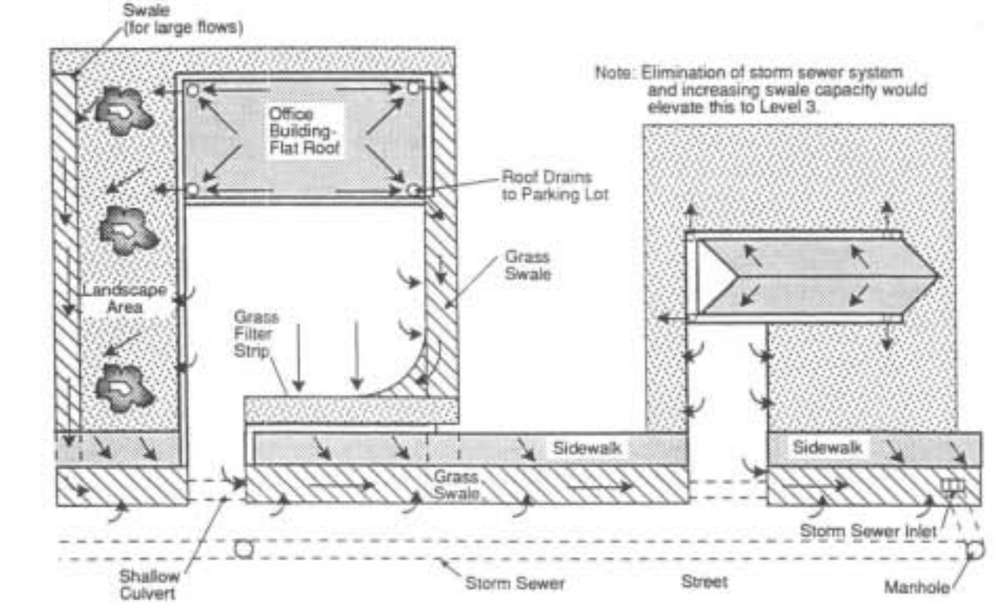
- Project Summary
- Introduction to minimizing Directly Connected Impervious Area (MDCIA) (Figure 2-2 from criteria manual, photos)
- On-Site vs. Sub-Regional Detention
- Alternatives
  1. 100-year on-site detention per current criteria (0.85 cfs/acre release rate)
  2. 5-year extended on-site detention (40 hour release rate)
  3. Subregional 100-year with 5-year extended detention
- Effect of MDCIA on stormwater runoff and volume
- Effect of MDCIA on water resources

PROJECT SUMMARY

- Outfall systems plan
- Hydrologic analysis
  - Closed Basins
- Develop alternatives
  - Maintain future developed runoff rates flowing into the City at or below existing rates that are currently experienced
  - Divert future developed runoff around the existing developed portion of the City
  - Alignments
  - Cost Estimates
- Policy Considerations
  - Land dedication requirements
  - On-site or sub-regional detention
  - Extend detention or current criteria
  - Traditional development or minimize directly connected impervious area



TRADITIONAL SITE & STREET DRAINAGE DESIGN



MINIMIZING DIRECTLY CONNECTED IMPERVIOUS AREAS (LEVEL 2 PRACTICES SHOWN)

FIGURE 2-2. EXAMPLES OF MINIMIZING DIRECTLY CONNECTED IMPERVIOUS AREAS



Traditional Residential Development



1960, 1960-EX3.DWG 2/4/97 EJM

WRC | EXAMPLES OF TRADITIONAL PRACTICE | City of Brighton



Grass Swale Adjacent to Major Arterial



Residential Area with Small Pipe Under Driveway

1960, 1960-EX3.DWG 2/3/97 EJM

WRC | EXAMPLES OF MINIMIZING DIRECTLY CONNECTED IMPERVIOUS AREA | City of Brighton



Roadside Ditch in Established Residential Area



Newer Residential Area with MDCIA near Greeley

1960, 1960-EX3.DWG 2/3/97 EJM

WRC

EXAMPLES OF MINIMIZING DIRECTLY CONNECTED IMPERVIOUS AREA

City of Brighton



Vegetated Area near Commercial Strip Mall

1960, 1960-EX3.DWG 2/3/97 EJM

WRC

EXAMPLES OF MINIMIZING DIRECTLY CONNECTED IMPERVIOUS AREA

City of Brighton

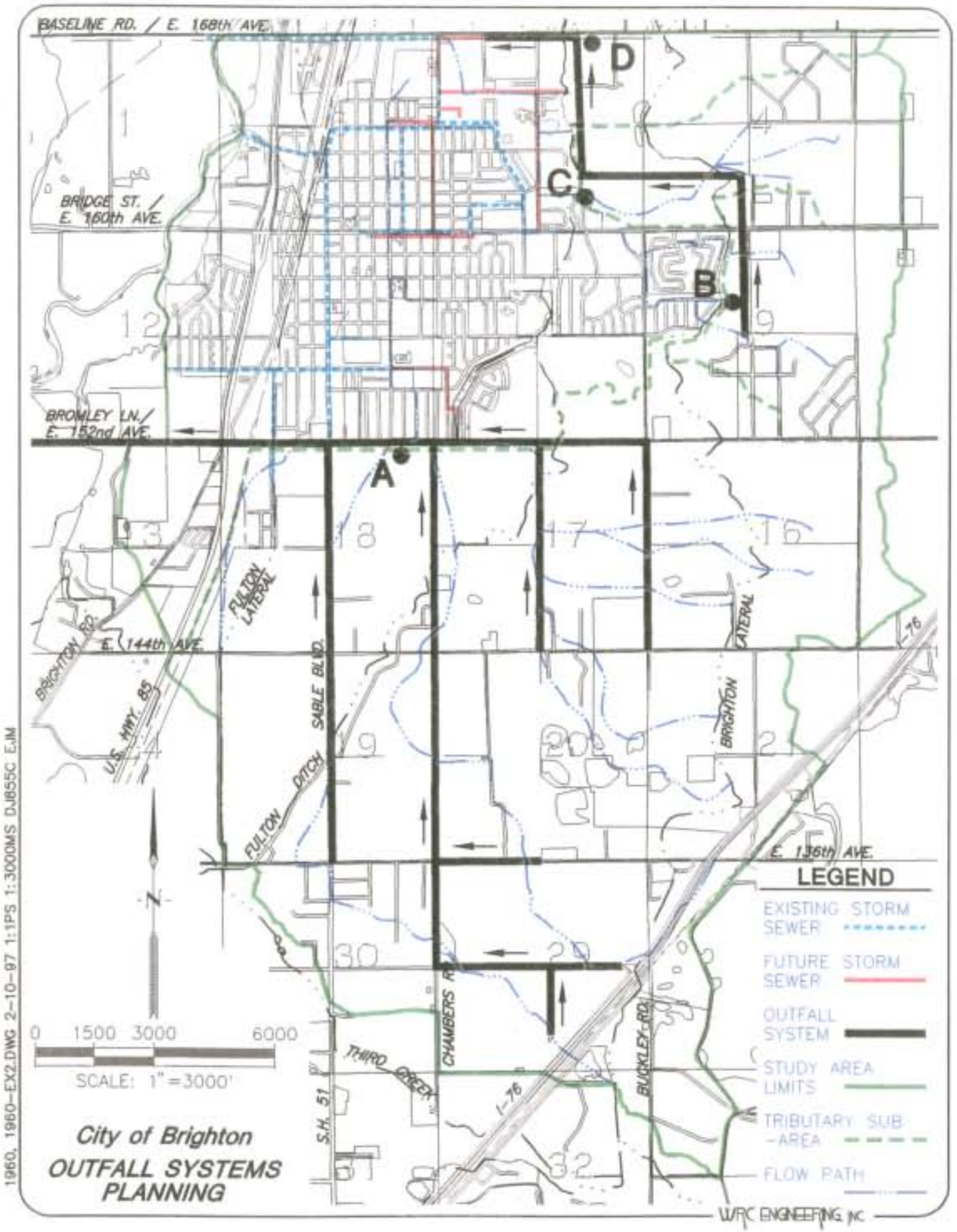


Commercial Development in Longmont - Parking Lot Drains Directly into Gutter and Storm Sewer

1960, 1960-EX3.DWG 2/4/97 EJM

ONSITE VS. SUB-REGIONAL DETENTION

ON-SITE	SUBREGIONAL
Potentially 200 or more detention ponds	Approximately 24 detention ponds fewer facilities to maintain
Ponds constructed as development occurs	Better reliability/publicly maintained
Implementation/timing of downstream drainage facilities	Cash flow required to implement
Publicly or privately maintained ponds?	Timing of ponds and downstream drainage facilities
Monitoring to ensure proper maintenance of privately maintained ponds	Easement cost
Pond construction is a site development cost paid by the developer	Constructed with public funds



ALTERNATIVE Nº. 1: ON-SITE 100-YEAR DETENTION

Future developments would provide on-site detention for 10- and 100-year storms in accordance with the current criteria. Allowable release rates from the ponds would be 0.23 and 0.85 cubic feet per second (cfs)/acre of tributary land area for the 10-and 100-year storms, respectively. Storm sewer sizes would range from 18-inch to 72 -inch diameter. Open channels would have up to a 100-foot bottom width.

- Estimated Community Cost
  - Conveyance Facilities $38,000,000
- Estimated Developer Cost
  - Detention Facilities $ 6,000,000
  - Assigned Land Value $ 7,300,000

Total Estimated Cost $51,300,000

NOTES:

1. Pond construction costs are assumed to be a site development cost paid by the developer.
2. Outfall systems are assumed to be located in dedicated street right-of-way.

ALTERNATIVE Nº. 2: 5-YEAR EXTENDED ON-SITE DETENTION

Future development would provide on-site detention for the 5-year storm event to be released over a 40-hour period. Storm sewer sizes would range from 18-inch to 72-inch diameter. Open channels would have up to a 100-foot bottom width.

- Estimated Community Costs
  - Conveyance Facilities $37,600,000
- Estimated Developer Cost
  - Detention Facilities $ 5,200,000
  - Assigned Land Value $ 6,300,000
  - Total Estimated Cost $49,100,000

NOTES:

1. Pond construction costs are assumed to be a site development cost paid by the developer.
2. Outfall systems are assumed to be located in dedicated street right-of-way.

ALTERNATIVE Nº. 3: SUBREGIONAL 100-YEAR WITH EXTENDED 5-YEAR DETENTION

Sub-regional ponds would be constructed to provide detention for 200-500 acre areas. The 100-year release from the pond would be restricted to 0.10 cfs/acre of tributary land area. The 5-year storm would be detained and released over a 40-hour period. Storm sewer sizes would range from 18- inch to 72- inch diameter. Open channels would have a bottom width up to 10-feet.

- Estimated Community Cost
  - Drainage Facilities $14,400,000
  - Detention Facilities $12,200,000
  - Assigned R.O.W. Value $14,900,000
  - Total Estimated Cost $41,500,000

NOTES:

1. Pond construction costs are assumed to be a site development cost paid by the developer.
2. Outfall systems are assumed to be located in dedicated street right-of-way.

ALTERNATIVES COST SUMMARY

Alternative	Detention Volume (ac-ft)	Costs			
		Conveyance Facilities	Detention Facilities	Detention Land Value	Total Estimated Cost
1	499	$38,000,000	$6,000,000	$7,300,000	$51,300,000
2	431	$37,600,000	$5,200,000	$6,300,000	$49,100,000
3	1011	$14,400,000	$12,200,000	$14,900,000	$41,500,000

1. The assigned land value is assumed to be $0.50 per square foot.
2. Estimated costs for conveyance and detention facilities include: 25% for contingencies, 10% for engineering, 5% for contractor mobilization, 10% for legal and administration.
3. Estimated costs for assigned land value includes 25% for contingencies, 10% for legal and administration.

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED

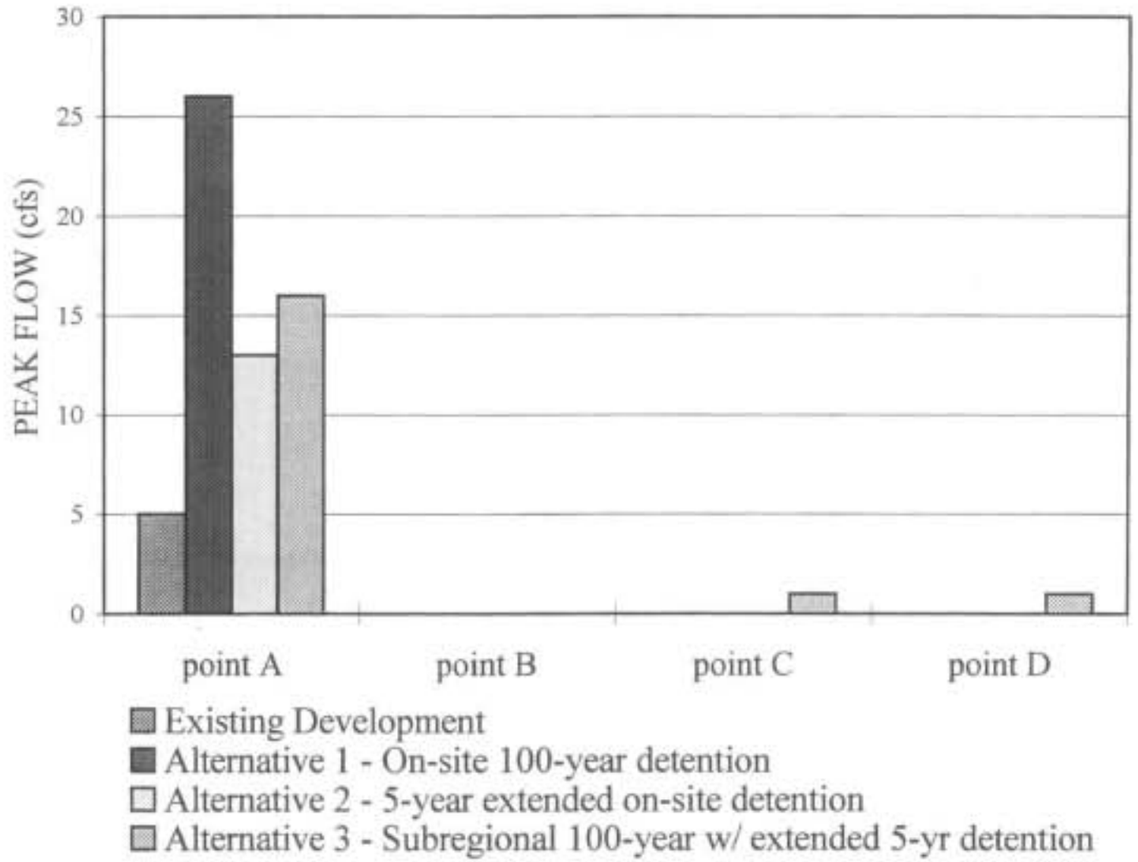
PEAK FLOW SUMMARY - 0.4 INCH STORM*

	point A	point B	point C	point D
Existing Development	5	0	0	0
Future Development	234	14	52	27
Alternative 1 - On-site 100-year detention	26	0	0	0
Alternative 2 - 5-year extended on-site detention	13	0	0	0
Alternative 3 - Subregional 100-year w/ extended 5-yr detention	16	0	1	1

* 0.4 - inch storm is the average storm in the Denver area experienced by the typical resident

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED

PEAK FLOW COMPARISON - 0.4 INCH STORM



OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED

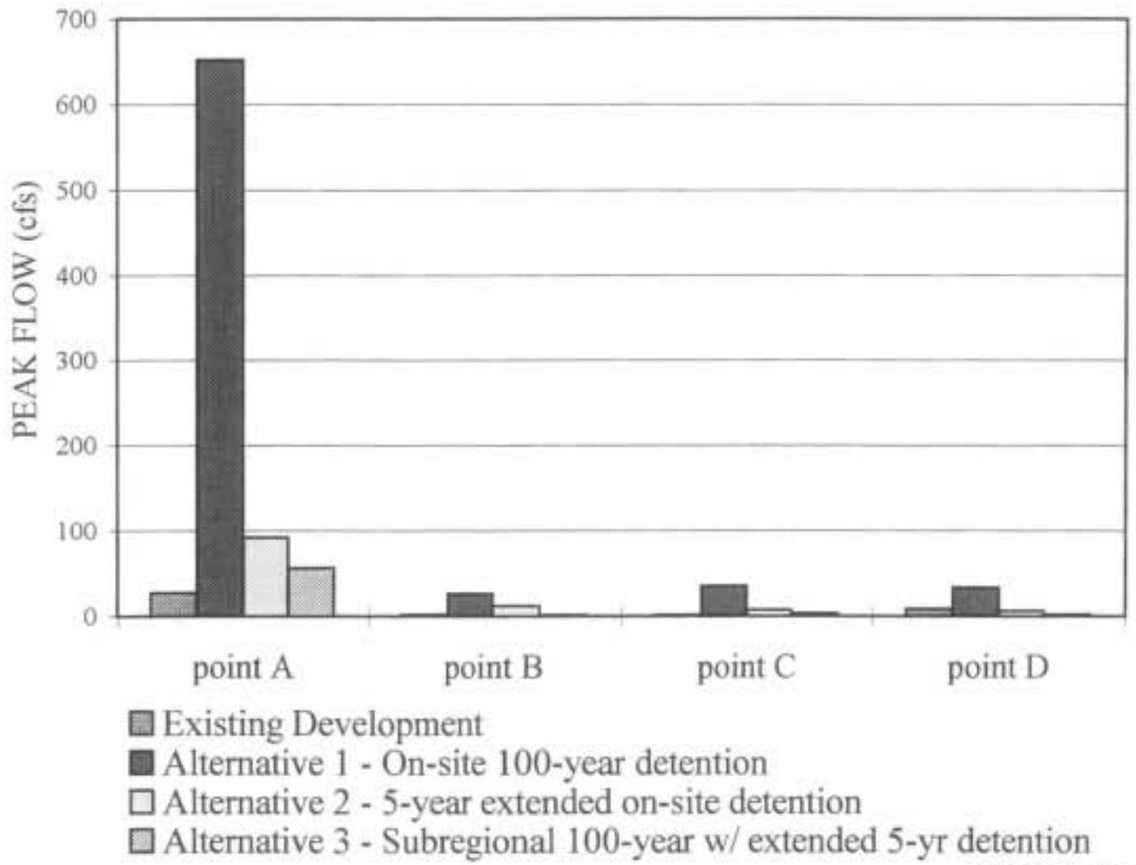
PEAK FLOW SUMMARY - 2 YEAR STORM*

	point A	point B	point C	point D
Existing Development	27	2	1	8
Future Development	1049	73	234	109
Alternative 1 - On-site 100-year detention	652	26	35	33
Alternative 2 - 5-year extended on-site detention	92	12	7	6
Alternative 3 - Subregional 100-year w/ extended 5-yr detention	56	1	3	2

* One hour design rainfall of 1.0 - inches

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED

PEAK FLOW COMPARISON - 2 YEAR STORM



OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED

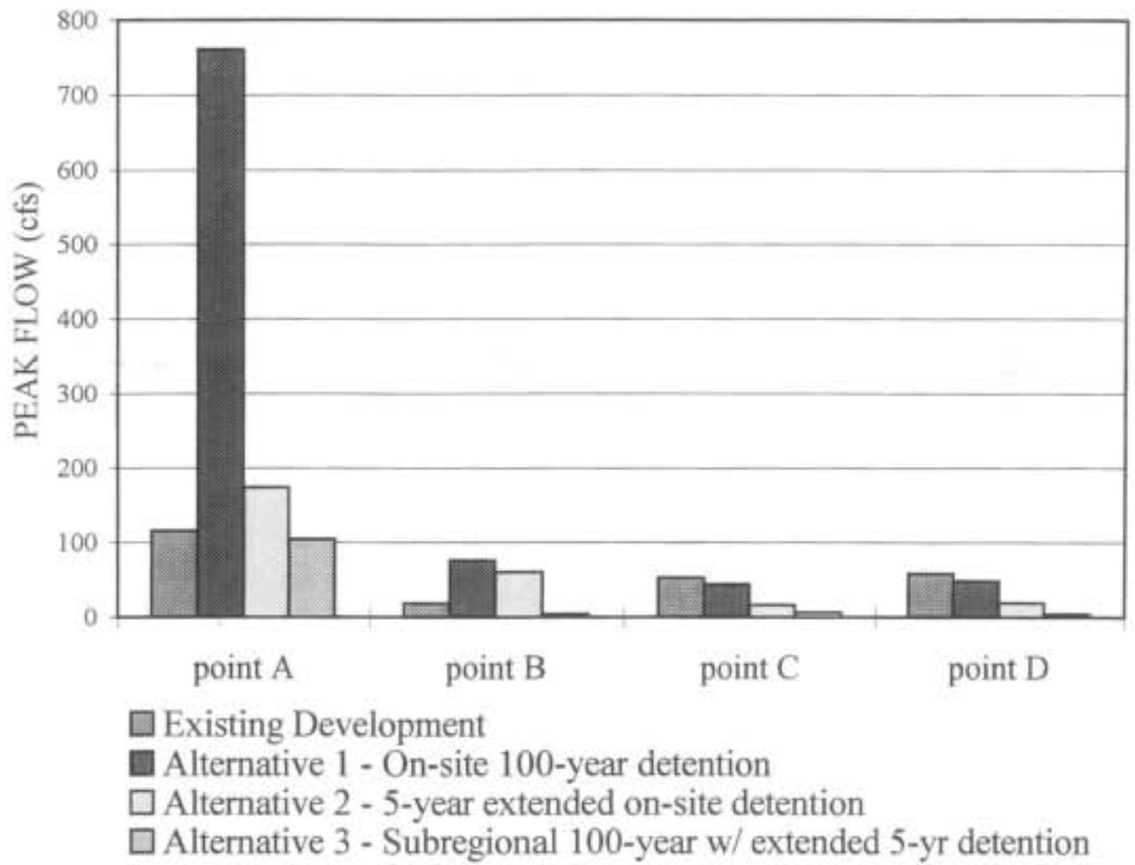
PEAK FLOW SUMMARY - 5 YEAR STORM*

	point A	point B	point C	point D
Existing Development	115	18	53	58
Future Development	2111	197	487	217
Alternative 1 - On-site 100-year detention	761	76	44	48
Alternative 2 - 5-year extended on-site detention	173	60	16	19
Alternative 3 - Subregional 100-year w/ extended 5-yr detention	104	4	6	4

* One hour design rainfall of 1.42 - inches

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED

PEAK FLOW COMPARISON - 5 YEAR STORM



OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED

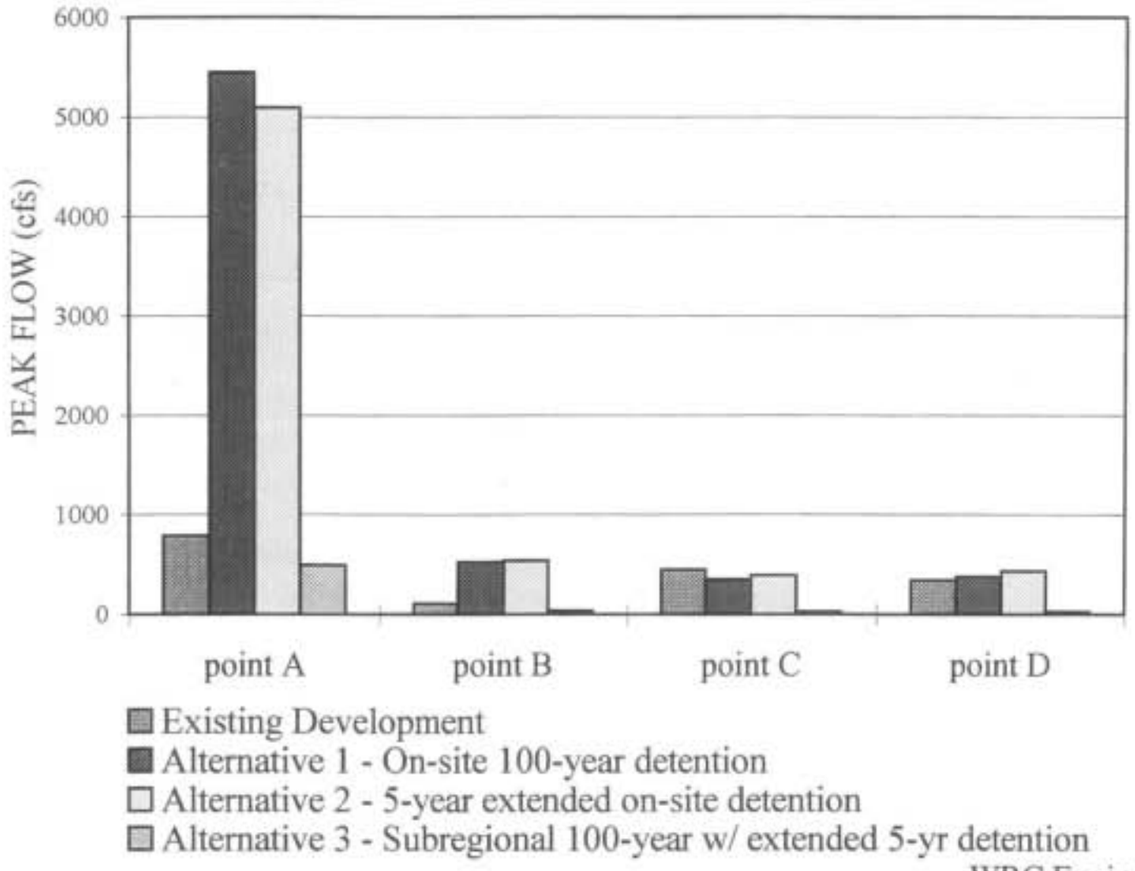
PEAK FLOW SUMMARY - 100 YEAR STORM*

	point A	point B	point C	point D
Existing Development	787	108	448	339
Future Development	7705	779	1710	685
Alternative 1 - On-site 100-year detention	5446	523	348	377
Alternative 2 - 5-year extended on-site detention	5091	538	389	434
Alternative 3 - Subregional 100-year w/ extended 5-yr detention	494	33	27	24

* One hour design rainfall of 2.71 - inches

OUTFALL SYSTEMS PLANNING
BRIGHTON WATERSHED

PEAK FLOW COMPARISON - 100 YEAR STORM



ALTERNATIVES COST SUMMARY

Alternative	Detention Volume (ac-ft)	Costs			
		Conveyance Facilities	Detention Facilities	Detention Land Value	Total Estimated Cost
1	499	$38,000,000	$6,000,000	$7,300,000	$51,300,000
2	431	$37,600,000	$5,200,000	$6,300,000	$49,100,000
3	1011	$14,400,000	$12,200,000	$14,900,000	$41,500,000

1. The assigned land value is assumed to be $0.50 per square foot.
2. Estimated costs for conveyance and detention facilities include: 25% for contingencies, 10% for engineering, 5% for contractor mobilization, 10% for legal and administration.
3. Estimated costs for assigned land value includes 25% for contingencies, 10% for legal and administration.

EFFECTS OF MDCIA ON WATER RESOURCES

- Enhanced water quality
- Increase stormwater infiltration
- Minimizes impacts to groundwater tables

EFFECTS OF MDCIA ON STORMWATER RUNOFF AND VOLUME.

- Enhanced water quality for minor storm events.
- Reduced peak runoff rates.
- Reduce runoff volume by approximately 25%.

APPENDIX E

PROJECT CORRESPONDENCE

CITY OF
BRIGHTON

22 SOUTH 4TH AVENUE ▪ BRIGHTON, COLORADO 80601 ▪ (303) 659-4050

RECEIVED
MAR 12 1997
U.D. & F.C.D.

March 10, 1996

Ben Urbonas
Urban Drainage and Flood Control District
2480 W. 26th Ave. Suite 156B
Denver, Co. 80211

Dear Ben,

As I discussed with you on the phone, City Council recently discussed the options on direction to proceed with the Drainage Master Plan for the City of Brighton. Their request is as follows:

1. Use the Minimum Directly Connected Impervious Area (MDCIA) concept on new Collector and Arterial streets and also in rural residential areas with lot sizes of 1 ½ acres or more.
2. Continue to use curb and gutter in the urban residential areas.
3. Use Sub-Regional Detention with 5-year extended detention as a standard for new development.

If you have any questions about Council's desires please contact me or Tim McCandless at 654-1637.

Sincerely,

James F. Holladay
Director of Operations

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

L. Scott Tucker, Executive Director

August 29, 1997

Besharrah Najjar
Adams County
4955 East 74th Avenue
Commerce City, CO 80022

Subject: Brighton Watershed Tributary to South Platte River
Outfall Systems Planning
Alternatives Evaluation Report

Dear Mr. Najjar:

Accompanying this letter are five (5) copies of the alternatives evaluation report for the above-referenced project. It is now time to select the alternative for the preliminary design report. According to the funding agreement, this needs to be completed within sixty days of your receiving these reports. As a result, I am requesting that you provide me with your preferences for the selected plan by October 31, 1997.

We may want to schedule a meeting with interested parties to discuss the report. If you think another meeting would be beneficial, please call me to set one up. Otherwise, I look forward to receiving your selected alternative.

Sincerely,

Ben Urbonas, P. E.
Chief, Master Planning and
South Platte River Programs

By: John T. Doerfer
Hydrologist
Master Planning Program

BRU/JTD/gb
Enclosures (5 copies)
cc: Alan J. Leak, WRC Engineering, Inc.

Board of Directors

Executive Committee:

Cathy Reynolds
Chairman
City of Denver

Linda Morton
Chairman Pro-Tem
City of Lakewood

Robert A. Christensen
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City of Littleton

Members:

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Paul Danish
Boulder County

Bill Himmelmann
City of Denver

B. H. Hoffmaster
Engineer

Fidel Montoya
City of Denver

Edna Mosley
City of Aurora

Deborah Ortega
City of Denver

Art Patton
Engineer

Mary Poe
Town of Morrison

Elaine Valente
Adams County

Debra Vickrey
Arapahoe County

2480 W. 26TH AVENUE • SUITE 156 B • DENVER, COLORADO 80211
TELEPHONE 303-455-6277 • FAX 303-455-7880

\dist\sponsors

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

L. Scott Tucker, Executive Director

2480 W. 26TH AVENUE • DENVER, COLORADO 80211 • TELEPHONE 303-455-6277 • FAX 303-455-7880 • SUITE 156 B

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Linda Morton, Chairman Pro-Tem, City of Lakewood
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Dennis Reynolds, Member, City of Littleton

Members:

Carolyn Buchholz, City of Lafayette
Margaret Carpenter, City of Thornton
Paul Danish, Boulder County
Bill Himmelmann, City of Denver
B. H. Hoffmaster, Engineer
Fidel Montoya, City of Denver
Edna Mosley, City of Aurora
Deborah Ortega, City of Denver
Art Patton, Engineer
Mary Poe, Town of Morrison
Elaine Valente, Adams County
Debra Vickrey, Arapahoe County

August 29, 1997

Blair Renfro
City of Brighton
Department of Public Works
22 South Fourth Avenue
Brighton, CO 80601

Subject: Brighton Watershed Tributary to South Platte River
Outfall Systems Planning
Alternatives Evaluation Report

Dear ~~Mr. Renfro~~ Blair:

Accompanying this letter are five (5) copies of the alternatives evaluation report for the above-referenced project. It is now time to select the alternative for the preliminary design report. According to the funding agreement, this needs to be completed within sixty days of your receiving these reports. As a result, I am requesting that you provide me with your preferences for the selected plan by October 31, 1997.

We may want to schedule a meeting with interested parties to discuss the report. If you think another meeting would be beneficial, please call me to set one up. Otherwise, I look forward to receiving your selected alternative.

Sincerely,

Ben Urbonas, P. E.
Chief, Master Planning and
South Platte River Programs

By: John T. Doerfer
Hydrologist
Master Planning Program

BRU/JTD/gb
Enclosures (5 copies)
cc: Alan J. Leak, WRC Engineering, Inc.

DRCOG
Denver Regional Council of Governments

2480 W. 26th Avenue • Suite 200B
Denver, Colorado 80211-5580
(303) 455-1000 • FAX (303) 480-6790
Accessible on RTD Route 28

A partnership of local governments serving the region since 1955

September 17, 1997

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SEP 19 1997
U.D. & F.C.D.

Ben Urbonas, P.E.
Chief, Master Planning and
South Platte River Programs
Urban Drainage & Flood Control District
2480 West 26th Avenue, Suite 156B
Denver, Colorado 80211

Dear Mr. Urbonas:

Re: Brighton Watershed, DRCOG File No. 25-97

The Denver Regional Council of Governments reviews and comments on a wide variety of proposals which affect the growth and development of the region. The process of project review is utilized to assist in the implementation of adopted regional plans and policies and to coordinate intergovernmental planning, programming and development. Implementation is achieved through action by local, state, and federal governments on proposals which are consistent with adopted plans and policies. The Urban Drainage and Flood Control District is encouraged to consider the following comments.

The alternative evaluation report on the Brighton Watershed outfall systems planning was reviewed from a water quality perspective. The recommended plan provides water quality benefits and is consistent with the regional Clean Water Plan.

If you have any questions, please contact Larry Mugler, Development Services Director at DRCOG.

Sincerely,

David A. Pampu
Deputy Executive Director

jh

c: Martin J. Flaum, Adams County Commissioner, DRCOG Board Representative
Ken Mitchell, Mayor Pro Tem, City of Brighton, DRCOG Board Representative

Board Officers
Margaret W. Carpenter, Chairman
Polly Page, Vice Chairman
Jan Schenck, Secretary-Treasurer
Roland E. Cole, Immediate Past Chairman
Robert D. Farley, Executive Director

Executive Committee
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Wellington E. Webb

UNION PACIFIC RAILROAD COMPANY

1416 DODGE STREET
OMAHA, NEBRASKA 68179-0323

September 25. 1997

RECEIVED
SEP 29 1997
U.D. & F.C.D.

Mr. Ben Urbonas, P.E.
Chief, Master Planning and
South Platte River Programs
Urban Drainage and Flood Control District
2480 West 26th Avenue
Denver, Colorado 80211
Phone: (303) 455-6277
Fax: (303) 455-7880

File: Drainage & Waterways (Culv. 17.64 +/- & 19.66 +/- Greeley Subdivision)
CO: Brighton
Brighton Watershed
MP 17.64 +/- & 19.66 +/- Greeley Subdivision

Dear Mr. Urbonas:

The Union Pacific Railroad Company has reviewed your proposal and has no structural objections. The following items must be addressed:

1. The proposal will require two crossing agreements between the Railroad Company and the City of Brighton and/or the drainage district. The contact person at the railroad is:
   Mr. Jon Devish
   Contracts Representative
   Real Estate Department
   1416 Dodge Street – WP001
   Omaha, Nebraska 68179
   Ph: (402) 997-3546
2. The reinforced concrete pipe located on the railroad right of way is to be Class V, w/D-Load = 3000 (Ultimate = 3750).
3. The reinforced concrete box culvert is to be designed according to Chapter 8 of the American Railway Engineering Association (AREA). The box design and any shoring required on the railroad right of way are to be sent to the railroad for approval.
4. A copy of the construction specifications and timetable must be approved by the railroad. This is one of the railroad's main tracks. The Operating Department will need to be notified if track time is required. The location plan indicates two tracks at located at both locations.

If you have any questions concerning this project, call me on (402) 271-5797.

Yours truly,

D. E. Hoden
Sr. Structural Designer

brighton.doc

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
TRI-LAKES PROJECT OFFICE, 9307 STATE HWY 121
LITTLETON, COLORADO 80123-6901

REPLY TO
ATTENTION OF

October 6, 1997

RECEIVED
OCT 08 1997
U.D. & F.C.D.

Mr. Ben Urbonas, P.E.
Urban Drainage and Flood Control District
2480 West 26th Avenue, Suite 156 B
Denver, Colorado 80211

RE: Brighton Watershed, Alternatives Evaluation Report, Corps File No. 199780804

Dear Mr. Urbonas:

Reference is made to the Brighton Watershed, alternatives evaluation report project. The project is located in Various Sections, Township 1 South, Range 66 West, Adams County, Colorado.

If any work associated with this project requires the placement of dredged or fill material, and any excavation associated with a dredged or fill project, either temporary or permanent, in streams or wetlands at this location, this office should be contacted by a proponent of the project for proper Department of the Army permits or changes in permit requirements pursuant to Section 404 of the Clean Water Act.

If there are any questions concerning this matter, contact **Mr. Terry McKee** of this office at 303-979-4120 and reference **Corps File No. 199780804.**

Sincerely,

Timothy T. Carey
Project Manager

STATE OF COLORADO

OFFICE OF THE STATE ENGINEER
Division of Water Resources
Department of Natural Resources

1313 Sherman Street, Room 818
Denver, Colorado 80203
Phone (303) 866-3581
FAX (303) 866-3589

RECEIVED
OCT 08 1997
U.D. & F.C.D.

Roy Romer
Governor

James S. Lochhead
Executive Director

Hal D. Simpson
State Engineer

October 6, 1997

Mr. Ben Urbonas, P.E.
Urban Drainage and Flood Control District, Suite 156B
2480 26th Avenue
Denver, CO 80211

Re: Brighton Watershed

Dear Mr. Urbonas:

In regard to your subject alternatives evaluation report submitted September 3, 1997, our main comment pertains to the construction of the detention basins. You are reminded that a Notice of Intent to Construct an Impoundment Structure (CRS 37-87-125) is required in accordance with our Regulations for Dam Safety and Dam Construction, Rule 11A.

Sincerely,

Alan Pearson, Principal Engineer
Dam Safety Branch

c:\hal\briton2.doc

STATE OF COLORADO

DEPARTMENT OF TRANSPORTATION

4201 East Arkansas Avenue
Denver, Colorado 80222
Hydraulics Unit, Region 6 - Room 415
(303) 757-9705

RECEIVED
OCT 09 1997
U.D. & F.C.D.

October 7, 1997

Mr. Ben Urbonas, P.E.
Urban Drainage and Flood Control District
2480 W. 26th Avenue, Ste. 156B
Denver, Colorado 80211

Dear Mr. Urbonas,

Thank you for giving us the opportunity to comment on Brighton Outfall System Planning Study. I have the following comments:

- The planning study is acceptable.
- CDOT has no projects planned within this area on US 85, SH 7, and SH 51.
- I concur with the alternative analysis recommendations. The Region may be concerned about any future traffic impacts from installing the proposed 6'H X 22'W storm sewer under US 85 for alternative No. 1S. This crossing will more than likely have to be open cut rather than jacked because roadway embankment is not very high in this area.

Please don't hesitate to call if you need any additional information.

Sincerely,

Mark S. Andrew, P.E.
CDOT Region 6 Hydraulic Engineer

MSA/msa

cc: Larry Glasser, Region 6 Central Program Engineer
File

CITY OF
BRIGHTON
22 SOUTH 4TH AVENUE ▪ BRIGHTON, COLORADO 80601 ▪ (303) 659-4050

RECEIVED
NOV 04 1997
U.D. & F.C.D.

Monday, November 03, 1997

Mr. John T. Doerfer
UDFCD
Diamond Hill Office Complex
2480 W. 26th Ave.
Denver, CO 80211

RE: Comments on the Alternatives Evaluation Report for the Brighton Outfall Systems

cc: file

Dear Mr. John Doerfer:

The City of Brighton agrees with the recommended plan as proposed by WRC in the Alternatives Report. We recommend that WRC to continue with the preliminary design, contingent upon addressing the following issues:

1. Assuming that a downstream sub-regional pond and conveyance system are in place, it's our understanding that all development within that subregion will be allowed to free release into the channel to the subregional pond, please clarify this in the report.

2. WRC staff will work with City of Brighton staff to analyze a couple of subregional pond sites that are of concern to inquiring developers. This will assist the planning staff in how to implement the drainage plan.

3. Please label the proposed subregional detention ponds on Figures 2-A and 2-B, (the RECOMMENDED PLAN), so they correlate the pond designations, (letters A through S), on Table 1-B.

4. Identify in the report the sub-regional detention ponds flexibility in terms of; pond depth (can we deepen the ponds to reduce the area), and horizontal pond location.

Please minimize the regional pond areas at the time of preliminary design, this should be done without increasing the width of the R.O.W.'s as shown on the Final Draft of the Alternatives Report.

5. Please quantify UDFCD assistance available in the preliminary design report in regards to the maintenance of the subregional detention ponds.

6. The Recommended Plan, (Figure 2A & 2B), appears to present a new plan for Brighton proper. This plan does not follow the drainage plan prepared by McLaughlin Water Engineers in 1991. The Final Alternatives Report shows a conveyance facility running up S. 4th Avenue, (from Bromley Lane to Bridge Street), that eventually releases into the Recreation Center. However the City has installed a new trunk line running west from the intersection of S. 4th Avenue & Jessup Street, to the existing South Outfall Channel west of the intersection of Miller Avenue and Jessup Street. The Recommended Plan also shows a proposed line starting at the intersection of Bromley Lane and S. 10th Avenue and running north up N. 8th Avenue to the existing Brighton Recreation Center. However the recommended proposal from McLaughlin was a line that collected flows along Bridge Street and then conveying the flows up N. 11th Avenue to the existing forebay at the Recreation Center. Is there any reason why we can't incorporate McLaughlin's plan and add to the relatively new improvements as they now exist?

7. The City has already committed to a ROW width of 100' from US HWY 85 to the existing South Outfall. During the preliminary design take this width into account.

Sincerely,
Blair B. Renfro, P.E.
Blair B. Renfro, P.E.

FILE: file:c\cip's\stormsewer\drnpln-4.doc

ADAMS COUNTY, COLORADO

PUBLIC WORKS DEPARTMENT
LEE ASAY, DIRECTOR

4955 EAST 74TH AVENUE
(303) 287-5249

COMMERCE CITY, COLORADO 80022-1551
FAX: (303) 287-3648

RECEIVED
OCT 30 1997
U.D. & F.C.D.

October 27, 1997

Mr. Ben Urbonas, P.E., Chief, Master Planning Program
Urban Drainage and Flood Control District
2480 W. 26th Avenue, Suite 156 B
Denver, CO 80211

RE: Brighton Watershed Tributary to South Platte River
Outfall Systems Planning
Alternatives Evaluation Report

Dear Ben,

We have received the report titled "*Brighton Watershed Tributary to South Platte River, Outfall Systems Planning, Alternatives Evaluation Report,*" prepared for the City of Brighton, Adams County, and the Urban Drainage and Flood Control District by WRC Engineering, Inc. and dated July 1997, along with your letter dated August 29, 1997. In your letter you have requested that the County provide you with preferences for the selected plan.

Most of the Brighton Watershed lies within the jurisdiction of the City of Brighton or designated as Municipal Growth Area that will be annexed to the City. This fact is supported by the County's draft Comprehensive Plan that was developed with cooperation with the City. Adams County will not approve any development that is inconsistent with the Comprehensive Plan, in other words, Adams County will not approve any development that lies with the Municipal Growth Area of Brighton.

Since we are expecting that the majority of the watershed will fall under the jurisdiction of the City of Brighton, and since the future land use that was used to develop the watershed hydrologic model indicate that a dramatic increase in the future runoff will occur, we believe that the *Recommended Alternatives Selections* on page V-6 in the Alternatives Evaluation Report will be adequate to control the peak flows from the developed basin, therefore Adams County is in support of the Recommended Alternatives.

Sincerely,

Besharah Najjar

Besharah Najjar, P.E.,
Senior Engineer

CC: Lee Asay, Director of Public Works
Daren Duncan, P.E., Engineering Manager
John T. Doerfer, Project Hydrologist
Alan J. Leak, WRC Engineering, Inc.

File C: udfcd/brighn1

BOARD OF COUNTY COMMISSIONERS:
ELAINE T. VALENTE DISTRICT 1
TED STRICKLAND DISTRICT 2
MARTIN J. FLAUM DISTRICT 3

CITY OF BRIGHTON

22 SOUTH 4TH AVENUE ▪ BRIGHTON, COLORADO 80601 ▪ (303) 659-4050

RECEIVED
DEC 24 1997
U.D. & F.C.D.

Tuesday, December 23, 1997

Mr. John Doerfer
UDFCD
2480 W. 26th Ave., Suite 156B
Denver, CO 80211

RE: Brighton Watershed Selected Plan (Draft)

Dear Mr. Doerfer:

In addition to our original comments to the above mentioned plan please add;

1) Prioritize the section of channel north of Bromley Lane that runs to the existing South Outfall east of Jessup Street. This large parcel of land has been approved for development. The developer is waiting for WRC's preliminary design so they can build the proposed channel, (100' ROW is what we have in this section), and the box culvert under Bromley Lane, (west of Kuner Road). The developer hopes to have housing units ready to sell in three months and hopes to be moving dirt as soon as possible.

2) Need a meeting with WRC to fine tune the design of almost all ponds adjacent to town. It would be best for us to have a field meeting to show them where these concerns are and to use WRC's expertise in fine tuning the locations for the regional detention ponds.

If you have any questions, please call me at 654-1637, extension 300.

Sincerely,

Blair Renfro, P.E.

Blair Renfro, P.E.
Staff Engineer

cc: files

FILE:MASTER3.DOC

URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

L. Scott Tucker, Executive Director

January 2, 1998

Board of Directors

Executive Committee:

Cathy Reynolds
Chairman
City of Denver

Linda Morton
Chairman Pro-Tem
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Elaine Valente
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Debra Vickrey
Arapahoe County

2480 W. 26TH AVENUE • SUITE 156 B • DENVER, COLORADO 80211

TELEPHONE 303-455-6277 • FAX 303-455-7880

Alan J. Leak
WRC Engineering, Inc.
950 South Cherry Street, Suite 404
Denver, CO 80246

Subject: Brighton Watershed
Selected Plan

Dear Mr. Leak:

The Urban Drainage and Flood Control District, the City of Brighton, and Adams County have evaluated the recommendations contained in the Alternatives Evaluation Report for the Brighton Watershed Outfall Systems Planning Study. The project sponsors have selected an alternative to be developed further and to be shown in the final preliminary design report. The selected plan is described in the accompanying document titled *Selected Plan for Brighton Watershed Outfall Systems Planning Study Preliminary Design Report* dated January 5, 1998.

This letter will constitute your notice to proceed effective January 12, 1998 with the Phase B portion of this outfall systems planning study. In accordance with Paragraph 6, Time of Performance, of our agreement, your firm has ninety (90) calendar days from that date to deliver to the District four (4) copies of the draft Outfall Systems Planning Report. This establishes the delivery date for the draft report at April 13, 1998. Please schedule the first progress meeting within the next two weeks to give us a chance to discuss the selected plan and how you propose to finalize this project within the above-stated time of performance. Should you have any questions, please call me.

Sincerely,

Ben Urbonas, P.E.
Chief, Master Planning and
South Platte River Programs

BRU/JTD/dc
Enclosure
cc: Blair Renfro, City of Brighton
Besharrah Najjar, Adams County

Selected Plan for Brighton Watershed
Outfall Systems Planning Study
Preliminary Design Report

January 5, 1998

The plan selected by the City of Brighton, Adams County and the Urban Drainage and Flood Control District (District) to be shown in the final Preliminary Design Report consists of two parts. The first part sets forth general comments and direction. The second part provides additional direction on specific aspects to be addressed in the final report. The consultant, WRC Engineering Inc., is hereby requested to complete the final Preliminary Design Report in accordance with the following selected plan:

GENERAL

1. The Selected Plan, unless specifically directed otherwise, is the recommended alternative as defined in the Alternatives Evaluation Report dated July 1997. This plan is based on a total of 24 sub-regional detention basins within the watershed, each detention basin will be sized with a volume to detain the 5-year storm event for an extended period of time (40 hours), and provisions to enhance water quality will be included within detention basins. Downstream of each detention basin will be an open channel sized to convey the release from a 100-year storm event, these channels will be located adjacent to arterial and major collector streets to the extent feasible, and two major outfalls (one south of Bromley Lane and the other north of Baseline Road) are required to prevent flooding of the downtown area.

2. Drainage systems in residential areas with lot size of 1.5 acres or greater will be designed to minimize directly connected imperviousness. Drainage systems in residential areas with lot size less than 1.5 acres, and in commecial and other dense areas, will utilize curb-and-gutter with storm sewers. The City of Brighton will need to modify its present drainage criteria to incorporate these principles when approving new-development within the watershed area.

3. The selected plan recommends the use of certain areas for detention purposes. As a first step, acquisition of right-of-way should be secured. One possible way to do this is through adequate assurances agreements between the City of Brighton and the District. Acquisition of properties can then be completed by obtaining a permanent runoff-storage easement from the landowners at the time of proposed development or through the purchase in fee simple by the City of Brighton, with District assistance whenever such acquisition becomes a problem for the city.

4. Incorporate the following note on each drawing: "This drawing is for master planning purposes and represents preliminary and conceptual engineering. Alternatives to this outfall system will be considered by local reviewing agencies and the Urban Drainage and Flood Control District provided the alternative offers equal hydraulic capacity and stream stability. The alternative must comply with all requirements of the local jurisdiction and the Urban Drainage and Flood Control District. This drawing shall not be used for construction purposes."

ADDITIONAL DIRECTION

1. A statement should be included in the Preliminary Design Report for clarification that: "If a downstream subregional detention basin and conveyance system are in place, all development upstream within that tributary watershed will be allowed to release undetained on-site flows into the drainage system."

2. Land-area requirements and surface area of each subregional detention basin should be minimized to the extent feasible in the preliminary design. Basin depth should be maximized given the limitations imposed by outlet design and downstream grades. In addition, include a general description in the Preliminary Design Report that discusses the extent of flexibility in final design of a sub-regional detention basin as to its depth, longitudinal position along the outfall relative to the subwatershed tributary area, and lateral position of a detention basin relative to outfall location.

3. The recommended plan appears to present a new plan for Brighton proper. The plan shown does not follow the drainage plan prepared by McLaughlin Water Engineers in 1991. The alternatives evaluation report shows a conveyance facility running up S. 4th Avenue (from Bromley Lane to Bridge Street) that eventually releases into the Recreation Center. However, the City has installed a new trunk line running west from the intersection of S. 4th Avenue and Jessup Street to the existing South Outfall channel west of the intersection of Miller Avenue and Jessup Street. The recommended plan also shows a proposed line starting at the the intersection of Bromley Lane and S. 10th Avenue and running north up N. 8th Avenue to the existing Brighton Recreation Center. However, the recommended proposal from McLaughlin was a line that collected flows along Bridge Street and then conveying the flows up N. 11th Avenue to the existing forebay at the Recreation Center. The plan and profile sheets prepared in the preliminary design should show the existing storm sewers noted above. Also, the master planned systems upstream of the existing sewers should take full advantage of the existing system outfalls to the South Platte River. Examine and use the proposed sewers in the McLaughlin plan to the maximum extent practicable.

4. The City of Brighton has committed to a right-of-way (ROW) width of 100-feet from US 85 to the existing South Outfall. Note this in the preliminary design and address its adequacy.

5. Costs for maintenance of the subregional detention basins, channels, and storm sewer systems should be reported in the preliminary design.

6. Jurisdictional boundary lines between the City of Brighton and Adams County need to be clearly drawn and labeled as: ". . . in effect as of 1998" on all figures, plan and profile drawings, and sheets included in the Preliminary Design report.

7. Recommend by a note on each sheet of the preliminary design that the City of Brighton and Adams County zone, manage, and regulate the development in this watershed to prevent future flood damages by following the recommendation of this plan."

8. Prioritize the section of channel north of Bromley Lane that runs to the existing South Outfall east of Jessup Street in the preparation of the preliminary design. Schedule a meeting with project sponsors to discuss this section of channel and also the regional detention basin locations adjacent to the City of Brighton.

WRC ENGINEERING, INC.

CITY OF BRIGHTON

OUTFALL SYSTEMS PLANNING

SUB-REGIONAL DETENTION FACILITY IMPLEMENTATION GUIDELINES

The purpose of the Master Plan is to preliminarily locate and size the required sub-regional detention facilities and to size the downstream collection facilities based upon these preliminary sub-regional detention facilities and locations.

Minor adjustments in size and location of the sub-regional detention facilities can be accommodated as long as the master plan design criteria (i.e. 5-year extended detention, 100-year restricted release rates) and the hydrologic/hydraulic function of the entire master planned drainage system are maintained.

For example, a sub-regional detention facility may be moved upstream or downstream if the following guidelines are addressed:

1. Pond size must be adjusted for the increase/decrease in tributary area.

2. The new location must not interfere with the outfall system from upstream sub-regional detention facilities.

3. The Master Plan flow rates downstream of the new location must be maintained or reduced. This should be checked using the master plan hydrologic model.

4. The new location/plan should not result in a proliferation of additional sub-regional detention facilities.

Tributary basin boundaries can be adjusted as long as the above guidelines are followed. However, a logical reason must exist for said change. Also, as facilities are implemented, some changes will not be possible in order to avoid retro-fitting of previously constructed facilities.

Since most of the sub-regional detention facilities are "off-line" of the collector system, their location may be adjusted from one side of the road to another as long as all hydraulic functions are maintained.

For the design of the detention facility itself, adjustments in the size of the minor and major storm storage areas can be accommodated but the overall facility size will change. For example, if a large manicured , active use park is desired, the facility and size may need to be increased in order to minimize the frequency of inundation of the active use area. In contract, it may be desirable in another area to use the facility as open space (no active recreation). In this example, the facility and size may be reduced but will have a larger area that may be frequently inudated with runoff.

The end result of any of these changes should be functionally equivalent system that:

- Minimizes maintenance requirements (less facilities is better)
- Minimizes land required (less facilities is better)
- Maintains public ownership or control (i.e. pertinent drainage easement) of sub-regional detention facilities.

1960-41.AJL July 8, 1998 WRC ENGINEERING, INC.

CONSULTING ENGINEERS

950 SOUTH CHERRY STREET • SUITE 404 • DENVER, COLORADO 80222 • (303) 757-8513 • FAX (303) 758-3208 • wrceng@eazy.net

Post-it™ Fax Note 7671 6/30/98 pages 1

To JOHN DORFER	From MARK HEIDT
Co./Dept. URBAN DRAINAGE	Co. BRIGHTON P&R
Phone # 455-6277	Phone # 655-2178
Fax # 455-7880	Fax # 655-2151

Memorandum
Parks & Recreation Department

TO Scott Bernhart, City Planner

Date: June 25, 1998

Prepared by: Dirk Richwine, Director

Subject: *Parks Department Response to Urban Drainage Master Plan*

I am enclosing the comments from the Parks and Recreation Department regarding the proposed Urban Drainage Plan for the Platte River Basin of the City of Brighton. Staff has reviewed the plan and each of the sub-basins within the overall drainage area. Based on the information that we have received and the comments from fellow staff, I would like to suggest the following comments be incorporated into the plan.

- Open Channels and Detention/Retention Ponds. The open channels and the detention/retention ponds can be credited as open space within the Brighton parks system. It is not acceptable that these areas be credited as neighborhood parks. However, the drainage land dedication can be credited towards open space dedication.

- Drainage Ponds. Drainage ponds be fully improved to include irrigation, turf, and landscaping. While these will not be designated as parks within our parks system, the open space needs to be improved to a developed standard. When the drainage basins are incorporated into private property and maintained by private property users or homeowners associations or on-site maintenance, the standards can vary but they must be developed to a fully improved standard.

- Standards Development. Standards need to be developed regarding landscaping, development, sloping, the maximum drainage depth, and the time by which the water can be eliminated from the facility.

- Connectivity of the Open Channels. While each of the sub-basins is connected through open or enclosed channels for the storm drainage to flow to the end of the outfall, these systems probably will not be able to connect to our existing and proposed trail system, it is therefore not essential that the parks have a connectivity trail system from each retention pond through the system.

I hope this information will be of use to you. Please contact me if I can provide you any further assistance.

APPENDIX F

PRELIMINARY WETLAND ASSESSMENT

AQUATIC AND WETLAND COMPANY
Consulting • Construction • Nurseries • Treatment Systems

24 February 1997

Mr. David P. Krickbaum, P.E.- Project Engineer
WRC Engineering, Inc.
950 South Cherry Street, Suite 404
Denver, CO 80222

RE: City of Brighton Outfall Master Plan

Dear Mr. Krickbaum:

Aquatic and Wetland Company (AWC) is submitting a sketch map of wetlands and riparian areas identified within the Brighton project area associated with the Brighton Outfall Master Plan. 1"= 600' scale black and white aerial photos (dated 4-17-96) were reviewed for possible wetland and riparian areas as indicated by the presence of surface water and hydrophytic vegetation. These areas were marked on a 1"=500' scale map (provided by WRC) and then field verified. Wetlands were assessed in the field using the methodology enumerated in the *1987 Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987). The enclosed map depicts the limits of all potential wetlands and waters which could be regulated under Section 404 of the Federal Clean Water Act. The outer edge of the black marker line and green highlighted areas depicted the limit of wetlands and waters of the U.S.

This map is a preliminary wetland assessment and does not represent an actual ACOE jurisdictional boundary determination. All potential jurisdictional wetland areas were identified on the enclosed map including irrigation ditches, ponds, lakes, major drainage ditches and constructed detention wetlands. Under further and more detailed investigation some of these areas identified may not be classified as "jurisdictional wetlands" or waters of the U.S.

Wetland habitats encountered within the project area include, palustrine emergent, lacustrine, and riverine. Several small palustrine emergent habitats identified are the result of human disturbance such as road construction, stormwater pipe discharge or drainage/irrigation ditches. These areas are typically vegetated with sandbar willows, cattail, and rushes. The area surrounding Barr Lake (the eastern limits of the project area) is the fringe of a lacustrine wetland habitat. The fringe consists of a variety of habitats, vegetated by large cottonwoods, willows, cattails, and rushes. The South Platte River located at the western limits of the project area provides a diverse riverine wetland habitat. Large cottonwoods and willows are very common along the corridor.

If you have any questions regarding the wetland map or results of the study please feel free to call. Thank you and we look forward to working with you in the future.

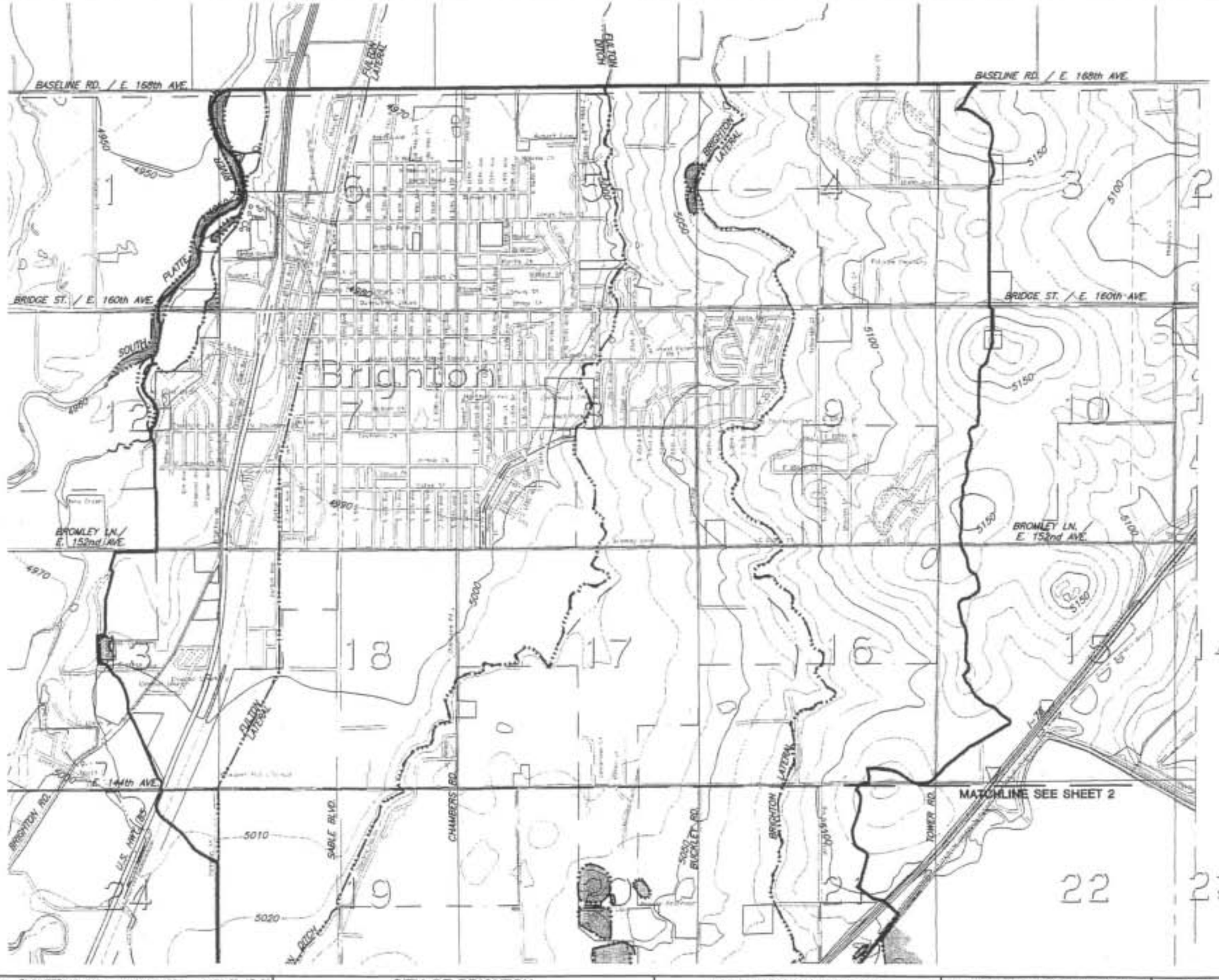
Sincerely,

Aquatic and Wetland Company

David Blauch
Wetland Ecologist

G:\AWC\PROJECTS\1424\MEMO.WPD

1655 Walnut • Suite 205 • Boulder, Colorado 80302 • (303) 442-5770/442-8133 FAX



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1000 500 0 1000 2000
SCALE IN FEET

LEGEND:

WETLAND TYPE VEGETATION

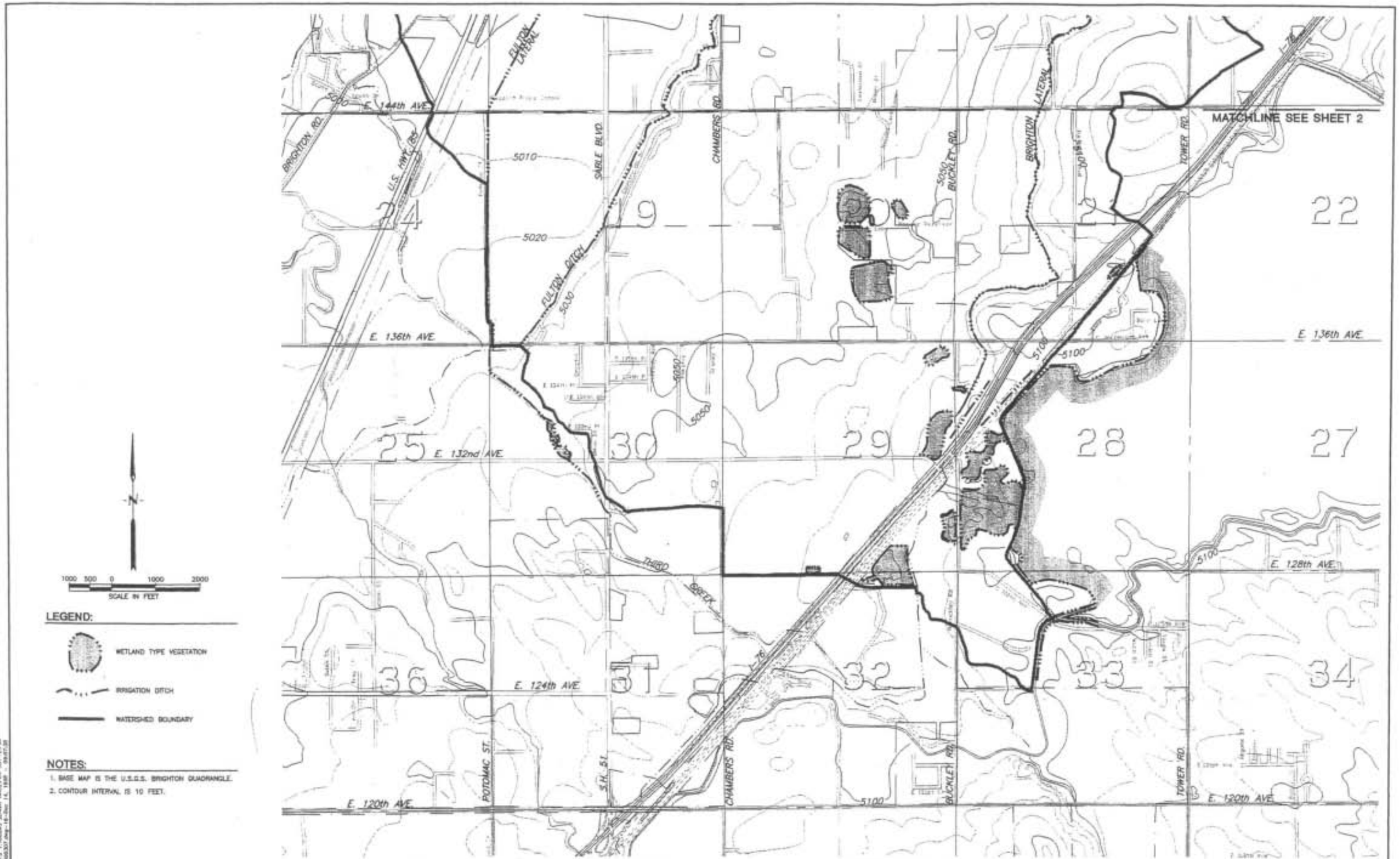
IRRIGATION DITCH

WATERSHED BOUNDARY

NOTES:

1. BASE MAP IS THE U.S.G.S. BRIGHTON QUADRANGLE.
2. CONTOUR INTERVAL IS 10 FEET.

WRC ENGINEERING, INC. 950 SOUTH ENERGY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 758-3208	DESIGNED DPN DATE 09-17-96 DRAWN EJM DATE 10-08-96 CHECKED DATE REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	PRELIMINARY WETLAND ASSESSMENT SHEET 1 OF 2	DWG. NO. F-1



WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8101 FAX NO. (303) 759-5205	DESIGNED DPK DATE 06-17-96 DRAWN SJM DATE 10-08-96 CHECKED ____ DATE ____ REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	PRELIMINARY WETLAND ASSESSMENT SHEET 2 OF 2	DWG. NO. F-2

APPENDIX G

LEGAL OPINION

Shoemaker, Wham, Krisor & Shoemaker

ATTORNEYS AT LAW

Edward J. Krisor, Jr.
J. Jay Shoemaker, LL.M.
David M. Naples, LL.M.

W. Joseph Shoemaker, of Counsel
Robert S. Wham, of Counsel

June 24, 1997

Mr. Ben Urbonas, P.E.
Chief, Master Planning Program
Urban Drainage And Flood Control District
2480 West 26th Avenue, Suite 156 B
Denver, Colorado 80211

BY HAND DELIVERY

Re: Legal opinion in regard to alternative and planned drainage facilities in general as contained in alternatives development and evaluation reports

Dear Ben:

You have asked me to provide you with a legal opinion that you may use to initially evaluate in general all alternatives development and evaluation reports for compliance with the law of the State of Colorado applicable to drainage. What follows is such an opinion which will need to be supplemented by a short legal opinion in regard to each report to either indicate that no further comment is necessary or that certain other factors, other than those noted herein, will need to be considered before proceeding to the selection and construction of drainage improvements contained in that specific report.

In order to properly evaluate these reports you first must take note of the following comments in regard to the law of drainage in Colorado:

I. GENERAL LEGAL DRAINAGE PRINCIPLES

Natural drainage conditions may be altered by an upper (dominant) owner provided the water is not sent down in a manner or quantity to do more harm than formerly to the lower (servient) owner, Hankins v. Borland, 163 Colo. 575, 431 P.2d 1007 (1967). Colorado follows the "rule of reasonableness" as related to drainage matters and in each drainage situation, the court will look at the relationship of the parties and at who is doing what to whom in order to determine "what is reasonable under the circumstances". Prior to the Hankins case, the Colorado Supreme Court ruled in Ambrosio v. Perl-Mack, 143 Colo. 49, 317 P.2d 803 (1960), that downstream owners had to accept additional runoff from an upstream developer.

1666 South University Boulevard, Suite B • Denver, Colorado 80210 • Telephone (303) 777-5501 • Fax (303) 698-0919

As the engineering technology has become more precise in drainage matters, it is possible to determine from the actual development and from land use decisions that will determine future development what the additional (more than natural) runoff will be because landowners make their land impermeable.

The Colorado Legislature in 1973 recognized this and adopted Sec. 30-28-113(4)(b) which requires developers in unincorporated areas to detain greater than historical flows. As a matter of drainage practice, cities as well as counties and the Urban Drainage District work to identify with precision "who is doing what" to whom so that the cost of drainage solutions to problems created by future development can be placed on those who would change the use of land from permeable to impermeable. Runoff from existing development is also computed and the need, if any, to solve existing drainage problems can be determined and costs of solutions estimated.

Drainage matters historically were resolved between or among property owners. However, as urbanization (multiple property owners) has taken place, governments have become involved for several reasons. In some cases, the government itself helped create additional runoff by making improvements. In other cases, government approved land use changes without regard to the problems of additional runoff. In still other situations, government got involved because constituents (owners) wanted government help in the difficult and expensive field of determining (identifying) where the additional runoff was coming from and the paying of costs of solutions. For whatever the reason, whenever government gets involved, it can be expected to be treated like a private party. 2 Farnham, Water and Water Rights, pp. 975 and 977, adopted by the Colorado Supreme Court in City of Boulder v. Boulder and White Rock Ditch Co., 73 Colo. 426, 216 P. 553 (1923). A municipality can be held to its negligence. It can also determine whether to become involved at all, if it did not create the problem.

An update of these legal principles has yielded the conclusion that the law of drainage as set forth above has not really changed to any substantially degree over the years. Both the Hankins and Ambrosio cases continue to be cited by the Colorado courts when dealing with the law of drainage. In the case of Metro Docheff v. City of Broomfield, 623 P. 2d 69 (Colo. App. 1980) the Colorado Court of Appeals held that: "Although we recognize the right of the owner of higher land to a drainage easement over the lower land of others, . . . the discharge of water will be enjoined as a continuing trespass if the drain sends the water down 'in a manner or quantity to do more harm than formerly.'" In the case of Hoff v. Ehrlich, 511 P. 2d 523 (Colo. App. 1973) the Colorado Court of Appeals was faced with the question of the propriety of a servient owner blocking drainage from a dominant estate in order to protect the servient owner's land. The Court held that: "The owner of the dominant estate has a legal and natural easement or servitude

in the lower or servient estate for the drainage of surface water flowing in its natural course and manner . . . When an interruption in the natural flow or passage of surface waters is caused by the servient owner to the detriment or injury of the estate of the dominant owner, the court should issue a mandatory injunction for the opening of the easement which has been blocked . . . [the servient owner] may not act to the extent that damage is caused thereby to the dominant landowner . . . in order for the owner of the servient estate to be afforded a remedy, it must be evident that the water was sent down in a manner or quantity causing more harm than it formerly had done."

If a government permits the development which in turn causes "more harm than formerly", then the government, as well as the developers, may be held liable. (Cases consistently move toward governmental, as well as developers' liability.) See Metro Docheff, *supra*, which held as follows: "The trial court found that the city had accepted the streets and storm drains for maintenance and control and, therefore, had exclusive control over the water collected in the subdivision. It determined that by approving the subdivision and drainage plan and accepting control, the city interfered with the natural conditions and thereby caused surface water to be collected and discharged upon plaintiff's land 'in a greater quantity or in different manner than had previously occurred under natural conditions."

Any improvements upstream must be made taking into consideration the outlet capability downstream. (Long line of case law.) See Hankins, *supra*, which states: "The trial court has found that the water which these defendants have sent into the Borland drain is in greater quantity and more rapid in time — a finding fully justified by the evidence. Under such circumstances it is the court's duty to determine what the dominant owners must do in order to prevent their increased waste water from damaging the servient owner."

Colorado generally imposes strict liability on owners of dams (regional detention ponds). (Long line of cases.)

Interfering with natural drainageways or channels is generally looked upon with disfavor by Colorado Courts. However, builders of irrigation canals, railroads, and highways in other times were not aware or were unconcerned with the problems they might be creating in the future by artificially blocking natural drainageways. Sometimes the very passage of time (at least eighteen years) provides an argument that the blockage should be allowed to be continued because parties have relied and should be able to continue to rely on this "protection". Generally, the laws of nature prevail in these situations and artificial structures such as canals, railroads and highways do not rise to the status of permanent dams which require spillways and other features under the jurisdiction in the State of Colorado of the State Engineer.

With the enactment of federal environmental (including water quality) provisions, the quality of the runoff may also have an effect, as well as on other ecological matters.

Natural waters are subject to the doctrine of prior appropriation in Colorado and what may have become a water right must also be considered with any plan for the "handling" of surface runoff in natural waterways.

Finally, any drainage, "facility" built by a government must be maintained. "If you're not going to maintain it, then don't build it!" is the theme of a long line of cases.

II. GENERAL COMMENTS ON COMMONLY PROPOSED FACILITIES AND CONSTRUCTION TECHNIQUES

1. It is my understanding that the purpose of all reports in regard to this subject is to examine alternatives which will, if implemented, improve upon and/or formalize the drainage that is within the study area.

2. In general, consideration must be given to any potential adverse effects of the selected alternative on properties within the study area and downstream of the study area.

3. If any selected facilities would increase or materially change the direction of the flows across downstream property in a study area, the downstream property has a right to claim damages and/or protection from such a material increase or change in flow. Thus, care should be taken to make sure that increased flows from upstream facilities are accommodated by sufficiently increasing the size of the downstream channels and conduits. If in final design, the selected alternative still has the effect of placing water on the residents and land owners in the area that they either never had or in a quantity larger than what they have had previously, the same must be revised to eliminate that result or the selected alternative must not be constructed.

4. If re-alignment of a channel is the selected alternative, careful consideration should be given to the channel's geometry, alignment and ability to carry flood flows so as not to create additional potential damages to surrounding landowners.

5. If the selected alternative is the collection of overland flows from a specific area and returning those flows to a drainage structure of some kind, care should be taken not to adversely impact landowners in the area.

6. If a selected alternative involves the redirection of flows from their historic path, prior to its finalization in the design process, caution should be taken that this redirection will not cause any increase in damage to those adjacent or downstream of the proposed redirection.

7. If any selected alternative, when it is finalized in the design process, is changed to include a plan for the diversion of runoff from one watershed to another; extreme caution should be used in implementing that portion of the selected alternative since the participants may be faced with the imposition of strict liability for any damage that occurs from any size storm event if it can be shown that the same would not have been suffered if the diversion had not occurred.

8. If the construction of crossing structures over irrigation canals are part of the selected alternative for the project, caution must be taken in regard to the capacity of those crossing structures. The structures, when designed for the design event, should not cause any more water than presently exists to flow into those canals.

9. The intentional routing, as opposed to inadvertent inflows, of flood flows into an irrigation ditch should be eliminated from any plan if at all possible unless a written agreement from the owner of the irrigation ditch is obtained permitting the use of the ditch to carry those flood flows. The participants have no control over the available capacity of the ditch at the time it would be necessary to carry flood flows so the ditch cannot realistically be used to control the flows downstream.

10. If an alternative is being selected that relies upon inadvertent detention and the participants do not intend to formalize such detention by written agreement, it is my opinion that the effect of that non-formalized inadvertent detention cannot be taken into consideration in the final design.

11. If a selected alternative includes the formalization of inadvertent detention it will be necessary for at least one of the participants to formalize that detention by entering into a written agreement with the owner of the facility causing the detention. The agreement must prohibit the owner from operating or modifying the facility in a way that would have the effect of lessening the inadvertent detention of the facility necessary to implement the selected alternative. Further, the owner must either agree to maintain the facility so that the same does not lose its current inadvertent detention or agree to permit at least one of the participants to maintain the facility.

12. If the owner of the facility will not agree to maintain the inadvertent detention facility, at least one of the participants should confirm in writing to all of the participants that the

participant is committed to maintaining the inadvertent detention facility in a manner that assures the necessary inadvertent detention to implement the alternative. This should be done prior to the implementation of any of the alternatives involving inadvertent detention. The level of maintenance must at least permit the facility to function as relied upon in flooding events and not fail structurally during the design and larger events.

13. Any formalized detention facilities that are utilized in the final design of a project will need to be the subject of a written agreement between the owner and at least one participant that the facility will be maintained in a manner that assures the necessary flood storage to implement the design and that adequate maintenance will be performed by either the owner or the participant so that the facility will function as designed in flooding events and that it will not fail structurally during the design and larger events.

The participating entities must agree amongst themselves, in writing, that any one of the participants may enforce the terms of the agreement with the owner of the facility if the responsible participant does not. This agreement must include the maintenance of no more than a certain level of water in the facility at any one time and that any one of the participants may, at their sole cost and expense, maintain the facility so that its effectiveness in the selected alternative will be continued in perpetuity.

14. The embankments of all detention facilities should be designed so that they will not fail during a design event.

15. If a potential wetland is involved in a design alternative, it will be necessary that a Section 404 Permit from the United States Army Corps of Engineers be applied for and obtained, if necessary. Such a Permit should be obtained before any construction is done on the recommended alternative.

16. During construction of the selected facilities, care should be taken in constructing those facilities so that downstream property is not adversely affected temporarily by such construction. Usually, with the exception of the construction of detention facilities, the best method to avoid that problem is construction from the downstream limit of the project in an upstream direction which would then have the effect of having the downstream facilities ready to accept any increased flows as a result of the project.

If you have any questions in regard to my comments and opinions contained in this letter, please feel free to telephone me to discuss the same.

Very truly yours,

Edward J. Krisor, Jr.

Edward J. Krisor, Jr.

APPENDIX H

FINAL MASTER PLAN HYDROLOGY

UPDATED DECEMBER 2006

TABLE H-1
Final Master Plan
CUHP Sub-watershed Parameters (Existing Development)

Basin ID	AREA sq mi	Length mi	Centriod mi	% Imp %	Slope ft/ft	Tc min	Perv Dep Storage	Imp Dep Storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
1	0.199	1.06	0.38	6.2	0.014	na	0.35	0.1	4.5	0.0018	0.6	B
2	0.087	0.38	0.19	18.8	0.011	85.7	0.35	0.1	4.5	0.0018	0.6	B
3	0.100	0.64	0.27	9.4	0.022	56.2	0.35	0.1	4.5	0.0018	0.6	B
4	0.140	0.19	0.09	2.0	0.022	43.4	0.35	0.1	4.5	0.0018	0.6	B
5	0.186	0.45	0.15	2.0	0.013	na	0.35	0.1	4.5	0.0018	0.6	B
6	0.097	0.57	0.19	2.5	0.013	116.2	0.35	0.1	4.5	0.0018	0.6	B
7	0.097	0.61	0.35	14.0	0.011	83.2	0.35	0.1	4.5	0.0018	0.6	B
8	0.084	0.47	0.22	2.0	0.018	55.6	0.35	0.1	4.5	0.0018	0.6	B
9	0.162	0.76	0.42	2.0	0.015	na	0.35	0.1	4.5	0.0018	0.6	B
10	0.171	0.63	0.20	45.2	0.011	na	0.35	0.1	4.5	0.0018	0.6	B
11	0.065	0.30	0.20	2.0	0.014	69.9	0.35	0.1	4.5	0.0018	0.6	B
12	0.193	0.64	0.34	2.0	0.021	na	0.35	0.1	4.5	0.0018	0.6	B
13	0.077	0.42	0.23	2.3	0.017	81.1	0.35	0.1	4.5	0.0018	0.6	B
14	0.079	0.30	0.32	2.0	0.031	50.4	0.47	0.1	4.5	0.0018	0.6	B
15	0.133	0.34	0.13	5.3	0.023	50.2	0.35	0.1	4.5	0.0018	0.6	B
16	0.050	0.36	0.23	8.0	0.020	39	0.35	0.1	4.5	0.0018	0.6	B
17	0.123	0.34	0.22	4.7	0.023	61.1	0.35	0.1	4.5	0.0018	0.6	B
18	0.104	0.43	0.21	8.0	0.013	48.4	0.35	0.1	4.5	0.0018	0.6	B
19	0.107	0.61	0.25	2.0	0.013	67.5	0.35	0.1	4.5	0.0018	0.6	B
20	0.155	0.74	0.30	2.0	0.019	na	0.35	0.1	4.5	0.0018	0.6	B
21	0.138	1.14	0.31	2.0	0.013	158.8	0.35	0.1	4.5	0.0018	0.6	B
22	0.064	0.27	0.07	2.0	0.033	49.4	0.35	0.1	4.5	0.0018	0.6	B
23	0.160	0.57	0.28	2.0	0.007	na	0.35	0.1	4.5	0.0018	0.6	B
24	0.090	0.45	0.19	2.0	0.020	57.8	0.35	0.1	4.5	0.0018	0.6	B
25	0.116	0.45	0.28	2.0	0.017	86.7	0.35	0.1	4.5	0.0018	0.6	B
26	0.082	0.45	0.25	2.0	0.020	80.8	0.48	0.1	4.5	0.0018	0.6	B
27	0.130	0.64	0.41	2.0	0.010	126.1	0.35	0.1	4.5	0.0018	0.6	B
28	0.057	0.34	0.18	2.0	0.011	53.2	0.35	0.1	4.5	0.0018	0.6	B
29	0.131	0.42	0.24	6.8	0.014	50.9	0.35	0.1	4.5	0.0018	0.6	B
30	0.125	0.27	0.13	2.0	0.010	73.1	0.35	0.1	4.5	0.0018	0.6	B
31	0.096	0.28	0.16	2.0	0.010	76.8	0.35	0.1	4.5	0.0018	0.6	B
32	0.044	0.30	0.17	43.0	0.021	48.7	0.35	0.1	4.5	0.0018	0.6	B
33	0.068	0.55	0.27	31.1	0.010	37.3	0.35	0.1	4.5	0.0018	0.6	B
34	0.084	0.45	0.19	16.4	0.020	77.1	0.35	0.1	4.5	0.0018	0.6	B
35	0.073	0.51	0.30	39.4	0.008	34.3	0.35	0.1	4.5	0.0018	0.6	B
36	0.147	0.38	0.27	68.1	0.015	na	0.35	0.1	4.5	0.0018	0.6	B
37	0.109	0.37	0.20	2.0	0.029	59.2	0.35	0.1	4.5	0.0018	0.6	B
38	0.068	0.36	0.19	2.0	0.027	46.3	0.35	0.1	4.5	0.0018	0.6	B
39	0.131	0.64	0.44	11.3	0.017	74.5	0.35	0.1	4.5	0.0018	0.6	B
40	0.150	0.49	0.14	3.6	0.015	na	0.35	0.1	4.5	0.0018	0.6	B
41	0.104	0.52	0.30	29.7	0.002	56.1	0.35	0.1	4.5	0.0018	0.6	B
42	0.113	0.38	0.32	50.7	0.015	41.4	0.35	0.1	4.5	0.0018	0.6	B
43	0.056	0.45	0.23	10.2	0.014	51.3	0.35	0.1	4.5	0.0018	0.6	B
44	0.207	0.45	0.20	47.2	0.003	na	0.35	0.1	4.5	0.0018	0.6	B
45	0.037	0.35	0.31	29.2	0.007	63.4	0.35	0.1	4.5	0.0018	0.6	B
46	0.104	0.42	0.18	43.0	0.010	29.7	0.35	0.1	4.5	0.0018	0.6	B
47	0.055	0.37	0.21	2.0	0.003	152.8	0.35	0.1	4.5	0.0018	0.6	B
48	0.140	0.66	0.33	39.4	0.007	88.5	0.35	0.1	4.5	0.0018	0.6	B
49	0.065	0.57	0.25	43.0	0.015	30.4	0.35	0.1	4.5	0.0018	0.6	B
50	0.129	0.49	0.30	2.0	0.010	116.5	0.35	0.1	4.5	0.0018	0.6	B
51	0.092	0.49	0.15	46.3	0.002	47.4	0.35	0.1	4.5	0.0018	0.6	B
52	0.080	0.66	0.28	47.4	0.002	47	0.35	0.1	4.5	0.0018	0.6	B
53	0.126	0.47	0.11	45.9	0.003	36	0.35	0.1	4.5	0.0018	0.6	B
54	0.046	0.23	0.08	8.0	0.020	48.6	0.35	0.1	4.5	0.0018	0.6	B
55	0.051	0.33	0.09	2.0	0.003	154.8	0.35	0.1	4.5	0.0018	0.6	B
56	0.127	0.66	0.41	48.7	0.002	76.9	0.35	0.1	4.5	0.0018	0.6	B
57	0.172	0.76	0.35	49.3	0.002	na	0.35	0.1	4.5	0.0018	0.6	B
58	0.185	0.78	0.33	47.5	0.002	na	0.35	0.1	4.5	0.0018	0.6	B

TABLE H-1
Final Master Plan
CUHP Sub-watershed Parameters (Existing Development)

Basin ID	AREA sq mi	Length mi	Centriod mi	% Imp %	Slope ft/ft	Tc min	Perv Dep Storage	Imp Dep Storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
59	0.128	0.74	0.28	49.0	0.003	51.2	0.35	0.1	4.5	0.0018	0.6	B
60	0.116	0.59	0.29	50.8	0.010	46.5	0.35	0.1	4.5	0.0018	0.6	B
61	0.091	0.47	0.19	19.6	0.005	65.7	0.35	0.1	4.5	0.0018	0.6	B
62	0.166	0.66	0.24	49.0	0.002	na	0.35	0.1	4.5	0.0018	0.6	B
63	0.132	0.49	0.51	35.0	0.002	206.9	0.35	0.1	4.5	0.0018	0.6	B
64	0.098	0.45	0.25	2.0	0.007	84	0.35	0.1	4.5	0.0018	0.6	B
66	0.093	0.45	0.17	67.1	0.008	34.8	0.35	0.1	4.5	0.0018	0.6	B
67	0.166	0.57	0.35	37.7	0.004	na	0.35	0.1	4.5	0.0018	0.6	B
68	0.161	0.53	0.30	40.6	0.006	na	0.35	0.1	4.5	0.0018	0.6	B
69	0.085	0.49	0.24	6.1	0.004	102.1	0.35	0.1	4.5	0.0018	0.6	B
70	0.096	0.45	0.14	74.0	0.009	31.3	0.35	0.1	4.5	0.0018	0.6	B
72	0.047	0.37	0.16	2.0	0.007	116.5	0.35	0.1	4.5	0.0018	0.6	B
73	0.182	0.55	0.42	60.9	0.007	na	0.35	0.1	4.5	0.0018	0.6	B
74	0.060	0.45	0.27	43.6	0.003	35.2	0.35	0.1	4.5	0.0018	0.6	B
75	0.153	0.55	0.29	47.0	0.003	na	0.35	0.1	4.5	0.0018	0.6	B
76	0.087	0.55	0.38	40.4	0.003	115.4	0.35	0.1	4.5	0.0018	0.6	B
77	0.091	0.68	0.22	30.4	0.006	179.7	0.35	0.1	4.5	0.0018	0.6	B
78	0.179	0.66	0.27	2.0	0.008	na	0.35	0.1	4.5	0.0018	0.6	B
79	0.133	0.45	0.27	4.8	0.003	125.5	0.35	0.1	4.5	0.0018	0.6	B
80	0.155	0.55	0.21	29.9	0.002	na	0.35	0.1	4.5	0.0018	0.6	B
81	0.102	0.45	0.27	2.0	0.003	185.9	0.35	0.1	3.0	0.0018	0.5	C
82	0.189	0.66	0.38	2.0	0.002	na	0.35	0.1	4.5	0.0018	0.6	B
83	0.103	0.61	0.32	2.0	0.003	238.6	0.35	0.1	3.0	0.0018	0.5	C
84	0.153	0.47	0.33	3.4	0.004	na	0.35	0.1	4.5	0.0018	0.6	B
85	0.136	0.49	0.22	2.0	0.004	175	0.35	0.1	4.5	0.0018	0.6	B
86	0.135	0.59	0.32	2.0	0.004	203.5	0.35	0.1	4.5	0.0018	0.6	B
87	0.130	0.57	0.34	2.0	0.003	225.5	0.35	0.1	4.5	0.0018	0.6	B
88	0.197	0.49	0.33	2.0	0.008	na	0.35	0.1	3.0	0.0018	0.5	C
89	0.119	0.59	0.36	2.0	0.003	232.1	0.35	0.1	4.5	0.0018	0.6	B
90	0.143	0.61	0.28	5.3	0.006	na	0.35	0.1	4.5	0.0018	0.6	B
91	0.088	0.65	0.27	15.0	0.006	65	0.35	0.1	4.5	0.0018	0.6	B
92	0.106	0.55	0.27	2.0	0.005	147.2	0.35	0.1	4.5	0.0018	0.6	B
93	0.118	0.66	0.19	11.1	0.005	160	0.35	0.1	4.5	0.0018	0.6	B
94	0.132	0.76	0.40	2.0	0.006	186.4	0.35	0.1	4.5	0.0018	0.6	B
95	0.102	0.67	0.34	2.0	0.004	166	0.35	0.1	4.5	0.0018	0.6	B
96	0.115	0.59	0.29	2.0	0.005	183.9	0.35	0.1	3.0	0.0018	0.5	C
97	0.083	0.32	0.13	2.0	0.006	104.1	0.35	0.1	4.5	0.0018	0.6	B
98	0.098	0.72	0.33	2.0	0.008	177	0.35	0.1	4.5	0.0018	0.6	B
99	0.190	0.66	0.44	5.8	0.009	na	0.35	0.1	4.5	0.0018	0.6	B
100	0.194	0.63	0.38	4.0	0.011	na	0.35	0.1	4.5	0.0018	0.6	B
101	0.202	0.68	0.47	3.0	0.014	na	0.35	0.1	4.5	0.0018	0.6	B
102	0.048	0.40	0.21	2.0	0.013	87.9	0.35	0.1	4.5	0.0018	0.6	B
103	0.178	0.66	0.45	2.9	0.017	na	0.35	0.1	4.5	0.0018	0.6	B
104	0.095	0.38	0.19	2.0	0.012	58.6	0.35	0.1	4.5	0.0018	0.6	B
105	0.150	0.47	0.19	2.0	0.019	na	0.35	0.1	4.5	0.0018	0.6	B
106	0.105	0.69	0.52	2.0	0.014	121.9	0.35	0.1	4.5	0.0018	0.6	B
107	0.143	0.85	0.47	2.0	0.009	na	0.35	0.1	4.5	0.0018	0.6	B
108	0.101	0.62	0.32	2.0	0.005	108.5	0.35	0.1	4.5	0.0018	0.6	B
109	0.187	0.78	0.26	2.0	0.059	na	0.35	0.1	4.5	0.0018	0.6	B
110	0.108	0.49	0.23	2.0	0.004	179.1	0.35	0.1	4.5	0.0018	0.6	B
111	0.167	0.61	0.33	2.0	0.006	na	0.35	0.1	4.5	0.0018	0.6	B
112	0.112	0.22	0.15	2.0	0.008	67.3	0.35	0.1	4.5	0.0018	0.6	B
113	0.055	0.44	0.23	2.0	0.004	152.9	0.35	0.1	4.5	0.0018	0.6	B
114	0.135	0.53	0.28	4.7	0.004	167.5	0.35	0.1	4.5	0.0018	0.6	B
115	0.077	0.49	0.31	2.0	0.004	149.4	0.35	0.1	4.5	0.0018	0.6	B
116	0.155	0.53	0.25	2.5	0.001	na	0.35	0.1	4.5	0.0018	0.6	B
117	0.146	0.49	0.25	3.5	0.001	na	0.35	0.1	4.5	0.0018	0.6	B
118	0.136	0.57	0.31	2.0	0.007	153.6	0.35	0.1	4.5	0.0018	0.6	B

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TABLE H-1

Final Master Plan
CUHP Sub-watershed Parameters (Existing Development)

Basin ID	AREA sq mi	Length mi	Centriod mi	% Imp %	Slope ft/ft	Tc min	Perv Dep Storage	Imp Dep Storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
119	0.116	0.51	0.20	2.0	0.008	118.6	0.35	0.1	4.5	0.0018	0.6	B
120	0.078	0.47	0.16	5.0	0.010	61.9	0.35	0.1	4.5	0.0018	0.6	B
121	0.101	0.34	0.14	2.0	0.007	101.9	0.35	0.1	4.5	0.0018	0.6	B
122	0.129	0.31	0.33	2.0	0.007	95.4	0.35	0.1	3.0	0.0018	0.5	C
123	0.158	0.68	0.38	2.0	0.004	na	0.35	0.1	3.0	0.0018	0.5	C
124	0.125	0.40	0.19	2.0	0.006	122.8	0.35	0.1	3.0	0.0018	0.5	C
125	0.051	0.22	0.13	2.0	0.007	73.8	0.35	0.1	3.0	0.0018	0.5	C
126	0.132	0.61	0.28	2.0	0.008	152.7	0.35	0.1	4.5	0.0018	0.6	B
127	0.101	0.45	0.15	2.0	0.006	120.5	0.35	0.1	4.5	0.0018	0.6	B

TABLE H-2

Final Master Plan - 2006 Update
CUHP Sub-watershed Parameters (Future Development)

Basin ID	AREA sq mi	Length mi	Centriod mi	% Imp %	Slope ft/ft	Tc min	Perv Dep Storage	Imp Dep Storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
1	0.127	0.60	0.30	19.1	0.014	N/A	0.35	0.1	4.5	0.0018	0.6	B
3	0.1	0.64	0.27	13.6	0.022	31.2	0.35	0.1	4.5	0.0018	0.6	B
4	0.178	0.57	0.19	37.0	0.022	N/A	0.35	0.1	4.5	0.0018	0.6	B
5	0.115	0.42	0.23	40.0	0.013	26.8	0.35	0.1	4.5	0.0018	0.6	B
6	0.064	0.57	0.36	37.9	0.058	18.8	0.35	0.1	4.5	0.0018	0.6	B
7	0.097	0.61	0.35	40.0	0.011	28.5	0.35	0.1	4.5	0.0018	0.6	B
8	0.074	0.47	0.22	45.0	0.018	24.7	0.35	0.1	4.5	0.0018	0.6	B
9	0.162	0.76	0.42	45.0	0.015	N/A	0.35	0.1	4.5	0.0018	0.6	B
10	0.171	0.63	0.20	47.6	0.011	N/A	0.35	0.1	4.5	0.0018	0.6	B
11	0.066	0.30	0.20	45.0	0.014	21.2	0.35	0.1	4.5	0.0018	0.6	B
12	0.112	0.48	0.19	46.0	0.016	N/A	0.35	0.1	4.5	0.0018	0.6	B
13	0.133	0.53	0.30	38.0	0.017	26.1	0.35	0.1	4.5	0.0018	0.6	B
14	0.022	0.09	0.04	41.5	0.031	12.6	0.35	0.1	4.5	0.0018	0.6	B
15	0.060	0.27	0.11	8.0	0.021	21.8	0.35	0.1	4.5	0.0018	0.6	B
16	0.050	0.36	0.23	8.0	0.020	24.4	0.35	0.1	4.5	0.0018	0.6	B
17	0.027	0.25	0.17	45.0	0.010	17.9	0.35	0.1	4.5	0.0018	0.6	B
18	0.093	0.30	0.15	20.9	0.013	19.4	0.35	0.1	4.5	0.0018	0.6	B
19	0.128	0.46	0.16	61.0	0.013	28.6	0.35	0.1	4.5	0.0018	0.6	B
20	0.170	0.57	0.16	73.0	0.019	N/A	0.35	0.1	4.5	0.0018	0.6	B
24	0.089	0.49	0.27	63.0	0.020	25.1	0.35	0.1	4.5	0.0018	0.6	B
25	0.053	0.43	0.22	51.0	0.017	25.1	0.35	0.1	4.5	0.0018	0.6	B
27	0.294	0.78	0.27	65.0	0.010	N/A	0.35	0.1	4.5	0.0018	0.6	B
28	0.213	0.81	0.38	62.0	0.011	N/A	0.35	0.1	4.5	0.0018	0.6	B
29	0.030	0.32	0.13	45.8	0.018	19.9	0.35	0.1	4.5	0.0018	0.6	B
30	0.092	0.27	0.13	61.0	0.010	18.5	0.35	0.1	4.5	0.0018	0.6	B
31	0.094	0.59	0.33	76.0	0.010	36.5	0.35	0.1	4.5	0.0018	0.6	B
32	0.044	0.30	0.17	43.0	0.021	18.2	0.35	0.1	4.5	0.0018	0.6	B
33	0.088	0.55	0.27	47.6	0.010	34.9	0.35	0.1	4.5	0.0018	0.6	B
34	0.084	0.45	0.19	43.0	0.020	23.3	0.35	0.1	4.5	0.0018	0.6	B
35	0.073	0.51	0.30	39.4	0.008	34.3	0.35	0.1	4.5	0.0018	0.6	B
36	0.147	0.38	0.27	74.5	0.015	N/A	0.35	0.1	4.5	0.0018	0.6	B
37	0.145	0.37	0.20	49.0	0.029	N/A	0.35	0.1	4.5	0.0018	0.6	B
38	0.068	0.36	0.19	45.0	0.027	17.7	0.35	0.1	4.5	0.0018	0.6	B
39	0.131	0.64	0.44	50.0	0.017	30.5	0.35	0.1	4.5	0.0018	0.6	B
40	0.118	0.49	0.14	56.0	0.015	N/A	0.35	0.1	4.5	0.0018	0.6	B
41	0.135	0.52	0.30	57.0	0.002	48.6	0.35	0.1	4.5	0.0018	0.6	B
42	0.113	0.38	0.32	50.6	0.015	22.7	0.35	0.1	4.5	0.0018	0.6	B
43	0.056	0.45	0.23	61.0	0.014	23.8	0.35	0.1	4.5	0.0018	0.6	B
44	0.207	0.45	0.20	47.2	0.003	N/A	0.35	0.1	4.5	0.0018	0.6	B
45	0.037	0.35	0.31	38.6	0.007	29.5	0.35	0.1	4.5	0.0018	0.6	B
46	0.104	0.42	0.18	40.1	0.010	30.1	0.35	0.1	4.5	0.0018	0.6	B
47	0.055	0.37	0.21	46.3	0.003	21.4	0.35	0.1	4.5	0.0018	0.6	B
48	0.140	0.66	0.33	41.2	0.007	47.9	0.35	0.1	4.5	0.0018	0.6	B
49	0.065	0.57	0.25	43.0	0.015	30.4	0.35	0.1	4.5	0.0018	0.6	B
50	0.129	0.49	0.30	46.3	0.010	24.9	0.35	0.1	4.5	0.0018	0.6	B
51	0.092	0.49	0.15	48.3	0.002	47.4	0.35	0.1	4.5	0.0018	0.6	B
52	0.080	0.66	0.28	47.4	0.002	47.0	0.35	0.1	4.5	0.0018	0.6	B
53	0.126	0.47	0.11	46.7	0.003	35.9	0.35	0.1	4.5	0.0018	0.6	B
54	0.132	0.34	0.06	45.0	0.008	20.2	0.35	0.1	4.5	0.0018	0.6	B
55	0.078	0.25	0.14	46.3	0.003	17.9	0.35	0.1	4.5	0.0018	0.6	B
56	0.127	0.66	0.41	48.7	0.002	57.3	0.35	0.1	4.5	0.0018	0.6	B
57	0.172	0.76	0.35	49.2	0.002	N/A	0.35	0.1	4.5	0.0018	0.6	B
58	0.185	0.78	0.33	47.5	0.350	N/A	0.35	0.1	4.5	0.0018	0.6	B
59	0.128	0.74	0.28	49.0	0.003	51.2	0.35	0.1	4.5	0.0018	0.6	B
60	0.116	0.59	0.29	60.4	0.010	34.7	0.35	0.1	4.5	0.0018	0.6	B
61	0.091	0.47	0.19	23.2	0.005	45.5	0.35	0.1	4.5	0.0018	0.6	B
62	0.166	0.66	0.24	49.0	0.002	N/A	0.35	0.1	4.5	0.0018	0.6	B
63	0.132	0.49	0.51	74.0	0.002	40.4	0.35	0.1	4.5	0.0018	0.6	B

TABLE H-2

Final Master Plan - 2006 Update
CUHP Sub-watershed Parameters (Future Development)

Basin ID	AREA sq mi	Length mi	Centriod mi	% Imp %	Slope ft/ft	Tc min	Perv Dep Storage	Imp Dep Storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
64	0.098	0.45	0.25	20.1	0.007	40.4	0.35	0.1	4.5	0.0018	0.6	B
66	0.093	0.45	0.17	69.5	0.008	29.6	0.35	0.1	4.5	0.0018	0.6	B
67	0.166	0.57	0.35	77.8	0.004	N/A	0.35	0.1	4.5	0.0018	0.6	B
68	0.161	0.53	0.30	57.1	0.006	N/A	0.35	0.1	4.5	0.0018	0.6	B
69	0.065	0.49	0.24	89.8	0.004	35.1	0.35	0.1	4.5	0.0018	0.6	B
70	0.096	0.45	0.14	74.0	0.009	27.6	0.35	0.1	4.5	0.0018	0.6	B
71	0.077	0.28	0.15	87.5	0.002	27.4	0.35	0.1	4.5	0.0018	0.6	B
72	0.038	0.37	0.16	78.3	0.007	22.2	0.35	0.1	4.5	0.0018	0.6	B
73	0.182	0.55	0.42	78.3	0.007	N/A	0.35	0.1	4.5	0.0018	0.6	B
74	0.060	0.45	0.27	43.6	0.003	35.2	0.35	0.1	4.5	0.0018	0.6	B
75	0.153	0.55	0.29	47.0	0.003	N/A	0.35	0.1	4.5	0.0018	0.6	B
76	0.087	0.55	0.38	85.1	0.003	36.0	0.35	0.1	4.5	0.0018	0.6	B
77	0.091	0.68	0.22	88.0	0.006	46.0	0.35	0.1	4.5	0.0018	0.6	B
78	0.179	0.66	0.27	95.0	0.008	N/A	0.35	0.1	4.5	0.0018	0.6	B
79	0.133	0.45	0.27	43.6	0.003	43.7	0.35	0.1	4.5	0.0018	0.6	B
80	0.078	0.28	0.15	80.0	0.002	27.4	0.35	0.1	4.5	0.0018	0.6	B
81	0.102	0.45	0.27	80.0	0.003	35.8	0.35	0.1	3.0	0.0018	0.5	C
82	0.189	0.66	0.38	80.0	0.002	N/A	0.35	0.1	4.5	0.0018	0.6	B
83	0.126	0.53	0.27	70.0	0.003	43.4	0.35	0.1	4.5	0.0018	0.6	B
84	0.125	0.47	0.33	58.0	0.004	24.3	0.35	0.1	4.5	0.0018	0.6	B
85	0.105	0.31	0.11	61.0	0.006	19.7	0.35	0.1	4.5	0.0018	0.6	B
86	0.173	0.59	0.32	58.0	0.004	N/A	0.35	0.1	4.5	0.0018	0.6	B
87	0.080	0.57	0.34	58.0	0.003	27.3	0.35	0.1	4.5	0.0018	0.6	B
88	0.230	0.49	0.33	43.5	0.006	N/A	0.35	0.1	3.0	0.0018	0.5	C
89	0.126	0.53	0.27	45.0	0.003	49.0	0.35	0.1	4.5	0.0018	0.6	B
90	0.143	0.61	0.28	37.5	0.006	N/A	0.35	0.1	4.5	0.0018	0.6	B
91	0.088	0.65	0.27	15.0	0.006	49.0	0.35	0.1	4.5	0.0018	0.6	B
92	0.106	0.55	0.27	45.0	0.005	46.1	0.35	0.1	4.5	0.0018	0.6	B
93	0.118	0.66	0.19	24.0	0.005	57.7	0.35	0.1	4.5	0.0018	0.6	B
94	0.132	0.76	0.40	45.0	0.006	43.0	0.35	0.1	4.5	0.0018	0.6	B
95	0.102	0.67	0.34	43.1	0.004	54.9	0.35	0.1	4.5	0.0018	0.6	B
96	0.115	0.59	0.29	45.0	0.005	48.4	0.35	0.1	3.0	0.0018	0.5	C
97	0.083	0.32	0.13	43.1	0.006	31.7	0.35	0.1	4.5	0.0018	0.6	B
98	0.098	0.72	0.33	45.0	0.006	47.3	0.35	0.1	4.5	0.0018	0.6	B
99	0.190	0.66	0.44	55.4	0.009	N/A	0.35	0.1	4.5	0.0018	0.6	B
100	0.253	0.97	0.38	76.0	0.011	N/A	0.35	0.1	4.5	0.0018	0.6	B
101	0.137	0.68	0.47	38.4	0.014	N/A	0.35	0.1	4.5	0.0018	0.6	B
105	0.286	0.81	0.43	87.0	0.019	N/A	0.35	0.1	4.5	0.0018	0.6	B
107	0.339	1.03	0.43	51.0	0.009	N/A	0.35	0.1	4.5	0.0018	0.6	B
108	0.101	0.62	0.32	45.0	0.005	50.0	0.35	0.1	4.5	0.0018	0.6	B
109	0.187	0.78	0.26	29.8	0.059	N/A	0.35	0.1	4.5	0.0018	0.6	B
110	0.108	0.49	0.23	7.0	0.004	51.0	0.35	0.1	4.5	0.0018	0.6	B
111	0.167	0.61	0.33	24.6	0.006	N/A	0.35	0.1	4.5	0.0018	0.6	B
112	0.112	0.22	0.11	42.0	0.008	22.6	0.35	0.1	4.5	0.0018	0.6	B
113	0.055	0.44	0.23	45.0	0.004	40.3	0.35	0.1	4.5	0.0018	0.6	B
114	0.135	0.53	0.28	13.7	0.004	50.8	0.35	0.1	4.5	0.0018	0.6	B
115	0.077	0.49	0.31	42.3	0.004	44.5	0.35	0.1	4.5	0.0018	0.6	B
116	0.190	0.53	0.25	37.4	0.001	N/A	0.35	0.1	4.5	0.0018	0.6	B
117	0.146	0.49	0.25	40.1	0.001	N/A	0.35	0.1	4.5	0.0018	0.6	B
118	0.136	0.57	0.31	37.4	0.007	43.6	0.35	0.1	4.5	0.0018	0.6	B
119	0.116	0.51	0.20	56.1	0.008	35.3	0.35	0.1	4.5	0.0018	0.6	B
120	0.078	0.47	0.16	34.3	0.010	33.5	0.35	0.1	4.5	0.0018	0.6	B
121	0.101	0.34	0.14	57.5	0.007	28.3	0.35	0.1	4.5	0.0018	0.6	B
122	0.129	0.31	0.33	45.0	0.007	28.9	0.35	0.1	3.0	0.0018	0.5	C
123	0.158	0.68	0.38	45.0	0.004	N/A	0.35	0.1	3.0	0.0018	0.5	C
124	0.125	0.40	0.19	45.0	0.006	35.7	0.35	0.1	3.0	0.0018	0.5	C
125	0.051	0.22	0.13	60.0	0.007	43.6	0.35	0.1	3.0	0.0018	0.5	C
126	0.132	0.61	0.28	52.4	0.008	40.6	0.35	0.1	4.5	0.0018	0.6	B

TABLE H-2
Final Master Plan - 2006 Update
CUHP Sub-watershed Parameters (Future Development)

Basin ID	AREA sq mi	Length mi	Centriod mi	% Imp %	Slope ft/ft	Tc min	Perv Dep Storage	Imp Dep Storage	Initial Rate	Decay Coef	Final Rate	Hydrologic Soil Group
127	0.101	0.45	0.15	42.2	0.008	34.7	0.35	0.1	4.5	0.0018	0.6	B
128	0.127	0.46	0.31	90.0	0.004	N/A	0.35	0.1	4.5	0.0018	0.6	B
129	0.118	0.32	0.21	90.0	0.005	N/A	0.35	0.1	4.5	0.0018	0.6	B
130	0.101	0.34	0.19	80.0	0.006	N/A	0.35	0.1	4.5	0.0018	0.6	B
131	0.034	0.18	0.10	50.0	0.001	N/A	0.35	0.1	4.5	0.0018	0.6	B
132	0.138	0.34	0.16	45.0	0.001	N/A	0.35	0.1	4.5	0.0018	0.6	B
133	0.106	0.31	0.13	40.0	0.021	N/A	0.35	0.1	4.5	0.0018	0.6	B
134	0.126	0.36	0.18	20.0	0.024	N/A	0.35	0.1	4.5	0.0018	0.6	B
135	0.066	0.54	0.11	20.0	0.014	N/A	0.35	0.1	4.5	0.0018	0.6	B
136	0.013	0.13	0.07	90.0	0.001	N/A	0.35	0.1	4.5	0.0018	0.6	B
137	0.020	0.19	0.09	90.0	0.001	N/A	0.35	0.1	4.5	0.0018	0.6	B
138	0.086	0.4462	0.2188	50	0.001	N/A	0.35	0.1	4.5	0.0018	0.6	B
139	1.505	2.127	1.233	5.59	0.019	N/A	0.35	0.1	4.5	0.0018	0.6	B
531	0.068	0.34	0.16	25	0.004	20	0.35	0.1	4.5	0.0018	0.6	B
529	0.057	0.34	0.16	95	0.018	15.6	0.35	0.1	4.5	0.0018	0.6	B

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TABLE H-3
Final Master Plan - Revised 2006
SWMM ROUTING ELEMENT PARAMETERS
(Future Development)

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	TYPE	WIDTH OR DIAMETER (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES HORIZ/VERT L	R	MANNING n		OVERBANK/ SURCHARGE DEPTH (FT)
170	279	0	3		0	1	0.001	0	0	0.001	0	10
130	12	0	3		0	1	0.001	0	0	0.001	0	10
12	113	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.4	1.4 2.9	2	4.3	2.5	5.8	2.8	7.2	3.2	3.2
	8	5.1	8.7	8.3 10.2	17.1	11.7	28.4	13.3	41.6	26.6	41.7	41.7
115	60	0	3		0	1	0.001	0	0	0.001	0	10
114	133	0	3		0	1	0.001	0	0	0.001	0	10
133	115	0	1	CHANNEL	4	830	0.017	4	4	0.035	0	10
113	37	0	3		0	1	0.001	0	0	0.001	0	10
112	395	0	1	CHANNEL	10	845	0.001	4	4	0.035	0	10
111	112	0	3		0	1	0.001	0	0	0.001	0	10
109	110	0	1	CHANNEL	10	545	0.002	4	4	0.035	0	10
395	109	0	3		0	1	0.001	0	0	0.001	0	10
77	203	0	3		0	1	0.001	0	0	0.001	0	10
78	504	0	3		0	1	0.001	0	0	0.001	0	10
79	70	0	3		0	1	0.001	0	0	0.001	0	10
80	413	0	3		0	1	0.001	0	0	0.001	0	10
81	202	0	3		0	1	0.001	0	0	0.001	0	10
82	216	0	3		0	1	0.001	0	0	0.001	0	10
83	71	0	3		0	1	0.001	0	0	0.001	0	10
84	212	0	3		0	1	0.001	0	0	0.001	0	10
85	222	0	3		0	1	0.001	0	0	0.001	0	10
86	523	0	3		0	1	0.001	0	0	0.001	0	10
87	41	0	3		0	1	0.001	0	0	0.001	0	10
88	185	0	3		0	1	0.001	0	0	0.001	0	10
89	194	0	3		0	1	0.001	0	0	0.001	0	10
90	590	0	3		0	1	0.001	0	0	0.001	0	10
91	187	0	3		0	1	0.001	0	0	0.001	0	10
92	296	0	3		0	1	0.001	0	0	0.001	0	10
93	292	0	3		0	1	0.001	0	0	0.001	0	10
94	232	0	3		0	1	0.001	0	0	0.001	0	10
95	96	0	3		0	1	0.001	0	0	0.001	0	10
96	382	0	1	CHANNEL	10	1500	0.001	4	4	0.035	0	10
98	45	0	3		0	1	0.001	0	0	0.001	0	10
99	288	0	3		0	1	0.001	0	0	0.001	0	10
100	33	0	1	CHANNEL	10	1580	0.001	4	4	0.035	0	10
101	100	0	3		0	1	0.001	0	0	0.001	0	10
102	327	0	1	CHANNEL	10	2100	0.003	4	4	0.035	0	10
103	334	0	1	CHANNEL	10	1300	0.001	4	4	0.035	0	10
104	106	0	3		0	1	0.001	0	0	0.001	0	10
105	106	0	1	CHANNEL	10	5350	0.004	4	4	0.035	0	10
106	32	0	3		0	1	0.001	0	0	0.001	0	10
107	108	0	3		0	1	0.001	0	0	0.001	0	10
108	146	0	1	CHANNEL	10	2200	0.001	4	4	0.035	0	10
303	999	0	3		0	1	0.001	0	0	0.001	0	10
365	999	0	3		0	1	0.001	0	0	0.001	0	10
366	466	0	3		0	1	0.001	0	0	0.001	0	10
367	999	0	3		0	1	0.001	0	0	0.001	0	10
152	153	0	3		0	1	0.001	0	0	0.001	0	10
203	145	0	4	CHANNEL	0.5	2070	0.016	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	2070	0.016	20	20	0.02		20
153	339	0	1	CHANNEL	10	1120	0.004	4	4	0.035	0	10
339	52	0	3		0	1	0.001	0	0	0.001	0	10
52	48	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	3.1	3.1 6.3	4.3	9.4	5.3	12.6	6.1	15.7	6.9	6.9
	19.4	8.4	23.2	10.5 30.6	15.5	38.1	21.4	45.6	28.2	91.2	28.3	28.3
172	282	4	3		0	1	0.001	0	0	0.001	0	10
	DIVERSION TO GUTTER NUMBER 362 - TOTAL Q VS DIVERTED Q IN CFS											
	.0 .0	38.3	38.3	38.4 38.3 5000.0 38.3								
362	171	0	2	PIPE	3	600	0.005	0	0	0.016	0	3
171	359	0	2	PIPE	3.5	1620	0.005	0	0	0.016	0	3.5
282	342	0	4	CHANNEL	0.5	1000	0.001	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	10	1000	0.001	20	20	0.02		20
341	241	0	3		0	1	0.001	0	0	0.001	0	10
241	118	0	1	CHANNEL	10	2500	0.002	4	4	0.035	0	30
340	260	0	3		0	1	0.001	0	0	0.001	0	10
260	157	0	4	CHANNEL	0.5	1500	0.001	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	1500	0.001	20	20	0.02		20
216	316	0	2	PIPE	3	850	0.023	0	0	0.013	0	3
316	218	0	3		0	1	0.001	0	0	0.001	0	10

TABLE H-3
Final Master Plan - Revised 2006
SWMM ROUTING ELEMENT PARAMETERS
(Future Development)

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	TYPE	WIDTH OR DIAMETER (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES HORIZ/VERT L	R	MANNING n		OVERBANK/ SURCHARGE DEPTH (FT)
218	132	0	2	PIPE	4	780	0.005	0	0	0.013	0	4
148	155	0	3		0	1	0.001	0	0	0.001	0	10
155	132	0	1	CHANNEL	10	500	0.028	4	4	0.035	0	10
132	27	0	3		0	1	0.001	0	0	0.001	0	10
27	59	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.4	1.4 2.8	2	4.3	2.4	5.7	2.8	7.1	3.1	3.1
	9.7	4.3	12.4	5.9 17.8	9.8	22.9	14.5	28.1	19.7	1328.2	19.7	19.7
310	254	0	3		0.1	1	0.001	0	0	0.001	0	10
212	311	0	1	CHANNEL	10	1800	0.012	4	4	0.035	0	10
254	307	0	4	CHANNEL	0.5	950	0.007	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	950	0.007	20	20	0.02		20
308	311	0	3		0	1	0.001	0	0	0.001	0	10
307	210	0	3		0	1	0.001	0	0	0.001	0	10
210	336	0	4	CHANNEL	0.5	2450	0.021	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	2450	0.021	20	20	0.02		20
336	836	0	3		0	1	0.001	0	0	0.001	0	10
236	356	0	4	CHANNEL	0.5	1800	0.003	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	1800	0.003	20	20	0.02		20
335	235	0	3		0	1	0.001	0	0	0.001	0	10
235	158	0	4	CHANNEL	0.5	2950	0.012	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	2950	0.012	20	20	0.02		20
348	245	0	3		0	1	0.001	0	0	0.001	0	10
245	158	0	4	CHANNEL	0.5	1750	0.02	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	1750	0.02	20	20	0.02		20
158	244	0	3		0	1	0.001	0	0	0.001	0	10
244	336	0	4	CHANNEL	0.5	2000	0.001	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	2000	0.001	20	20	0.02		20
356	256	0	3		0	1	0.001	0	0	0.001	0	10
256	357	0	5	PIPE	1.5	1600	0.001	0	0	0.016	0	1.5
	0	0	0	OVERFLOW	1	1600	0.001	20	20	0.02		10
277	381	0	1	CHANNEL	10	5260	0.002	4	4	0.035	0	10
381	248	0	3		0	1	0.001	0	0	0.001	0	10
248	395	0	1	CHANNEL	10	1400	0.004	4	4	0.035	0	10
121	297	0	3		0	1	0.001	0	0	0.001	0	10
10	31	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.9	1.9 3.8	2.8	5.8	3.2	7.7	3.7	9.6	4.2	4.2
	12.1	10	14.6	19.8 19.8	46.6	24.6	81.2	29.7	121.6	59.4	121.7	121.7
297	146	0	1	CHANNEL	10	1650	0.007	4	4	0.035	0	10
146	10	0	3		0	1	0.001	0	0	0.001	0	10
31	104	0	1	CHANNEL	10	7400	0.002	4	4	0.035	0	10
145	68	0	3		0	1	0.001	0	0	0.001	0	10
178	295	0	3		0	1	0.001	0	0	0.001	0	10
295	147	0	1	CHANNEL	10	2850	0.004	4	4	0.035	0	10
296	147	0	1	CHANNEL	10	1300	0.002	4	4	0.035	0	10
147	294	0	3		0	1	0.001	0	0	0.001	0	10
294	117	0	1	CHANNEL	10	900	0.007	4	4	0.035	0	10
117	394	0	3		0	1	0.001	0	0	0.001	0	10
394	104	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	2.4	2.4 4.8	3.3	7.3	4.1	9.7	4.7	12.1	5.3	5.3
	14	9.7	16	17.4 19.8	38.2	23.6	64.8	27.5	96	55	96.1	96.1
50	393	0	1	CHANNEL	10	1670	0.008	4	4	0.035	0	10
292	138	0	4	CHANNEL	0.5	1050	0.002	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	1050	0.002	20	20	0.02		20
138	270	0	3		0	1	0.001	0	0	0.001	0	10
270	390	0	4	CHANNEL	0.5	750	0.011	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	750	0.011	20	20	0.02		20
390	50	0	3		0	1	0.001	0	0	0.001	0	10
391	293	0	3		0	1	0.001	0	0	0.001	0	10
293	393	0	1	CHANNEL	10	800	0.008	4	4	0.035	0	10
393	11	0	3		0	1	0.001	0	0	0.001	0	10
11	106	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	4.2	4.1 6.3	5.8	12.5	7.1	16.7	8.2	20.8	9.2	9.2
	24.8	18.3	28.8	33.9 36.7	76.7	44.6	131.2	52.6	195.2	105.2	195.3	195.3
32	277	0	1	CHANNEL	10	7100	0.004	4	4	0.035	0	10
182	186	0	3		0	1	0.001	0	0	0.001	0	10
186	165	0	1	CHANNEL	10	2650	0.009	4	4	0.035	0	10
187	165	0	4	CHANNEL	0.5	350	0.009	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	350	0.009	20	20	0.02		20

TABLE H-3
Final Master Plan - Revised 2006
SWMM ROUTING ELEMENT PARAMETERS
(Future Development)

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	TYPE	WIDTH OR DIAMETER (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES HORIZ/VERT L	SIDE SLOPES HORIZ/VERT R	MANNING n		OVERBANK/ SURCHARGE DEPTH (FT)
165	18	0	3		0	1	0.001	0	0	0.001	0	10
18	99	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	5.2	5.2 10.4	7.2	15.6	8.9	15.3	10.2	26	11.5	11.5
	29.9	20.7	33.8	36.4 41.5	79.3	49.3	134.1	57	198.4	114	198.4	198.4
288	299	0	4	CHANNEL	0.5	4150	0.002	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	4150	0.002	20	20	0.02		20
382	19	0	3		0	1	0.001	0	0	0.001	0	10
19	111	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	4.8	4.8 9.6	6.7	14.4	8.2	19.2	9.4	24	10.6	10.6
	26.1	15.9	28.3	24.9 32.6	49.7	37	81.3	41.3	118.4	82.6	118.5	118.5
319	623	0	3		0	1	0.001	0	0	0.001	0	10
219	102	0	4	CHANNEL	0.5	1870	0.015	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	1870	0.015	20	20	0.02		20
317	517	0	3		0	1	0.001	0	0	0.001	0	10
217	229	0	1	CHANNEL	10	1411	0.02	4	4	0.035	0	10
329	61	0	3		0	1	0.001	0	0	0.001	0	10
229	327	0	1	CHANNEL	11.5	2400	0.003	0	0	0.016	0	4
376	25	0	3		0	1	0.001	0	0	0.001	0	10
61	229	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	0.9	0.9 1.7	1.2	2.6	1.5	3.4	1.7	4.3	1.9	1.9
	5	2	5.7	2.3 7.2	3	8.6	3.9	10.1	5	1010.1	5	5
41	185	0	1	CHANNEL	10	1700	0.012	4	4	0.035	0	10
185	53	0	3		0	1	0.001	0	0	0.001	0	10
53	167	0	1	CHANNEL	10	1150	0.01	4	4	0.035	0	10
167	42	0	3		0	1	0.001	0	0	0.001	0	10
42	379	0	1	CHANNEL	10	2350	0.004	4	4	0.035	0	10
379	21	0	3		0	1	0.001	0	0	0.001	0	10
21	192	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.5	1.5 3.1	2.1	4.6	2.6	6.2	3	7.7	3.4	3.4
	9.1	6.6	10.5	12.2 13.2	27.4	16	46.7	18.8	69.4	1018.8	69.4	69.4
220	320	0	2	PIPE	3	1750	0.008	0	0	0.016	0	3
320	319	0	3		0	1	0.001	0	0	0.001	0	10
227	327	0	2	PIPE	3.5	2450	0.016	0	0	0.016	0	3.5
327	23	0	3		0	1	0.001	0	0	0.001	0	10
23	98	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	4.5	18.6 9	23.3	13.6	28.5	18.1	92.9	22.6	37	37
	23.8	48.4	24.8	68 27.3	121.6	29.6	189.9	31.9	270	1031.9	270	270
222	422	0	1	CHANNEL	10	990	0.017	4	4	0.035	0	10
422	522	0	3		0	1	0.001	0	0	0.001	0	10
522	226	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	2.3	8 4.7	11.1	7	13.6	8.4	15.8	11.7	17.7	17.7
	12.9	20.2	14.1	24.4 16.5	36	19	50.7	21.4	68	1021.4	68	68
226	326	0	2	PIPE	3.5	1400	0.009	0	0	0.016	0	3.5
135	226	0	3		0	1	0.001	0	0	0.001	0	10
226	326	0	1	CHANNEL	10	1400	0.014	4	4	0.035	0	10
326	327	0	3		0	1	0.001	0	0	0.001	0	10
330	221	0	3		0	1	0.001	0	0	0.001	0	10
221	376	0	1	CHANNEL	10	900	0.005	4	4	0.035	0	10
225	325	0	2	PIPE	2	950	0.016	0	0	0.016	0	2
325	483	0	3		0	1	0.001	0	0	0.001	0	10
231	452	0	2	PIPE	3	1900	0.009	0	0	0.016	0	3
331	284	0	3		0	1	0.001	0	0	0.001	0	10
284	300	0	1	CHANNEL	4	1340	0.005	4	4	0.035	0	4
192	168	0	1	CHANNEL	10	1800	0.005	4	4	0.035	0	10
168	193	0	3		0	1	0.001	0	0	0.001	0	10
193	169	0	1	CHANNEL	10	2200	0.009	4	4	0.035	0	10
169	55	0	3		0	1	0.001	0	0	0.001	0	10
55	300	0	1	CHANNEL	10	1300	0.004	4	4	0.035	0	10
300	56	0	3		0	1	0.001	0	0	0.001	0	10
56	97	0	1	CHANNEL	10	1300	0.004	4	4	0.035	0	10
97	66	0	3		0	1	0.001	0	0	0.001	0	10
66	301	0	1	CHANNEL	12	1640	0.0041	0	0	0.016	0	7
194	90	0	1	CHANNEL	4	1500	0.005	4	4	0.035	0	10
160	195	0	1	CHANNEL	10	800	0.005	4	4	0.035	0	10
195	48	0	3		0	1	0.001	0	0	0.001	0	10
384	48	0	3		0	1	0.001	0	0	0.001	0	10

TABLE H-3
Final Master Plan - Revised 2006
SWMM ROUTING ELEMENT PARAMETERS
(Future Development)

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	TYPE	WIDTH OR DIAMETER (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES HORIZ/VERT L	SIDE SLOPES HORIZ/VERT R	MANNING n		OVERBANK/ SURCHARGE DEPTH (FT)
48	97	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	0.6	0.6 1.3	0.9	1.9	1.1	2.6	1.3	3.2	1.4	1.4
	6	4.9	8.9	10.8 14.5	27	20.1	47.7	25.7	72	1025.7	72	72
163	184	0	3		0	1	0.001	0	0	0.001	0	10
184	164	0	1	CHANNEL	10	3150	0.01	4	4	0.035	0	10
164	13	0	3		0	1	0.001	0	0	0.001	0	10
13	34	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.9	1.9 3.8	2.6	5.7	3.2	7.6	3.7	9.4	4.2	4.2
	11.3	8.5	13.2	16 17	36.4	20.7	62.3	24.5	92.8	49	92.9	92.9
159	298	0	3		0	1	0.001	0	0	0.001	0	10
298	197	0	1	CHANNEL	10	3200	0.005	4	4	0.035	0	10
125	150	0	3		0	1	0.001	0	0	0.001	0	10
150	149	0	1	CHANNEL	10	700	0.002	4	4	0.035	0	10
197	149	0	3		0	1	0.001	0	0	0.001	0	10
149	14	0	3		0	1	0.001	0	0	0.001	0	10
14	101	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	4.9	4.9 9.8	6.8	14.7	8.3	19.7	9.6	24.6	10.8	10.8
	28.2	19.2	31.8	33.6 39	73.1	46.1	123.4	53.3	182.4	106.6	182.5	182.5
267	149	0	1	CHANNEL	10	750	0.005	4	4	0.035	0	10
34	101	0	1	CHANNEL	10	3820	0.008	4	4	0.035	0	10
151	267	0	3		0	1	0.001	0	0	0.001	0	10
355	21	0	3		0	1	0.001	0	0	0.001	0	10
199	173	0	1	CHANNEL	10	1450	0.006	4	4	0.035	0	10
173	15	0	3		0	1	0.001	0	0	0.001	0	10
15	266	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	3.2	3.2 6.3	4.4	9.5	5.4	12.7	6.2	15.9	7	7
	18.5	13.2	21.1	23.9 26.5	53.3	31.8	90.6	37.1	134.4	1037.1	134.4	134.4
33	266	0	1	CHANNEL	10	2650	0.009	4	4	0.035	0	10
266	35	0	3		0	1	0.001	0	0	0.001	0	10
16	266	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	2	2 4	2.8	6	3.4	8	3.9	10	4.4	4.4
	11.8	8.7	13.6	16.2 17.3	36.5	20.9	62.4	24.5	92.8	49	92.9	92.9
35	38	0	1	CHANNEL	10	2660	0.003	4	4	0.035	0	10
56	387	0	1	CHANNEL	10	2700	0.009	4	4	0.035	0	30
387	20	0	3		0	1	0.001	0	0	0.001	0	10
20	301	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.5	12.8 2.9	18	4.4	22	5.8	25.4	7.3	28.5	28.5
	6.8	30.1	10.3	33 13.3	40.7	16.3	50.5	19.3	62	1019.3	62	62
200	40	0	3		0	1	0.001	0	0	0.001	0	10
232	334	0	1	CHANNEL	10	1150	0.012	4	4	0.035	0	10
334	234	0	3		0	1	0.001	0	0	0.001	0	10
234	348	0	4	CHANNEL	0.5	2310	0.013	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	2310	0.013	20	20	0.02		20
348	246	0	3		0	1	0.001	0	0	0.001	0	10
246	346	0	1	CHANNEL	10	340	0.009	4	4	0.035	0	10
119	333	0	3		0	1	0.001	0	0	0.001	0	10
333	103	0	3		0	1	0.001	0	0	0.001	0	10
346	120	0	3		0	1	0.001	0	0	0.001	0	10
120	255	4	3		0	1	0.001	0	0	0.001	0	10
	DIVERSION TO GUTTER NUMBER 249 - TOTAL Q VS DIVERTED Q IN CFS											
	.0 .0	55.0	55.0	55.1 55.0	300.0	55.0						
110	283	0	3		0	1	0.001	0	0	0.001	0	10
283	378	0	4	CHANNEL	0.5	780	0.001	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	780	0.001	20	20	0.02		20
255	353	0	4	CHANNEL	0.5	2500	0.002	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	2500	0.002	20	20	0.02		20
353	253	4	3		0	1	0.001	0	0	0.001	0	10
	DIVERSION TO GUTTER NUMBER 397 - TOTAL Q VS DIVERTED Q IN CFS											
	.0 .0	40.4	40.4	40.5 40.4	500.0	40.4						
253	351	0	4	CHANNEL	0.5	800	0.003	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	800	0.003	20	20	0.02		20
351	251	0	3		0	1	0.001	0	0	0.001	0	10
251	357	0	4	CHANNEL	0.5	2670	0.001	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	2670	0.001	20	20	0.02		20
275	374	0	4	CHANNEL	0.5	1170	0.001	12	12	0.016	0	0.5

TABLE H-3
Final Master Plan - Revised 2006
SWMM ROUTING ELEMENT PARAMETERS
(Future Development)

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	TYPE	WIDTH OR DIAMETER (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES HORIZ/VERT L	SIDE SLOPES HORIZ/VERT R	MANNING n		OVERBANK/ SURCHARGE DEPTH (FT)
	0	0	0	OVERFLOW	5	1170	0.001	20	20	0.02		20
374	274	0	3		0	1	0.001	0	0	0.001	0	10
274	352	0	5	PIPE	2	2300	0.002	0	0	0.016	0	2
	0	0	0	OVERFLOW	1	2300	0.002	20	20	0.02		10
352	252	4	3		0	1	0.001	0	0	0.001	0	10
	DIVERSION TO GUTTER NUMBER 399 - TOTAL Q VS DIVERTED Q IN CFS											
	.0 .0 13.0 13.0 13.1 13.0 271.0 13.0											
252	357	0	4	CHANNEL	0.5	1570	0.001	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	1570	0.001	20	20	0.02		20
357	257	0	3		0	1	0.001	0	0	0.001	0	10
257	127	0	5	PIPE	4.5	1950	0.0026	0	0	0.016	0	4.5
	0	0	0	OVERFLOW	1	1950	0.0026	20	20	0.02		10
127	126	4	3		0	1	0.001	0	0	0.001	0	10
	DIVERSION TO GUTTER NUMBER 344 - TOTAL Q VS DIVERTED Q IN CFS											
	.0 .0 11.6 11.6 11.7 11.6 3000.0 11.6											
344	354	0	2	PIPE	2	400	0.004	0	0	0.016	0	2
126	354	0	5	PIPE	5.5	2590	0.005	0	0	0.016	0	5.5
	0	0	0	OVERFLOW	1	2590	0.005	20	20	0.02		10
369	259	5	3		0	1	0.001	0	0	0.001	0	10
	DIVERSION TO GUTTER NUMBER 559 - TOTAL Q VS DIVERTED Q IN CFS											
	.0 .0 1.0 1.0 71.0 71.0 72.0 71.0 5000.0 71.0											
259	118	0	5	PIPE	3.5	1750	0.007	0	0	0.016	0	3.5
	0	0	0	OVERFLOW	5	1750	0.007	20	0	0.02		20
118	361	0	3		0	1	0.001	0	0	0.001	0	10
361	261	0	3		0	1	0.001	0	0	0.001	0	10
261	157	0	5	PIPE	2	700	0.01	0	0	0.016	0	2
	0	0	0	OVERFLOW	10	700	0.01	4	4	0.02		10
360	265	0	3		0	1	0.001	0	0	0.001	0	10
265	157	0	4	CHANNEL	0.5	600	0.002	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	600	0.002	20	20	0.02		20
354	258	5	3		0	1	0.001	0	0	0.001	0	10
	DIVERSION TO GUTTER NUMBER 526 - TOTAL Q VS DIVERTED Q IN CFS											
	.0 .0 1.0 1.0 250.0 250.0 251.0 250.0 5000.0 250.0											
258	157	0	4	CHANNEL	0.5	2330	0.003	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	2330	0.003	20	20	0.02		20
157	557	0	3		0	1	0.001	0	0	0.001	0	10
279	110	0	1	CHANNEL	10	900	0.002	4	4	0.035	0	10
377	278	0	3		0	1	0.001	0	0	0.001	0	10
278	378	0	4	CHANNEL	0.5	850	0.016	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	850	0.016	20	20	0.02		20
378	273	0	3		0	1	0.001	0	0	0.001	0	10
273	373	0	4	CHANNEL	10	1900	0.006	1.2	1.2	0.2	0	4.5
	0	0	0	OVERFLOW	100	1900	0.006	50	50	0.035		10
373	272	0	3		0	1	0.001	0	0	0.001	0	10
272	371	0	1	CHANNEL	10	670	0.003	4	4	0.035	0	30
371	271	0	3		0	1	0.001	0	0	0.001	0	10
271	999	0	1	CHANNEL	10	2200	0.005	4	4	0.035	0	10
302	413	0	5	PIPE	3.5	1500	0.017	0	0	0.016	0	3.5
	0	0	0	OVERFLOW	10	1500	0.017	4	4	0.02		10
313	213	0	3		0	1	0.001	0	0	0.001	0	10
213	209	0	1	CHANNEL	10	1600	0.015	4	4	0.035	0	10
305	51	0	3		0	1	0.001	0	0	0.001	0	10
209	115	0	1	CHANNEL	4	1820	0.008	4	4	0.035	0	10
342	242	0	3		0	1	0.001	0	0	0.001	0	10
242	124	0	5	PIPE	5	1380	0.01	0	0	0.016	0	5
	0	0	0	OVERFLOW	1	1380	0.01	20	20	0.02		20
124	241	0	3		0	1	0.001	0	0	0.001	0	10
345	341	0	3		0	1	0.001	0	0	0.001	0	10
370	139	0	3		0	1	0.001	0	0	0.001	0	10
139	140	0	1	CHANNEL	10	1500	0.005	4	4	0.035	0	10
140	268	0	3		0	1	0.001	0	0	0.001	0	10
268	368	0	4	CHANNEL	0.5	1150	0.003	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	1150	0.003	20	20	0.02		20
368	269	0	3		0	1	0.001	0	0	0.001	0	10
269	999	0	4	CHANNEL	0.5	1000	0.006	12	12	0.016	0	0.5
	0	0	0	OVERFLOW	5	1000	0.006	20	20	0.02		20
343	26	0	3		0	1	0.001	0	0	0.001	0	10
249	143	0	2	PIPE	5	2400	0.001	0	0	0.016	0	5
143	142	0	3		0	1	0.001	0	0	0.001	0	10
142	396	0	2	PIPE	3.5	2700	0.005	0	0	0.016	0	3.5
397	396	0	2	PIPE	4	1520	0.001	0	0	0.016	0	4
375	275	4	3		0	1	0.001	0	0	0.001	0	10

TABLE H-3
Final Master Plan - Revised 2006
SWMM ROUTING ELEMENT PARAMETERS
(Future Development)

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	TYPE	WIDTH OR DIAMETER (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES HORIZ/VERT L	SIDE SLOPES HORIZ/VERT R	MANNING n		OVERBANK/ SURCHARGE DEPTH (FT)
	DIVERSION TO GUTTER NUMBER 396 - TOTAL Q VS DIVERTED Q IN CFS											
	.0 .0 86.2 86.2 86.3 86.2 500.0 86.2											
177	156	0	5	PIPE	5.5	1350	0.001	0	0	0.016	0	5.5
	0	0	0	OVERFLOW	1	1350	0.001	20	20	0.02		10
156	178	0	3		0	1	0.001	0	0	0.001	0	10
178	373	0	5	PIPE	6	2600	0.003	0	0	0.016	0	6
	0	0	0	OVERFLOW	1	2600	0.003	20	20	0.02		10
398	154	0	2	PIPE	3	2410	0.002	0	0	0.016	0	3
399	154	0	2	PIPE	2	2000	0.005	0	0	0.016	0	2
154	174	0	3		0	1	0.001	0	0	0.001	0	10
174	999	0	5	PIPE	4	2200	0.005	0	0	0.016	0	4
	0	0	0	OVERFLOW	1	2200	0.005	20	20	0.02		10
396	177	0	3		0	1	0.001	0	0	0.001	0	10
24	98	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0 0 1 0.9 1.3 2.9 1.6 3.8 1.9 4.8 2.1 2.1											
	5.6 4.2 6.5 7.8 8.2 17.6 10 30.1 11.7 44.8 23.4 44.9 44.9											
45	97	0	1	CHANNEL	10	2800	0.007	4	4	0.035	0	10
29	376	0	1	CHANNEL	10	1750	0.001	4	4	0.035	0	10
25	97	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0 0 2.1 2.1 4.2 2.9 6.2 3.5 8.3 4.1 10.4 4.6 4.6											
	11.3 7.9 12.2 13.6 14 29.1 15.8 48.8 17.6 72 1017.6 72 72											
301	46	0	3		0	1	0.001	0	0	0.001	0	10
46	200	0	1	CHANNEL	12	1040	0.0041	0	0	0.016	0	7
43	166	0	2	PIPE	3.5	3100	0.014	0	0	0.016	0	3.5
166	22	0	3		0	1	0.001	0	0	0.001	0	10
22	44	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0 0 4.5 9 9 12.6 13.6 15.4 18.1 17.8 22.6 20 20											
	24.7 25.1 26.8 34 31 58.1 35.3 88.9 39.5 125 1039.5 125 125											
44	169	0	1	CHANNEL	10	1350	0.005	4	4	0.035	0	10
36	99	0	1	CHANNEL	10	2450	0.003	4	4	0.035	0	10
328	332	0	3		0	1	0.001	0	0	0.001	0	10
332	122	0	1	CHANNEL	10	1300	0.002	4	4	0.035	0	10
122	17	0	3		0	1	0.001	0	0	0.001	0	10
17	113	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0 0 2.7 2.7 5.4 3.7 8.1 4.5 10.8 5.3 13.4 5.9 5.9											
	15.5 10.8 17.6 19.2 21.7 42.1 25.9 71.3 30 105.8 66 105.7 105.7											
40	372	0	1	CHANNEL	10	1450	0.017	4	4	0.035	0	10
37	299	0	1	CHANNEL	10	1300	0.002	4	4	0.035	0	20
299	38	0	3		0	1	0.001	0	0	0.001	0	10
38	111	0	1	CHANNEL	10	1175	0.001	4	4	0.035	0	20
350	26	0	3		0	1	0.001	0	0	0.001	0	10
550	551	0	3		0	1	0.001	0	0	0.001	0	10
551	350	0	1	CHANNEL	10	1421	0.014	4	4	0.035	0	10
26	372	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0 0 2.5 1.8 5 2.5 7.6 3.1 10.1 3.6 12.6 4 4											
	14.3 7.6 15.9 13.7 19.2 30.5 22.5 51.9 25.8 77 1025.8 77 77											
161	369	0	3		0	1	0.001	0	0	0.001	0	10
369	30	0	1	CHANNEL	10	1500	0.015	4	4	0.035	0	10
30	350	0	1	CHANNEL	10	1400	0.001	4	4	0.035	0	10
372	47	0	3		0	1	0.001	0	0	0.001	0	10
47	113	0	1	CHANNEL	10	1350	0.001	4	4	0.035	0	10
51	209	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0 0 0.8 4.5 1.7 6.3 2.5 7.7 3.3 8.9 4.2 10 10											
	6.6 10.3 9 10.8 13.8 12.1 18.6 13.7 23.4 15.7 1023.4 15.7 15.7											
311	28	0	3		0	1	0.001	0	0	0.001	0	10
28	114	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0 0 2.5 2.5 5.1 3.5 7.6 4.3 10.1 5 12.7 5.6 5.6											
	15.5 6.7 18.3 8.2 23.9 11.8 29.5 16.1 35.1 21 1035.1 21 21											
337	64	0	3		0	1	0.001	0	0	0.001	0	10
64	75	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0 0 0.9 0.9 1.7 1.2 2.6 1.5 3.5 1.7 4.3 1.9 1.9											
	7.9 2.8 11.6 4.2 16.9 8.2 26.1 13.3 33.4 19.2 1033.4 19.2 19.2											
309	67	0	3		0	1	0.001	0	0	0.001	0	10
67	337	0	1	CHANNEL	10	1650	0.001	4	4	0.035	0	10

TABLE H-3
Final Master Plan - Revised 2006
SWMM ROUTING ELEMENT PARAMETERS
(Future Development)

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	TYPE	WIDTH OR DIAMETER (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES HORIZ/VERT L	SIDE SLOPES HORIZ/VERT R	MANNING n		OVERBANK/ SURCHARGE DEPTH (FT)
59	114	0	2	PIPE	3	1950	0.001	0	0	0.016	0	3
60	338	0	1	CHANNEL	4	3000	0.013	4	4	0.035	0	10
338	62	0	1	CHANNEL	10	1300	0.009	4	4	0.035	0	10
62	75	0	1	CHANNEL	4	2700	0.004	4	4	0.035	0	10
75	63	0	1	CHANNEL	10	2350	0.001	4	4	0.035	0	10
63	49	0	1	CHANNEL	4	2150	0.002	4	4	0.035	0	10
65	145	0	1	CHANNEL	10	1500	0.003	4	4	0.035	0	10
68	339	0	1	CHANNEL	10	2040	0.023	4	4	0.035	0	10
69	313	0	1	CHANNEL	10	915	0.051	4	4	0.035	0	10
70	305	0	1	CHANNEL	10	1120	0.011	4	4	0.035	0	10
71	306	0	1	CHANNEL	10	1450	0.012	4	4	0.035	0	10
306	72	0	3		0	1	0.001	0	0	0.001	0	10
72	132	0	1	CHANNEL	10	1500	0.017	4	4	0.035	0	10
73	822	0	3		0	1	0.001	0	0	0.001	0	10
49	76	0	3		0	1	0.001	0	0	0.001	0	10
76	157	0	1	CHANNEL	4	4500	0.002	4	4	0.035	0	10
524	481	0	3		0	1	0.001	0	0	0.001	0	10
481	225	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1	3.3	1.9	4.7	2.9	5.7	3.8	6.6	4.8	7.4	7.4
	5.3	8.4	5.8	10.2	6.8	15.1	7.7	21.2	8.7	26.5	1008.7	26.5	26.5
431	482	0	3			0	1	0.001	0	0	0.001	0	10
482	331	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.4	4.5	2.6	6.3	4.2	7.7	5.6	8.9	7	10	10
	7.4	13.6	7.7	19.8	8.4	36.9	9.2	58.5	9.9	84	1009.9	84	84
523	220	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	2	6.4	4	8.9	6.1	10.9	8.1	12.6	10.1	14.2	14.2
	10.9	16.2	11.8	19.6	13.5	28.8	15.2	40.6	16.9	54.5	1016.9	54.5	54.5
623	227	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.3	12.2	2.6	17.1	4	20.9	5.3	24.2	6.6	27.2	27.2
	7.3	31	8	37.5	9.4	55.3	10.9	78	12.3	104.6	1012.3	104.6	104.6
483	231	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	0.5	5.9	0.9	8.3	1.4	10.1	1.8	11.7	2.3	13.1	13.1
	2.6	14.9	2.9	18	3.5	26.6	4	37.5	4.6	50.3	1004.6	50.3	50.3
622	43	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	4.2	10.7	8.4	15	12.7	18.3	16.9	21.2	21.1	23.8	23.8
	22.6	27.1	24.1	32.8	27.1	48.4	30.2	88.2	33.2	91.5	1033.2	91.5	91.5
521	168	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	3.3	5.4	6.6	7.6	9.9	9.2	13.2	10.7	16.5	12	12
	17.8	17	19.1	25.6	21.8	49	24.5	78.9	27.1	114	1027.1	114	114
517	217	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1	1	2.1	1.5	3.1	1.8	4.2	2	5.2	2.3	2.3
	6.3	2.6	7.4	3.2	9.7	4.7	11.9	6.6	14.1	8.8	1014.1	8.8	8.8
478	578	0	3			0	1	0.001	0	0	0.001	0	10
578	378	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	0.2	0.9	0.4	1.2	0.7	1.5	0.9	1.7	1.1	1.9	1.9
	1.2	2.1	1.2	2.5	1.3	3.6	1.5	5	1.6	6.6	1001.6	6.6	6.6
466	566	13	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	0.2	2.3	0.4	3.3	0.6	4	0.8	4.7	1	5.2	5.2
	1	6	1.1	7.3	1.2	10.9	1.4	15.5	1.5	20.9	1.5	1000	1000
566	999	5	1	CHANNEL		10	10	0.01	4	4	0.02	0	30
	DIVERSION TO GUTTER NUMBER 154 - TOTAL Q VS DIVERTED Q IN CFS												
	.0	.0	1.0	1.0	71.0	71.0	72.0	71.0	1000.0	71.0			
413	513	0	3			0	1	0.001	0	0	0.001	0	10
513	313	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.8	1.8	3.6	2.5	5.4	3.1	7.2	3.8	9.1	4	4
	11.1	4.5	13.1	5.4	17.1	8	21.1	11.2	25.1	14.9	1025.1	14.9	14.9
569	69	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	0.9	0.9	1.8	1.2	2.7	1.5	3.5	1.7	4.4	1.9	1.9
	4.7	1.9	4.9	2	5.5	2.2	6	2.4	6.5	2.6	1006.5	2.6	2.6

TABLE H-3
Final Master Plan - Revised 2006
SWMM ROUTING ELEMENT PARAMETERS
(Future Development)

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	TYPE	WIDTH OR DIAMETER (FT)	LENGTH (FT)	SLOPE (FT/FT)	SIDE SLOPES HORIZ/VERT L	SIDE SLOPES HORIZ/VERT R	MANNING n		OVERBANK/ SURCHARGE DEPTH (FT)
504	65	12	2	PIPE	0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	0.9	4.1	1.7	5.7	2.6	6.9	3.5	8	4.3	9	9
	4.6	11.7	4.9	16.3	3.5	29	6.1	45.2	6.8	64.2	1006.8	64.2	64.2
559	127	0	5	PIPE		4.5	1130	0.0019	0	0	0.016	0	4.5
	0	0	0		OVERFLOW	1	1130	0.0019	20	20	0.02		10
526	999	0	2	PIPE		7	2000	0.0022	0	0	0.016	0	7
590	36	12	2	PIPE		0.1	1	0.001	0	0	0.001	0	0.1
	RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
	0	0	1.8	1.5	3.1	2.1	4.7	2.6	6.3	3	7.8	3.4	3.4
	9.7	7.9	11.7	15.7	15.5	37	19.4	64.2	23.2	96	1023.2	96	96
435	534	0	3			0	1	0.001	0	0	0.001	0	10
534	434	0	0			1	10	0.001	26	10	10	0	0.04
434	533	0	3			0	1	0.001	0	0	0.001	0	10
533	433	0	1	CHANNEL		10	1439	0.024	10	10	0.04	0	10
432	538	0	3			0	1	0.001	0	0	0.001	0	10
532	432	0	1	CHANNEL		10	2600	0.0015	10	10	0.04	0	10
631	531	0	3			0	1	0.001	0	0	0.001	0	10
531	430	0	1	CHANNEL		10	2023	0.0015	10	10	0.035	0	10
437	529	0	3			0	1	0.001	0	0	0.001	0	10
429	536	0	3			0	1	0.001	0	0	0.001	0	10
436	528	0	3			0	1	0.001	0	0	0.001	0	10
428	999	0	3			0	1	0.001	0	0	0.001	0	10
439	539	0	3			0	0	0.001	0	0	0.001	0	10
430	537	0	3			0	0	0.001	0	0	0.001	0	10
433	539	0	3			0	0	0.001	0	0	0.001	0	10
438	530	0	3			0	0	0.001	0	0	0.001	0	10
569	429	0	1	CHANNEL		10	2600	0.015	10	10	0.035	0	10
557	430	0	1	CHANNEL		10	2600	0.0015	10	10	0.035	0	10
478	532	0	3			0	1	0.001	0	0	0.001	0	10
537	437	0	1	CHANNEL		10	600	0.015	10	10	0.035	0	10
536	436	0	1	CHANNEL		10	600	0.0015	10	10	0.035	0	10
538	438	0	1	CHANNEL		10	1000	0.0015	10	10	0.035	0	10
528	428	0	1	CHANNEL		10	1600	0.0015	10	10	0.035	0	10
529	429	0	1	CHANNEL		10	355	0.0015	10	10	0.035	0	10
530	430	0	1	CHANNEL		10	400	0.0015	10	10	0.035	0	10
836	342	0	5	PIPE		5	1990	0.01	0	0	0.016	0	5
	0	0	0		OVERFLOW	1	1990	0.01	20	20	0.02		20

TABLE H-4
Final Master Plan - Revised 2006
PEAK FLOW SUMMARY

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME HR	TIME MIN
10	96	0.1	26.5	2	0
11	173	0.1	49.8	1	55
12	40	0.1	13.2	1	50
13	79	0.1	22.8	1	45
14	168	0.1	51.5	1	45
15	125	0.1	35.9	1	45
16	0	0		0	0
17	106	0.1	31.4	1	40
18	190	0.1	56	1	45
19	117	0.1	41.1	1	45
20	62	0.1	24.2	1	30
21	65	0.1	18.2	1	40
22	120	0.1	38.9	2	5
23	270	0.1	33.4	1	25
24	0	0		0	0
25	72	0.1	23.9	1	30
26	66	0.1	24.3	1	35
27	19	0.1	27.4	2	0
28	20	0.1	34.2	2	10
29	91	2.5		0	50
30	88	2.4		0	55
31	77	1.9		2	50
32	267	3		2	50
33	237	2.3		2	10
34	76	1.3		2	0
35	349	3.6		2	10
36	437	4		2	15
37	989	6.3		2	5
38	1543	8.8		2	20
40	786	3.5		2	0
41	0	0		0	0
42	0	0		0	0
43	92	2.7		1	35
44	120	1.9		2	10
45	270	2.6		1	55
46	786	5.5		1	55
47	845	6.8		2	0
48	23	0.1	13	1	35
49	109	(DIRECT	FLOW)	3	30
50	431	3.2		0	50
51	15	0.1	22.2	2	20
52	24	0.1	41.2	3	35
53	0	0		0	0
55	272	3		1	55
56	360	3.4		1	55
58	0	0		0	0
59	18	3	0	2	40
60	67	1.5		2	30
61	5	0.1	10.5	2	10
62	67	1.9		2	50
63	84	2.5		3	25
64	19	0.1	33.3	2	15
65	64	1.6		2	25
66	725	5.1		1	55
67	268	4.1		0	50
68	183	1.6		0	55
69	0	0		0	0
70	152	1.8		0	45
71	113	1.5		0	45
72	234	2		0	45
73	972	(DIRECT	FLOW)	0	35
75	85	2.4		3	10

TABLE H-4
Final Master Plan - Revised 2006
PEAK FLOW SUMMARY

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME HR	TIME MIN
76	107	2.8		4	5
77	152	(DIRECT	FLOW)	0	40
78	448	(DIRECT	FLOW)	0	35
79	153	(DIRECT	FLOW)	0	45
80	182	(DIRECT	FLOW)	0	40
81	260	(DIRECT	FLOW)	0	40
82	70	(DIRECT	FLOW)	0	40
83	118	(DIRECT	FLOW)	0	40
84	437	(DIRECT	FLOW)	0	35
85	0	(DIRECT	FLOW)	0	0
86	577	(DIRECT	FLOW)	0	30
87	0	(DIRECT	FLOW)	0	0
88	0	(DIRECT	FLOW)	0	0
89	145	(DIRECT	FLOW)	0	40
90	426	(DIRECT	FLOW)	0	45
91	217	(DIRECT	FLOW)	0	40
92	163	(DIRECT	FLOW)	0	50
93	148	(DIRECT	FLOW)	0	45
94	106	(DIRECT	FLOW)	0	35
95	707	(DIRECT	FLOW)	0	40
96	607	5.9		0	50
97	725	(DIRECT	FLOW)	1	55
98	270	(DIRECT	FLOW)	1	15
99	602	(DIRECT	FLOW)	2	10
100	239	3.9		2	0
101	242	(DIRECT	FLOW)	1	50
102	0	0		0	0
103	127	2.9		0	55
104	152	(DIRECT	FLOW)	2	25
105	144	2.2		2	50
106	284	(DIRECT	FLOW)	2	25
107	91	(DIRECT	FLOW)	0	45
108	76	2.3		1	10
109	1813	8.2		2	25
110	1825	(DIRECT	FLOW)	2	25
111	1654	(DIRECT	FLOW)	2	15
112	1653	9.1		2	20
113	960	(DIRECT	FLOW)	2	0
114	39	(DIRECT	FLOW)	2	10
115	67	(DIRECT	FLOW)	2	20
117	383	(DIRECT	FLOW)	0	55
118	1588	(DIRECT	FLOW)	0	55
119	147	(DIRECT	FLOW)	0	45
120	707	(DIRECT	FLOW)	0	45
121	205	(DIRECT	FLOW)	0	45
122	660	(DIRECT	FLOW)	0	45
124	1334	(DIRECT	FLOW)	0	45
125	200	(DIRECT	FLOW)	0	45
126	1593	8.6		1	10
127	1639	(DIRECT	FLOW)	1	5
130	226	(DIRECT	FLOW)	0	45
132	505	(DIRECT	FLOW)	0	40
133	39	1.1		2	15
135	0	(DIRECT	FLOW)	0	0
137	430	(DIRECT	FLOW)	0	45
138	218	(DIRECT	FLOW)	0	50
139	217	2.5		0	45
140	600	(DIRECT	FLOW)	0	40
142	55	2.7		2	10
143	55	(DIRECT	FLOW)	2	10
145	187	(DIRECT	FLOW)	0	50
146	398	(DIRECT	FLOW)	0	50

TABLE H-4
Final Master Plan - Revised 2006
PEAK FLOW SUMMARY

CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME HR	TIME MIN
147	385	(DIRECT	FLOW)	0	55
148	51	(DIRECT	FLOW)	0	35
149	991	(DIRECT	FLOW)	0	45
150	195	3		0	50
151	444	(DIRECT	FLOW)	0	40
152	174	(DIRECT	FLOW)	0	35
153	155	2.3		0	40
154	84	(DIRECT	FLOW)	1	25
155	50	0.8		0	35
156	179	(DIRECT	FLOW)	1	20
157	3000	(DIRECT	FLOW)	1	5
158	210	(DIRECT	FLOW)	0	45
159	249	(DIRECT	FLOW)	0	35
160	0	0		0	0
161	122	(DIRECT	FLOW)	0	35
162	511	(DIRECT	FLOW)	0	40
163	133	(DIRECT	FLOW)	0	50
164	416	(DIRECT	FLOW)	0	35
165	1034	(DIRECT	FLOW)	0	45
166	736	(DIRECT	FLOW)	0	40
167	0	(DIRECT	FLOW)	0	0
168	162	(DIRECT	FLOW)	1	30
169	273	(DIRECT	FLOW)	1	50
170	197	(DIRECT	FLOW)	0	45
171	38	2.1		0	55
172	346	(DIRECT	FLOW)	0	40
173	220	(DIRECT	FLOW)	0	45
174	83	3.3		0	55
176	147	(DIRECT	FLOW)	0	40
177	179	7		1	20
178	177	4.6		1	20
184	118	1.6		1	0
185	0	(DIRECT	FLOW)	0	0
186	471	3.2		0	50
187	219	1.7		0	45
192	64	1.4		1	50
193	161	1.9		1	40
194	141	2.6		0	50
195	0	(DIRECT	FLOW)	0	0
197	393	(DIRECT	FLOW)	0	45
199	0	0		0	0
200	786	(DIRECT	FLOW)	1	55
202	264	4.7		0	40
203	146	1.1		0	45
209	29	1.1		2	25
210	400	1.5		0	40
212	406	2.8		0	40
213	13	0.4		2	15
216	69	1.8		0	40
217	9	0.3		2	10
218	71	2.5		0	40
219	0	0		0	0
220	52	3	0.2	2	5
221	247	2.7		0	40
222	0	0		0	0
225	25	2	0.2	2	5
226	0	0		0	0
227	105	2.9		1	40
228	67	2.5		1	25
229	61	1.1		0	45
231	49	2.3		1	25
232	99	1.4		0	40

TABLE H-4
Final Master Plan - Revised 2006
PEAK FLOW SUMMARY

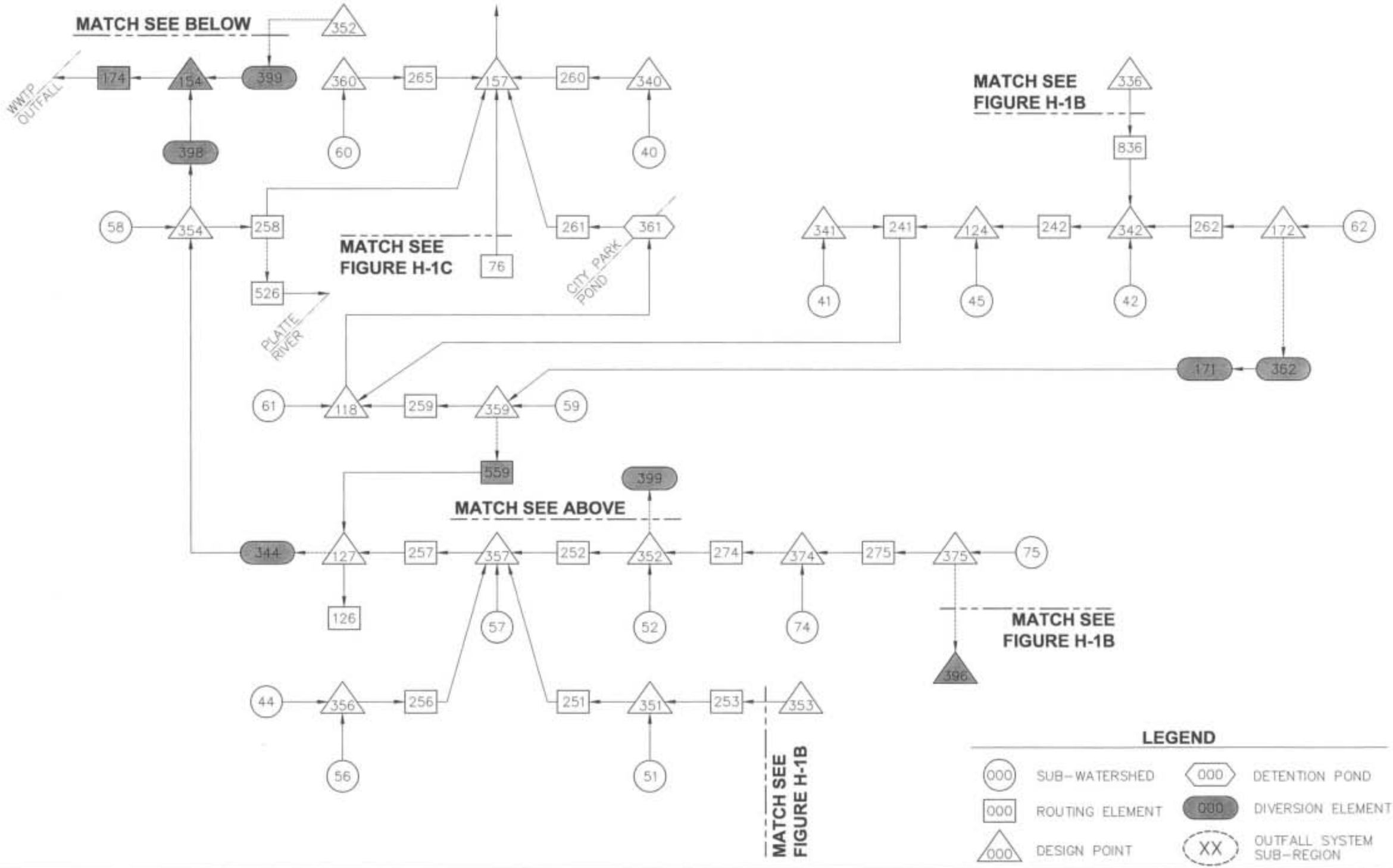
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME HR	TIME MIN
234	341	1.5		0	50
235	104	1		0	50
236	0	0		0	0
241	1357	7.2		0	55
242	1277	7.5		0	45
244	177	1.9		1	0
245	112	0.9		0	45
246	533	3.4		0	50
248	253	2.9		3	20
249	55	3.5		2	10
251	716	3.2		1	10
252	288	2.3		1	5
253	707	2.6		0	55
254	439	1.9		0	40
255	574	2.6		0	55
256	513	4.4		0	50
257	1568	8.1		1	5
258	1497	3.5		1	15
259	132	4.5		0	55
260	300	2.3		0	40
261	1592	6.2		0	55
262	276	2.2		0	45
265	222	1.8		0	45
266	355	(DIRECT	FLOW)	2	0
267	443	3.6		0	40
268	572	2.4		0	45
269	767	2.4		0	45
270	216	1.3		0	50
271	1929	6.9		2	35
272	1932	7.7		2	30
273	1830	6.5		2	30
274	224	3.8		0	55
275	189	2		0	45
277	253	3.4		3	15
278	173	1.1		0	50
279	189	3		0	50
283	1823	4.6		2	25
284	84	2		2	0
288	582	2.6		2	25
292	142	1.5		0	55
293	93	1.5		0	45
294	383	3.1		0	55
295	112	1.9		0	55
296	153	2.7		0	55
297	198	2.2		0	50
298	182	2.3		0	50
299	1548	(DIRECT	FLOW)	2	15
300	361	(DIRECT	FLOW)	1	50
301	787	(DIRECT	FLOW)	1	55
305	363	(DIRECT	FLOW)	0	40
306	243	(DIRECT	FLOW)	0	40
307	439	(DIRECT	FLOW)	0	40
308	150	(DIRECT	FLOW)	0	40
309	339	(DIRECT	FLOW)	0	40
310	456	(DIRECT	FLOW)	0	35
311	700	(DIRECT	FLOW)	0	40
313	13	(DIRECT	FLOW)	2	10
316	69	(DIRECT	FLOW)	0	40
317	329	(DIRECT	FLOW)	0	35
319	307	(DIRECT	FLOW)	0	40
320	53	(DIRECT	FLOW)	1	5
325	115	(DIRECT	FLOW)	0	40

TABLE H-4
Final Master Plan - Revised 2006
PEAK FLOW SUMMARY

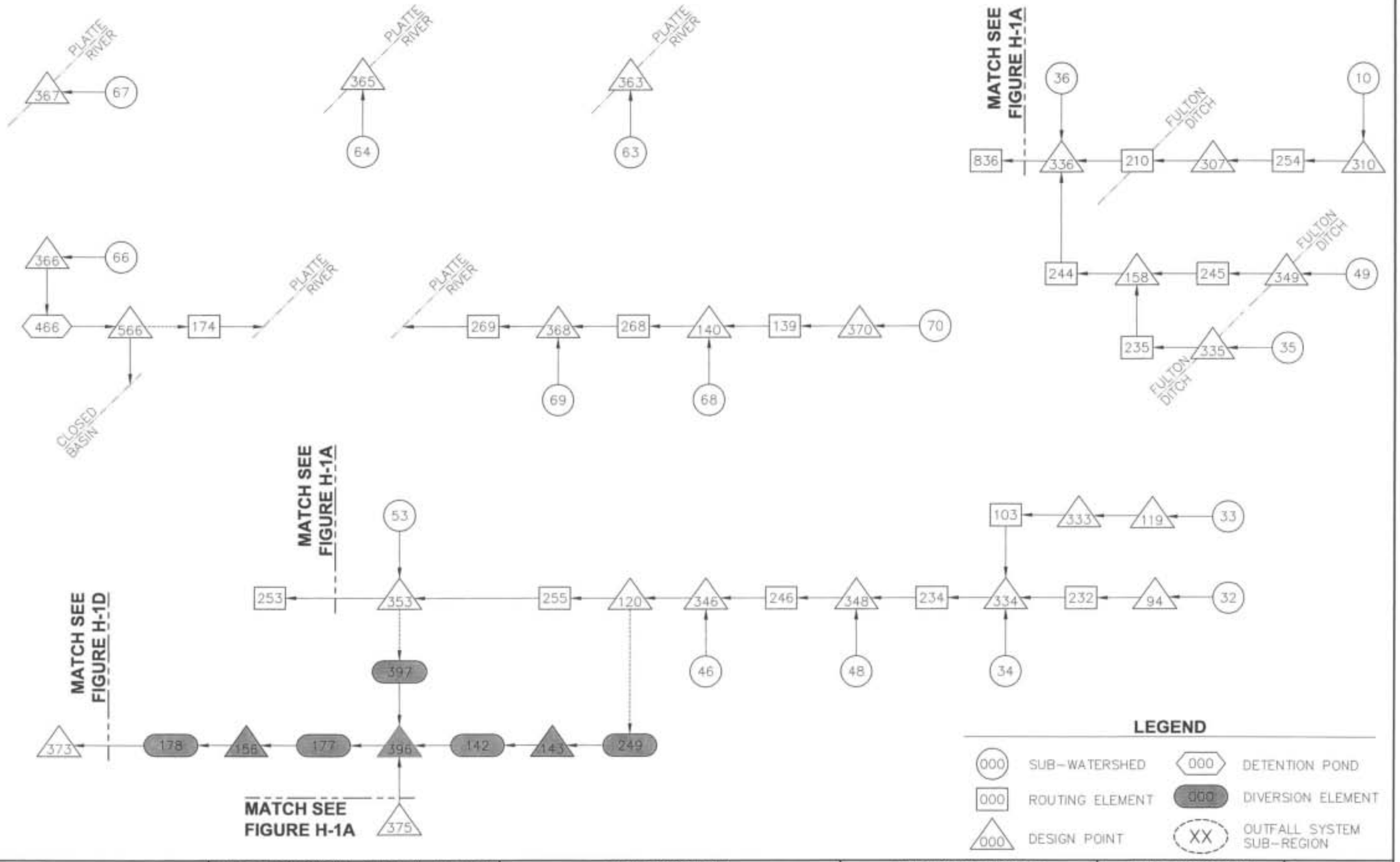
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME HR	TIME MIN
326	67	(DIRECT	FLOW)	1	25
327	945	(DIRECT	FLOW)	0	35
328	545	(DIRECT	FLOW)	0	35
329	250	(DIRECT	FLOW)	0	35
330	263	(DIRECT	FLOW)	0	35
331	84	(DIRECT	FLOW)	1	25
332	490	4.6		0	45
333	147	(DIRECT	FLOW)	0	45
334	353	(DIRECT	FLOW)	0	40
335	116	(DIRECT	FLOW)	0	40
336	820	(DIRECT	FLOW)	0	40
337	588	(DIRECT	FLOW)	0	35
338	67	1.2		2	35
339	547	(DIRECT	FLOW)	0	45
340	384	(DIRECT	FLOW)	0	35
341	206	(DIRECT	FLOW)	0	50
342	1279	(DIRECT	FLOW)	0	45
343	128	(DIRECT	FLOW)	0	40
344	12	1.7		0	30
345	0	(DIRECT	FLOW)	0	0
346	707	(DIRECT	FLOW)	0	45
348	533	(DIRECT	FLOW)	0	45
349	115	(DIRECT	FLOW)	0	40
350	513	(DIRECT	FLOW)	0	40
351	828	(DIRECT	FLOW)	0	55
352	327	(DIRECT	FLOW)	0	55
353	750	(DIRECT	FLOW)	0	55
354	1784	(DIRECT	FLOW)	1	10
355	343	(DIRECT	FLOW)	0	40
356	806	(DIRECT	FLOW)	0	40
357	1596	(DIRECT	FLOW)	1	0
359	214	(DIRECT	FLOW)	0	50
360	222	(DIRECT	FLOW)	0	45
361	1588	(DIRECT	FLOW)	0	55
362	39	2.5		0	30
363	261	(DIRECT	FLOW)	0	45
365	129	(DIRECT	FLOW)	0	40
366	213	(DIRECT	FLOW)	0	40
367	470	(DIRECT	FLOW)	0	35
368	761	(DIRECT	FLOW)	0	45
369	115	1.4		0	40
370	238	(DIRECT	FLOW)	0	40
371	1932	(DIRECT	FLOW)	2	30
372	847	(DIRECT	FLOW)	1	55
373	1932	(DIRECT	FLOW)	2	30
374	282	(DIRECT	FLOW)	0	45
375	318	(DIRECT	FLOW)	0	40
376	581	(DIRECT	FLOW)	0	40
377	171	(DIRECT	FLOW)	0	50
378	1836	(DIRECT	FLOW)	2	25
379	0	(DIRECT	FLOW)	0	0
381	253	(DIRECT	FLOW)	3	15
382	765	(DIRECT	FLOW)	0	45
384	296	(DIRECT	FLOW)	0	40
387	590	(DIRECT	FLOW)	0	40
390	439	(DIRECT	FLOW)	0	45
391	93	(DIRECT	FLOW)	0	40
393	831	(DIRECT	FLOW)	0	45
394	84	0.1	26	2	10
395	1814	(DIRECT	FLOW)	2	25
396	181	(DIRECT	FLOW)	1	15
397	40	4	0.1	2	15

TABLE H-4
Final Master Plan - Revised 2006
PEAK FLOW SUMMARY

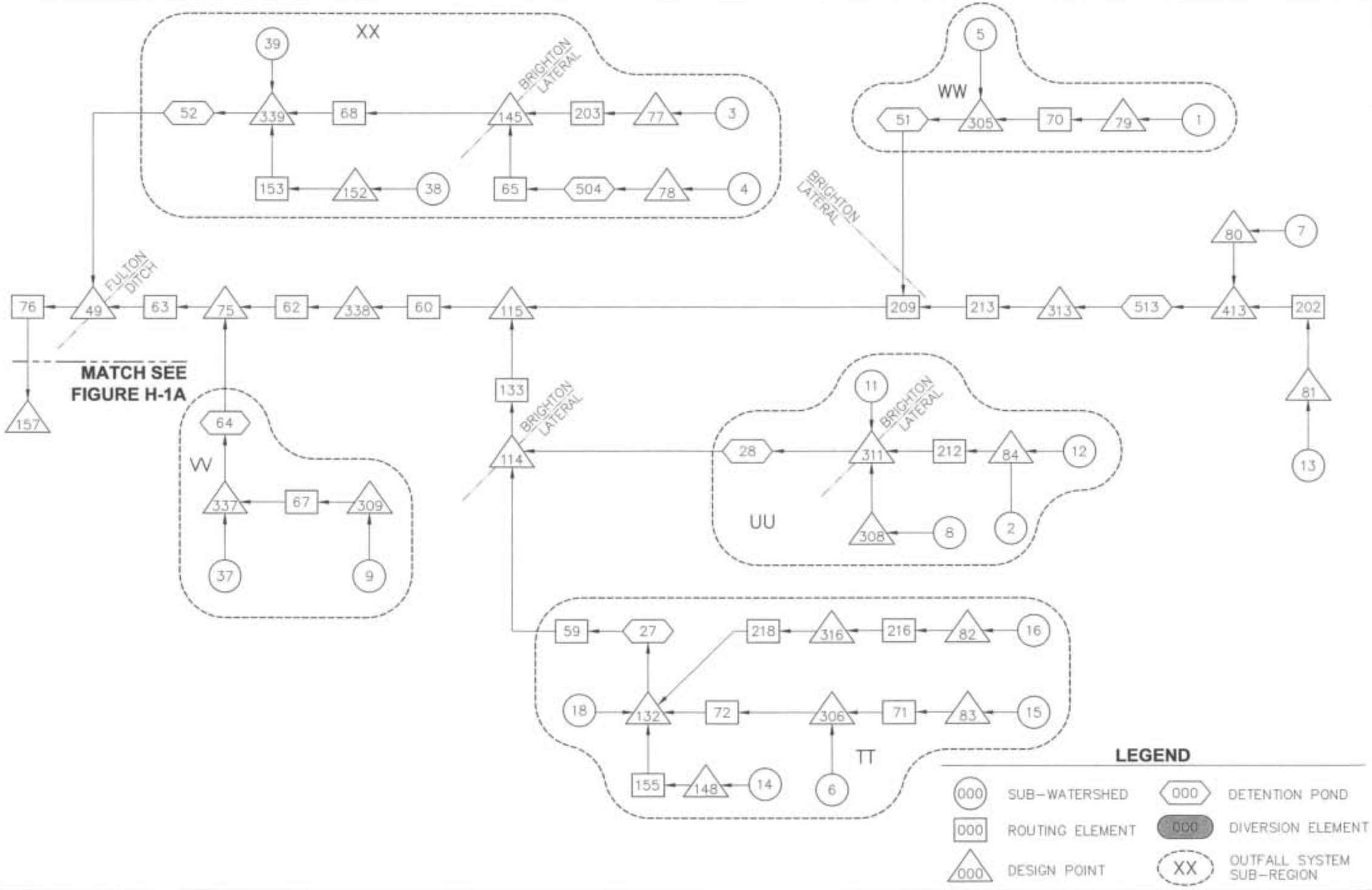
CONVEYANCE ELEMENT	PEAK (CFS)	STAGE (FT)	STORAGE (AC-FT)	TIME HR	TIME MIN
398	0	0		0	0
399	13	1.6		2	10
413	445	(DIRECT	FLOW)	0	40
422	544	(DIRECT	FLOW)	0	40
428	4175	(DIRECT	FLOW)	1	20
429	4163	(DIRECT	FLOW)	1	10
430	4105	(DIRECT	FLOW)	1	10
431	193	(DIRECT	FLOW)	0	45
432	1122	(DIRECT	FLOW)	1	5
433	652	(DIRECT	FLOW)	0	35
434	389	(DIRECT	FLOW)	0	35
435	292	(DIRECT	FLOW)	0	40
435	292	(DIRECT	FLOW)	0	40
436	4176	(DIRECT	FLOW)	1	15
437	4110	(DIRECT	FLOW)	1	10
438	1233	(DIRECT	FLOW)	0	55
439	779	(DIRECT	FLOW)	1	15
466	324	0.1	1.5	0	40
476	0	(DIRECT	FLOW)	0	0
478	20	(DIRECT	FLOW)	0	40
481	29	0.1	8.8	1	25
482	84	0.1	10.5	1	40
483	49	0.1	4.5	1	20
504	64	0.1	13.9	1	15
513	13	0.1	23.4	2	10
517	9	0.1	13.9	2	5
521	110	0.1	26.8	1	20
522	67	0.1	21.3	1	25
523	55	0.1	18.1	1	15
524	209	(DIRECT	FLOW)	0	40
526	250	5.9		1	45
528	4121	9		1	20
529	4110	9		1	15
530	1232	5.5		0	55
531	52	1.4		0	50
532	0	0		0	0
533	377	2		0	40
534	292	(DIRECT	FLOW)	0	40
534	292	(DIRECT	FLOW)	0	40
536	4169	9		1	15
537	4098	5.6		1	10
538	1119	5.3		1	5
539	1000	5.1		1	10
550	202	(DIRECT	FLOW)	0	35
551	188	1.8		0	40
557	2850	7.7		1	15
559	71	3.8		1	30
563	0	0		0	0
566	323	2		0	40
569	0	0		0	0
576	3	0.1	1.3	1	45
590	96	0.1	23.8	1	45
622	92	0.1	33.5	1	25
623	105	0.1	12.7	1	25
631	98	(DIRECT	FLOW)	0	35
836	782	6.9		0	45



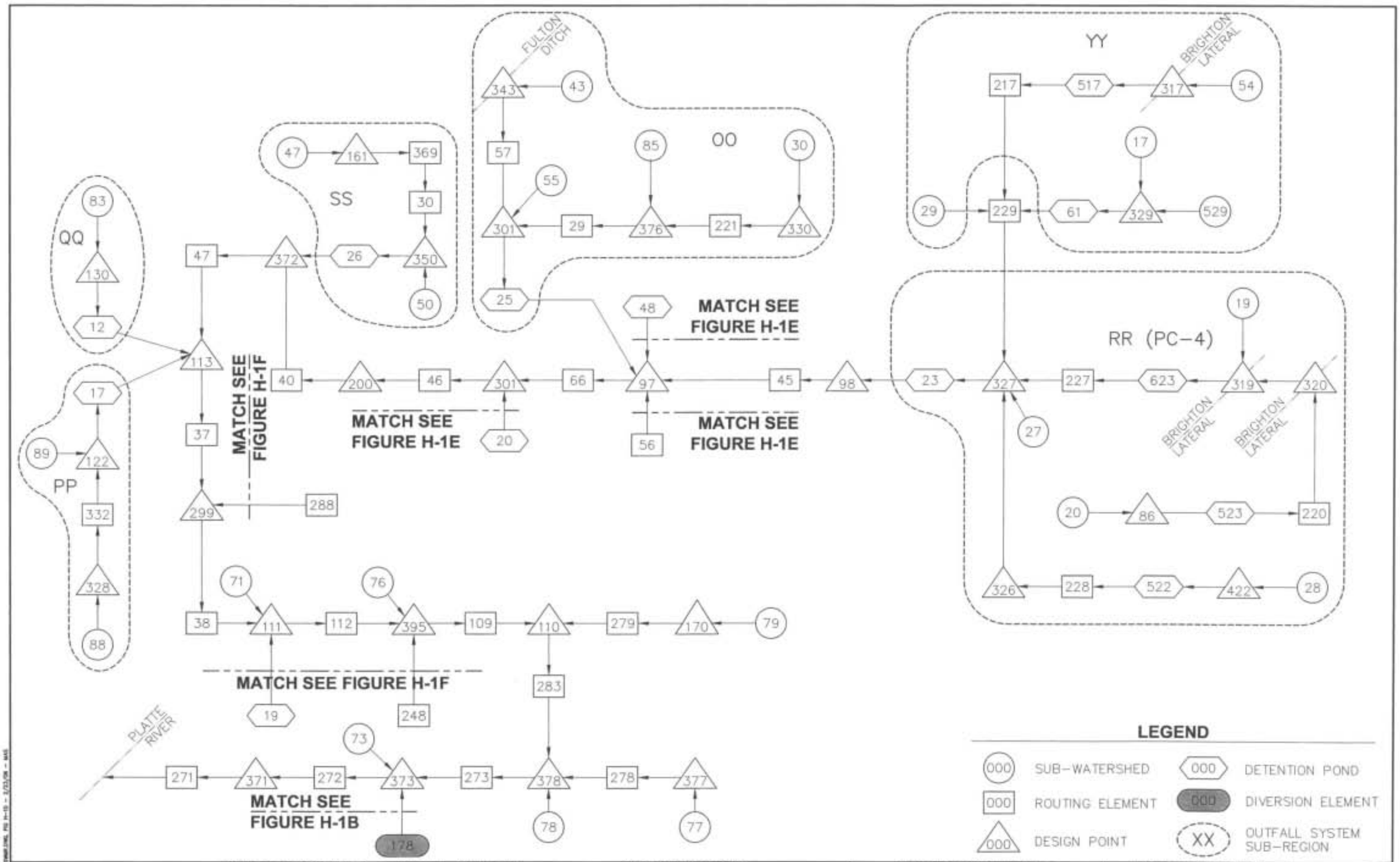
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 759-3208 DESIGNED APM DATE 2/21/08 DRAWN MAS DATE 2/21/08 CHECKED ____ DATE ____ REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING SCHEMATIC	FIGURE H-1A



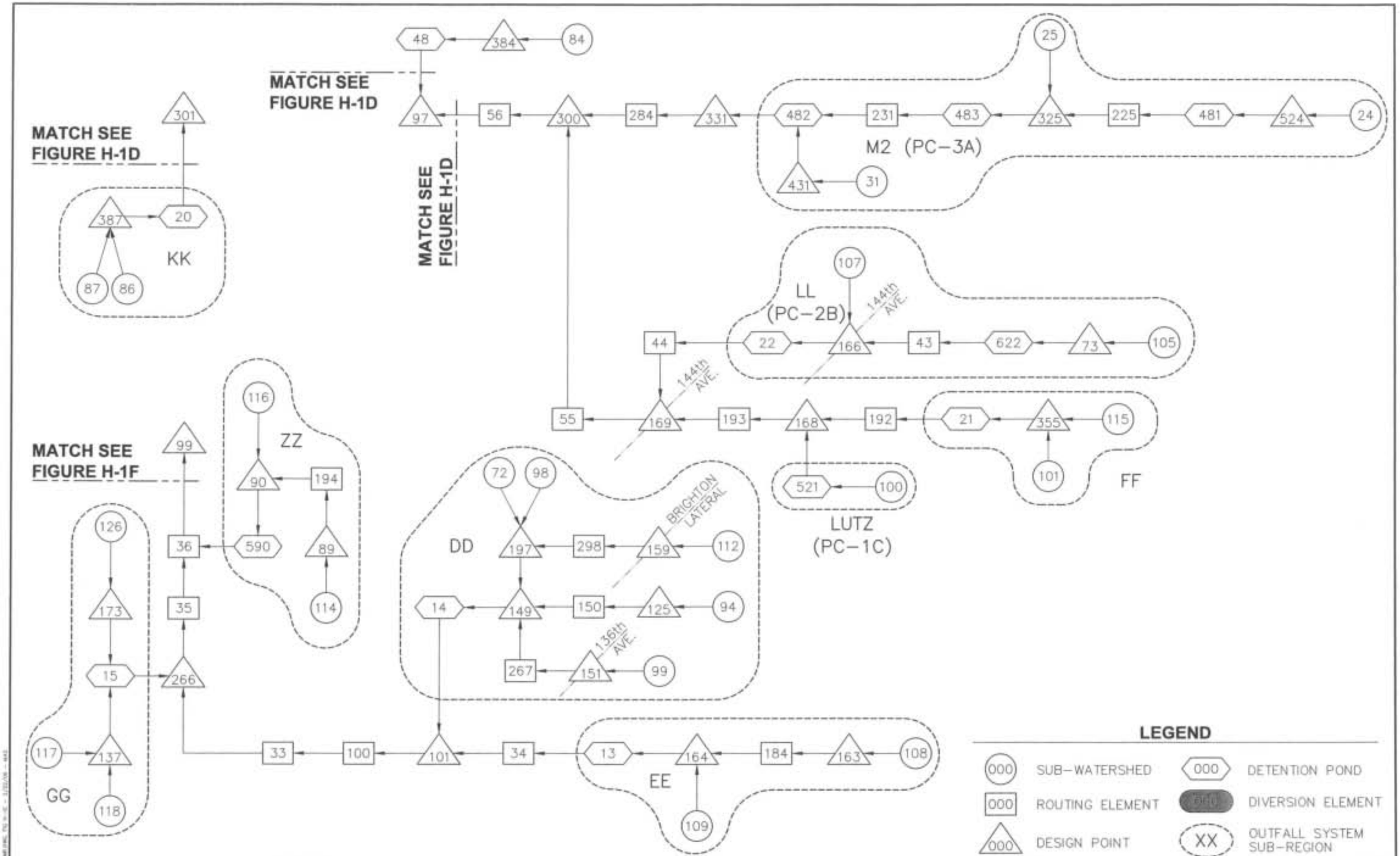
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 756-3308 DESIGNED APM DRAWN MAS CHECKED REVISED AS-BUILT DATE 2/21/08	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING SCHEMATIC	FIGURE H-1B



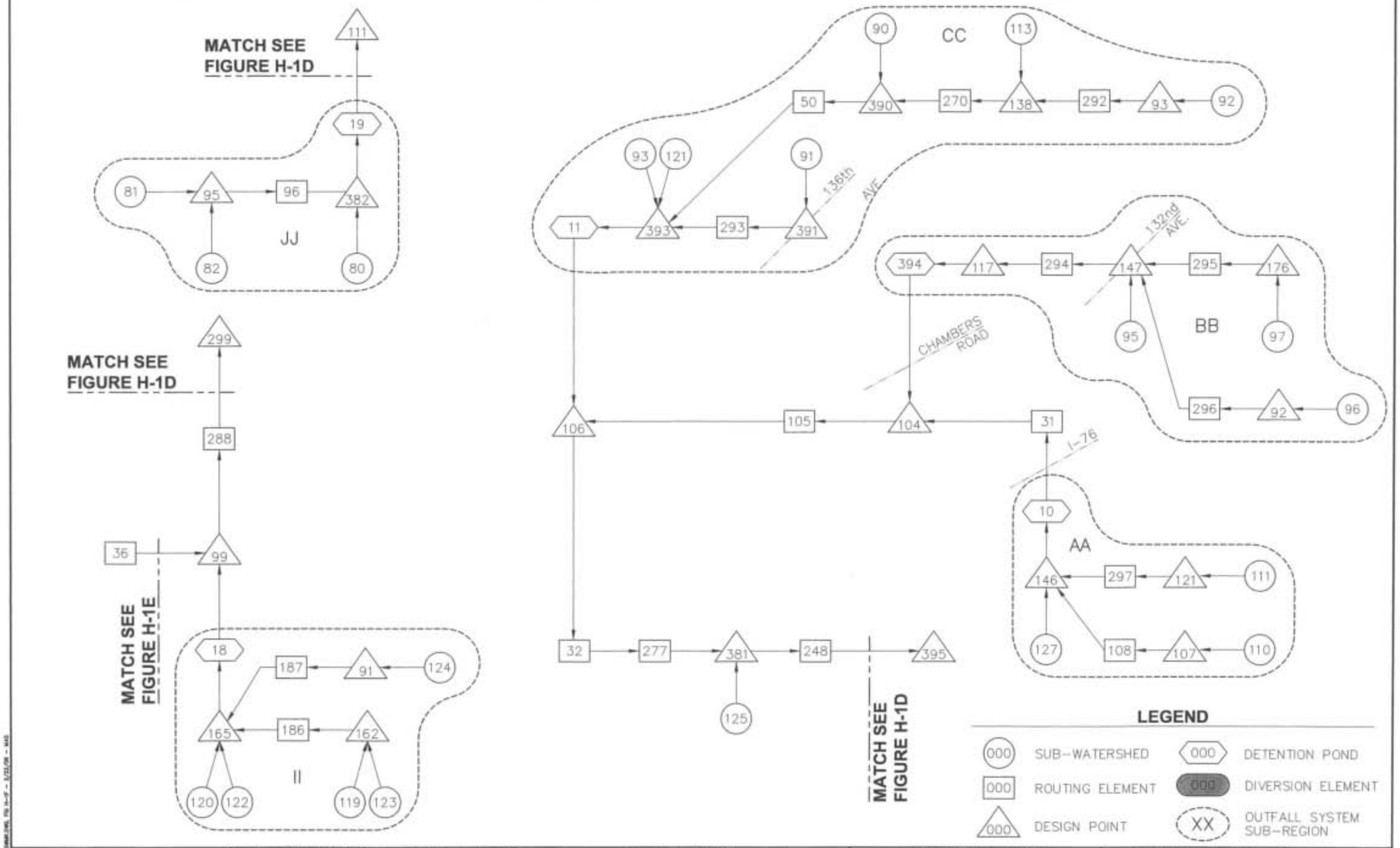
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8913 FAX NO. (303) 758-3208	DESIGNED AFM DATE 2/21/08 DRAWN MAG DATE 2/21/08 CHECKED DATE REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING SCHEMATIC	FIGURE H-1C



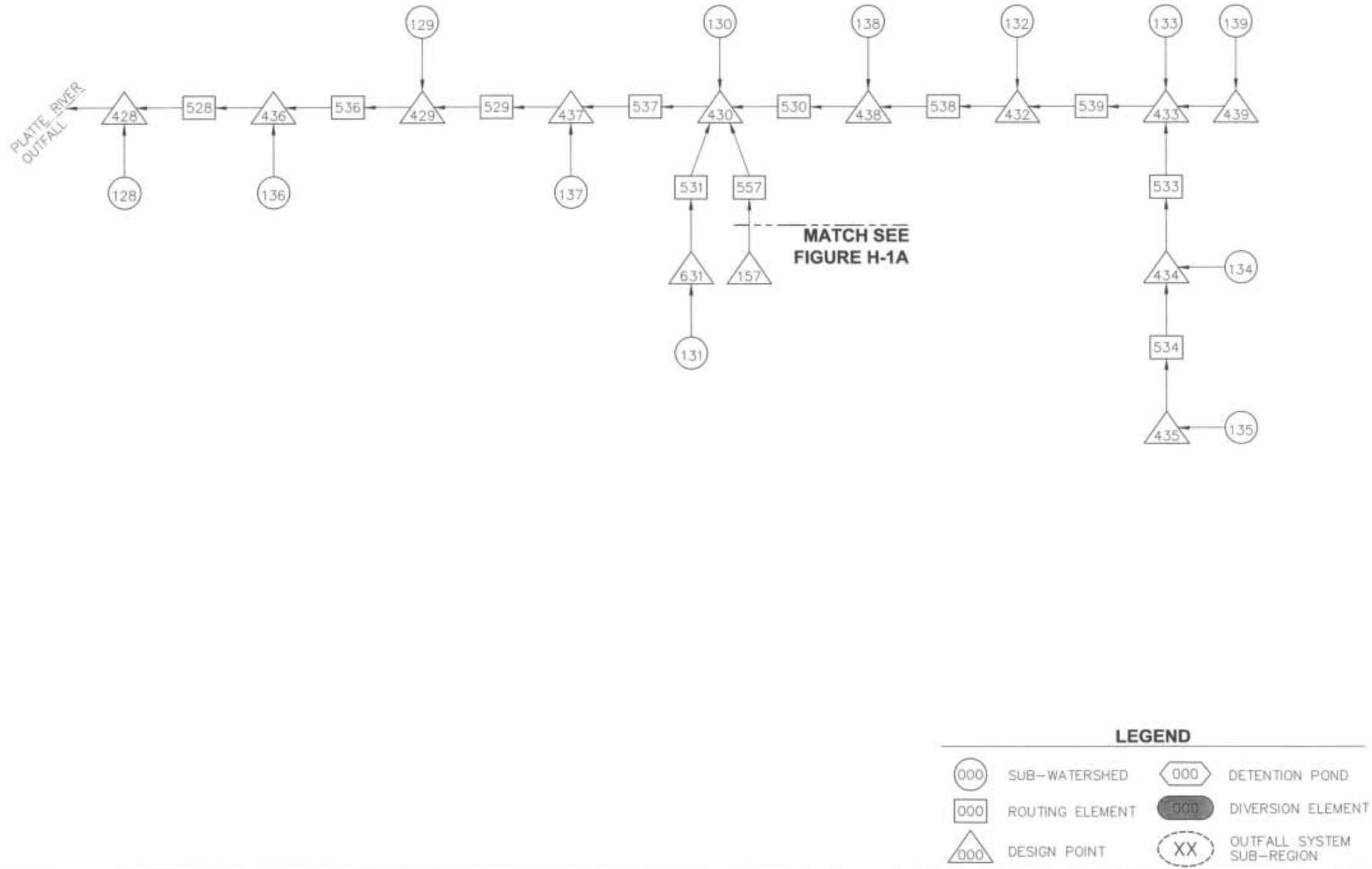
WRC ENGINEERING, INC.	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING SCHEMATIC	FIGURE H-1D



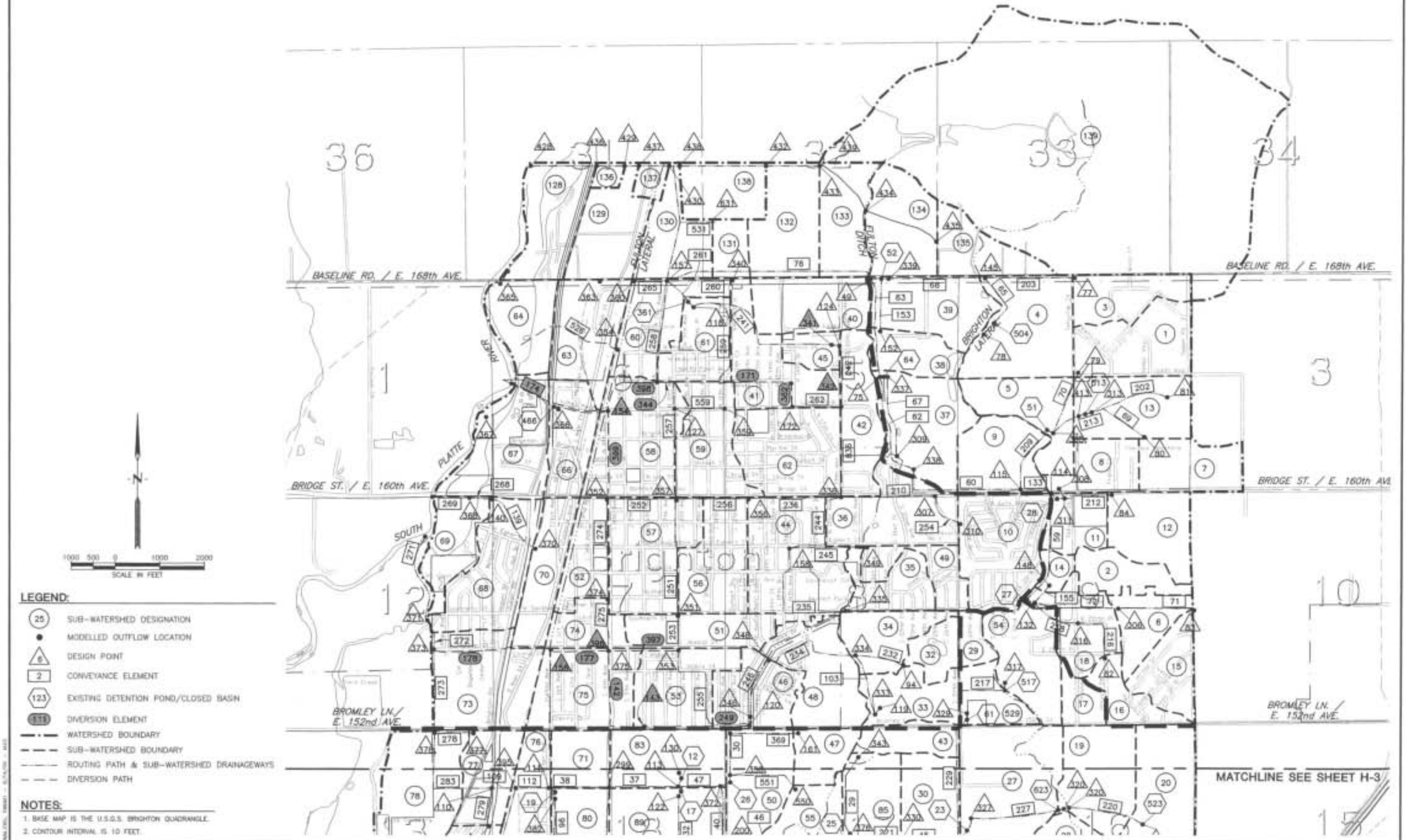
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8513 FAX NO: (303) 758-3208	DESIGNED GFB DATE 11-26-96 DRAWN EJM DATE 11-26-96 CHECKED DFK DATE 11-26-96 REVISED APM DATE 12-2006 AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING SCHEMATIC	FIGURE H-1E



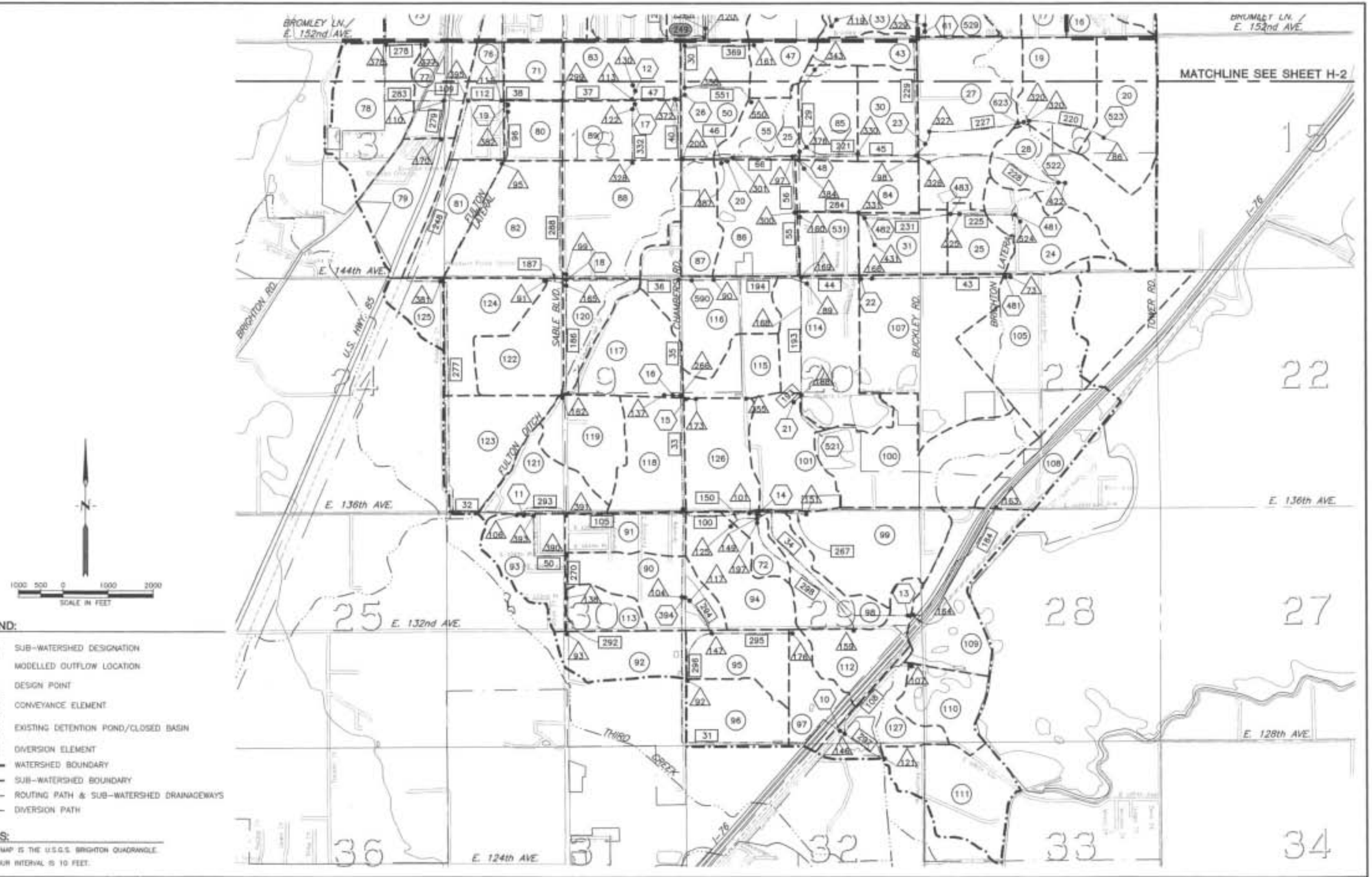
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8013 FAX NO: (303) 758-5008	DESIGNED GPB DATE 11-28-96 DRAWN EJM DATE 11-28-96 CHECKED GPK DATE 11-28-96 REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING SCHEMATIC	FIGURE H-1F



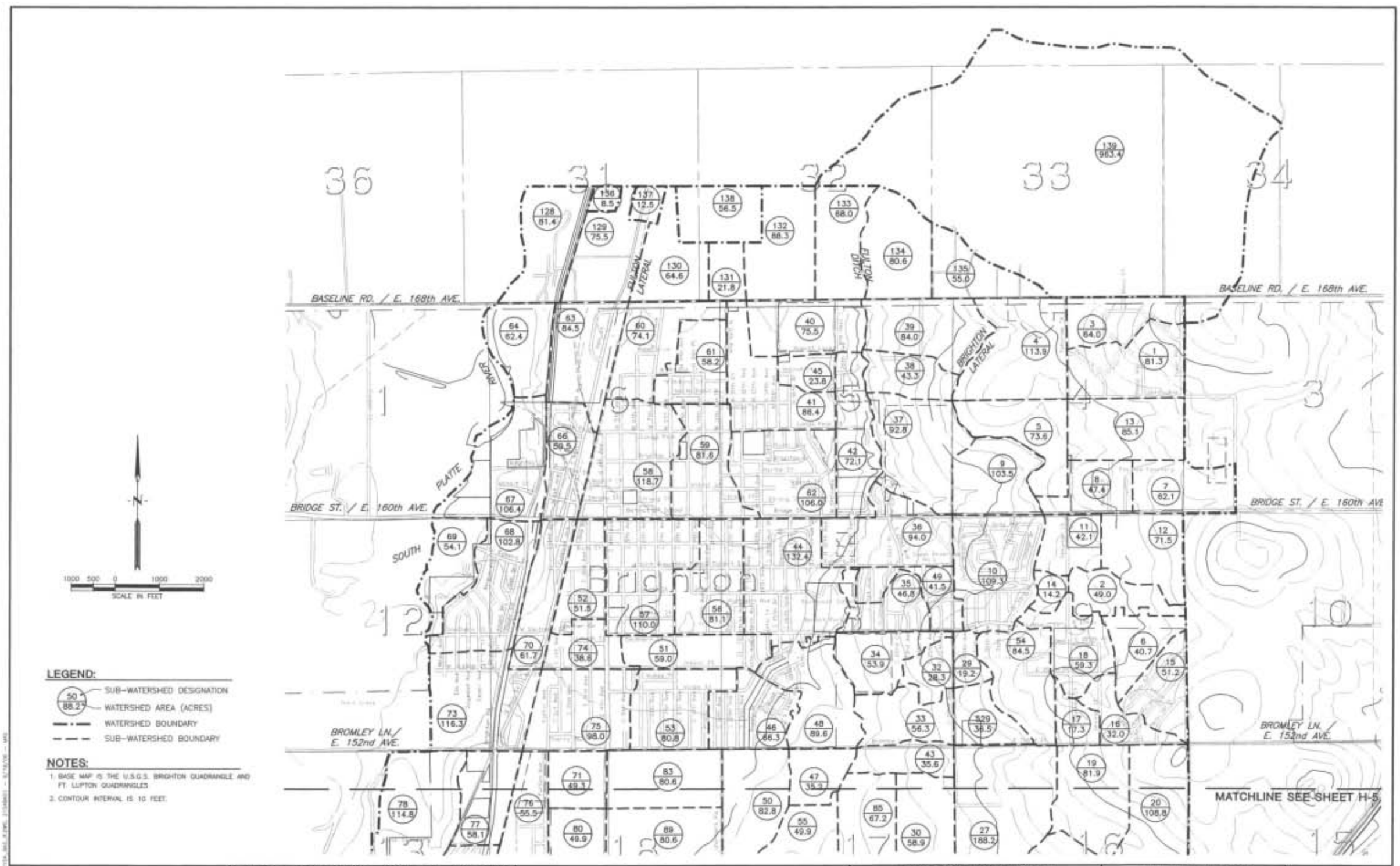
WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 758-3208	DESIGNED GPB DATE 11-26-96 DRAWN EJM DATE 11-26-96 CHECKED DPK DATE 11-26-96 REVISED DATE AS-BUILT DATE	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING SCHEMATIC	FIGURE H-1G



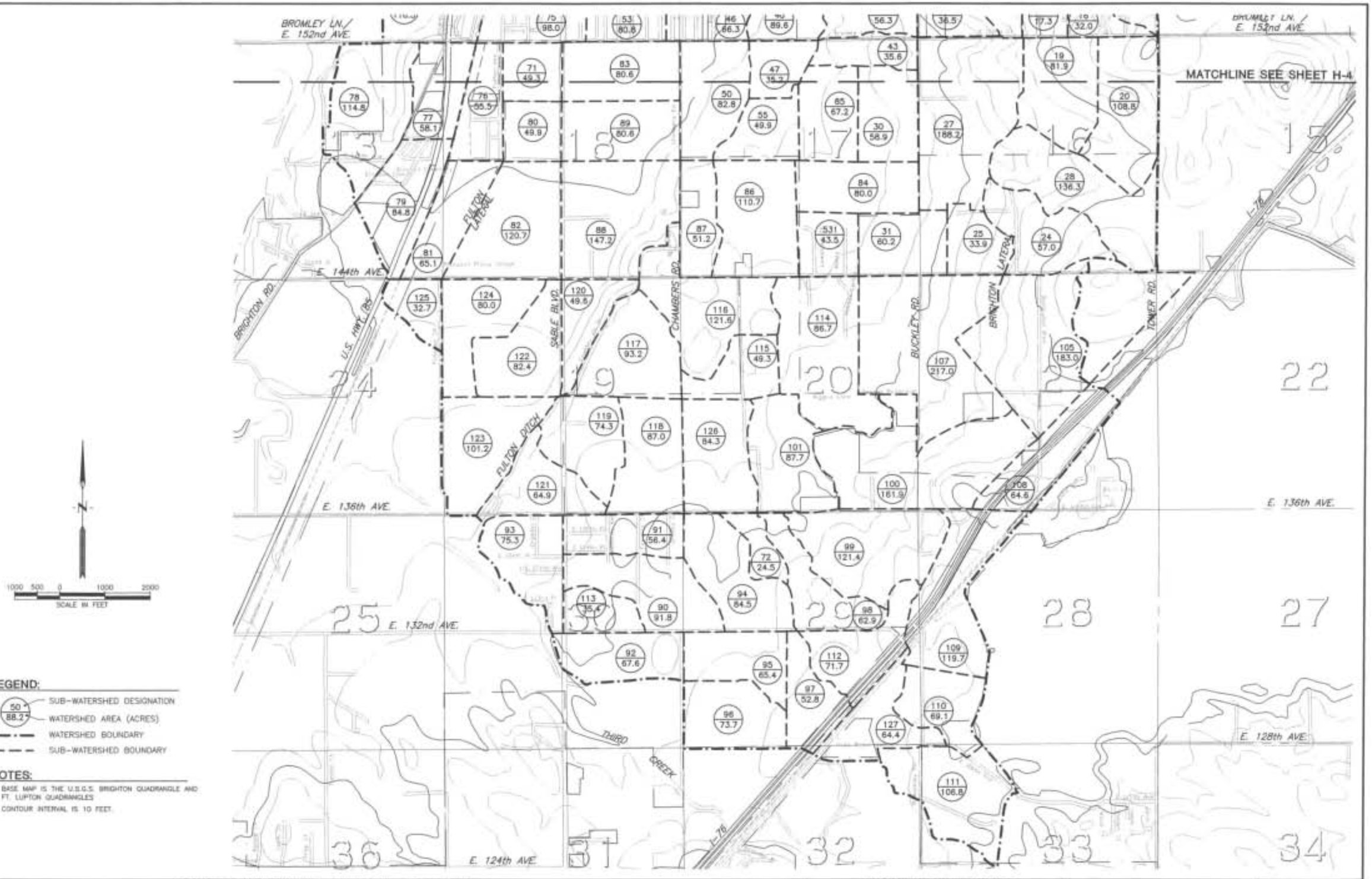
	WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8513 FAX NO. (303) 759-3206 DESIGNED APM DATE 7/25/08 DRAWN MRS DATE 7/25/08 CHECKED ____ DATE ____ REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING ELEMENTS MAP SHEET 1 OF 2	FIGURE H-2



	WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO. (303) 757-8013 FAX NO. (303) 759-3206	DESIGNED APM DATE 3/23/06 DRAWN MAS DATE 3/23/06 CHECKED ____ DATE ____ REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON ADAMS COUNTY URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SWMM ROUTING ELEMENTS MAP SHEET 2 OF 2	FIGURE H-3



WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8101 FAX NO: (303) 759-3208 DESIGNED FTC DATE 1/28/05 DRAWN MKS DATE 1/28/05 CHECKED ____ DATE ____ REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SUB-WATERSHED DELINEATION MAP SHEET 1 OF 2	FIGURE H-4



	WRC ENGINEERING, INC. 950 SOUTH CHERRY STREET, SUITE 404 DENVER, COLORADO 80222 PHONE NO: (303) 757-8913 FAX NO: (303) 758-3208	DESIGNED TTC DATE 1/28/05 DRAWN MAS DATE 1/28/05 CHECKED ____ DATE ____ REVISED ____ DATE ____ AS-BUILT ____ DATE ____	CITY OF BRIGHTON URBAN DRAINAGE & FLOOD CONTROL DISTRICT	BRIGHTON WATERSHED TRIBUTARY TO S. PLATTE RIVER OUTFALL SYSTEMS PLANNING	FINAL MASTER PLAN SUB-WATERSHED DELINEATION MAP SHEET 1 OF 2	FIGURE H-5