PINE CREEK DRAINAGE BASIN

DRAINAGE BASIN PLANNING STUDY

JUNE, 1988
REVISED OCTOBER, 1988

CITY OF COLORADO SPRINGS
AND
EL PASO COUNTY

Obering, Wurth & Associates
Consulting Civil Engineers

PINE CREEK
DRAINAGE BASIN

Drainage Basin
Planning Study

June, 1988
Revised October, 1988

CITY OF COLORADO SPRINGS
AND
EL PASO COUNTY

OBERING, WURTH & ASSOCIATES
Consulting Civil Engineers

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SUMMARY STATEMENT

The Pine Creek Drainage Basin Planning Study contained herein has been completed in accordance with the drainage criteria indicated. This report is the result of a great deal of study, research, input, discussions, review, and comment by the Consultant; Vintage Development at Briargate (the principal landholder in the Basin and the funding source of this Study); and the Federal, State, County, and City officials.

The stormwater management concept for the Pine Creek Basin includes detention of a portion of the developed runoff flows by use of both private off-stream and public on-stream facilities. The implementation of the Basin's recommendations for improvements is planned to be a phased approach. The stormwater release rate at the U.S. Air Force Academy boundary, State Highway 83, will be maintained at a historic rate of 1210 CFS for a 24 hour, Q_{100} storm until such time as all proposed downstream improvements are in place and operational. The downstream improvements will be sized for and flows will be accepted for up to a maximum stormwater release rate of 2536 CFS for a 24 hour, Q_{100} storm at the U.S. Air Force Academy boundary from the basin in an urbanized condition.

The Pine Creek Drainage Basin has been approved by jurisdictional agencies (City and County) as a "No-Fee" basin as it relates to the respective City Ordinances and County Resolutions. The Study is intended to be a Stormwater Management guideline for the Basin for the safe and orderly handling of stormwater runoff through and from the Basin. This study is subject to the conditions set forth herein.

NEW DRAINAGE CRITERIA STATEMENT

This Drainage Study has been prepared under the City Drainage Criteria adopted in 1977. In October, 1987, a new City/County Criteria manual was adopted. It has been agreed by the City Engineering Division to allow the study to be approved as presented with the former criteria. The following considerations will be given to the study as subsequent studies and development occurs within the Basin.

1. This study for purposes of the new criteria will be referred to as the Drainage Basin Planning Study (D.B.P.S.).

2. A Master Development Drainage Plan (M.D.D.P.) will be prepared in accordance with the new criteria for areas required. This will include but not be limited to Gatehouse Village, Penrose Village, Business Campus, Pine Creek Golf Course, Pine Creek Village and Briargate East development areas.

3. The new criteria will be used for the Master Development, Preliminary and Final Drainage Reports (M.D.D.P., P.D.R. and F.D.R.) for individual subdivisions as they develop. Storm systems and street capacities will be sized accordingly. This report has been prepared using a 5 year duration storm. All subsequent studies will use a 10 year duration storm.

4. A 15% Storm System Contingency has been included in the cost estimate to cover the anticipated upgrade required in minor systems for pipe sizes, inlet sizes, and inlet frequency of spacing. This contingency has also been extended to the anticipated additional freeboard requirements for the major channel systems.

5. The basin Bridge Cost has been determined based on the City Subdivision Ordinance definition whereby a bridge is "a structure which is constructed to carry an arterial roadway over any natural or manmade drainage way". This differs from the new criteria definition, however since the study and the annexation agreement were prepared prior to adoption of the new criteria, it was determined to continue to use the Ordinance definition for this study. The Bridge Structures and Arterial Roadways have been determined by the Director of Public Works (City Engineer) for purposes of establishing the Bridge Cost.

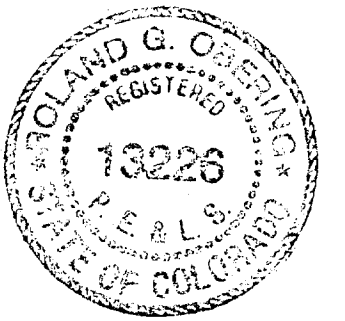
6. Reference has been made to Soil Type "A" in this study. It should be noted that the new criteria does not recognize an A soil in a disturbed or developed condition.

CERTIFICATION

I, Roland G. Obering, a Registered Professional Engineer in the State of Colorado, hereby certify that the attached Drainage Basin Planning Study for the Pine Creek Basin was prepared under my direction and supervision, and is correct to the best of my knowledge and belief.

Roland G. Obering

Roland G. Obering, P.E. & L.S. Colorado #13226



APPROVAL
CITY OF COLORADO SPRINGS

The City of Colorado Springs City Council and Department of Public Works does hereby approve the contents of the attached Pine Creek Drainage Basin Planning Study. This study shall be used as a guide for the development of all drainage facilities within the study area.

Gary R. Haynes City Engineer
Department of Public Works
Date: June 20, 1989

See Attached Agenda and Minutes
City Council
Date: December 13, 1988 Meeting

APPROVAL
EL PASO COUNTY

The El Paso County Board of Commissioners, Department of Public Works, and Planning Commission approve the contents of the attached Pine Creek Drainage Basin Planning Study as a guide for the development of all drainage facilities within the study area.

(See Drainage Board Minutes)
Department of Public Works
Date: May 19, 1988

(See attached Minutes)
Board of Commissioners
Date: August 25, 1988

(See attached Letter)
Planning Commission
Date: June 21, 1988

REVIEWS
U.S. AIR FORCE ACADEMY
COLORADO DEPARTMENT OF HIGHWAYS

The U.S. Air Force Academy and Colorado Department of Highways have reviewed this study and their review comments and acknowledgements are attached.

DEPARTMENT OF THE AIR FORCE

HEADQUARTERS UNITED STATES AIR FORCE ACADEMY

COLORADO SPRINGS, COLORADO 80840 -5546

19 MAY 1988

REPLY TO ATTN OF: DE

SUBJECT: Pine Creek Master Plan

TO: Mr Gary Haynes
City of Colorado Springs
Department of Public Works
Engineering Division
30 South Nevada Avenue
Colorado Springs CO 80901

1. The Pine Creek Master Plan developed by the Briargate Development Group is approved subject to incorporation of comments in USAF Academy letter dated 5 August 1987.

2. The engineering firm of Obering, Wurth and Associates responded with a letter dated 15 September 1987 advising that our comments would be incorporated into the final plan.

WILLETT R. STALLWORTH, Colonel, USAF
DCS/Civil Engineering

2 Atch
1. USAFA Ltr, 5 Aug 87
2. Obering, Wurth and Associates Ltr, 15 Sep 87

file

Obering, Wurth & Associates
Consulting Civil Engineers
Registered Land Surveyors

1015 Elkton Drive • Colorado Springs, Colorado 80907 • Phone (303) 531-6200

September 15, 1987

U.S. Air Force Academy
Colorado Springs, CO 80840-5546

Re: Pine Creek
Master Plan

Attn: Willett R. Stallworth, Col. USAF
DCS/Civil Engineer

Project No. 10-286

Dear Col. Stallworth:

This letter will confirm a meeting this date with Mr. John Goeforth, Mr. Mike Babbler, and Mr. Mel Rezak of the AFA, Briargate and our firm relative to the letter dated August 5, 1987 regarding this subject. We discussed each of the items in detail and reached the following agreements.

1a. We will change the wording in the implementation section of the report to indicate downstream improvements must be in place prior to exceeding historic discharge onto the AFA property.

1b. We will add a discussion in the implementation section regarding the referenced ponds and wetlands below State Highway 83. We recognize the need for 404 Permit compliance. We further recognize the need to develop a plan to preserve the two ponds. -At this level of planning we will confine that plan to being one of: routing the drainage improvements around the ponds while maintaining some inflow/outflow; relocation of the ponds in another equally acceptable location and surroundings; or modification of the ponds in their present location to accommodate drainage improvements while minimizing or mitigating impact to the ponds and wetlands. We further recognize any final plan will require submittal, review, comment, and approval by the USAFA (as well as the City) prior to construction and will include this statement in the text.

1c. The comment regarding the channel improvements downstream of Academy Boulevard is a complicated one to resolve. Since the City's Drainage Ordinance has, since 1979, included the Academy Boulevard box culvert and all improvements downstream in the Cottonwood Creek Drainage Basin and has (theoretically) collected fees for funding of the improvements in this area, the refinement of facility requirements and subsequent updating of this Master Plan are beyond the scope of this Pine Creek Study as indicated. The 1979 study did, in fact, anticipate a greater than historic flow at the Academy Boulevard Box Culvert (2570 CFS). Our Pine Creek Master Plan estimates 2094 CFS which is consistent with both the 1979 study and the Colorado Deparment

of Highways projected flows. An additional flow of 3768 CFS and 1067 CFS joins this channel from the Chapel Hills Mall outfall and the North Cottonwood Creek outfall, respectively. The majority of this flow is occurring today while Pine Creek still contributes only historic flows. We will, as part of this report in the North Cottonwood Creek section, discuss the need for an updated North Cottonwood Creek Master Plan study that more specifically defines the improvements required in this reach of stream and an adjusted fee for the Cottonwood Creek Basin based on any additional improvements. The recommended improvements in the Pine Creek study are the result of field inspections by the Consultant and a response to protection of the most obvious erosion areas.

The channel in this reach is extremely unique in that it is deeply incised into bedrock, contains much natural vegetation and wetlands; is located in City, County, USAFA, I-25, and private properties; and has virtually no access for channel improvement construction or maintenance equipment. Any improvements to the channel will be extremely expensive and difficult. The impact to this section of channel by Pine Creek will be negligible until the discharge is in excess of historic. This is expected to be five (5) years or more as indicated in this Master Plan and should give all parties adequate time to restudy, plan, find, and implement a suitable channel improvement format.

2. The siltation of the previously referenced pond was discussed and it was determined that the source of this silt was from several construction activities. This includes the interchange, utility construction by Northgate, and cable construction by Mountail Bell. It was decided to "wait and see" allowing revegetation to occur in surrounding disturbed areas and the development of a specific plan for the ponds relative to drainage channel improvements for Pine Creek.

Hopefully this accurately summarizes and satisfactorily responds to the USAFA's concerns in the referenced letter. As the Consultant we will be making the referenced changes to the study prior to submittal for final approval. We hope this Master Plan will be acted upon by the Colorado Springs City Council at their second meeting in October and will publish a final report after their approval making any adjustments that may be required by their action and including the changes referenced in this letter.

On behalf of our client, Briargate, we wish to thank you and your staff for your continued cooperation on this project. We certainly expect to continue the dialogue and joint review/comment process of this proposed Master Plan as it evolves into reality.

Very truly yours,
OBERING, WURTH & ASSOCIATES

Roland G. Obering

Roland G. Obering, P.E. & L.S.

cc: BDG, Jerry Novak
City, Gary Haynes

Attachments: August 5 Letter

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS UNITED STATES AIR FORCE ACADEMY
COLORADO SPRINGS, COLORADO 80840-5546

5 AUG 1987

REPLY TO ATTN OF: DE

SUBJECT: Pine Creek Master Drainage Plan

TO: Mr Mike DeGrant
Briargate Development Corp
7710 North Union Blvd
Colorado Springs CO 80918

1. The Pine Creek Master Drainage Plan dated December 1986 has been reviewed with the following comments:

a. All downstream improvements must be in place before historical flows are exceeded. This condition is correctly stated in the summary on page VI-3, however, page VIII-3 states that improvements should be scheduled to begin when historic discharge is reached. Please correct this statement.

b. The discussion on page VII-4 addresses our concerns about the impact on wetlands in the area, specifically the two ponds just below State Highway 83. The implementation section of the report, however, is void of any discussion of pond mitigation or protection. This issue must be included in section VIII.

c. Although the Pine Creek Plan does incorporate recommended improvements from the 1979 Cottonwood Creek Basin Study, we are still concerned that the recommended improvements are not adequate to solve the existing erosion problems. Pine Creek discharges greater than historical were certainly not anticipated in the 1979 report. It is evident after seeing the Pine Creek channel that the proposed improvements are far short of solving the problem. The Pine Creek channel from Academy Boulevard to the confluence of Cottonwood Creek must be included in the the Pine Creek Master Plan using the updated flow calculations from the Briargate development.

2. We have recently inspected the two small impoundments referred to in paragraph 1b above. The ponds have become severely silted as a result of the new construction now proceeding directly upstream. We should meet to discuss possible corrective actions.

WILLETT R. STALLWORTH, Colonel, USAF
DCS/ Civil Engineering

cc: Mr Bob Adamczyk
Colorado Springs Dept of
Public Works
Engineering Division
30 S Nevada Ave
Colorado Springs CO 80908

STATE OF COLORADO

DEPARTMENT OF HIGHWAYS

District II
905 Erie - P.O. Box 536
Pueblo, Colorado 81002
(303) 544-6286

August 17, 1987

Mr. Mike DeGrant
Land Development Manager
Briargate Development
7710 North Union Boulevard
Colorado Springs, CO. 80918

Dear Mr. DeGrant:

As you requested, the Department of Highways has reviewed the Pine Creek Drainage Basin, Master Drainage Study. Below are the Department's comments as submitted to this office by our Staff Hydraulics unit:

1) Pine Creek crossing of Academy Boulevard: This report recommends a triple 12' x 8' CBC (cost $500,000) with a 400' shift to the west. This shift will improve the alignment of the crossing, but increases the length of this culvert by more than four times.

   The report's basis for CDOH responsibility ($186,000) is based on the incorrect assumption that: "The Pine Creek channel alignment was completely altered in this area for I-25 construction in the late 1950's." The attached 1949 USGS Map does not support this statement and shows the same alignment for Pine Creek prior to the construction of I-25. Therefore, we feel this additional cost should not be the CDOH responsibility.

2) Pine Creek crossing of S.H. 83: This report recommends the existing 8' x 6' CBC to be utilized as a secondary drainage crossing with a new 11.5' x 8' CBC being proposed from the outlet of the Detention Facility No. 1 outlet. We are concerned about excessive ponding depth (20 ft.) and the potential problem due to the hydraulic forces such as piping and slug flow. This detention facility and final structural details should be reviewed prior to construction.

3) The implementation of the reports proposed recommendations will substantially change the floodplain limits as established by FEMA. The developer should request for a Letter of Map Revision (LOMR) at the time of final design, prior to the construction.

With regard to Paragraph 1 above, the Department is not denying financial responsibility at this time. However, we do feel the reasoning and subsequent distribution formula are incorrect. Therefore, it is our position that a different formula be derived for the distribution of financial responsibility.

It should also be noted that the Department does not currently have funds within its 5-year plan to contribute to the new CBC. Can you give us a time frame for construction of the CBC?

If you have any questions, please contact me at 546-5403 in Pueblo.

Sincerely,

Brian L. Borge
Engineering Technician III

BLB/hw

cc: Deke Miller
Max Rothschild

CITY OF COLORADO SPRINGS
The "America the Beautiful" City
DEPARTMENT OF PUBLIC WORKS CITY ENGINEERING DIVISION (719) 578-6606
30 S. NEVADA SUITE 403 P.O. BOX 1575
COLORADO SPRINGS, COLORADO 80901

CITY OF COLORADO SPRINGS/EL PASO COUNTY

DRAINAGE BOARD AGENDA

for June 16, 1988

The City of Colorado Springs/El Paso County Drainage Board will hold its regularly-scheduled meeting at 2:00 PM on June 16, 1988 in the City Council Chambers, City Administration Building, 30 South Nevada Avenue.

Item 1

Approval of the minutes of the May 19, 1988 Board Meeting. The minutes were previously mailed out.

Item 2

Request for cash reimbursement for construction of drainage facilities in Chapel Hills Shopping Center, Cottonwood Creek Basin, General Growth Development, P. O. Box 1536, Des Moines, IA, 50306, Attention: Phillip M. Engel, Developer.

Item 3

Open for discussion.

Gary R. Haynes
City Engineer

GRH/dg

c: Drainage Board Members
J. D. Phillips, Acting City Manager
Jim Colvin, City Attorney
Jack Smith, Asst. City Attorney
DeWitt Miller, Director of Public Works
Hugh King, Deputy Director of Public Works for Planning and Administration
Bruce A. Thorson, Assistant City Engineer
Max Rothschild, County Dir. of Public Works
Alan Morrice, County Stormwater Manager
Chris Smith, Subdivision Administrator
Bev Dustin, Land Development Specialist
Dan Bunting, Floodplain Administrator
Public Relations
Bob Brockman, Planning
Bill Ruskin, Park & Recreation
Don Steger, HBA, 3730 Sinton Road, #110, COS, 80907
General Growth Development, Attn: Phillip M. Engel, P. O. Box 1536, Des Moines, IA, 50306

M I N U T E S

EL PASO COUNTY PORTION

DRAINAGE BOARD

for May 19, 1988

The City of Colorado Springs/El Paso County Drainage Board held its regularly scheduled meeting at 2:00 p.m. on May 19, 1988 in the City Council Chambers, City Administration Building, 30 South Nevada Avenue.

MEMBERS PRESENT: Mr. Richard Dailey, Chairman; Messrs. Guenther Polok, Ron Waldthausen, Fred Gibson and Roland Obering.

MEMBERS ABSENT: Mr. Mike Mallon and Mr. Rick Brown

OTHERS PRESENT: Mr. Alan Morrice, County Stormwater Manager
Mr. Gary Haynes, City Engineer
Mr. Chris Smith, Subdivision Administration
Mr. Jerry Novak, Vintage Communities
Mr. Mike DeGrant, Vintage Communities

PROCEEDINGS:

Item 1

Mr. Obering moved approval of the April 21, 1988 minutes as mailed. Mr. Gibson seconded and the motion carried unanimously.

Item 2

PRESENTATION OF THE PINE CREEK MASTER DRAINAGE BASIN REPORT AS PREPARED BY OBERING, WURTH & ASSOCIATES FOR BOARD ACTION:

Mr. Obering excused himself from this item and left the room.

Mr. Smith stated that, with the Board's permission, it would be appropriate at this time for the applicant to address the Board and give a background as to where this issue stands from the last Board meeting and then staff will address questions or concerns after the presentation.

Mr. Jerry Novak with Vintage Communities, representing Briargate, was present. He introduced Mr. Mike DeGrant, also with Vintage Communities.

Mr. Novak reported on a meeting held with the Department of the Air Force on May 18, 1988. He then provided Mr. Smith with an

original and six (6) copies of a letter from the Air Force, with Obering, Wurth & Associates' response letter attached. (Correspondence attached to these minutes.) The two main points

of the Air Force letter are:

1) That the Pine Creek Master Plan developed by Briargate Development was approved subject to the incorporation of comments in the Air Force Academy letter dated August 5, 1987; and

2) The engineering firm of Obering, Wurth & Associates responded to that letter with a letter dated September 15, 1987 advising that the Air Force comments would be incorporated into the final plat.

Mr. Novak stated that the above has been done. The item 1a in their letter states that the wording be changed in the implementation section of the report to indicate downstream improvements be in place prior to exceeding historic discharge onto the Air Force Academy property.

Item 1b is their concern about the wetlands. Mr. Novak explained that they are aware of the wetlands considerations and have dealt with these before during the interchange construction. He stated that this is not the appropriate time to deal with them, but Vintage understands that the construction plans are developed, and prior to construction they will have to mitigate the wetlands impact.

Item 1c concerns discussion of improvements on the Cottonwood Creek Basin study, a greater than historic flow below the Academy Blvd. Obering, Wurth & Associates has responded to that issue to the Air Force's satisfaction. Mr. Novak stated that he feels the Air Force has been responded to on all items. In earlier negotiations with the Air Force they agreed to accept over developed historic flows. With the City's approval of the basin they would also approve it.

Mr. Dailey asked if paragraph two (2) of the cover letter relates to the 1b on the letter.

Mr. Novak answered that this will also be addressed. Presently there are two ponds between Highway 83 and I-25 that have silted in. The Air Force and the Highway Department, with Vintage, have looked them over, but there has been so much construction to that crossing it is difficult to identify the party responsible. To this point it has not been a major issue. Vintage realizes that when improvement construction begins, shown on the Pine Creek Drainage study, there will be an impact in these areas and they are prepared to deal with that.

Mr. Novak reported that, also discussed, was the subject of Pine Creek being a closed basin, with no fees collected by the City. On this subject, Vintage views two parcels in the basin, that they do not own, as prospects for development. The first being the

Mountain View Elementary School which District 20 has already initiated discussion for purchase of that parcel with Vintage. This may occur in the near future.

The second parcel is the ground owned by J. Bradley. Mr. Novak has had discussions with both parties and has obtained draft agreements from each. At the time of platting these parties will pay Briargate some equivalent fee so they could then discharge over historic flows.

Mr. Novak stated that he has, reluctantly, forwarded copies of these draft agreements to City staff. He is of the opinion that these are private agreements between private parties, and do not impact this study or the implementation of the plan. It has been agreed in this plan that the City will not collect fees from anywhere in Pine Creek, as Vintage is responsible for the facilities. If Vintage is able to negotiate with these parties to reimburse them for some of those facilities, then it should be a private issue. Mr. Novak further reported a discussion on this subject with Mr. Jim Colvin, City Attorney, reference a telephone conversation, where Mr. Colvin stated that he felt no obligation for the City Attorney's office to review these draft agreements.

Mr. Gibson asked how many other property owners, besides Vintage Communities, are involved in this basin.

Mr. Novak answered that the additional property owners are numerous. There is an area around the Challenger Middle School that has probably 50-60 lots occupied. The Spring Crest development has 1-5 acres and it is developed. If there is redevelopment of these areas it will be minor. The plan accepts the developed water assuming the land use remains as presently projected.

Mr. Waldthausen asked if the two major landowners were made aware of this presentation and had the opportunity to appear if they had problems.

Mr. Novak answered that they were, and given that one of them is a public agency, School District 20, their attorney has reviewed the agreement and feels it is acceptable for presentation at the next School Board meeting. Mr. Novak further stated that he plans to have the documented agreements from both parties in hand, approved, prior to final submittal to the City Council and the Board of County Commissioners.

Mr. Dailey asked if there were any further questions or comments for Mr. Novak.

Mr. Smith stated that he had no comment in reference to the

discussion between Mr. Novak and the City Attorney regarding the nature of a contract between two private parties.

Mr. Smith added that there is one slight adjustment to the proposed agreement that the City Attorney may not be aware of. Currently the assurances for the new drainage facilities will go to Briargate and City staff would like to see this changed so that the assurances go to the City.

Mr. Novak stated that under City policy the assurances would have to go the City and there has been no intention to supersede any City criteria.

Mr. Smith stated that this is simply a mechanical item and could easily be worked out.

Mr. Waldthausen asked, if he understood it properly, Vintage Communities would be responsible for the assurances in any case.

Mr. Novak stated that if these parties proposed to develop a piece of ground the conventional City review would occur and the setting of the outfall would determine where facilities need to be constructed.

Mr. Smith reiterated that this is strictly a verbiage change in the agreement, but under certain circumstances having these assurances go to Briargate may not be in the best interest of all. City staff has not yet had the opportunity to discuss this change with the attorneys.

Mr. Dailey asked Mr. Smith if City Staff concurs with the plan as submitted, other than the verbiage change mentioned.

Mr. Smith stated that he has not had an opportunity to review the letter from the Air Force, but with a brief review it appears no major changes have occurred.

Mr. Smith said there has been discussion regarding the 24 hour historic flow onto the Air Force Academy. It is City staff's understanding that 1177 CFS is able to be placed on the Air Force Academy using the new criteria, but this is something to be worked out with the developer.

Mr. Smith further stated that, other than the technical details, there are no major discrepancies or disagreements regarding the proposed plan. It is City staff's intent that this Board take action on the plan as proposed, with the understanding that these technical details will be clarified prior to final submittal of the plan to City Council. It is the City's understanding that this stipulation would be acceptable to Mr. Novak.

Mr. Novak stated that this stipulation is acceptable to them.

Mr. Dailey asked if any portion of this basin is in the county?

Mr. Morrice said that part of the basin is in the County and that his concerns were similar to Mr. Smiths. Mr. Morrice stated that the County staff feels that the proposed plan should be reviewed prior to publication to insure that all wording is properly done and agreeable with the County Attorney.

Mr. Morrice stated that another concern by County staff regards the calculation of bridge fees and that some of the acreages used in that calculation were slightly high. Additionally, the County would recommend that there be the understanding, or condition, that at the time of the Cottonwood Creek Drainage Basin final study, the outfall improvements be identified and designed. Since these improvements have been deferred to that study, it may be appropriate at that time to have Pine Creek pay a prorated, equitable, share of these costs. The County, as well as the Air Force, feels that there is additional improvements needed downstream at some point in time, prior to exceeding historic flow rates.

Mr. Novak commented that to discuss that during the restudy of Cottonwood Creek is appropriate. He would, however, make the same argument he has in the past, that fees have been paid assuming that those improvements were to be paid for by the Cottonwood Creek Basin, and it should stay that way, even though the designs for the facilities in the previous study were not sufficient to take care of the flows.

Mr. Dailey asked if this would create a problem with the Air Force approval, since they are apparently asking that these facilities be installed prior to any increases.

Mr. Novak reviewed the first item in the Air Force's letter which states that improvements be in place before historic flows are exceeded. One of the initial construction items will be the major detention dam at Briargate Parkway and that there will be a restricted outlet there. The basin will develop slowly and the historic will not be exceeded for several years, allowing time to do the design, take care of the wetlands mitigation and downstream facilities. Vintage is also a major property owner in the Cottonwood Creek Basin.

Mr. Dailey asked Mr. Morrice to elaborate on the bridge fee situation.

Mr. Morrice stated that in the calculation of bridge fees some of the county platted acreages would need to be subtracted from the

number used. However, if there will be no fees in the basin, it would not create a problem. He commented that the County would still like the opportunity to review the proposed plan before it is submitted for final publication, relative to the technical and legal details.

Mr. Gibson said that the County's concerns were mainly to review the report and give their approval before final submittal.

Mr. Novak stated that Mr. Morrice has educated them in the process for County approval, and Vintage understands they are obligated to present this to the El Paso County Planning Commission.

Mr. Haynes stated that the technical concerns by City staff will be fully reviewed with the County.

Mr. Waldthausen asked if County staff has had the opportunity to be involved in the discussions between Vintage, the City and the Air Force.

Mr. Novak stated that County staff has been copied with all documents presented to the City, and most recently by the submittal date for this meeting, a complete new book was put together with all the changes that have occurred over the last couple of years. He further stated that he has received correspondence from Mr. Morrice stating that he had forwarded the information to the County Attorney for comments.

Mr. Haynes explained that many of the technical items mentioned are caught between the old and the new criteria. The City using the new criteria whenever possible and is working closely with the consultant.

Mr. Dailey asked if both staffs are comfortable with the proposal, with the exception of working out the technical items.

Mr. Haynes stated that the City will not proceed with the proposal without fully addressing Mr. Morrice's concerns and obtaining his acceptance of the plan.

Mr. Waldthausen stated that he is pleased with a no fee basin as long as the major problems are addressed and corrected.

Mr. Haynes summarized the list of general concerns as follows:

1) A no fee basin; no drainage or bridge fees;

2) The Academy Boulevard culvert. This item will be addressed at the May 24, 1988, City Council meeting;

3) The 35% detention;

4) The out parcel legal issues and the developed discharge of the Air Force Academy flow.

Mr. Dailey asked how the 35% detention was resolved.

Mr. Haynes explained that it was resolved by Vintage providing overflow. If the detention pond were to be inadequately maintained or inoperable, by using the full street right of way in accordance with the new criteria, the overflow would go in the street and not on private property.

Mr. Morrice commented that the 100 year overflow was a good addition to the plan. The County's concern is with the outfall, although it appears the improvements will be completed before the Air Force will allow anything over historic.

After discussion, Mr. Gibson moved that the concept for the Fine Creek Drainage Basin Planning Study be approved contingent on the technical and legal items being agreed upon by the City and County Engineering Departments, and with the developer, noting that this is a no fee basin, and that the detention required be approved by both City and County personnel.

Mr. Polok seconded and the motion carried unanimously.

Mr. Obering reentered the meeting.

Item 3

OPEN FOR DISCUSSION

Mr. Dailey stated that Item 3 is open for discussion and asked if there were additional items to be brought before the Board.

Mr. Morrice presented the Drainage Basin and Bridge Fund Balance Report for the Boards information.

Mr. Obering asked which basins will be studied.

Mr. Morrice stated that the County is involved in the Black Forest Basin and the Big Johnson Basin, stating that the Black Forest Basin is not yet a fee basin.

Mr. Dailey asked if there were any further questions or comments on the Drainage Basin and Bridge Fund Balance Report.

There being none, and no further business to be brought before the Board, Mr. Gibson moved the meeting be adjourned. Mr. Obering seconded and the motion carried unanimously.

Alan Morrice
County Stormwater Manager

AM/pc

cc: Max Rothschild
City Engineering Department

JUL - 6 1988

EL PASO COUNTY

LAND USE DEPARTMENT

27 EAST VERMIJO
COLORADO SPRINGS, COLORADO 80903

June 29, 1988

Mr. Alan Morrice, Manager
Stormwater Management Division
Department of Public Works
3105 North Stone Avenue
Colorado Springs, Colorado 80907

RE: Amendment to the County Master Plan - Pine Creek Master Drainage Basin Planning Study (MP-88-2)

This is to inform you that the above-referenced request for approval of the Pine Creek Master Drainage Basin Planning Study as an amendment to the Master Plan for the Development of El Paso County was heard and approved by the El Paso County Planning Commission on June 21, 1988. The 3,200 acre basin is located between the Kettle Creek Basin and the Cottonwood Creek Basin on the south and east sides of the United States Air Force Academy.

The following condition was placed upon this approval:

1. §30-28-109, C.R.S. requires the Planning Commission to certify a copy of the Master Plan, or any adopted part or amendment thereof or addition thereto, to the Board of County Commissioners and to the Planning Commission of all municipalities within the County. The Planning Commission's action to amend the Master Plan by the approval of this Drainage Basin Planning Study shall not be considered final until the applicant submits a minimum of ten (10) complete sets of the final Study documents and maps to the Land Use Department and such documents and maps are certified by the Chairman of the Planning Commission and distributed as required by law.

As you know, the Board of County Commissioners does not hear an amendment to the Master Plan and the Planning Commission's action is the final approval.

The Drainage Basin and Bridge Fees proposed resulting from this Basin Study will require Board of County Commissioner approval at a public hearing. These proposed fees have been scheduled for the Board of County Commissioners' hearing on August 25, 1988. For your information, the long delay between Planning Commission and Board of County Commissioners' hearing is a result of the required thirty (30) day legal advertising.

Should you have any questions or if I can be of further assistance, please contact me at 520-6300.

Sincerely,

Kenneth G. Rowberg
Assistant Director

cc: Jerry Novak
Vintage Communities
7710 North Union Boulevard
Colorado Springs, Colorado 80918

Mr. Roland Obering
1015 Elkton Drive
Colorado Springs, Colorado 80907

Dave Watt
El Paso County Public Works Department

W. White

Commissioners Meeting, Centennial Hall Auditorium
Thursday, August 25, 1988
Marcy Morrison, Chairman
Commissioners Campbell, Whittemore, Meier and Shupp
Beth Whittier, County Attorney
Stan Griffis, Director of Finance/Administration
Bill Fence, Budget Officer
John Fisher, Land Use Department Director
Doris Hardy, Clerk to the Board
Ardis W. Schmitt, County Clerk,
by Kenda Ortega, Deputy

The Board convened at 9:05 a.m., and the Chairman called the meeting to order. The meeting began with the Pledge of Allegiance.

2. Minutes.

It was moved by Commissioner Campbell, seconded by Commissioner Shupp, and carried unanimously that the Board approve the minutes of the April 7 and 18, and June 13, 16 and 23, 1988, Board meetings as submitted.

3. Public comments on items not scheduled on the agenda.

Dave Hughes, small business owner in Old Colorado City, stated that a major landowner affected by the Midland Expressway Corridor Study was not officially informed by the County that the Study would affect his land. He requested the Board communicate with the landowner and attempt to gain his cooperation with the Study. Mr. Hughes was also distressed that the Fanta Study concluded that the economic future of the Pikes Peak region was primarily with existing businesses. He requested the Board to develop its own views on economic progress.

John Fisher, Land Use Department Director, stated at his direction property owners affected by the Midland Expressway Corridor Study were notified by his staff and that he would discuss Mr. Hughes' comments with them.

Commissioner Whittemore stated he requested appointment on a local business retention committee two weeks ago. He felt a second County Commissioner should serve on the committee.

4. Request approval of an extension to the existing contract between the Board of County Commissioners, El Paso County Health Department and Pikes Peak Mental Health Center for detoxification services.

draft a resolution containing water quality information it would like to be provided with or see accomplished. He recommended the Land Use Department take monthly County observation well readings and that an annual report to summarize the trends be provided to the Board.

Commissioner Meier moved adoption of Resolution No. 88-268, Land Use-91, approving amendments to the El Paso County Land Development Code/El Paso County Water Resource Management Regulations concerning subdivision water supply requirements, and more specifically, Chapter III, Definitions, Chapter V, Subdivision Regulations, Section 49.5, Water Supply Standards, Section 51.2, Water Resources Report, and Section 49 F.3.b.2., Submittal and Review Requirements, Minor Subdivisions, incorporating by reference the findings, actions, conclusions and conditions of the Planning Commission, and the amendment to F.2.b. of Chapter III, Definitions, as proposed by the County Attorney, such resolution being more particularly described in Book M-1, Resolutions of the Board of County Commissioners. Commissioner Campbell seconded the motion and it carried unanimously, and the Resolution was adopted.

11. Request by the El Paso County Public Works Department to revise drainage fees for the Pine Creek Basin based upon the approval of the Pine Creek Master Drainage Basin Planning Study by the Planning Commission as an amendment to the Master Plan for the Development of El Paso County. The 3,200 acre basin is located between the Kettle Creek Basin and the Cottonwood Creek Basin on the south and east sides of the United States Air Force Academy. Approved unanimously with condition by the Planning Commission.

Alan Morrice, Stormwater Management Manager for the Department of Public Works, reviewed the Comment Agenda pertaining to the request on pages 132-143. He stated that approximately six to seven percent of the Pine Creek Drainage Basin was located within unincorporated El Paso County.

Jerry Novak, representing Vintage Communities, displayed two maps of the subject area and traced the Pine Creek Drainage Basin. Due to the situation of the basin, he proposed it be a closed basin in that no fees would be collected. The Planning Commission and City/County Drainage Board approved the request unanimously.

Max Rothschild, Public Works Department Director, stated that Vintage Development Company would be responsible for administering the basin and they should be included as a party to any liability lawsuit resulting from its misadministration.

Ms. Whittier indicated that Vintage Development Company was administering the basin on behalf of the City of Colorado

Springs and that the City would ultimately be responsible for any misadminstration. She was concerned that Vintage Development may be able to amend the basin plan without City or County approval.

Mr. Novak noted Vintage Development was only responsible for administration of funds and not physical aspects of the basin. Mr. Rothschild stated his concern was alleviated with Mr. Novak's statement and he recommended approval of the request.

Commissioner Meier expressed concern that higher density than initially proposed would impact downstream drainage. Mr. Novak stated the developer could be required in this case to conduct another study on the impact of increased flows on the present facilities.

Commissioner Meier moved adoption of Resolution No. 88-269, Transportation-31, approving the revision of drainage fees for the Pine Creek Basin based upon the approval of the Pine Creek Master Drainage Basin Planning Study by the Planning Commission as an amendment to the Master Plan for the Development of El Paso County, incorporating by reference the findings, actions, conclusions and conditions of the Planning Commission, such resolution being more particularly described in Book M-1, Resolutions of the Board of County Commissioners. Commissioner Shupp seconded the motion and it carried unanimously, and the Resolution was adopted.

12. Reports and other business.

Commissioner Whittemore requested the Board's approval to serve on the regional Economic Development Stewardship Committee.

It was moved by Commissioner Campbell and seconded by Commissioner Shupp that the Board authorize Commissioner Whittemore to accept an appointment to the Economic Development Stewardship Committee and any other subcommittees established by such Committee.

Commissioner Whittemore felt the County should consider drafting an intergovernmental agreement with the City of Colorado Springs supporting the assistance of new area businesses. Chairman Morrison was opposed to such an endeavor for the reason that an intergovernmental agreement of this nature could indicate financial participation on the County's part. She called the question and the motion carried unanimously.

Mr. Rothschild gave an update on the Criminal Justice Center Facility. The architect reviewed the structure to

15. Award of contract to Frazee Construction Company in the amount of $91,757.70 for Mesedge and Delmonico Drainage Improvements.

Funds are available in Account Code No. 038-300-6310-5121, Line Item Identification: Mesedge Drainage Account and Account Code No. 041-300-6315-5121, Line Item Identification: (New) Mesedge Drainage Account.

See attached memorandum from the Director of Public Works.

16. A resolution partially abandoning the Ramona Storm Sewer Account and transferring funds in the amount of $60,000.00 to the Storm Sewer Replacement Account.

See attached memorandum from the Director of Public Works and copy of proposed resolution.

17. Award of contract to Pate Construction Company, Inc., in the amount of $141,848.90 for construction of the DePaul Street Storm Sewer Replacement, Alternate II.

Funds are available in Account Code Nos. 038-300-6310-4362 and 041-300-6310-4362. Line Item Identification: Storm Sewer Replacement.

See attached memorandum from the Director of Public Works.

18. A resolution approving and adopting the drainage basin planning study for the Pine Creek Drainage Basin.

See attached memorandum from the Director of Public Works and copy of proposed resolution.

19. A resolution establishing the unit drainage fee and arterial roadway bridge fee for each drainage basin effective January 1, 1989.

See attached memorandum from the Director of Public Works and copy of proposed resolution.

20. Ratification of 1989 Regional Building Department Budget.

See attached memoranda from the Director of Budget & Management Analysis and from the Regional Building Department and proposed budget.

21. An ordinance repealing and reordaining Part 2 (Building Permit Fees) of Article 3 (Permits and Fees) of Chapter 16 (Building) of the Code of the City of Colorado Springs 1980, as amended.

See attached memoranda from the City Attorneys Office, the City Auditor and copy of proposed ordinance.

22. An ordinance amending Section 101 (Authority of Police and Fire Department Officials) of Article 24 (Obedience to Traffic Regulations) of Chapter 22 (Motor Vehicles and Traffic) of the Code of the City of Colorado Springs 1980, as amended.

See attached memorandum from the City Attorney's Office and copy of proposed ordinance.

Motion by Makepeace, second by Fisher, that the resolution be adopted.

Ayes: Fisher, Isaac, Makepeace, McNally, Parisi, Purvis, Shepard, Vieth, Young
Noes: None
Absent: None

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17. **Award of contract to Pate Construction Company, Inc., in the amount of $141,848.90 for construction of the DePaul Street Storm Sewer Replacement, Alternate II.**

Motion by Young, second by Shepard, that the proper City officials be authorized to enter into a contract with Pate Construction Company, Inc., in the amount of $141,848.90 for construction of the DePaul Street Storm Sewer Replacement, Alternate II. The motion unanimously carried.

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18. Resolution No. 236-88 was presented: "A RESOLUTION APPROVING AND ADOPTING THE DRAINAGE BASIN PLANNING STUDY FOR THE PINE CREEK DRAINAGE BASIN."

Mr. King stated this came before the Drainage Board on May 19, 1988; that it is a closed basin and all improvements will be taken care of in the Briargate area.

Motion by McNally, second by Young, that the resolution be adopted.

Ayes: Fisher, Isaac, Makepeace, McNally, Parisi, Purvis, Shepard, Vieth, Young
Noes: None
Absent: None

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19. Resolution No. 237-88 was presented: "A RESOLUTION ESTABLISHING THE UNIT DRAINAGE FEE AND ARTERIAL ROADWAY BRIDGE FEE FOR EACH DRAINAGE BASIN EFFECTIVE JANUARY 1, 1989."

Mr. King stated the staff recommends this 2% increase as they felt this was necessary to provide a cushion on each of the drainage basins.

Motion by Shepard, second by Vieth, that the resolution be adopted.

Ayes: Fisher, Isaac, Makepeace, McNally, Parisi, Purvis, Shepard, Vieth, Young
Noes: None
Absent: None

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20. **Ratification of 1989 Regional Building Department Budget.**

Dave Nickerson, Director of Budget and Management Analysis, stated his office has reviewed the budget and they did have some concerns about increasing the fees and charges in a down economy, but they believe it is appropriate now to protect the County and City from possibly having to provide financial support to the Regional Building Department if work should decline; that Mr. Philipsen states

SECTION I

PURPOSE AND SCOPE OF STUDY

I. PURPOSE AND SCOPE OF STUDY

The purpose for the preparation of the Drainage Basin Planning Study for the Pine Creek Drainage Basin is to provide a storm water management plan for the urbanization of the Pine Creek Basin. The plan has been prepared in accordance with Chapter 15, Article 3, Part 9 of the City of Colorado Springs Subdivision Ordinance and in compliance with the 1982 Briargate Annexation Agreement. This document is intended to be a guide to City officials, the Colorado Department of Highways, the U.S. Air Force Academy, El Paso County Department of Transportation, developers, and the general public with respect to drainage related improvements and the subdivision of the Pine Creek Basin.

The Pine Creek Basin, hereinafter referred to as the Basin, lies almost totally within the corporate limits of the City of Colorado Springs with the Ownership of nearly the entire basin being under the control of the Briargate Development Group. (See Figure II at the end of Section II.) The Basin has not had a previous hydrologic engineering study, the exception to this being the Federal Emergency Management Agency (FEMA) study (preliminary report issued November, 1983) by Camp Dresser, and McKee, Inc. The City of Colorado Springs is currently participating in the National Flood Insurance Program administered by FEMA.

In order to produce a useful and meaningful Master Plan goals have been set and steps to achieve those goals have been identified. The goals can be summarized as follows:

1. Determine as reasonably accurately as possible meaningful design flows for the basin based on projected land use patterns and estimated in accordance with current City criteria and good sound engineering practice.

2. Analyze existing basin facilities, recommend improvements, and define new facilities necessary to safely and adequately convey

projected storm water runoff to a suitable outfall point, in the case of this Basin, Monument Creek.

3. Estimate a construction cost for the recommended facilities and determine a unit (per acre) Basin Drainage Cost.

4. Receive jurisdictional concurrence with the Study.

The following steps have been taken in order to accomplish these goals:

1. Discussions with and input from all affected agencies and parties including the City, El Paso County, the Colorado Department of Highways, the U.S. Air Force Academy, the Regional Flood Plain Administration, the Briargate Development Group, and several other Basin landowners with relatively small acreages.

2. Topographic mapping of the majority of the Basin at 1"=200', 2' contour interval with the portion of the basin lying within El Paso County using the existing U.S.G.S. mapping at a 1"=2000', 5' contour interval format.

3. Inventory of the existing drainage facilities within the Basin and determination of condition and adequacy.

4. Research and review of any available existing drainage studies within or immediately adjacent to the Basin. This included review of design plans for the Colorado Department of Highways, Air Force Academy channel, Cottonwood Creek Master Plan (Lincoln DeVore Testing Laboratory, 1979) and a number of individual subdivision studies both City and County.

5. Review and analysis of the pertinent soils information for the Basin from the "Soil Survey of El Paso County Area, Colorado" by the Soil Conservation Service of the U.S. Department of Agriculture and as supplemented by more recent detailed soil surveys within the study area.

6. Computation of subbasin and basin hydrology in accordance with the current City of Colorado Springs Criteria and standard engineering practices for 5 year and 100 year return frequency storms with 6 hour and 24 hour durations.

7. Preliminary definition, location, and sizing of storm water management facilities for the Basin.

8. Estimation of a construction cost for the facilities that have been defined and calculation of a Unit Basin Cost.

9. Developing a schedule and funding mechanism for the implementation of the proposed facilities.

10. Preparation of a report and exhibits to clearly and concisely illustrate the findings and recommendations of the study.

11. Presentation of the study to all interested agencies and parties for adoption by the Colorado Springs City Council and El Paso County Planning Commission as the Master Plan for the Basin.

The study has been necessarily based on certain assumptions, particularily as to land uses. The result is a storm water management plan establishing general guidelines for partial storm water detention together with a series of permanent "hard lined" facilities for the safe and efficient conveyance of developed storm water flows through the Basin and to Monument Creek.

The general guidelines are subject to refinement, further more detailed study, and and final design as subdivision within the Basin occurs. The subdivision process typically results in a relatively high degree of detail as to land uses, street patterns, lot layouts, grading etc., all factors that allow refinement to the Master Plan in the form of a Subdivision Drainage Report/Plan.

The current City of Colorado Springs Subdivision Ordinance, as it relates to drainage, requires that subdivisions must be in substantial compliance with the Drainage Basin Planning Study for storm water management, general routing, and outfall. This Drainage Basin Planning Study is intended to be the guideline for such compliance.

END OF SECTION I

SECTION II

STUDY AREA DESCRIPTION

II. STUDY AREA DESCRIPTION

The process of developing a hydrologic engineering study and Basin Planning Study as it relates to stormwater management requires consideration of numerous factors. The most significant of these include the basin characteristics, natural and proposed topography, vegetation, soils, and proposed land uses as well as others. These factors have been analyzed and are further discussed in this Section. Two Vicinity Maps are included at the end of this section. The first is an overall map illustrating the relationship of this basin to the adjacent Basins in the area. The second is a Basin Vicinity Map illustrating the basin in relation to existing and proposed street networks in Colorado Springs.

THE BASIN

The total Pine Creek Drainage Basin, consisting of approximately 3200 acres, is an average sized Basin relative to other drainages recently studied within the Pikes Peak region. The basin lies generally between the Kettle Creek drainage on the North and the Cottonwood Creek drainage on the South. The geographic center of the Basin lies approximately seven (7) miles East of the Front Range Foothills. The construction of Interstate 25 during the late 1950's and early 1960's resulted in the rerouting of the historic alignment and the channelization of the lower portions of the Basin from State Highway 83 to a point below Academy Boulevard.

The Basin includes portions of Sections 25-29 and 32-36 in Township 12 South, Range 66 West and Sections 2-5 in Township 13 South, Range 66 West. The majority of the Basin (87%), lies within the current Corporate limits of the City of Colorado Springs. Approximately 7% lies within a Military Reservation, the United States Air Force Academy and the remainder, approximately 6%, lies within El Paso County. The lower 6300 feet of Pine Creek, that portion downstream of Academy Boulevard meanders partially within the U.S. Air Force Academy, partially within the City of Colorado

Springs, partially within the El Paso County, and partially within the Interstate Right-of-Way. This lower approximately 6300 L.F. (1.2 mi.) has been previously included in the Cottonwood Creek Master Drainage Plan, Lincoln DeVore Testing Laboratory, 1979, and was designated as in that study as a portion of the "North Cottonwood Creek Basin". The historical maps reviewed including all U.S.G.S. quad sheets label this system as "Pine Creek" to the Monument Creek outfall. The "North Cottonwood Creek Basin" as defined in the Cottonwood Creek Master Plan is physically the South Basin to Pine Creek. The Pine Creek Basin, for purposes of this study and Unit Drainage Cost Determination has been considered to extend downstream only to the upstream (Northeast) side of the Academy Boulevard crossing. The portion of the Pine Creek drainage downstream of this point continues to be considered as a portion of the "North Cottonwood Creek Basin" for facilities and costs and has been considered in a separate section of this report. This could be considered as an addendum to a portion of the referenced Cottonwood Creek Master Plan.

The Pine Creek/"North Cottonwood Creek" drainage system outfalls into Monument Creek at approximately mile post 9.15 as designated by the Corps of Engineers in the 1971 Flood Plain Information study for Monument Creek, Colorado. This confluence is located approximately 0.5 miles above Woodmen Road on the West side of Interstate 25. Using this confluence point as Milepost 0.00 for Pine/North Cottonwood Creek, the following major features are encountered proceeding upstream and shown on the "Exterior Basin" map.

MP 0.00: Confluence with Monument Creek.
MP 0.00-0.25: Existing natural channel eroded to bedrock.
MP 0.25: Cross North and South bound lanes I-25.
MP 0.25-0.40: Existing natural channel, narrow, incised into claystone, vertical walls.
MP. 0.40: Cross abandoned AT&SF Railroad Grade.
MP 0.40-0.55: Existing natural channel, meandering and incised to claystone with wetlands and much vegetation.
MP 0.55: Confluence with North Cottonwood Creek Outfall.

MP 0.60: Enter U.S. Air Force Academy property.

MP 0.55-0.70: Existing natural channel with large meanders, eroded to claystone, irregular cross-section, heavy vegetation, waterfall.

MP 0.70: Confluence with Chapel Hills Mall Outfall Channel.

MP 0.81-0.95: Well defined manmade channel, partially improved.

MP 0.95-1.21: Broad flat undefined channel section with much vegetation, marsh and wetlands. (See Section VII.)

MP 1.21-1.30: Eroded channel section with vertical sides, 3 riprap check dams and vertical concrete walls below box (South side).

MP 1.30: Colorado Department of Highways Box Culvert at Academy Boulevard (Sheraton Inn Box). End of North Cottonwood Creek System - begin Pine Creek Exterior System.

MP 1.30-1.65: Poorly defined natural channel with approximately 800 L.F. of grouted rock riprap improvements.

MP 1.65-2.03: Concrete lined channel adjacent to I-25.

MP 2.02-2.25: Broad open natural channel erodible in spots.

MP 2.25: Colorado Dept. of Highways Box Culvert at State Highway 83 and end of Exterior system - begin Detailed Pine Creek Basin study.

The lower 2.25 miles of the Pine Creek Channel has a very small contributing area. The channel passes through City, County, State, and Air Force Acadmey property. There are several platted/developed subdivisions adjacent to the channel. They have for the most part developed without any encroachment by or into the channel section. With the exception of approximately 2050 L.F. of concrete lining within the Air Force Academy property, no permanent channel improvements have been done to date. The referenced Cottonwood Creek Master Plan outlined improvements proposed from the confluence with Monument Creek upstream to and including Acadmey Boulevard. These improvements have been further quantified in the North Cottonwood Creek section of this study.

The construction of the Briargate Interchange on Interstate 25 is occurring within the Basin Area with completion scheduled for late summer

1987. A detailed analysis of the Kettle Creek drainage basin and its impact on both the new interchange and Pine Creek was completed by URS Corporation in 1985. The conclusion was that the existing detention facility on Kettle Creek immediately North of the new interchnage is adequate to accommodate (detain) a 100 year storm event with no spill (maximum water surface elevation approximately 27.5 feet below existing spillway crest). The potential for any Kettle Creek flows being a consideration in this Basin has been determined to be negligible. At the end of this section is a copy of a letter from the C.D.O.H. to the Air Force Academy where the interchange construction and Kettle Creek Dam location are discussed. (See paragraphs 2 and 3.) In addition, a copy of portions of the URS Drainage Report is also included with pertinent sections underlined.

The Pine Creek Basin which was considered in detail in this study has a Western boundary at State Highway 83. The main channel extends upstream approximately 1.5 miles (MP 3.80) where it splits into a North and South Fork. Each of these forks extends approximately an additional 3 miles to their respective headwaters. The lower portion of the basin has a well defined channel in most areas. Some erosion has occurred in the central portion of the basin and the upper reaches of the South Fork with the confluence of the two forks being the only area where sedimentation and siltation has resulted in a lack of defined channel.

The studied basin slopes downward East to West with the Exterior Basin sloping generally North to South or Southwest. The following table illustrates the U.S.G.S. elevations at various points of interest and natural channel slopes.

LOCATION	MILEPOST	U.S.G.S. ELEVATION	AVG. SLOPE
Monument Creek Confluence	0.00	6270	2.3%
Academy Boulevard	1.30	6430	1.8%
State Highway 83 (West Boundary Detailed Study Area)	2.25	6520	2.3%
North/South Fork Confluence	3.80	6710	4.7%+/-
Top of Basin	6.8+/-	7460	

The Pine Creek Channel has a year round base flow with peaks reaching as high as 500 G.P.M. at the Western boundary of the study area. The primary source of this "live water" is groundwater seepage along the creek banks in some areas. The result of this base flow is extensive wetlands particularily in the lower reaches of the basin and in the Exterior Basin channel. Numerous WPC type stock Ponds can also be found within the basin, none within State Engineering's jurisdiction. All stock ponds will be removed by development.

The basin terrain is typically characterized by broad sloping plains and rolling hills. The upper portion of the basin approaches the Black Forest area. Slopes typically range from 1%-10% with the majority of the basin in the 3% to 6% range. The most notable exceptions to this are a steep slope in the South Central portion of the basin and some steep slopes on the North Fork about a mile upstream of the confluence.

The basin is virtually undeveloped at this time. The Exterior Basin - between State Highway 83 and Academy Boulevard contains only a very small amount of privately owned property contributing to the drainage and for practical purposes it was all developed prior to this study. The Basin study area - above State Highway 83 - contains several residential developments platted under El Paso County criteria, one high density residential development platted under City criteria, and the two District 20 schools. The Wolfe Ranch which was the historic headquarters for the cattle ranching operation in this area lies very near the Pine Creek headwaters of the North Fork of Pine Creek.

SOIL & GEOLOGY

The most recent and comprehensive Soils and Geologic study of the Pine Creek basin was completed by the U.S.D.A. Soil Conservation Service and published in 1975 as "Soil Survey of El Paso County Area, Colorado". This document corrulates soils names and descriptions with hydrology for use in computing runoff for various storms. Soil types are also important

relative to wind and water erosion when planning for land uses and developing storm management plans.

A total of sixteen soil types were identified within the basin study area. Hydrologically, they range from the extremely permeable Blakeland (sand dunes) to the highly impermeable Travessilla (rock). See Table 1 at the end of this section for a complete listing. Generally the following geologic summary can be made. The soil for the most part is comprised of sandy loams formed from weathered aerosic sedimentary rock. The soils are well drained, moderately permeable, and in some cases susceptible to erosion by wind and water. Areas of natural streambed erosion caused by high precipitation and heavy runoff are evident throughout the Basin.

The Northeast portion of the basin is underlain by the Peyton/Pring complex. The Southeast portion contains Bresser and Stapleton Loam and Sand. Both of these soil complexes are relatively well drained with moderate surface runoff and fall in Hydrologic Soil Group B. Much of the central and Western portion of the site are Blakeland and Columbine sand with well drained characteristics highly permeable and relatively low runoff potential. These soils fall into Hydrologic Soil Group A. A large area of the Kutch soil complex and a smaller area of Travessilla have been identified, the former in the West central area and the later in the North central area. These soils have low permeability and a relatively high runoff potential and fall into Hydrologic Soil Groups C & D respectively. The soils classifications and hydrologic groupings have been included on Exhibit IV-B "Hydrologic Soils Groups Map" in the Appendix of this report.

The referenced "Soil Survey" has a a great deal of engineering and storm water management information for each of the soil types. Although it is beyond the scope of this study, the information is available for the detailed subdivision Drainage Report/Plan that will be necessitated as the basin is platted. Consideration should be given to "site specific" characteristics as more detailed site development information becomes available.

The vegetation in a basin is an important factor in determining historic runoff. To a lesser degree, the landscaping of a basin as it is developed becomes a factor in determining runoff.

The natural vegetation in the basin is quite varied and quite typical for the Eastern Colorado plains. The upper most reaches of the basin are on the fringe of the Black Forest area. The ground cover consists of coniferous stands as well as low shrubs. Native grasses are predominate throughout the basin. The central portion of the basin contains few trees or shrubs. A large grove of cottonwoods exists near the confluence of the North and South forks. The presence of running water year round has resulted in the growth of wetlands type vegetation along the streambeds. Several stands of coniferous trees can be found in the Northwest portion of the Basin. Since trees are at a premium in the basin it would be desirous to have the land planning concentrate on preservation of the vegetation in the streambeds and on the uplands wherever possible.

The urbanization of the Pine Creek Basin will undoubtedly alter the surface soils and vegetation. In some cases this may be significant with extensive grading and land development. Care should be taken as each area urbanizes to consider and possibly reconsider the information used in this study as it may relate to stormwater management. This should be done initially at the time of area Mini-Master Plans and then further at the time of individual subdivision studies.

LAND USE

The Pine Creek Basin has experienced only a very limited amount of urbanization to date. With the 1982 annexation by the Briargate Development Group of this and their other holdings, extensive urbanization over the next 10-20 years is very likely. The majority of the Basin that was studied in detail, lying East of State Highway 83, is currently under the ownership/control of the Briargate Development Group and has for the

most part been masterplanned. The annexation masterplan was very general in nature. Subsequent area "mini-master plans" have been developed to date. The land use information, road alignments, and open space areas defined in these subsequent studies are the land use projections used in the stormwater runoff estimates for this study.

The land uses in the Exterior Basin area are primarily going to remain as they are today. The lower portion of the exterior basin - below Academy Boulevard - has been included previously in the North Cottonwood Creek study and has not been further analyzed for land uses or runoff in this study. The channel improvements as a result of Pine Creek flows and the North Cottonwood Creek and Chapel Hills outfalls are the only items of detailed consideration included in this study for this area.

The Exterior Basin between Academy Boulevardand State Highway 83 lies almost totally within the U.S. Air Force Academy boundary. The exception is a small amount of developing land known as Perkins Subdivision (the Town North Centre project). The proposed I-25 Briargate Interchange North of the Pine Creek Channel is within the basin and U.S. Air Force Academy boundary and has been considered in detail as part of the design process (URS 1985). The Pine/Kettle basin boundary is formed by the Kettle Creek detention structure and has been determined in the URS study to have no impact on this Basin. In both cases facilities have been proposed and in most cases are or will be constructed over the next year. (See attached letter, Page II-18, 19, from C.D.O.H. to the Air Force Academy in reference to the Kettle Creek Detention Structure.)

Since land uses have a significant impact on storm water runoff, a reasonable projection of uses is important to developing realistic and reliable storm runoff flows for design purposes. This study includes a summary of platted (developed) land and uses within the Basin (Table III in Section IX) and mini-master plan data for the various parcels within the basin. A brief discussion of the various areas follows.

The platted land within the Study Basin totals approximately 166 acres or 5.6% of the Basin East of State Highway 83. With the exception of the Springcrest and Kittyhawk areas, all of the platted area was under the jurisdiction of the City of Colorado Springs when platted. The Springcrest area is a 3-5+ acre single family subdivision in the Northwest corner of the basin. There is also a developed school site (Mountain View Elementary) in this area. The Kittyhawk area is a 3-5 du/acre development adjacent to Springcrest in the Northwest. It also contains a developed school site (Challenger Middle School). This Basin lies within School District 20.

The portion of the Basin lying North of Old Ranch Road is totally within El Paso County. This 116+ acre area has multiple ownerships of various sized parcels - mostly 5 acres in size. A number of the parcels contain single family residences. Under current County criteria these parcels are considered as a one (1) acre parcel. Since there are no known development plans, for purposes of this study land uses have been assumed to remain the 5 acre rural residential. Facilities have been extended into the area but have been sized according to these land use assumptions. The Springcrest area is also within El Paso County, but is platted.

The Briargate Master Plan identified major land usages, the Pine Creek Golf Course, and the major road network within the study area. The golf course which has been constructed and will be open for use in early 1988, comprises approximately 190 acres from near State Highway 83 upstream to the confluence of the North and South forks then extends Northeast on the North side of the North fork. The 18 hole course will be under the jurisdiction and maintenance of a private administrator. A second 18 hole course is tentatively planned to extend along the South fork of Pine Creek, however, the Pine Creek Area Mini Master Plan has been developed without consideration for this second course. This study has used the existing 18 hole course only in developing the stormwater

management plan. If the second 18 hole course is constructed, an amendment to this study (revising peak flows and total runoff downward) is recommended. For purposes of sizing facilities this report contains conservative land use estimates.

The major road network within the Basin study area is similar to that shown on the Master Plan. The three major East/West arterial roads are Research Parkway (165 foot right-of-way) which forms or is near much of the South boundary of the Basin, and Briargate Parkway (165 foot maximum right-of-way) which will be an extension of the Briargate interchange and will run through the Central and South Central part of the basin; and Old Ranch Road (60-80 foot right-of-way) which forms the approximate North boundary of the Basin. The North/South arterial roads include State Highway 83 (right-of-way varies 160 foot minimum) forming the West boundary of the study area; Chapel Hills Drive (80-120 foot right-of-way); Lexington Drive (80 foot right-of-way); Union Boulevard (120 foot right-of-way); Austin Bluffs Parkway (120 foot right-of-way); and Powers Boulevard (150 foot maximum right-of-way). These roads are all either existing or proposed extensions of existing roads adjacent on the South and will extend beyond the North boundary of the Basin. The roads within the Basin subject to the Arterial Road and Bridge Reimbursement ordinance as defined in the City Subdivision Ordinance, include Briargate Parkway, Union Boulevard and Powers Boulevard. The Arterial Bridges, as defined by the City Engineer, that are subject to the reimbursement Ordinance, include facilities under State Highway 83, Briargate Parkway, Chapel Hills Drive, and Lexington Drive.

The Briargate Business Campus Mini-Master Plan, consisting of approximately 360 acres and located in the West and Southwest portion of the Basin has been planned in detail, zoned, and portions are currently being platted. This will likely be the first major development within the Basin. The entire area is zoned office and will undergo extensive site grading for large office building or research/development type users.

The Penrose Area Mini Master Plan, consisting of approximately 570 acres is located in the South Central part of the Basin. The name was derived from the future Penrose Hospital site in the area (but within the Cottonwood Creek Basin. The area has been planned for residential uses, two school sites, some park, and a small amount of commercial usage. The residential uses vary from medium (8-12) du/Ac.) to high (20-25 du/Ac.). This area will likely be subject to an extensive amount of grading.

The Gatehouse Village Area Mini Master Plan, consisting of approximately 134 acres within the Basin, is located in the Southeast part of the Basin. This area has been planned primarily for residential uses similar to the Penrose area. The excepton is a relatively large Research and Development (R & D) area within the basin that will be zoned similar to the Business Campus. The Western portions of this area are subject to extensive grading as will be the R & D area. The possible second 18 hole golf course would be located in the North portion of both this and the Penrose areas, if it should occur.

The Pine Creek Village Area Mini Master Plan, consisting of approximately 1070 acres includes the remainder of the study area West of Powers Boulevard. This is generally the North half of the study area between State Highway 83 and proposed Powers Boulevard. The area is the most complex from a land planning standpoint in the study area. About one third of the area has been developed into the referenced 18 hole golf course. This is approximately in the center of the planning area. Residential land uses ranging from low to medium-high are adjacent to the golf course. A low density residential area has been planned for a relatively steep and topographically "rough" area in the East portion of the area. A large R & D land use, a continuation of that land use in the Gatehouse Area, has been planned for the East portion of the study area. The densities of the residential areas are relatively low and the golf course grading has anticipated leaving adjacent areas natural so grading within this planning area should be relatively minor. The exception is expected to be the R & D area. Again, some of this area would be affected by the second 18 hole golf course should it occur.

The Briargate East Mini Master Plan area has recently been prepared for the land holdings East of Powers Boulevard. The degree of planning is not the level of any of the previous Mini Master Areas discussed, however, is a refinement of and contains a greater level of detail than the annexation Master Plan. A large area of R & D is anticipated in the West portion adjacent to Powers Boulevard. The balance has been planned for residential uses ranging in density from very low to medium. A park site and a commercial site are also included in this area. The Wolfe Ranch is located in a residential holdings tract in the extreme Northeast corner adjacent to the City/County boundary. The R & D area would be expected to be subject to extensive grading, but the balance would likely be developed in somewhat of a natural topographic state.

The Basin land usage projections within the Briargate boundaries only can be summarized generally as follows:

LAND USE	ACRES	% BRIARGATE AREA
Parks	52	2%
Golf Course	187	7%
Residential	1,344	50%
*Office	342	13%
*R & D	541	20%
*Commercial	125	5%
*Schools	81	3%
TOTAL	2,672**	100%
*TOTAL	1,089	41%

** The total Basin acreage of 2964 acres (Detailed Study Area) includes 2672 acres in Briargate. The remaining 292 acres includes the Air Force Academy, the Wolfe Ranch, platted County land, and school parcels.

With the exception of the parks and schools, the above acreages include roads. The last four uses listed (*) are subject to a special stormwater management concept proposed for the Basin. This concept, discussed in

detail in IV-8, IV-9, and IV-13 of the Hydraulics section, requires onsite detention of 35% of the increased storm water runoff due to urbanization. It should be noted that these percentages are of Briargate holdings, not total basin areas.

The basin land uses impact the potential runoff significantly and they have been considered in this study based on the most recent and complete information available. The individual subdivision drainage studies should reflect a confirmation or refinement of these masterplanned land uses. If major land use changes occur, an analysis of the changes should be made on the entire basin and a possible Master Plan amendment is appropriate. This potentialy could occur in the second golf course use, the Powers/Union R & D tract and the County area.

Land Uses have been illustrated on Exhibit IV-A, the "Basin Land Use/Platted Area Map" found in the Appendix of this study.

The Pine Creek Basin is potentially subject to a great deal of urbanizaton over the next decade and a comprehensive stormwater management plan is vital for the successful development. The basin properties discussed in this section together with the rainfall and design parameters are all essential to accurately predict rainfall, runoff, and methods of accommodating the runoff safely and efficiently. The general nature of this study results in guidelines and recommendations subject to site specific conditions as well as changes in development plans and potential philosophies.

FINAL DRAINAGE REPORT

PLANNED BRIARGATE PARKWAY/I-25 INTERCHANGE

AUGUST, 1985

Prepared for: BRIARGATE DEVELOPMENT GROUP
7710 N. UNION BOULEVARD
COLORADO SPRINGS, COLORADO 80918

Prepared by: URS Engineers
3955 East Exposition Avenue
Denver, Colorado 80209
Telephone: 303/744-1861

URS# 5060

a maximum storage capacity of approximately 2,700 acre-feet, a nine foot diameter concrete pressure conduit outlet and a 200 foot wide spillway having an estimated full flow capacity of 6,700 cfs. The existing spillway diverts runoff to the south along the east side of I-25 to the Pine Creek diversion channel. The existing spillway has not operated in the 28 years since the reservoir was constructed. The drainage area above the Kettle Creek detention reservoir encompasses approximately 16.5 square miles. Elevations within the Kettle Creek basin above the detention reservoir range from 6353 to 7642.

3.1 100-YEAR INFLOW HYDROGRAPH

A preliminary 100-year inflow hydrograph for the Kettle Creek detention reservoir was prepared using the U.S. Soil Conservation Service's (SCS) tabular method presented in the SCS publication "Procedures for Determining Peak Flows in Colorado (includes and supplements - Technical Release No. 55 "Urban Hydrology for Small Watersheds")". Sub-basin data used in preparing this hydrograph are presented in Table 1. The resultant composite hydrograph is presented in Table 2. This preliminary 100-year inflow

pressure flow for water surface elevations above 6546. Calculations associated with outlet works rating curves are presented in Tables 7 and 8 and Figure 5.

The stage-storage relationship for the existing Kettle Creek detention reservoir was developed from 1" = 100" with 2' contours topographic mapping and is presented in Table 9 and Figure 6.

The estimated 100-year future flood hydrograph was routed through the existing Kettle Creek detention reservoir using the procedures presented in the U.S. Bureau of Reclamation publication "Design of Small Dams" in conjunction with the reservoir stage-storage curve (Figure 6) and the minimum performance reservoir outlet routing curve shown in Figure 5. Calculations associated with this routing are presented in Table 10 and Figure 7.

Routing the estimated 100-year future flood hydrograph through the existing Kettle Creek detention reservoir indicates a maximum 100-year reservoir water surface elevation of approximately 6582.5 which is approximately 27.5 feet below the existing spillway crest; a maximum utilized detention storage volume of approximately 617

acre-feet which is approximately 23 percent of total reservoir storage capacity; and a maximum 100-year reservoir release through the existing nine foot diameter pressure conduit of approximately 1400 cfs. It is estimated that the existing emergency overflow spillway would operate only during storms much greater than 100 years.

The Office of the State Engineer of Colorado (State Engineer) has jurisdiction over the Kettle Creek detention reservoir. This Office was contacted early in the preliminary design process. Design and construction of the Kettle Creek reservoir was not reviewed or approved by the state Engineer. The existing Kettle Creek detention reservoir spillway is too small to meet present design criteria of the State Engineer. It is our understanding the State Engineer will eventually require that the U.S. Air Force Academy upgrade the existing Kettle Creek detention reservoir spillway to meet current design standards of the State Engineer, whether or not the interchange is constructed. An additional complication is that operation of the Kettle Creek detention reservoir spillway under existing conditions would result in the transbasin diversion of storm runoff from Kettle Creek to

AUG 3 1985

STATE OF COLORADO

DEPARTMENT OF HIGHWAYS

District II
905 Erie - P.O. Box 536
Pueblo, Colorado 81002
(303) 544-6286

August 2, 1985

Colonel Willett Stallworth,
DE, Civil Engineering
United States Air Force Academy
USAF Academy, CO 80840

Dear Colonel Stallworth:

We hereby request the following Air Force approvals for construction of an interchange at I-25 and Briargate Parkway: Permanent and temporary right-of-way easements, Early Right of Entry for Construction License, and a material source location.

Since our previous request to you dated May 17, 1985, certain minor changes have been made which reduce right-of-way needs. The two most notable of these changes are the elimination of any modification or disturbance to the Kettle Creek Dam and a reconfiguration of the SH 83/Briargate Parkway intersection.

The original concept design proposed a relocation of the dam spillway to accommodate certain interchange features. This is no longer necessary. The interchange has now been designed to avoid any involvement with the dam. This will be reflected in the final right-of-way and construction plans.

The concept design also proposed a split intersection at SH 83 and Briargate Parkway. Further analysis indicated that this design was not necessary, and the plans have been revised accordingly.

For Interstate traffic and safety reasons, the Department will prohibited the hauling of excavated material across the mainline of I-25. The designers of the interchange, URS Corporation, are therefore required to designate a borrow source west of I-25 for embankment construction. The area identified by them, approximately 19 acres, is contiguous to the southbound on-ramp and has been staked. The right-of-way and construction plans incorporate this change.

After construction of the interchange, the surface of the excavated borrow area will be carefully contoured to blend the interchange embankments into the existing terrain. The disturbed area will then be restored in accordance with Department of Highways and AFA specifications to approximate the current low maintenance vegetation pattern.

A permanent easement is requested for the interchange proper and the supplemental fringe areas needed for maintenance operations. The total area needed is approximately 45 acres.

Temporary easements are also requested for the borrow source. The total area required for temporary easements is about 19 acres.

The final right-of-way plans in reproducible form, together with precise legal descriptions, will be submitted to you by URS Corporation.

Enclosed is a copy of the Finding of No Significant Impact approved and adopted by the Department of Highways and the Federal Highway Administration. This completes State and FHWA responsibilities under the National Environmental Policy Act.

It is our understanding that all requirements for Air Force approval have now been met. Upon granting of these approvals by the Air Force, the Department is prepared to authorize construction of the interchange. We also understand that the Briargate Public Building Authority has scheduled the beginning of construction for October of this year. That schedule is acceptable to the Department.

We appreciate the cooperation extended to us by the Air Force Academy on this project and value the excellent working relationship we have with you and your staff.

Sincerely,

Frank L. Soller
District Engineer

REA:com

cc: Jerry Novak, Vice President
Briargate Development Group

DeWitt Miller, Director
Colorado Springs Department
of Public Works

Gene Muhich, URS Corporation

COLORADO-EL PASO CO
7.5 MINUTE SERIES (TOPOGRAPHIC)

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

KETTLE CREEK BASIN

PINE CREEK BASIN

NORTH COTTONWOOD CREEK BASIN (SOUTH PINE CREEK)

COTTONWOOD CREEK BASIN

I-25

U.S.A.F.A.

PINE CREEK CHANNEL

MONUMENT CREEK

ACADEMY BLVD.

COLORADO SPRINGS

BLACK FOREST

FIGURE I
VICINITY MAP

PINE CREEK DRAINAGE
BASIN PLANNING STUDY

BY

Obering, Wurth & Associates
Consulting Civil Engineers
Registered Land Surveyors

1"=4000'±


LEGEND
BASIN BOUNDARY
MINI-MASTER AREAS
1 BRIARGATE BUSINESS CAMPUS
2 PENROSE AREA
3 GATEHOUSE VILLAGE AREA
4 PINE CREEK VILLAGE AREA
5 BRIARGATE EAST
LIMITS OF BRIARGATE HOLDINGS
NON-BRIARGATE AREAS
PINE CREEK BASIN
U.S. AIR FORCE ACADEMY
INTERSTATE 25
NO. 83
SPRINGCREST
KITTYHAWK
OLD RANCH ROAD
HOWELL
EL PASO COUNTY
CITY OF COLORADO SPRINGS
WOLFE RANCH
U.G. GAS
TALL TREES
GOLF COURSE
BRIARGATE
PARKWAY
UNION BOULEVARD
CHAPEL HILLS DRIVE
LEXINGTON DRIVE
RESEARCH
AUSTIN BLUFFS PKWY.
LIBERTY HIGH SCHOOL
CHAPEL HILLS MALL
1" = 1200'
BASIN VICINITY MAP
PINE CREEK DRAINAGE BASIN
Obering, Wurth & Associates
Consulting Civil Engineers
Registered Land Surveyors
1015 Elkton Drive
Colorado Springs, Colorado 80907
Phone (303) 531-6200
PROJECT NO. 10-286
FIGURE II

T A B L E I

PINE CREEK DRAINAGE STUDY

HYDROLOGIC SOIL CLASSIFICATION

SCS MAPPING UNIT	FORMATION	SLOPE	EROSION POTENTIAL	HYDROLOGIC SOIL GROUP
8	Blakeland Loamy Sand	1%-9%	Moderate	A
12	Bresser Sandy Loam	3%-5%	Slight to Moderate	B
19	Columbine Gravelly Sandy Loam	0%-3%	Slight to Moderate	A
41	Kettle Gravelly Loamy Sand	8%-40%	Moderate	B
45	Kutch Clay Loam	5%-20%	Moderate	C
67	Peyton Sandy Loam	5%-9%	Moderate	B
68	Peyton-Pring Complex	3%-8%	Moderate	B
69	Peyton-Pring Complex	8%-15%	Moderate to High	B
71	Pring Coarse Sandy Loam	3%-8%	Moderate	B
83	Stapleton Sandy Loam	3%-8%	Moderate	B
85	Stapleton-Bernal Sandy Loams	3%-20%	Moderate	B-D
93	Tomah-Crowfoot Loamy Sands	8%-15%	Moderate	B
94	Travessilla-Rock Outcrop Complex	8%-90%	High	D
97	Truckton Sandy Loam	3%-9%	Moderate	B
98	Truckton-Blakeland Complex	9%-20%	Moderate to High	A-B
101	Ustic Torrifluvents, Loamy	0%-3%	Moderate to High	B

SEE EXHIBIT IV-B FOR FORMATION LOCATIONS

END OF SECTION II

SECTION III

BASIN HYDROLOGY

III. BASIN HYDROLOGY

The average annual precipitation in the Pikes Peak region is approxiamtely 15" inches. Precipitation falls in the following general forms: (1) Snowfall which accounts for 40%-50% of the total; (2) Upslope storms which produce moderate amounts of precipitation over relative long time periods of 2-4 days and; (3) Intense thunderstorms in the spring, summer and fall of relatively short duration. The thunderstorm occurrences typically produce great concentrated amounts of runoff with potentially hazardous results. This type of storm is the one for which a basin stormwater management plan is typically developed and facilities installed. It is this thunderstorm for a 5 year and 100 year reoccurrence interval (20% and 1% chance in any given year) that this study has been completed hydraulically.

The City of Colorado Springs and El Paso County drainage criteria (prior to October 1987) has been summarized in the City's manual for "Determination of Storm Runoff Criteria". The guidelines established in this manual have been used in this study. Two technical publications have been followed in as recommended in the criteria manual; (1) "Procedures for Determining Peak Flows in Colorado", Soil Conservation Service, March 1980 and ; (2) "Areawide Urban Runoff Control Manual", G.M.S., Inc., September 1979, revised. The procedures outlined in this data have been widely used by other Consultants and Governmental agencies throughout the Pikes Peak Region, are consistent with other basin Master Plan studies, seemingly result in reasonable and acceptable storm water runoff data, and are consistent with U.S. Air Force Academy and Colorado Department of Highways hydrologic criteria.

The Pine Creek Basin, consisting of approximately 2964 acres in the detailed study area East of State Highway 83, has been divided into 25 subbasins for purposes of estimating runoffs by the Soil Conservation Service Method. Since most subbasins are similar hydrologically this method seems to be appropriate. Considering assumptions that have been made for soil types, grading, land usages, and potential channel improvements

it is felt that this method results in reasonable and possibly conservative peak runoff estimates for the Basin.

The 25 subbasins have been defined as carefully as possible based on land uses, road patterns, potential grading patterns, and existing, known, or proposed channel alignments. Twelve points of interest were selected for purposes of either evaulating existing structure capacity or providing design data for proposed detention facilities, roadway crossings, channel improvements, or facility upgrading. Three additional points of interest were identified, one in the Exterior Basin area and two in the North Cottonwood Creek Basin. All subbasins, areas and peak flows have been shown on the Drainage Plan included in this study. A schematic of the basins, detention facilities and points of interest interrelations to each other is included as Figure III at the end of this section.

The design storms for this study have been considered relative to the City/County criteria, City Staff input, other governmental agency input, consistent with other recently completed master plans in the Pikes Peak region, and good engineering judgement and practice. The following design storm events have been analyzied for three basin conditions, namely undeveloped, developed with no basin detention, and developed with partial onsite and offsite detention. The total precipitation values were determined from SCS rainfall intensity-duration curves. Major Drainage Facilities were sized based on the 24 hour, 100 year storm while minor facilities were sized based on the 6 hour, 5 year storm.

DURATION	FREQUENCY	PRECIPITATION
6 Hour	5 Year	2.1
6 Hour	100 Year	3.5
24 Hour	5 Year	2.6
24 Hour	100 Year	4.4

It should be noted that 5 year and 100 year storms have a 20% and one (1)% chance of occurring, respectively, in any given year, but could

conceivably occur more than once in a given year. Further studies will be required on an individual subdivision basis by Current City/County Criteria prior to final design of any major or minor facilities.

The volume of precipitation for a storm event has been identified for a Type II and Type IIA storm which are classified as above and below 8000 feet. The extreme upper end of this basin approaches 7500 feet; however due to the location relative to the front range uplift and the conservative intent of the study the more intense Type IIA storm was used for computation.

Two rather significant assumptions were made for this study. The first was that a normal Antecedent Moisture Condition (AMC-II) existed prior to the storm. This is probably quite reasonable for a master plan, however, as individual subdivision studies occur and critical structures are sized it may be advantageous to consider other than this condition. The second assumption was that the selected storm occurs over the entire 2964 acre detailed study area simultaneously. This is not unreasonable, but is probably quite unlikely and the results are a conservative peak design flow estimate.

The three different basin conditions analyzed and mentioned previously were historic, developed with no basin detention, and developed with partial offsite and onsite detention. In preparing a stormwater management plan for this basin these three peak runoff conditions were essential to consider. The plan is further discussed in the Hydraulics section of this study, however briefly includes the partial detention of developed storm flows for certain land uses and at certain locations. The undeveloped flows calculated are necessary for this determination.

The Soil Conservation Service Method for computation recommends the following equation for the determination of peak runoffs and this study is consistent with that recommendation.

$$qp = QAq$$

qp - peak runoff, CFS

Q - direct runoff, inches

A - subbasin area, square miles

q - runoff rate, CFS/INCH/SQ.MI. or CSM/IN.

The direct runoff Q is a function of rainfall, soil type, land uses, ground cover, and antecedent moisture. The runoff to rainfall relationship is determined from a Curve Number (CN) for the particular subbasin and it varies throughout the basin. Tables are available in the SCS Procedures manual for these values. If several subbasins are summed at a design point or point of interest a weighted curve number is determined taking all of the contributing area's characteristics into account commensurately. All calculations were performed with the Corps of Engineers HEC 1 Computer Program.

The basin area A is typically planimetered in acres from the Drainage Map at 1"=400 feet and converted to a square mile subbasin area.

The runoff rate q is a function of the time of concentration for the design point for the particular type and duration of storm and is included on charts in the referenced "SCS Procedures Manual". The time of concentration Tc has been defined as the time required (in hours) for runoff to travel from the hydraulically most distant point to the point of interest or bottom of the subbasin. Overland flow charts and graphs are available. Developed basins contain improvements such as street curbs, storm sewers, and improved open channels that impact, and typically reduce the times from historic. These factors have all been included in determining concentration times for subbasins or points of interest as well as routings through detention facilities.

The hydrologic information gathered when applied over a time interval results in a hydrograph for the various subbasins and when routed, a hydrograph at the design points. These hydrographs are combined and attenuated at the referenced detention facilities. Typically, composite

peak combining of flows are in a less than linear summation of peak flows because of the staggered times to peak.

The hydrologic computations have been summarized in the Appendix of this report in Exhibit I. Summary of design point flows have also been tabulated for the various storms and the various development conditions based on HEC I Computer runs. Reference is made to the SCS, City, and Area Wide manuals as well as several other excellent technical publications including the Denver Regional Council of Governments Drainage Criteria Manual for further information on hydrology of urban areas.

SUB-BASIN SCHEMATIC

LEGEND

SUB-BASIN IDENTIFICATION NUMBER

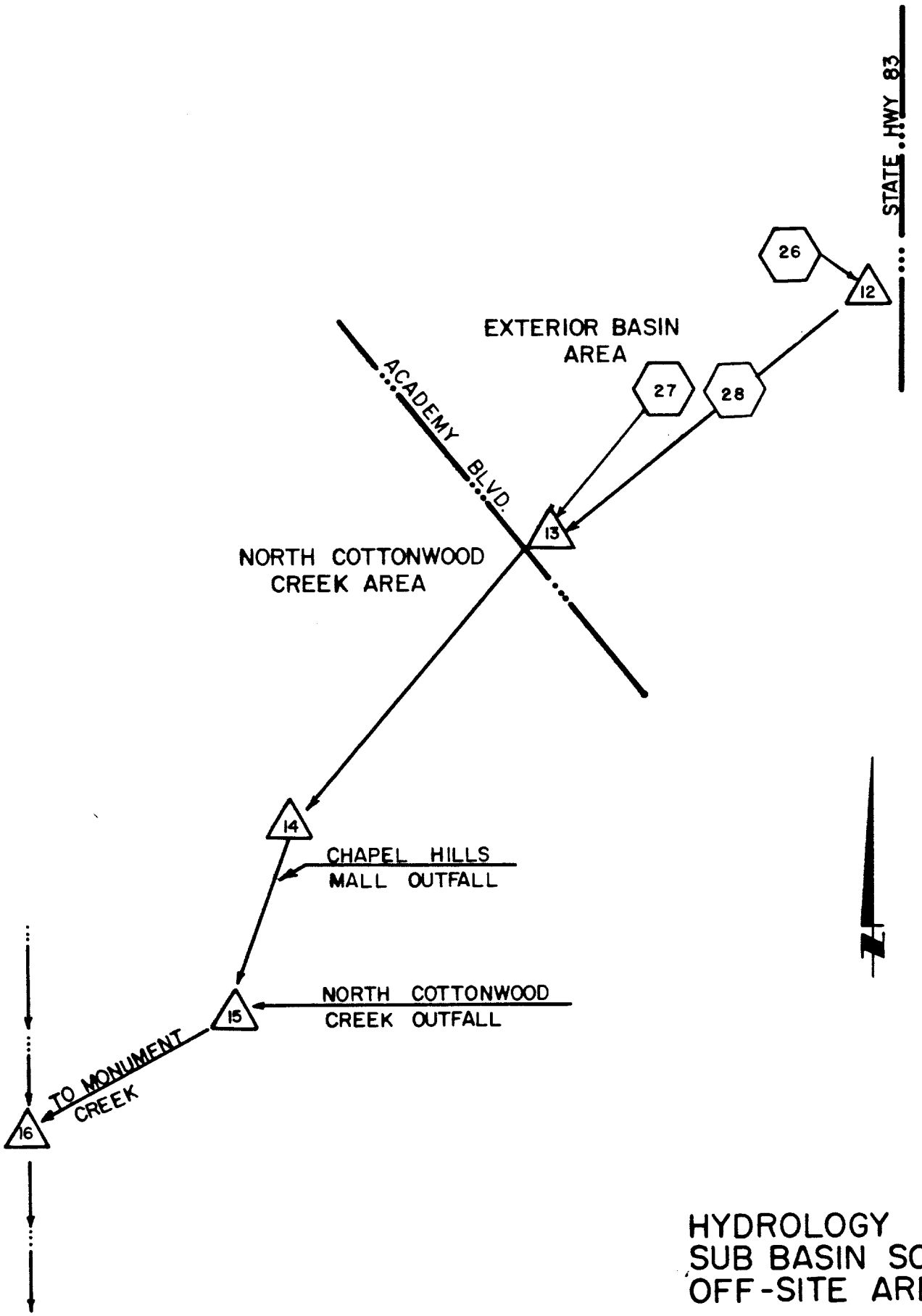
SUMMARY POINT NUMBER

DIRECTION OF FLOW

REGIONAL DETENTION
FACILITY IDENTIFICATION

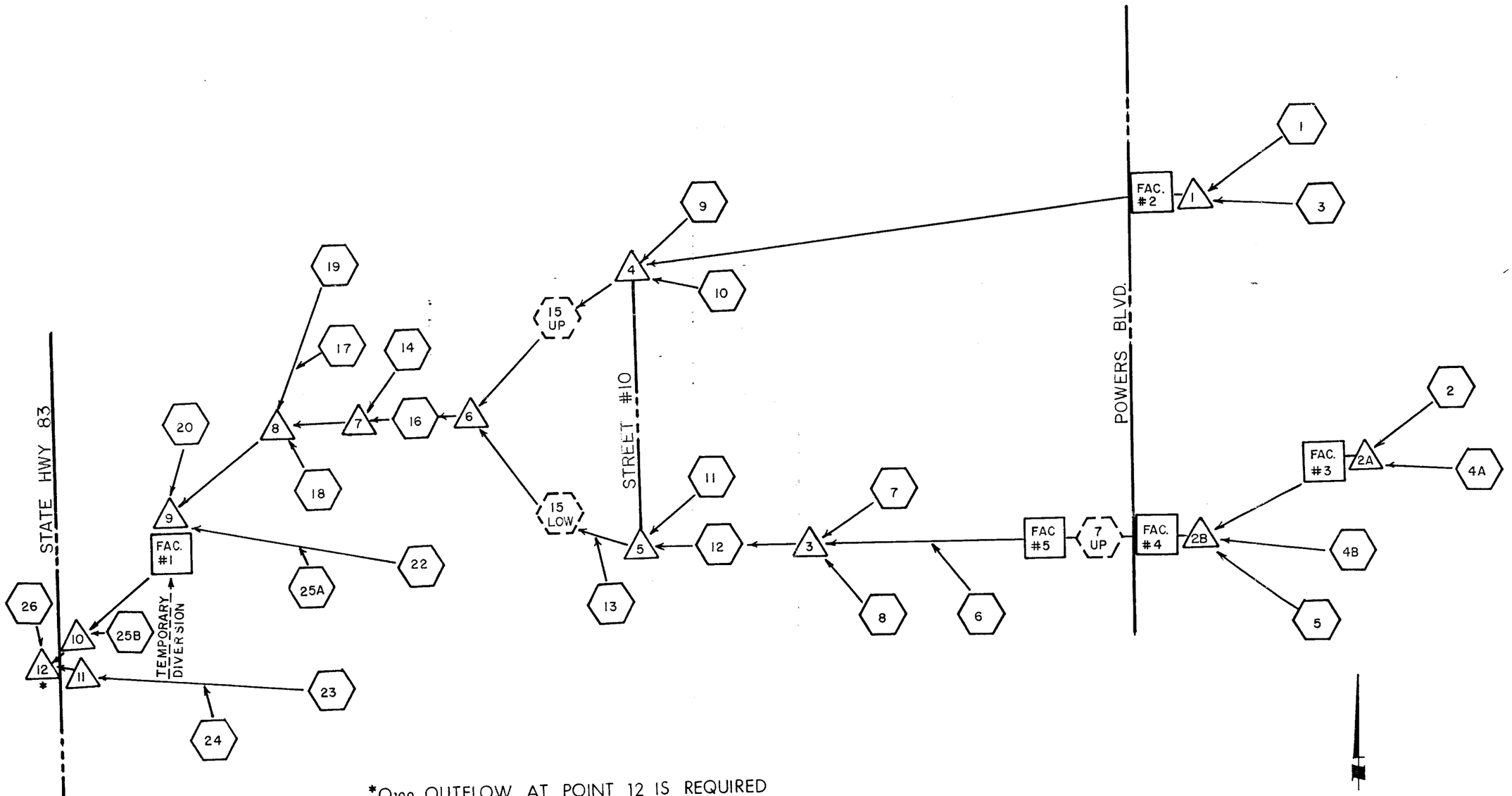
SUB-BASIN ADDED SPECIFICALLY
FOR THE HEC I COMPUTER RUNS

FIGURE III



HYDROLOGY
SUB BASIN SCHEMATIC
OFF-SITE AREA

FIGURE III SHEET 2 of 3



*Q_{100} OUTFLOW AT POINT 12 IS REQUIRED TO BE AT OR BELOW HISTORIC UNTIL DOWNSTREAM IMPROVEMENTS ARE IN PLACE. THIS NEEDS TO BE DONE BY TEMPORARY DIVERSION AND/OR DETENTION.

HYDROLOGY
SUB-BASIN SCHEMATIC
STUDY AREA

FIGURE III

SHEET 3 of 3

SECTION IV

BASIN HYDRAULICS

IV. BASIN HYDRAULICS

A storm water management plan for the urbanization of the Pine Creek Basin was one of the primary goals of this study. The development of such a plan is typically the most difficult task in the planning study of a Drainage Basin and such was the case with the Pine Creek Basin. Since the majority of the Basin that was studied in detail is under the control/ownership of the Briargate Development Group, the "onsite" plan was primarily influenced by the developer's land use plans and the City's criteria and policy guidelines. The Exterior Basin, Academy Boulevard to State Highway 83, involves City, County, U.S. Air Force Academy, and Colorado Department of Highways owned lands with virtually no privately owned (developable) land. The portion of the Exterior Basin below Academy Boulevard was previously considered in the Cottonwood Creek Basin Study and has not been reconsidered in detail in this study. A separate section on channel improvements for this area has been included in this study together with related costs. The plan developed has been prepared with input from all affected agencies and hopefully considers all comments received from all agencies, the City, and the Developer.

The stormwater management plan for the urbanization of this Basin can be summarized as one using a combination of channelization and detention to convey an attenuated developed peak runoff through the Basin and Exterior Basin areas to the ultimate outfall at Monument Creek. This concept is consistent with the philosophy in the previously completed North Cottonwood Creek study which considered the channel below Academy Boulevard. The channelization plan includes some realignment from the natural drainage courses, but for the most part follows the existing drainage courses. Varying degress of channel treatments ranging from leaving the channel natural to full concrete lining have been proposed. Detention has been utilized in the plan in two forms (1) five major regional (on-stream) public detention facilities and (2) onsite (off-stream) detention of 35% of the increase in runoff due to development on certain office, commercial, R & D, and school sites. The following is a summary of key peak flows for the 100 year design storm for Pine Creek at Academy Boulevard.

100 YEAR DESIGN FLOW		
6 HOUR	24 HOUR	CONDITION/SOURCE
949 CFS	1,252 CFS	Undeveloped (Historic)
2,570 CFS	--	1979 North Cottonwood Creek Study (LDTL)
6,554 CFS	6,067 CFS	Developed-No Detention-This Study (Theo.)
--	2,542 CFS	Proposed in this Study

Although the increase in runoff over historic is significant, the utilization of detention has a very important reduction on the peak flows allowing substantial savings in costs of channelization in the Exterior Basin area and utilization of some existing downstream facilities.

The City of Colorado Springs criteria (prior to October, 1987) defines a major channel as one in which the peak flow is greater than 500 CFS for the 100 year storm event. If flows are less than the 500 CFS, a 5 year design storm is used for design of improvements or facilities. This study has included special consideration for 100 year storm flows in the 300-500 CFS range. In certain situations the 100 year rather than the 5 year peak runoff has been used for sizing facilities where, in the engineer's opinion, the larger design flows through facilities were justified. Examples of this include arterial road crossings, sump conditions, and areas where the 100 year overflow could cause potential damage to proposed development because overflow routing appears difficult.

The major channel including the North and South Forks has been sized for the 24 hour, 100 year storm event virtually through the entire Basin. In the case of channelization, a freeboard factor of 0.3 was added to the operational depth. Road crossings typically are pipes or box culverts. The exception is a clear span bridge at the Chapel Hills Drive crossing. The channelization has for the most part followed natural channel locations. In some cases alignments are shown with the best information available, but could certainly be adjusted to conform to site specific development plans with no hydraulic impact and relatively minimal economic impact. The placing of open channels as called out in a Master Plan in underground pipe systems at the time of development is a typical deviation from the Master Plan in any basin. This upgrade

often results in some added system costs, but the costs are usually offset by the added usable land along the route. Several underground conduits primarily through the Business Campus have been defined in this Planning Study and have been included as underground facilities for cost estimate purposes.

The major channel improvements include several different sections depending on location (ownership), flows, slope, subsurface conditions, and asthetic considerations. The following channel sections have been proposed with locations being illustrated on the Drainage Plan. The channel percentages given in the following discussions relate to the Detailed Study area only (upstream of Academy Boulevard).

CONCRETE LINED CHANNEL

This cross-section is typically the most efficient from a land use standpoint consisting of B=D where possible (B=8' minimum for maintenance) with 1 1/2:1 side slopes, 6" minimum of reinforced concrete with a 30% freeboard factor. The fully lined channel accommodates high velocities in steep areas while preventing erosion and also acts as an excellent entrance and exit treatment for box culverts or pipes at road crossings. This section has been proposed in channel realignment areas. The City's design Standards include expansion/contraction joints, superelevation, cutoff walls, and a maintenance/access road. Approximately 65% of the main channel contains this recommended treatment.

FULLY LINED RIPRAP CHANNEL

This cross-section has been used in areas where little or no realignment is proposed, where asthetics are a major consideration, or where groundwater or unstable bank conditions are encountered. Velocities should be limited to 15 FPS maximum. Rock size and thickness is a function of flow velocity and specific gravity of the stone. The section is typically in a B=D configuration with 2:1-3:1 side slopes and a 30% freeboard factor. City standards require subgrade preparation and treatment, superelevation, concrete cutoff walls, and a

maintenance/access road and suitable easement. Approximately 15% of the main channel is proposed to have this treatment.

ROCK RIPRAP SIDES - NATURAL BOTTOM

This cross-section has been recommended in areas where the channel bottom is relatively stable, having been historically eroded to bedrock but curvilinear alignment, high velocities or increased flows is resulting in bank erosion. Some bank shaping may be necessary but generally the rock can be dumped and shaped to a 2:1-3:1 slope. Toe-in of the rock is desirable, but may not be possible in extreme bedrock conditions. Protection on only one bank where a localized erosion problem is occurring may also be appropriate. This section is typically used in this Basin in the incised areas of Pine Creek where access is difficult and is usually via the streambed. Only the area of the main channel downstream of Academy Boulevard is proposed to have this cross-section. This area lies within the North Cottonwood Creek Basin.

UNDERGROUND SYSTEM

The use of underground systems is an important part of the overall stormwater conveyance facility in the Basin. Typically these occur at roadway crossings, as detention facility outlets, and in areas where open channel adjacent to roadways becomes a traffic hazard or land use dictates closed conduits. The underground systems used in this Basin include reinforced concrete box culverts (RCBC) with entrance/exit improvements and Reinforced Concrete Pipe (RCP) of varying sizes. The final sizing of these facilities will be dependent upon more detailed hydraulic parameters at the time of final design. The sizes indicated will likely be reduced if they are changed. Underground systems are more subject to refinement than the other major channel conveyances. Approximately 5% of the major channel systems are proposed to be closed conduit systems.

NATURAL CHANNELS

The use of natural channels within the Basin has been proposed through the majority of the golf course area. This is also the proposed treatment of several smaller tributaries within the golf course area. The channel sections represent essentially existing conditions with very little grading. In the case of grading, it is expected to be a filling adjacent to the channel, essentially stabilizing and increasing the channel section. Several areas of wetlands (as defined by the Corps of Engineers) exist within these proposed natural channel sections. Wetlands are further discussed in a later section. It should be further noted that the areas where the natural channel sections are proposed do not have any masterplanned development within the immmediate channel area that would be endangered by siltation, erosion or potential channel overtopping. Suitable easements and private maintenance agreements as well as stabilization requirements will need to be addressed for these natural channel sections as platting occurs. The format of these agreements will need to be approved by all parties involved. Approximately 15% of the major channel systems are proposed to remain in this undisturbed channel section. (See Typical Section at the end of this section, Page IV-13.)

The second factor in stormwater management of this Basin within the major channel areas and the 100 year design storm flows is that of online stormwater detention. Much discussion has been conducted regarding the use of detention within the Basin. The result of these discussions was one of "partial" detention attenuating the developed peak flows as summarized on page IV-2 of this section. In addition to the larger Regional detention facilities proposed, a concept of onsite partial detention has been incorporated into the overall management plan. This is discussed later in this section.

The Regional (on-stream) detention consists of five (5) proposed detention facilities, four (4) of which are planned to be created by the construction of major roadway embankments. These facilities will function basically by impounding runoff behind the embankment and releasing at a lower controlled rate downstream through the downsized outlet works. This concept has the effect of lowering the runoff peaks while conveying the same runoff volume to the outfall point.

The five (5) Regional detention facilities can be classified in two categories. The first category is that of three (3) of the detention facilities having embankments in excess of the 10 feet in height against a major arterial. Those facilities are No. 1 created by the Briargate Parkway fill and Nos. 2 and 4 created by the Powers Boulevard fill on the North fork of Pine Creek. The second category consists of the remaining two (2) facilities that are also in excess of 10 feet in embankment height but are not aganist major arterial streets. Facility No. 3 is located at an embankment created by a yet to be named North/South roadway crossing the South fork. The facility No. 5 location is not exactly determined, but is generally in a large R & D parcel on the South fork between Briargate Parkway and Powers Boulevard. This facility is subject to further analysis in reference to location and benefit to the basin with the possibility of being eliminated based on a cost/benefit analysis. Facilities No. 3 and 5 will most likely be final designed to create an embankment of less than 10 feet.

The State Engineer has jurisdiction of small dams in the State if any one of the three (3) conditions occur:

a) Vertical height from top of dam to natural invert downstream is greater than 10 feet.
b) Water surface area in excess of 20 acres at maximum water depth.
c) Maximum storage volume is in excess of 100 acre feet.

The State Engineer further recognizes that impoundments created by roadway embankments are not within their jurisdiction. (Rule 15.A.(1) of Rules and Regulations for Dam Safety and Dam Construction). A copy of Page 37

of these regulations, Sixteenth Rev., 2/88 is included at the end of this section with the referenced paragraph highlighted.

The lack of jurisdiction on the three (3) proposed facilities does not totally exempt the facilities of being designed and constructed within certain criteria as established by the State and the City of Colorado Springs. The five (5) Regional facilities are all proposed to be publicly owned and publicly maintained for functional purposes. Any asthetic maintenance beyond the City's maintenance would be by and totally at the expense of others and will require an agreement with the City. One example of secondary maintenance may be Facility No. 1 which could be a part of the golf course maintenance program. The hydraulics of the five (5) facilities are summarized in Exhibit III in the Appendix of this report.

The three facilities that have embankments adjacent to major arterials (Facilities No. 1, 2 and 4) have the following specific minimum design parameters that need to be considered:

FACILITY NO. 1 - BRIARGATE PARKWAY

a) Designed for a 100 year storm event based on upstream development occurring in accordance with the Master Plan and upstream stormwater management in accordance with this Master Plan.
b) Assume the outlet facility is 50% clogged during peak flow operation.
c) With the above circumstances provide a minimum of one (1') foot of freeboard before overtopping of the roadway.

NOTE: A typical section of this facility is included as part of this Study to illustrate design parameters. (Exhibit III-B.)

FACILITY NO. 2 & NO. 4 - POWERS BOULEVARD

a) Designed for a 100 year storm event based on upstream development occurring in accordance with the Master Plan and upstream stormwater management in accordance with this Master Plan.
b) Assume the outlet facility is 100% clogged during peak flow operation.
c) With the above circumstances provide a minimum of two (2') feet of freeboard before overtopping of the roadway.

d) Acceptable alternate to the 2' of freeboard with 100% clogging would be to provide a second 36" outlet located vertically four (4') feet below the roadway to the flowline as a "spillway".

NOTE: A typical section of this facility is included as part of this Study to illustrate design parameters. (Exhibit III-C.)

In addition to the above referenced facilities, the two remaining proposed regional facilities may require special consideration. Facility No. 3 is proposed to be created by a roadway embankment. Since the type of roadway, nature of utilities, and immediately adjacent land uses are totally unknown, no minimum design parameters have been established. This will be necessary when more information becomes available. Facility No. 5 is proposed to be located in a non-embankment configuration and will likely be within the State Engineer's jurisdiction when development occurs (Exhibit III-D).

The use of Regional (on-stream) detention, construction of embankments and outlets, provision for access and maintenance, and related safety features such as fencing should all be coordinated with the City Engineer and the City's maintenance division during preliminary design of each facility. Several area jurisdictions have developed detention pond design recommendations including recent Basin Planning Studies prepared for other basins in the Pikes Peak region. These should be consulted during preliminary design and recommendations as they relate to the facilities in this Basin should be considered and implemented where appropriate.

The second type of Basin detention being proposed is one of "onsite" (off-stream) detention. This concept has for a number of years been required on many areas of development along the Front Range and is somewhat unique in the Colorado Springs area. The concept is proposed to occur on specially selected land uses, those being office, R&D, Commercial, and schools.

The small individual onsite detention ponds are typically undesirable for obvious maintenance, enforcement, and land requirement considerations.

Rooftop detention, although an effective location for detention, has been considered by both the local agencies and architects as undesirable and unacceptable. The most efficient remaining area for onsite detention on the land uses indicated was defined to be parking lots and landscaped areas.

Studies were conducted on typical office park sites and a conclusion was reached that 35% of the flow resulting from development (the difference between historic and developed) could be practically and efficiently detained onsite with little or no disruption to the typical site plan. This detention can be accomplished primarily by restricting onsite flows at private draingae facilities prior to those facilities being connected to the public storm system. Typically, some amount of temporary onsite ponding results in the referenced parking and landscape areas.

This concept of 35% onsite detention has been included in the Pine Creek Basin stormwater management plan for approximately 41% of the studied basin area. This specifically is proposed to be implemented on all office, research/development (R&D) commercial and school land uses. These areas are highlighted on Exhibit IV-A in the Appendix of this report.

The implementation of this concept is proposed to occur in two ways. Since Briargate currently has control of all of the parcels on which this concept is proposed to be used it will become a contractual requirement between Briargate as Seller and the Buyer of the Property. Secondly, as each of the pre-identified land use parcels is platted an individual subdivision Drainage Report/Plan will be prepared, reviewed, and the detailed implementation technique approved.

The 35% onsite detention concept requires a dual outlet, one for the minor and one for the major storm event. An underground storm system or open channel has been master planned for a public outfall for each of the parcels where detention is proposed. In the case of the Business Campus, the approximately 360 acre office park outfalls into an underground system(s). These underground systems(s) have been sized to accommodate

65% of the difference between the developed and historic Q_{100} flow plus historic. Suitable public drainage easements will be required for all underground facilities and overflow conditions. A total conveyance system consisting of underground or open channel, overland routing in swales or streets, and suitable rights of way of public drainage easements will be necessary from each of the parcels on which detention is proposed to a publicly maintained outfall system (channel or detention facility). This total conveyance system is required to be sized to adequately convey 100% of the developed Q_{100} flow in a public drainage easement or right of way. A schematic is included at the end of this section (Figure IV) to illustrate the 35% detention conveyance.

The Basin hydraulics for this Drainage Basin Planning Study have been defined for minor storm flows of less than 500 CFS in the 100 year event on a Subbasin basis. Individual susbbasins, roadway systems, or land use areas have been considered to the extent existing information allowed. Each subbasin, averaging about 120 acres in size, has some defined roadway network and land usage(s) for which storm sewer systems have been identified. These storm sewer systems identified on a Subbasin level have been shown on the Drainage Basin Map, Exhibit IV-D. The next level of basin study as included in the Master Development Drainage Plan will require analysis of each roadway network in accordance with the criteria being applied at time of that study.

In the case of defined road networks, storm sewer systems have been shown in the road alignments with inlet systems at intersections, obvious sumps, where street capacities would appear to be exceeded, and at obvious outfall points to specific residential land use areas. The specific residential land use areas - typically as bounded by street systems - have been considered as needing some type of public storm system of an unknown extent, size or alignment. These networks have been defined and shown based on no development information, but from review of some typical subdivisions in the adjacent developed areas. It should be emphasized that the storm sewer systems shown are subject to much further refinement as to size, location, subbasin boundaries. In most cases this refinement

needs to begin to occur at the time of the area mini master plans prior to when the individual subdivision studies occur.

Subbasin storm systems have not been shown in the non-residential land use areas. These include the office, R & D, commercial, and school/park land uses all of which will require partial onsite detention and all of which will require some type of onsite systems. These onsite systems are presumed to be privately constructed and maintained.

The outfall storm sewer system for Subbasins 23 and 24 and a portion of 25 parallels and existing major utility corridor containing a 60" water transmission system and a High Pressure gas main. The 100 year flow leaving Subbasin 23 is in excess of 300 CFS and at the downstream end of Subbasins 24/25 is in excess of 400 CFS. This area is within the Briargate Business Campus and accommodation of overland flow of this magnitude would be extremely difficult. It has been recommended in this study that an upsized outfall system and overflow easement be installed. The major design challenge anticipated will be developing inlets of adequate size and frequency to divert flows to the proposed underground system. Additional study will be required, however for purposes of this study an upsized pipe and inlets exceeding minimum City Criteria has been identified and included in the cost estimate.

The subbasin boundaries and proposed storm systems have been defined primarily by topography and proposed roadway alignments. These boundaries and roads are subject to change as more detailed development concepts become available. It should be repeated that these systems are only guidelines and subject to refinement at various stages of the political process.

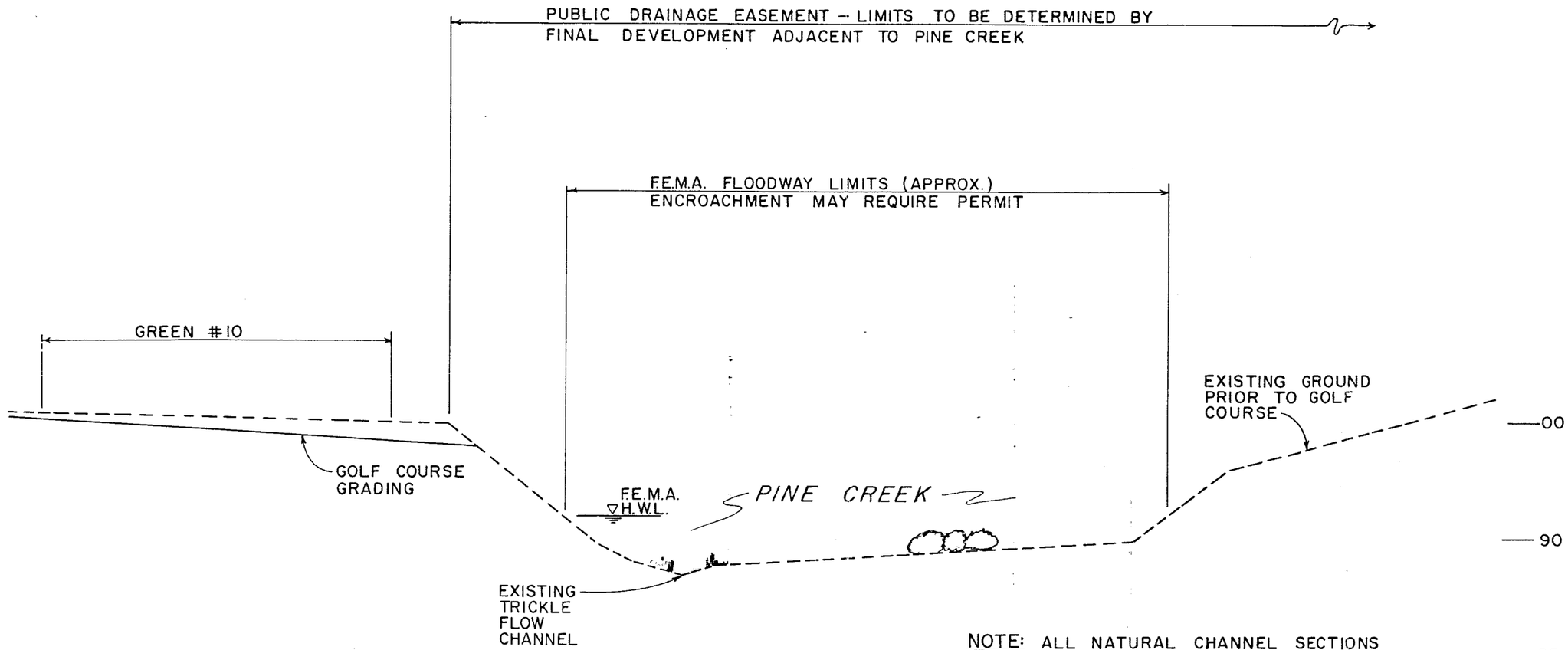
The current subdivision ordinance allows for the establishment of an Arterial Bridge Reimbursement fund. The intent of this fund is to credit developers who construct drainage structures in arterial road rights-of-way for the structure cost in excess of 68' in width. The "Bridge" in the subdivision ordinance can be interpreted to mean bridge, box culvert,

pipe arch etc., any drainage structure which is constructed to carry an arterial roadway over any natural or manmade drainage way. The City Engineer defines a "bridge" as a structure with a clear span greater than or equal to 20 feet, a clear opening greater than one equal to 200 square feet, or a capacity greater than or equal to 1600 CFS. The following facilities have been defined as "Bridge" facilities in this Basin for purposes of compliance with the City Engineer's definition.

1. State Highway 83 Box Culvert.
2. Briargate Parkway Box Culvert.
3. Street No. 14 Box Culvert (Pt. 6)
4. Chapel Hills Drive Clear Span Bridge.

The Academy Boulevard box culvert has been included in the North Cottonwood Creek portion of the cost estimate and partially qualifies for Arterial Bridge reimbursement. This facility has been included in the Cottonwood Creek Arterial Bridge Fund for reimbursement.

The Basin hydraulics have been summarized in tabular form in Exhibit II in the Appendix of this study. The proposed facilities have been shown on the Basin Map (Exhibit IV-D) and Exterior Basin Map (Exhibit IV-C), both found in the Appendix of this report. All facilities are shown with the best information available and are subject to further refinement during the various steps of the urbanization process. The facilities shown are the basis for the cost estimate and Per Acre Drainage Costs for the Basin.



NOTE: ALL NATURAL CHANNEL SECTIONS WILL REQUIRE SUITABLE EASEMENTS AND PRIVATE MAINTENANCE AGREEMENTS.

STABILIZATION OF SLOPES MAY BE REQUIRED TO PREVENT BANK EROSION.

NATURAL CHANNEL TYPICAL SECTION

SCALE: 1" = 20' H
1" = 10' V

NOTE: THIS IS AN ACTUAL SECTION TAKEN NEAR GREEN 10 – LOOKING DOWNSTREAM.

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Consulting Civil Engineers
Registered Land Surveyors
1015 Elkton Drive
Colorado Springs, Colorado 80907

the estimated cost of construction including engineering costs, but the maximum fee shall not exceed $200. When an owner resubmits an application which was previously received and disapproved by the State Engineer, the owner shall submit a new filing fee in accordance with the above. Checks shall be made payable to the Colorado Division of Water Resources.

14.B. Pursuant to Sections 37-87-106 and 111, C.R.S. (1973)(1987 Supp.), the dam owner shall be responsible for payment of invoices from the State Engineer for safety inspections and construction observation. The invoice shall include actual salary, travel, subsistence, and itemized extraordinary expenses at prevailing rates for state officers and employees not to exceed $125 per day per dam or reservoir. The payment is due within 30 days of receipt of the invoice.

Rule 15. Exempt Structures:

15.A. Existing or proposed structures not designed or operated for the purpose of impounding water are exempt from these rules and regulations. Exempt structures include:

15.A.(1) Highways, roadfills, and railroad embankments, (except those designed or modified with the purpose or effect of impounding water for uses other than flood detention); and,

15.A.(2) Diversion dams if less than jurisdictional size, and all diversion dams of any size if Class III.

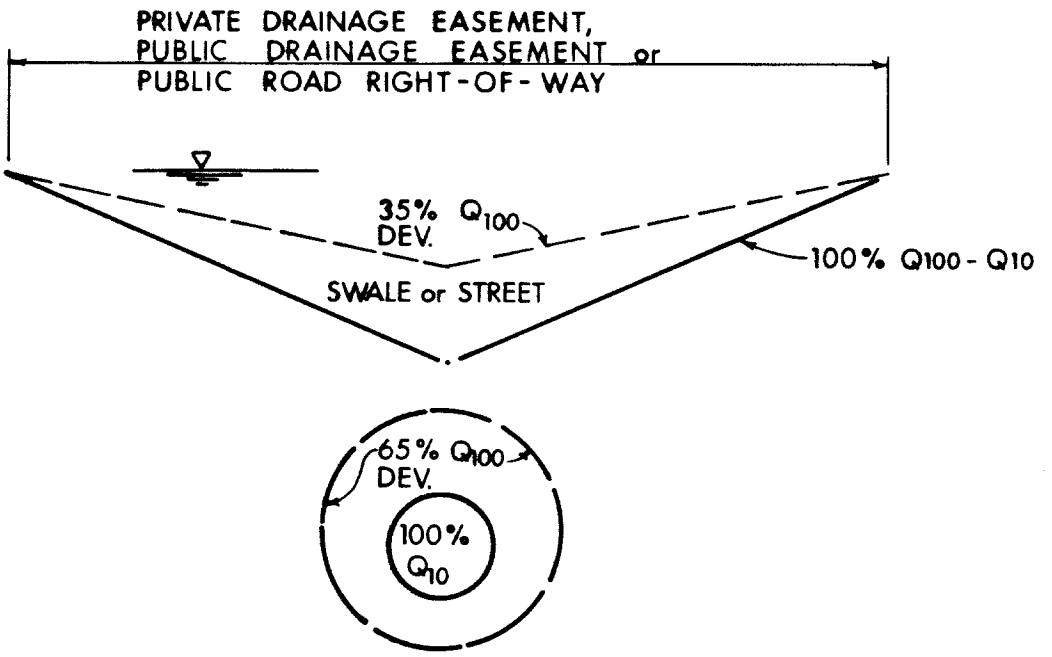
15.A.(3) Refuse embankments; (e.g., solid waste disposal facilities).

15.B. Mill tailing impoundments which are permitted under the Colorado Mined Reclamation Act, Sections 34-32-101 through 125, C.R.S. (1973)(1987 Supp.)(Minerals), or the Colorado Surface Coal Mining Reclamation Act, Sections 34-33-101 through 137, C.R.S. (1973)(1987 Supp.) (Coal) are exempt from these rules and regulations.

15.C. Uranium mill tailing and liquid impoundment dams, permitted under the Colorado Department of Health are exempt from these rules and regulations. Raw and potable water dams, sewage effluent dams, and water treatment sludge dams associated with the uranium mill are not exempt.

15.D. Siltation structures which are permitted under the Colorado Surface Coal Mining Reclamation Act, Sections 34-33-101 through 137, C.R.S. (1973)(1987 Supp.)(Coal), are exempt from these rules and regulations.

35% ON-SITE DETENTION OUTFALL SYSTEM (SCHEMATIC)



THE COMPLETE CONVEYANCE SYSTEM FROM ANY PARCEL TO AN OUTFALL CHANNEL MUST CONSIST OF DRAINAGE IMPROVEMENTS (STORM SEWER OR OPEN CHANNEL) AND AN OVERLAND ROUTE (SWALES OR STREETS) IN A PRIVATE DRAINAGE EASEMENT, PUBLIC RIGHT-OF-WAY OR PUBLIC DRAINAGE EASEMENT.

FIGURE IV

END OF SECTION IV

SECTION V

EXISTING DRAINAGE FACILITIES

V. EXISTING DRAINAGE FACILITIES

The Pine Creek Basin is relatively undeveloped with few existing drainage facilities. The notable exception to this is primarily the roadway crossings and facilities installed as a result of the construction of roads. Several developed subdivisions have resulted in minor drainage systems being installed. The existing facilities have been inventoried for (1) North Cottonwood Creek; (2) Exterior Basin; and (3) Pine Creek Study Area. A brief discussion of facilities within these three (3) areas follows. Facilities have been summarized in the Appendix Exhibit II-F for existing facilities on the major channels.

NORTH COTTONWOOD CREEK MP 0.00 - MP 1.30

The downstream portion of the Basin outfall contains three channel crossings. Beginning at the confluence with Monument Creek and proceeding upstream the first structure encountered is a clear span bridge at the Pine Creek Road (recently renamed Commerce Center Drive). The structure has a 40 foot clear span with 24 feet on each of the two end spans. Piers are built on caissons which are experiencing erosion. The I-25 North and South bound lanes cross the channel with two clear span arch bridges 80 feet in width and approximately 40 feet of clearance. A vertical concrete wall is on the outside of the curve upstream of the bridges. The abandoned AT&SF Railroad right-of-way has a channel crossing with two 25'x21' stone arch bridges. Erosion of the South footer of the South arch and partial footer failure was noted. All of these structures have a capacity far in excess of the projected developed flows from Pine Creek, Chapel Hills Mall, and the North Cottonwood Creek tributary.

The crossing of Academy Boulevard at Pine Creek is the only other major facility in this area and the upper end of this reach. This facility is a 6'x10' box culvert with very poor entrance and exit conditions. Various efforts at determining hydraulic capacity of the structure have been done and the conclusions all seem to agree

the capacity is in the 800-850 CFS range. This capacity generally is consistent with the various sources of historic flow rates, estimated to be 1252 CFS in this study. The exit condition consists of a protective vertical concrete wall adjacent to the Sherton Inn parking lot and large dumped rock riprap boulders and check dams causing a potential backwater condition reducing capacity. The entrance condition is one of wingwalls with grouted rock riprap of no particular cross-section extending upstream some 800 feet. This facility is marginally adequate to accommodate historic and inadequate to accommodate any developed flows. Relocation and enlargement is being proposed as an addendum to the Cottonwood Creek Basin Master Plan.

The only other facility in this area is a recently reconstructed entrance of the Chapel Hills Mall outfall system at the main channel. This facility is adequate to convey flows into the channel and is reasonably well protected from main channel flows. Two aerial sanitary sewer crossings also exist in this segment of the channel.

EXTERIOR BASIN MP 1.30 - MP 2.25

The Exterior Basin area lies totally within the U.S. Air Force Academy between Academy Boulevard and State Highway 83. The lower 800'+/- of channel includes grouted rock riprap protection of an undefined section. This improvement is apparently temporary based on the adjacent drainage report/plan presuming a relocation and reconstruction of the existing box culvert.

Approximately 2050 L.F. of concrete lined channel was constructed adjacent to I-25 during its construction in the late 1950's. This alignment accommodated a realignment of Pine Creek for the highway. The channel section is adequate to accommodate 1560 CFS with no freeboard. The historic flow of 1257 CFS is contained in the existing section with 0.43 feet of freeboard. The estimated developed peak flow of 2440 CFS in this reach of channel will be contained in the

total section, but not completely within the concrete lining. Several small cross-culverts draining the Interstate are located in this area and all appear to be adequate. The recent planning and construction of the Briargate interchange has resulted in a detailed drainage analysis by the design engineer. Several storm systems including inlets and pipes have been proposed and are or will be installed. These facilities have little or no impact on the main channel system.

The Kettle Creek detention pond, located just upstream of the Briargate interchange is a major storm water detention facility constructed to detain Kettle Creek storm runoff. A thorough analysis of this facility by the interchange design consultant resulted in the conclusion that this facility will function properly resulting in no impact on the interchange and no impact on the Pine Creek Drainage Basin. The dam forms the Basin boundary in this area.

BASIN STUDY AREA MP 2.25 - UPSTREAM

The crossing of Pine Creek by State Highway 83 has an existing 6'x8' box culvert. Condition is relatively poor with silt and vegetation. Wingwalls provide a reasonable entrance and exit condition. The approximate capacity of this facility is 1,150 CFS with ponding to the top of the roadway (no overtopping). This facility is planned to remain and be utilized as a "secondary" drainage crossing of the Highway accommodating flows from Subbasins 23 and 24 and possibly a small portion of 25, with a new box culvert being proposed for the major flow from the Detention Facility No. 1 outlet. The Facility's capacity is marginal to accommodate historic flows.

The Basin study area contains several small platted areas that were for the most part developed under County jurisdiction. The exception is the Tall Trees Subdivision, a multi family City development, the Briargate Golf Course Subdivision No. 1, a plat of a maintenance facility building, Briargate Business Campus Filing No. 3, in the

office park, and portions of Briargate Business Campus Filings No. 1 and No. 2 and Briargate Subdivisions No. 21, 27 and 37 and Gatehouse Village at Briargate Filing Nos. 5 and 6.

An inventory of facilities within the two platted County subdivisions was completed in this study. The two referenced areas are Springcrest and Kittyhawk. Their facilities typically include driveway culverts in borrow ditches constructed to County standards. No noticible drainage problems were identified during a field inspection although some of the facilities may be inadequate. Since the areas were previously platted and for the most part developed, no drainage fees are anticipated. The platted sites are located at or very near the top of the basin boundary with no developed flows from planned urbanization going through the sites. No additional development which would increase flows is anticipated. Any upgrading of drainage systems would need to occur as part of the replat process which would require amending this Master Drainage Basin Planning Study.

The referenced Tall Trees Subdivision contains a small storm system. The Briargate Golf Course Subdivision No. 1 does not contain any proposed drainage facilities. The Briargate Business Campus Filing No. 3 development has a storm system proposed, but the facility will not be constructed until just prior to the building being occupied in 1988. The Briargate Business Campus Filings No. 1 and 2 contain small storm systems in Research Parkway. These facilities are all assumed to be existing for purposes of this study.

The existing major drainage facilities have been tabulated in the Appendix and are also shown on the Exterior Basin Map and the Basin Map. Minor storm systems have not been included in the tabulation. Facilities all appear to be adequate and consistent with the proposed stormwater management plan for the Basin with the exceptions noted - most prominantly the two State Highway box culverts. All facilities are subject to routine maintenance for functional ability and should be inspected periodically by agencies with maintenance responsibility.

END OF SECTION V

SECTION VI

NORTH COTTONWOOD CREEK BASIN

VI. NORTH COTTONWOO CREEK BASIN

The Pine Creek Basin has been defined in this study as extending downstream to the upstream (Northeast) side of the Academy Boulevard crossing for purposes of documentation and drainage facility recommendations. The main channel downstream to the otufall at Monument Creek on some maps has been referred to as Pine Creek, however for purposes of this study it has been referred to as "North Cottonwood Creek" and included for information only. The reason for this designation is that the area was included in the referenced 1979 Cottonwood Creek Drainage Basin, August 1979. Facilities were recommended based on a 6 hour, 100 year storm, cost estimates prepared, and a Basin Unit Fee for the Cottonwood Creek Basin determined with these facilities included. Since the channel is essentially a continuation of the Pine Creek channel as defined in this study, the previous study information has been reviewed, researched, refined, summarized herein. Reference is also made to these facilities in the implementation section of this study. The U.S. Air Force Academy, in their review of the Pine Creek Drainage Basin Planning Study, has referenced the necessary improvements in the North Cottonwood Creek Basin.

The North Cottonwood Creek Basin contributory to the main channel between Academy Boulevard and Monument Creek consists of approximately 2800 acres. There are two (2) major concentrated drainage outfalls entering from this area in addition to the Pine Creek flow. The following is a summary of the three (3) major inflows from the 1979 Cottonwood Creek Drainage Basin Report.

CONTRIBUTION	Q_{100} CFS (LDTL)	% TOTAL**
Pine Creek	2573*	34.7%
Chapel Hills Mall Channel	3768	50.9%
North Cottonwood Creek	1067	14.4%
Monument Creek Outfall	5997	100%

*This flow compares to 2559 CFS as an outfall based on the Pine Creek stormwater management plan proposed in this study.

**The percentage given is that portion of the total flow added lineally from the three contributing points (7408 CFS and not the routed flow of 5966 CFS), but the relative impact should be similar.

The purpose of including this data is to emphasize that the facility downstream of the North Cottonwood Creek contribution is impacted by only 34% (or less in the case of total implementation of the recommendations of this study) of the total flows reaching Monument Creek. No attempt has been made to confirm these flows as part of this study but they should be confirmed as a part of a Cottonwood Creek Basin restudy.

The 1979 study included recommendations for main channel improvements in the North Cottonwood Creek Basin. These can be briefly summarized as following from the downstream point upstream.

Monument Creeek to I-25 Bridge - No improvements.

I-25 Bridge to North Cottonwood Creek Confluence - Riprap sides, natural bottom.

North Cottonwood Creek Confluence to Academy Boulevard - Riprap sides, natural bottom.

Academy Boulevard Crossing - Add 6'x12'x80 L.F.

A more detailed summary of the 1979 study including costs has been included at the end of this section as Figure V. It should be noted that no costs were included in the 1979 study for that portion of the channel between the I-25 bridge and the North Cottonwood Creek confluence. No explanation was found for this omission, but it would appear to simply have been an oversight and it is assumed the contingency would cover this cost.

The Academy Boulevard box culvert upgrade and costs, were included in the North Cottonwood Creek 1979 study. Improvements consisted of addition of a second barrel of approximately the same size adjacent to the existing facility. A present dollar amount for this facility as well as the other Cottonwood Creek North improvements has been computed

based on the anticipated costs in the North Cottonwood Creek Study. This conversion from 1979 dollars has also been summarized in Figure V. The North Cottonwood Creek's contribution to the new Academy Boulevard facility is a dollar amount of $78,970 (1987 dollars).

Although this study has not included detailed analysis of the hydrology in the North Cottonwood Creek Basin, a field inspection was made to evaluate hydraulic recommendations that were included in the Study. This field inspection has resulted in a refined list of improvements in the channel area. Some rock riprap requirements were quantified together with work around existing structure foundations to prevent further degredation. Generally, the channel was found to be quite stable except on the outside of some curves. Recommendations for protection of banks in some private property areas were also made. The recommended improvements have been summarized in the Facility Inventory in Exhibit II-F and shown on the Exterior Basin Map, Exhibit IV-C of the Appendix. The refined cost estimate of $332,500 compares to an estimate of $326,775 calculated by coverting the 1979 study dollars to current costs.

In summary, the North Cottonwood Creek portion of the Exterior Basin of the Pine Creek Master Plan study has been previously studied and included for funding. This study appears to be valid from the standpoint of previously anticipated contributory flows from the Pine Creek area upstream. The Cottonwood Creek Basin Bridge Fee has been revised to include full cost of the Academy Boulevard Box Culvert. The implementation of the recommendations for channel improvements and particularly the Academy Boulevard box culvert need to be considered and budgeted for starting at the time of approval of this study. Improvements need to be in place and functional at the time discharges from the Pine Creek Basin exceed historic. This should occur with some funding from the Cottonwood Creek Basin and coordinated time wise with this Study. The details of this are discussed more in the Implementation Section of this report section (VIII).

It should be re-emphasized that no attempt has been made to evaluate the accuracy of the hydrology or hydraulics of the 1979 study except as noted herein. There has been an attempt to restudy the Cottonwood Creek Basin in the recent years with no approved restudy as of this date. In addition to the concerns of the Air Force Academy, there is a community need for this restudy to occur in the near future. This restudy should more specifically define the improvements required in the subject reach of Pine Creek in conjunction with the contributary flows from North Cottonwood Creek. The Cottonwood Creek fees could then be adjusted based on any additional improvements.

COTTONWOOD CREEK DRAINAGE BASIN
MASTER PLAN STUDY

by: Lincoln DeVore
Date: August 7, 1979

SUMMARY OF PINE CREEK RELATED FACILITIES

I. Box culvert at the Academy Boulevard crossing of Pine Creek
   EXISTING: 6'x10' RCBC, 80 LF
   REQUIRED: Additional 6'x12' RCBC
   Q_{100} = 2570 CFS (anticipated developed flow from Pine Creek)
   Cost = $46,400

   Information appears in the text, on the drainage plan, and sheet 1 of 2, Appendix List E - Major Culvert Inventory

II. Pine Creek Channel from Academy Boulevard to the junction with North Cottonwood Creek (Lincoln DeVore Pt. 18)
   EXISTING: Natural (unimproved) channel
   PROPOSED: Riprap sides, natural bottom channel
   B=16' d=5' ROW=50' L=3200'
   Q_{100} = 2573 CFS (anticipated developed flow from Pine Creek)
   Cost = $192,000

   Information appears in the text, on the drainage plan, and Sheet 4 of 4, Appendix List C - Ditch & Stream Inventory.

III. Pine Creek Channel from the North Cottonwood Creek Junction to the Interstate 25 Crossing.
   EXISTING: Natural (unimproved) channel
   PROPOSED: Riprap Sides, Natural bottom channel
   B=20' d=5' L=1440'
   Cost = None could be found - apparently inadvertently omitted.

   Information appears in the text and on the drainage plan.

IV. Pine Creek Channel from I-25 Crossing to Confluence with Monument Creek.

   No existing channel conditions or proposed improvements were found in the study.

TABULATION

Converting 1979 Costs for Improvements to 1986 Costs Based on Drainage Fee Increases to the Cottonwood Creek Drainage Basin

YEAR FROM	YEAR TO	DRAINAGE FEE INCREASE	ACADEMY BOULEVARD RCBC	PINE CREEK CHANNEL
--	1979	--	$46,400	$192,000
1979	1980	0%	$46,400	$192,000
1980	1981	12%	$51,968	$215,040
1981	1982	11%*	$57,684	$238,694
1982	1983	8%	$62,299	$257,790
1983	1984	9.5%	$68,218	$282,280
1984	1985	5%	$71,628	$296,394
1985	1986	5%	$75,210	$311,214
1986	1987	5%	$78,970	$326,775

* Basin Fee increase was 44%, however the standard fee increase that year was 11% which is what this table reflects.

In summary, the Cottonwood Creek Drainage Basin has included in its fee determination an equilavent $78,970.00 for the Academy Boulevard RCBC and $326,775.00 for improvements to the Pine Creek Channel below the box. Based on the Pine Creek Study, the estimated cost will be $332,500 for channel improvements and $495,000 for the Academy Box.

FIGURE IV
Sheet 2 of 2

END OF SECTION VI

SECTION VII

FEDERAL REGULATORY COMPLIANCE

VII. FEDERAL REGULATORY COMPLIANCE

The implementation of the Basin stormwater management plan for the Pine Creek Drainage Basin will require the compliance with all the Local, State, and Federal rules and regulations. Local and State compliance has been included as part of the formulation of the Plan and will continue to be important as the recommendations are implemented. Federal regulations require specific consideration both at the planning level and at the implementation level. The primary known Federal programs having jurisdictional impacts on the implementation of this Plan are the Federal Emergency Management Agency's (FEMA) administered Flood Insurance Study and the U.S. Army Corps of Engineer's (Corps) administered Section 404 Program of the Clean Water Act. These two Federal programs are discussed further in this section as they may impact this Study.

FLOOD INSURANCE STUDY - FEMA

The City of Colorado Springs is currently participating in the FEMA Flood Insurance Program. The regulatory maps dated December 18, 1986 have been adopted and are being used as guidelines when determining development relative to the designated floodplains. Briefly, the floodplain consists of a floodway and a floodfringe area. Development can occur within the floodfringe area by permit and if the development is elevated above the base flood elevation. No development can occur in the floodway that will result in an increase in the base flood elevation.

The implementation of the stormwater management plan in this Study will result in significant changes to the floodplain limits when facilities are constructed and operational. FEMA has a process allowing for the changes to the maps, that being one of issuance of a Letter of Map Revision (LOMR). The process can be subdivided into a Conditional LOMR which can be requested at the time final design plans are complete, giving a favorable

opinion that if the design is implemented the maps would be revised and the LOMR which directs the revision to occur and can be issued upon at least 50% of the completion of the improvements.

The Basin will require, for purposes of constructing permanent development improvements, a LOMR in four general locations:

1. State Highway 83 upstream through Detention Facility No. 1 where an underground conduit and Detention are proposed.

2. Existing confluence of North and South Forks upstream to new confluence where concrete lined channel is proposed.

3. South Fork Pine Creek from new confluence upstream to the end of mapping where channel realignment and concrete channelization is proposed.

4. North Fork Pine Creek at Detention Facility No. 2 where Detention and channelization are proposed.

Floodplain Development Permits are required for any activity within the designated Floodplain and are processed and granted locally by the Regional Floodplain Administrator. Map Revisions are made through the Central Washington office of FEMA. Since final design plans are required prior to issuance of a Conditional LOMR and the implementation of the basin plan may take 20-30 years, it would appear a Step by Step process for request for Revision, although not very efficient, may be the most reasonable sequencing. It would appear that this would, in fact, be the most reasonable process for the Map Revision compliance.

The Exterior Basin area of this Study - downstream of State Highway 83 - contains a FEMA designated floodplain at and below Academy Boulevard that includes a substantial amount of developed property. No attempt has been made in this Study to determine the accuracy of that mapping, however, it is suggested that a LOMR in this area may be appropriate given the current existing conditions and is certainly appropriate upon completion of the proposed box culvert relocation and upsizing project.

The compliance with the FEMA Flood Insurance Study is an important and essential one. It is believed that with the local Floodplain Development Permit process and the Regional/Federal LOMR process, the stormwater management plan included in this Study and the FEMA compliance can be successfully achieved.

SECTION 404 (CORPS OF ENGINEERS)

The Federal Clean Water Act as amended in 1977 included a provision requiring a Permit under Section 404 for the alteration of navigable waters (or tributaries thereto) or wetlands adjacent to these waters or their tributaries. The implementation of the stormwater management plan for this Basin would appear to fall under the requirements of this Federal regulation, administered locally by the Resource Management Section, Albuquerque District, U.S. Army Corps of Engineers. Generally, activities proposed that would require a 404 Permit include: site development fills as part of residential, commercial, or recreational construction; roadfills in waters or wetlands; dams; and protection devices such as channelization, riprap or bank stabilization.

Permitting for encroachment into waterways would appear to be a necessity for the implementation of this plan. There are currently three levels of permit available: Individual, Regional, and Nationwide. A strong local effort to obtain a Regional Permit is currently being conducted and if successful would cover the majority of the requirements for this

basin. Individual permits are otherwise required for work within the waterways. The Nationwide Permit covers minor encroachments such as work near headwaters, repair or rehabilitation, utility crossings, and minor fill or bank stabilization.

The encroachment into designated wetlands by the recommendations of this Study has been minimized as much as possible at this level of planning. Several wetland areas have been identified. They consist primarily of seepage areas in or very near the streambed in the area of the proposed golf course and two existing water impoundments just below State Highway 83 on the U.S. Air Force Academy property.

The former areas mentioned have attempted to be preserved and not encroached upon by the planning of the golf course as a primary land use. Crossings by roads and been limited (one planned as a clear span bridge) and channel improvements are very minimal. Mitigation costs are included as a per acre amount for up to 10 acres. The exact area requiring mitigation is indeterminate at this time.

The latter as mentioned above - the pond features - are recognized as an important asset to the land Owner (U.S. Air Force Academy). They are currently located on the main stream of Pine Creek and are subject to the base stream flow as the primary source for fresh water and plant and aquatic nutrients. They are also subject to the periodic flooding and siltation which occurs naturally. Implementation of the Plan developed in this study would result in an increased peak discharge outfalling from an underground conduit under State Highway 83 immediately upstream. This may result in detrimental affects on the ponds. Since the U.S. Air Force Academy has and will continue to have review and approval of any activity on their property and will need to grant easements for any improvements, they will have several review and comment opportunities prior to actual implementation. During this process it is recommended

that various alternates be investigated for the preservation of these wetland areas including but not limited to rerouting of the channel, extension of the conduit, relocation of the ponds etc.

The 404 Permit process is one that requires first of all recognition as a necessary one for this Plan and secondly compliance on a case by case basis. Resolution of the Regional Permit concept will assist greatly in the waterway encroachment. Wetlands will necessitate a closer consideration than is within the scope of this Study. It is believed that the extended review and approval process, particularly with the U.S. Air Force Academy, will result in a satisfactory implementation plan throughout the Basin study area.

It should be noted that portions of the North Cottonwood Creek section of the Pine Creek outfall may be subject to the above referenced Federal Regulations. Implementation of the improvements recommended in the Cottonwood Creek Master Plan (1979) will require similar consideration as that within the Pine Creek Study area. The revisions to the original recommendations that have been included in this report have taken the existence of considerable wetlands into consideration.

In summary, the Federal regulations discussed are recognized as impacting the recommendations of this Study. Compliance is required and is suggested to be considered at each degree of the planning, engineering, and construction process. Costs associated with compliance have been included only for wetlands mitigation as noted. As more information and a higher level of planning evolves, it may be appropriate to quantify additional compliance in terms of dollars and amend the Per Acre Drainage Costs appropriately.

END OF SECTION VII