HYDROLOGY M16/D13 2 PLANS

M16/D13

2 Plans

M16/013

RECEIVED
MAR 06 1986
HYDROLOGY SECTION

D.R.B. Case No. 86-122
D.R.C. Project No. _____
Date Submitted 02-25-86

EXHIBIT "D"
to Subdivision Improvements Agreement

DEVELOPMENT REVIEW BOARD (D.R.B.)
REQUIRED INFRASTRUCTURE LISTING
for Tracts A-1-A and A-1-B; Airport Park

Following is a summary of Public/Private Infrastructure required to be constructed or financially guaranteed to be constructed for the above development.

Size	*Type Improvement	Location	From	To
NA	Std. Curb & Gutter*	Columbia Drive S.E.	Alamo Ave.S.E.	End of Columbia
20'	Permanent Collector St. Pavement	*Columbia Drive S.E.	Alamo Ave.S.E.	End of Columbia
4'	Temporary Paving**	Columbia Drive S.E.	Alamo Ave.S.E.	End of Columbia
4'	Concrete Sidewalk*	Columbia Drive S.E.	Alamo Ave.S.E.	End of Columbia
4'	Concrete Sidewalk***	*Alamo Ave. S.E.	NW Corner Tract A-1-B	West Edge Columbia Dr. S.E.
8"	Sanitary Sewer Line with Manholes	Columbia Drive. S.E.	Alamo Ave.S.E.	South End of Columbia Dr. S.E.

* West side of street only.

** Temporary paving necessary to produce a total 24' of paving.

*** South side of street only.

Prepared by Jeffrey G. Mortensen
Print Name Jeffrey G. Mortensen, P.E.
Firm Tom Mann & Associates, Inc.

Page 1 of 1

Development Review Board Member Approvals

Traffic — Date 3-4-86
WUD — Date 3/4/86
Parks & Rec. — Date 3-4-86
City Engineer/AMAFCA — Date 3/4/86
DRB Chairman — Date 3-4-86

Rev. 10/85
ID3901D

5-77

50821

10/6/85
41052
M16/DB

RECEIVED
OCT 08 1985
HYDROLOGY SECTION

AIRPORT BUSINESS PARK
RUNDOWN CALCULATIONS

WEIR CONTROL ON CHANNEL ENTRANCE

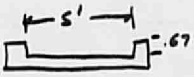
FLOW RATE 7.7 CFS

WIDTH 5' MAXIMUM DEPTH ALLOWED .67'

ACTUAL DEPTH .61'

DUE TO THE ROUNDED ENTRANCE ON THE CHANNEL AND 2% SLOPE THIS DEPTH WILL NOT BE OBTAINED.

DEPTH DUE TO SLOPE ON ENTRANCE & EXIT



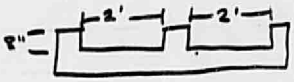
S= .0200 n= .015 d= .276'

V= 5.56 FPS F= 1.86 (SUPERCRITICAL)

CAPACITY OF "V" SECTION

S= .0572 n= .015 d= .425

V= 8.37 FPS F= 2.26

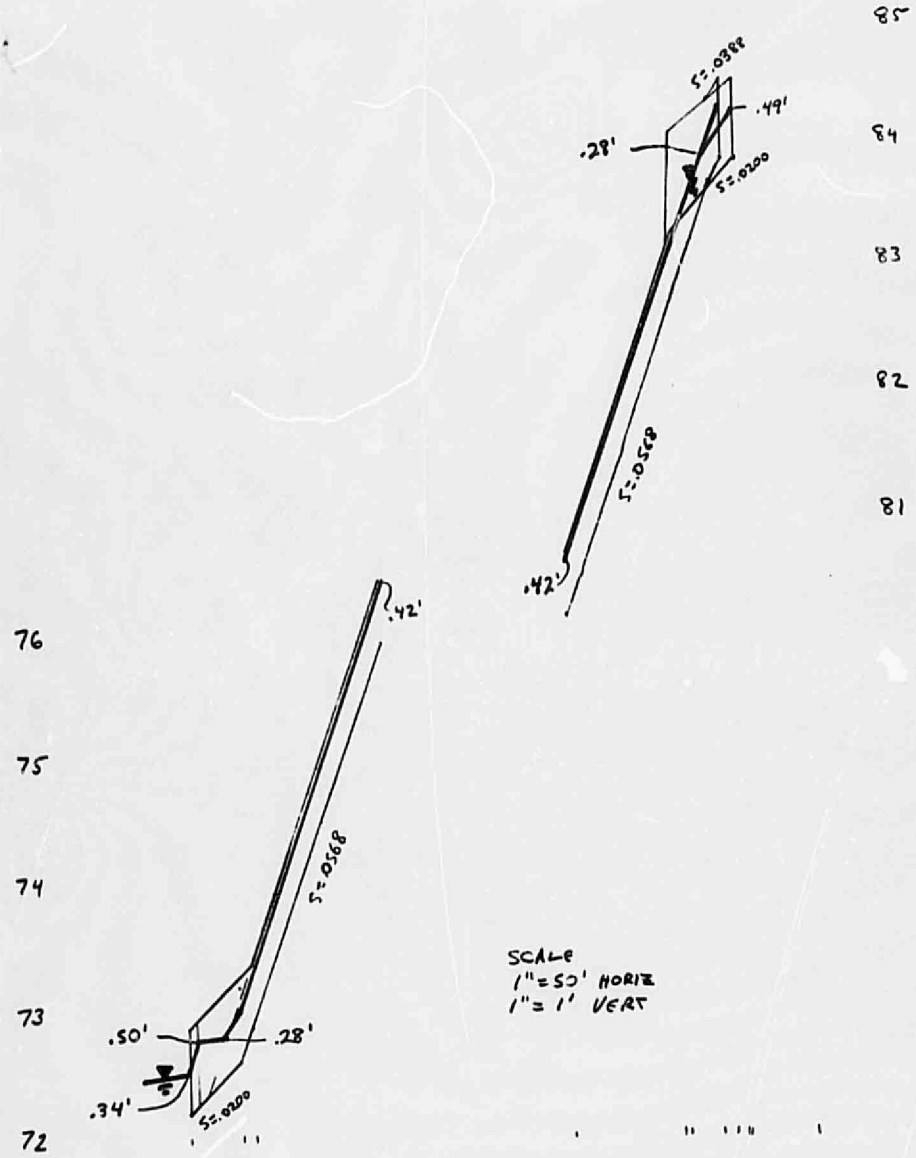


OUTLET CAPACITY (SIDEWALK CULVERT)

S= .0200 n= .015 d= .34

V= 5.63 FPS F= 1.70

BY ORIFICE EQ. THE CULVERTS HAVE A CAPACITY OF 7.46 CFS. THE ORIFICE EQUATION DOES NOT APPLY, HOWEVER, SINCE THE APPROACH VELOCITY TO THE CULVERTS IS 5.56 FPS AND THERE IS A SMOOTH FLOW TRANSITION.



PROJECT NAME AIRPORT BUSINESS PARK SHEET 2 OF 2

PROJECT NO. 41052 BY WW DATE 10/8/85

SUBJECT RUNDOWN HGL CH'D _____ DATE _____

BOHANNAN-HUSTON INC.
4125 CARLISLE BLVD. N.E. ALBUQUERQUE, NEW MEXICO 87107 505 881-2000
UNIVERSITY PLAZA, 330 GARFIELD SUITE 104 SANTA FE, N. M. 87509 505 986-7671
6713 VISCOUNT BLVD. EL PASO, TEXAS 79925 915 778-4491

August 28, 1984

Mr. Billy Goolsby
City/County Flood Plain Administrator
Hydrology Department
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Airport Business Park (M16-D13)

Dear Billy:

In regards to your comments on Airport Business Park, I would like to make these responses.

1. As we stated in the original letter, the drainage report submitted was an addendum to the original approved drainage report. The purpose of this addendum was to update the earlier report to include pond drainage and upstream drainage changes. In the revised report the flows that were shown to discharge from the site were less then those given in the approved report. Therefore, we do not feel that an analysis of downstream capacity is necessary.

2. The crossed out area on Plate 3 represented a phase line. This should not have appeared here and a revised print is included with this submittal.

3. The City is currently reviewing the construction plans for the site. Street grades would be included with this review. The project number for these plans is 2199 and we are anticipating final sign off within the next two weeks.

4. The plat for this subdivision was filed in May, 1983, prior to the requirements for financial guarantees. With this being the case, we do not believe that guarantees should be required.

If you have any questions or comments concerning this letter, please call Dave Woods or me.

Sincerely,

Brian G. Burnett, P.E.
Project Manager

Enclosures

cc: Mr. Jack Westman
Mr. Chuck Lewis

DWW/bl
Job No. 41050

RECEIVED
SEP 04 1984
HYDROLOGY SECTION

PRINCIPALS
JERRY R. BOHANNAN, P.E. & L.S.
LARRY W. HUSTON
MICHAL M. EMERY, P.E.

Enclosed are the calculations and plates which detail the changes mentioned above. It should also be noted that this drainage report addendum is only an interim drainage plan. As with the original report, the owner of each lot will be required to file a final drainage plan when the lot is developed. If you have any questions or comments concerning this letter, please call Kent Alexander or me.

Sincerely yours,

Brian G. Burnett

Brian G. Burnett, P.E.
Project Manager

Enclosures

cc: Mr. Jack Westman

KBA/mws
Job No. 4 105 2

RECEIVED
JUL 26 1984
HYDROLOGY SECTION

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

DESIGN HYDROLOGY SECTION
123 Central NW, Albuquerque, NM 87102
(505) 766-7644

August 16, 1984

Mr. Brian Burnett
Bohannan-Huston, Inc.
4125 Carlisle Boulevard NE
Albuquerque, NM 87107

REF: DRAINAGE REPORT FOR AIRPORT BUSINESS PARK (M16-D13) RECEIVED JULY 26, 1984

Dear Brian:

I apologize for the late response on the submittal, somehow it has been overlooked until now. I hope it has not created a problem for you or your client.

I have reviewed this submittal and only have a few comments.

The runoff from the site has been developed; however, there is no analysis provided to show what the downstream capacity is.

On Plate 3, the area south of Miles Road has been crossed out as not part of this project, Plate 4 picks up with Lots 10 through 19, which I assume is part of the project. My question is, how are these lower lots to be provided access if the section between is not to be built?

No grading approvals will be given until City approved street grades are provided to insure the grading compatability between the on-site and street grades.

Financial assurance will be required for both public and private infrastructure improvements prior to final sign-off.

Should you have any questions or comments, please contact me at 766-7644.

Sincerely yours,

Billy J. Goolsby

Billy J. Goolsby, PE
Civil Engineer/Hydrology

BJG:mrk

BOHANNAN-HUSTON INC.
4125 CARLISLE BLVD., N.E. ALBUQUERQUE, NEW MEXICO 87107 505 881-2000
8713 VISCOUNT BLVD., EL PASO, TEXAS 79925 915 778-4491
330 GARFIELD, SANTA FE, NEW MEXICO 87501 505 988-7671

July 26, 1984

Fred J. Aguirre, Design Hydrologist
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Airport Business Park Drainage (M16-D13)

Dear Fred:

Enclosed is an addendum to the original drainage report for Airport Business Park. Since this report was approved in 1977, there have been some policy changes which need to be addressed:

1. The volumes shown for the temporary ponds had been calculated using outdated information. These have been updated using the DPM criteria (see sheets 2 and 3).

2. The ponds were shown as total retention facilities. They now are required to drain through a 4" pipe (see plates 1 and 2).

3. Since the original report was approved, Girard Blvd. has been realigned. When this was done, the catch basins in this street were removed and the runoff from Girard reaching this point was conveyed to Gibson Blvd.

4. Miles Road was extended through the project at the request of the Traffic Engineer. This allows most of the runoff conveyed north in Air Park Road to be conveyed west to Columbia Drive through Miles Road.

5. The amount of runoff entering the catch basins on Columbia was 42.2 cfs. Our calculations show that the proposed discharge will be 29.8 cfs (see sheet 11).

6. Under the approved report, no runoff will be discharged to Alamo. Since we are now asked to provide controlled discharge from our ponds, this is no longer valid. Airport Business Park's contribution to the flow down Alamo is 2.7 cfs (discharge from ponds 11, 12, 13 and 14).

RECEIVED
JUL 26 1984
HYDROLOGY SECTION

PRINCIPALS
JERRY R. BOHANNAN, P.E. & L.S.
LARRY W. HUSTON
MICHIAL M. EMERY, P.E.

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

DESIGN HYDROLOGY SECTION
123 Central NW, Albuquerque, NM 87102
(505) 766-7644

October 12, 1984

Mr. Brian Burnett
Bohannan-Huston, Inc.
4125 Carlisle Boulevard NE
Albuquerque, New Mexico 87107

RE: DRAINAGE REPORT FOR AIRPORT BUSINESS PARK (M16-D13) RECEIVED SEPTEMBER 4, 1984

Dear Brian:

The above referenced plan dated September 4, 1984 is approved.

Please attach a copy of this approved plan to the construction set prior to Hydrology sign-off.

If I can be of further assistance, please contact me at 766-7644.

Sincerely yours,

Billy J. Goolsby
Civil Engineer/Hydrology

BJG/bm

INFORMATION SHEET

PROJECT TITLE Airport Business Park TYPE OF SUBMITTAL Drainage Report

ZONE ATLAS PAGE NO. M-16 D13 CITY ADDRESS none

LEGAL DESCRIPTION Section 34, Township 10 North, R 3 E NMPM

ENGINEERING FIRM Bohannan - Huston CONTACT Brian Burnett

ADDRESS 4125 Carlisle Boulevard PHONE 881-2000

OWNER Westman Investments CONTACT Jack Westman

ADDRESS 4600 Montgomery NE PHONE 883-5221

ARCHITECT none CONTACT

ADDRESS PHONE

SURVEYOR Bohannan - Huston CONTACT Dwain Weaver

ADDRESS 4125 Carlisle Boulevard PHONE 881-2000

CONTRACTOR none CONTACT

ADDRESS PHONE

PRE-DESIGN MEETING:

___ YES
X NO
___ COPY OF CONFERENCE RECAP SHEET PROVIDED

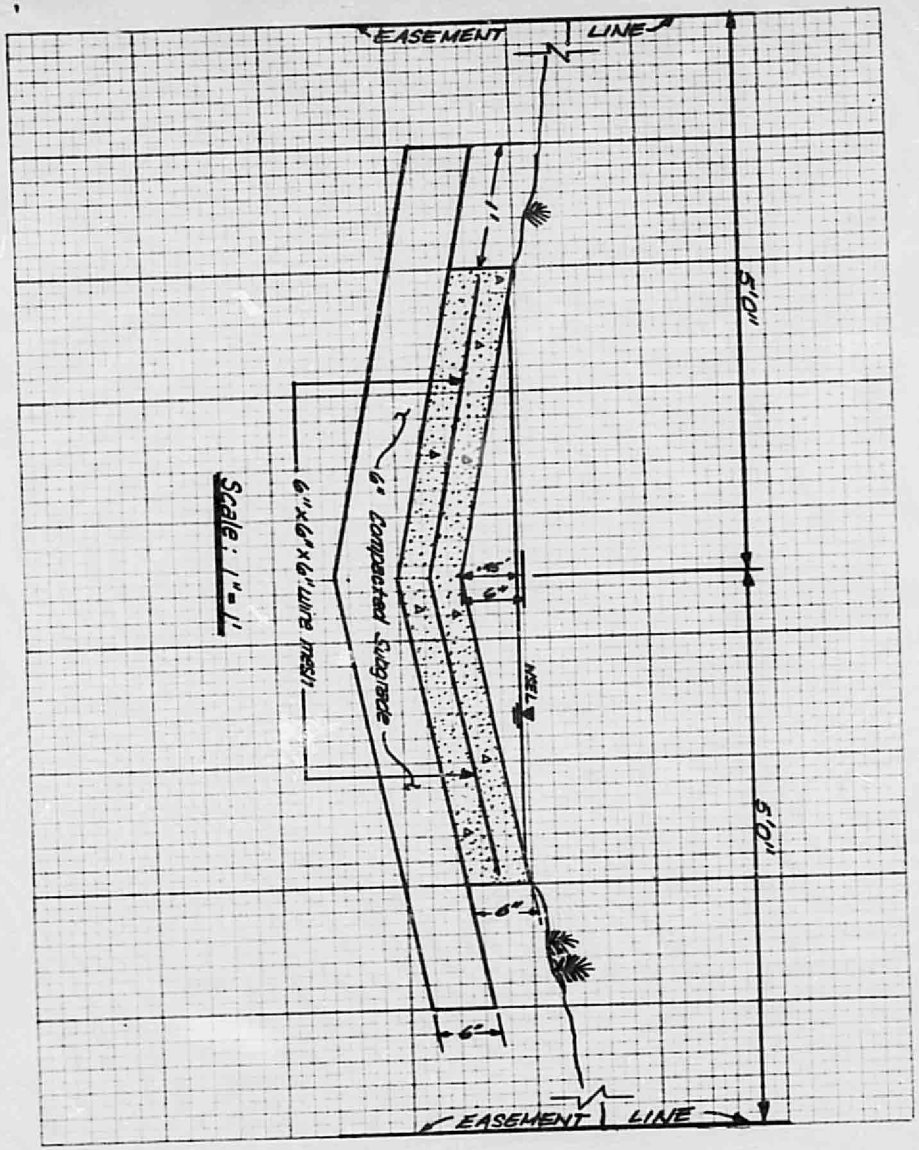
PLEASE CHECK TYPE OF APPROVAL EXPECTED WITH THIS SUBMITTAL:

___ SKETCH PLAT APPROVAL
___ PRELIMINARY PLAT APPROVAL
___ SITE DEVELOPMENT PLAN APPROVAL
___ FINAL PLAT APPROVAL
___ BUILDING PERMIT APPROVAL
___ CERTIFICATE OF OCCUPANCY APPROVAL
X ROUGH GRADING PERMIT APPROVAL
X GRADING/PAVING PERMIT APPROVAL
___ OTHER _____ (SPECIFY)

DATE SUBMITTED: Brian Burnett

BY: 7-26-84

RECEIVED
JUL 26 1984
HYDROLOGY SECTION



PROJECT NAME [illegible] SHEET 1 OF 1

PROJECT NO. 41052 BY SR DATE 1-16-85

SUBJECT Modified Drainage Rundown CH'D DW DATE 1-16-85

CITY OF ALBUQUERQUE
MUNICIPAL DEVELOPMENT DEPARTMENT
ENGINEERING DIVISION

HYDROLOGY SECTION PROJ. NO. _____ DATE: 7/27/87

PLANNING DIVISION NO. _____

CONFERENCE RECAP

SUBJECT: Tract 1+2 Airport Industrial Park M16

	WHO	REPRESENTING
ATTENDANCE:	Jim Immel	Engineering Group
	ESR	City

FINDINGS:

1. Conferred discussion regarding drainage or flooding conditions downstream of the site.

2. Drainage Plan required for the DPM Checklist.

The undersigned agrees that the above findings are summarized accurately and are only subject to change if further investigation reveals that they are not reasonable or that they are based on inaccurate information.

SIGNED: [illegible] SIGNED: [illegible]

TITLE: _____ TITLE: _____

DATE: 7/27/87 DATE: _____

BOHANNAN-HUSTON INC.
4125 CARLISLE BLVD., N.E. ALBUQUERQUE, NEW MEXICO 87107 505 881-2000

December 13, 1977

RECEIVED
DEC 15 1977
CITY ENGINEER

Mr. Bruno Conegliano
Assistant City Engineer-Hydrology
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Modifications to the Drainage Report for Puerto Del Cielo

Dear Mr. Conegliano:

As a result of discussions held with you on December 7, 1977, and December 12, 1977, we hereby submit the following modifications to the Puerto Del Cielo Drainage Report:

1. The internal storm sewer and curb inlets initially proposed to drain to the existing 27" storm sewer will not be constructed. Runoff from the internal streets will drain through the surface drainage easement at the north end of the site onto Columbia Drive.

2. Final drainage solutions for each lot will have to be submitted on an individual basis to the City Hydrologist for approval. It is recommended that each lot provide enough permanent storage to retain the difference between the developed and undeveloped runoff volumes for a 100-year storm. The maximum allowable discharge rate from each lot should be determined by the Equation $Q = C\,(I)(A)$ where:

Q = Peak discharge in cubic feet per second
$C = 0.35$
$I = 1.40$ in/hr
A = Area of the lot in acres

This equation in effect reduces the discharge rate from each lot to undeveloped conditions for a ten year storm with a duration of 40 minutes. The ten year storm was selected since this appears to agree with the design storm used to size the existing storm sewer. The forty minute duration has typically produced the storm with the largest storage volume requirements. Additional temporary storage will be needed to allow this reduction in runoff rate, which may be available in parking areas or on roofs.

The interim drainage solution remains as proposed in the September, 1977 drainage report. Each lot will be provided with a temporary pond capable of retaining all of the runoff from said lot during a 100-year storm.

Cremons Inc

If these modifications are acceptable please sign in the space provided below and return the letter to our office so that the plat may be submitted for signatures.

If you have any questions, please contact me or Mr. Ray Macy of this office.

Sincerely,

Michial M. Emery

Michial M. Emery, P.E.
Chief Design Engineer

Signed by _____

Date _____

cc: Mr. Jack Westman
Mr. Bud Lewis
Mr. V. M. Kimmick

RWM/mna
Job No. 77-147

BOHANNAN-HUSTON INC.
4125 CARLISLE BLVD., N.E. ALBUQUERQUE, NEW MEXICO 87107 505 881-2000

December 13, 1977

Mr. Bruno Conegliano
Assistant City Engineer-Hydrology
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Modifications to the Drainage Report for Puerto Del Cielo

Dear Mr. Conegliano:

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$C = 0.35$
$I = 1.40$ in/hr
A = Area of the lot in acres

This equation in effect reduces the discharge rate from each lot to undeveloped conditions for a ten year storm with a duration of 40 minutes. The ten year storm was selected since this appears to agree with the design storm used to size the existing storm sewer. The forty minute duration has typically produced the storm with the largest storage volume requirements. Additional temporary storage will be needed to allow this reduction in runoff rate, which may be available in parking areas or on roofs.

The interim drainage solution remains as proposed in the September, 1977 drainage report. Each lot will be provided with a temporary pond capable of retaining all of the runoff from said lot during a 100-year storm.

Cremans Inc
Engineers Planners
El Paso Texas

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinhenz

November 22, 1977

Ray Macey
Bohannan & Huston & Assoc.,Inc.
4125 Carlisle Blvd.,NE
Albuquerque, New Mexico

RE: Drainage report for Puerto del Cielo

Dear Ray:

From the drainage report mentioned above as well as from others, a misconception appears to have taken hold, namely the Amafca Resolution concerns itself with a reduction of the peak flow and that the volume reduction is an inconsequential matter. The peak discharge for any small subdivision or parcel of land, may occurr with high intensity short duration storm (say 10 minutes duration, 100 yrs. frequency). If devices such as detention and orifices are used for the purpose of reducing this instantaneous peak discharge to the pre-development value, the same devices would have no restraining effect on the runoff from the longer duration storms (say 1.0 hrs. or greater).

The unfortunate thing is that, from the point of view of the major collector networks, these larger duration storms are precisely those which result in the peak floods or peak discharges. Therefore, in order to minimize the impact that urbanization would have on the hydrologic regimen of the receiving arroyos, it is mandatory that the volume be controlled as well as the peak discharge. Only then, the mandates of the Amafca Resolution and of the Drainage Policy Resolution would be satisfied and more costly remedies than those already necessary, would not be required.

Addressing more directly the questions pertaining to the drainage report for the Puerto del Cielo Subdivision, the storm sewer that crosses the property will be used to remove the runoff from Girard Ave., Gibson Boulevard and Yale Boulevard and cannot be counted on for the relief of the internal drainage of Puerto del Cielo. In the light of the prior discussion I am satisfied with the proposed provision for the interm period of development. Nevertheless upon development, each parcel of land will have to submit its own drainage plan which will have to include storm water retention and infiltration;

this requirement is made in order to avoid further over taxing the existing drainage facilities which, as you indicate, may at best represent a 10 yrs. frequency design.

A revision of the report in letter form will be necessary before approval is granted and a set of recommendations submitted that are consistent with the discussion above.

If you want to discuss the matter further please feel free to contact me.

Very truly yours,

Bruno Conegliano

Bruno Conegliano
Asst. City Engineer-Hydrology

BC/gm

cc; Jim Smith
V.M. Kimmick
Drainage file

BOHANNAN-HUSTON INC.
4125 CARLISLE BLVD., N.E. ALBUQUERQUE, NEW MEXICO 87107 505 881-2000

RECEIVED
SEP 30 ..
CITY ENGINEERS

September 28, 1977

Bruno

Mr. V. M. Kimmick
City Engineer
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Drainage Report for Puerto Del Cielo

Dear Mr. Kimmick:

Enclosed are three copies of the above-referenced project for your review and approval.

If you have any questions concerning this matter, please feel free to call our office.

Sincerely,

Raymond W. Macy

Raymond W. Macy
Design Engineer

Enclosure

cc: Mr. Jack Westman

RWM/mna
Job No. 77-147

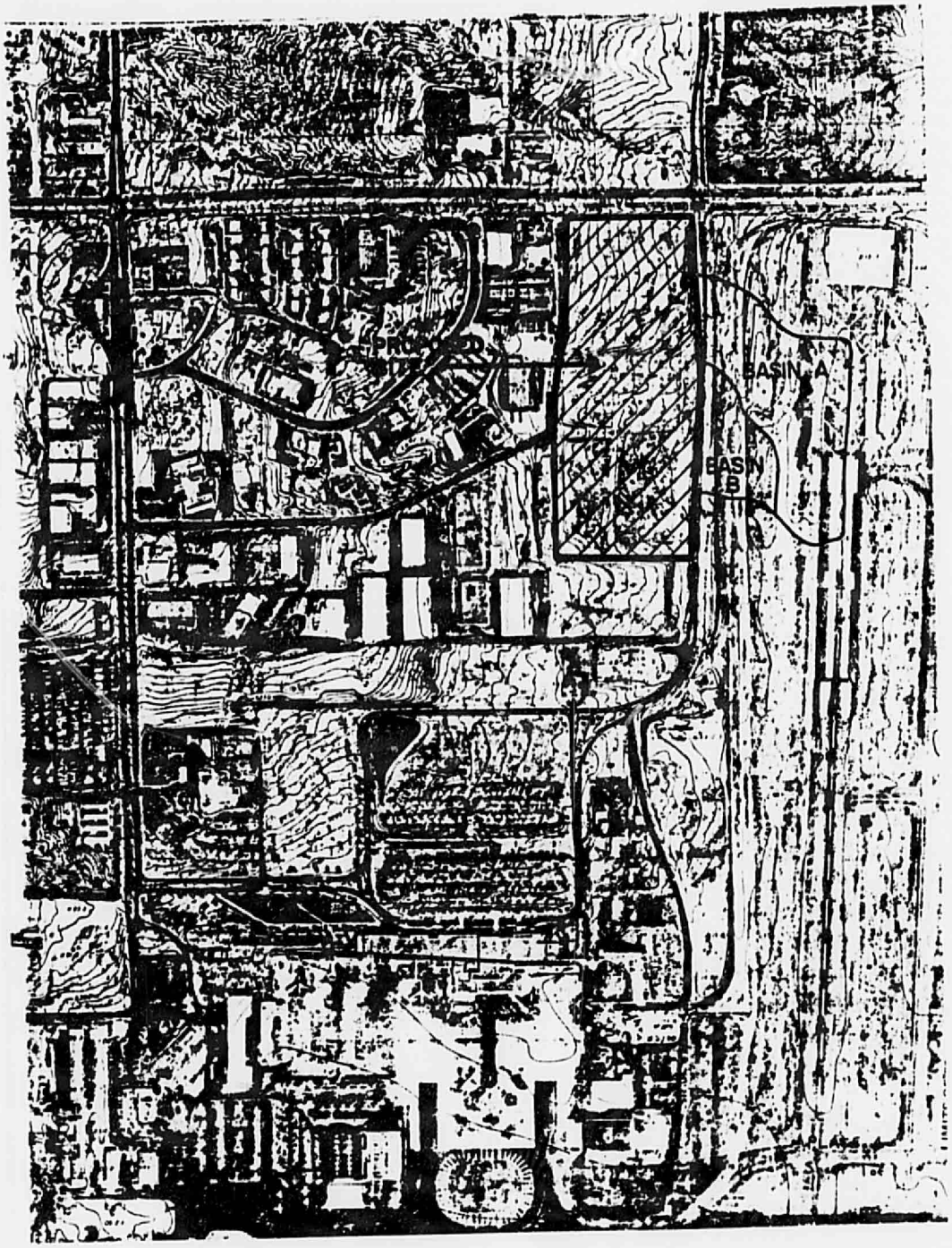
Cremans Inc.

ADDENDUM TO DRAINAGE REPORT
FOR
AIRPORT BUSINESS PARK

July 1984

RECEIVED
JUL 26 1984
HYDROLOGY SECTION

THIS MICROIMAGE IS THE BEST POSSIBLE
REPRODUCTION DUE TO THE POOR QUALITY
OF THE ORIGINAL DOCUMENT



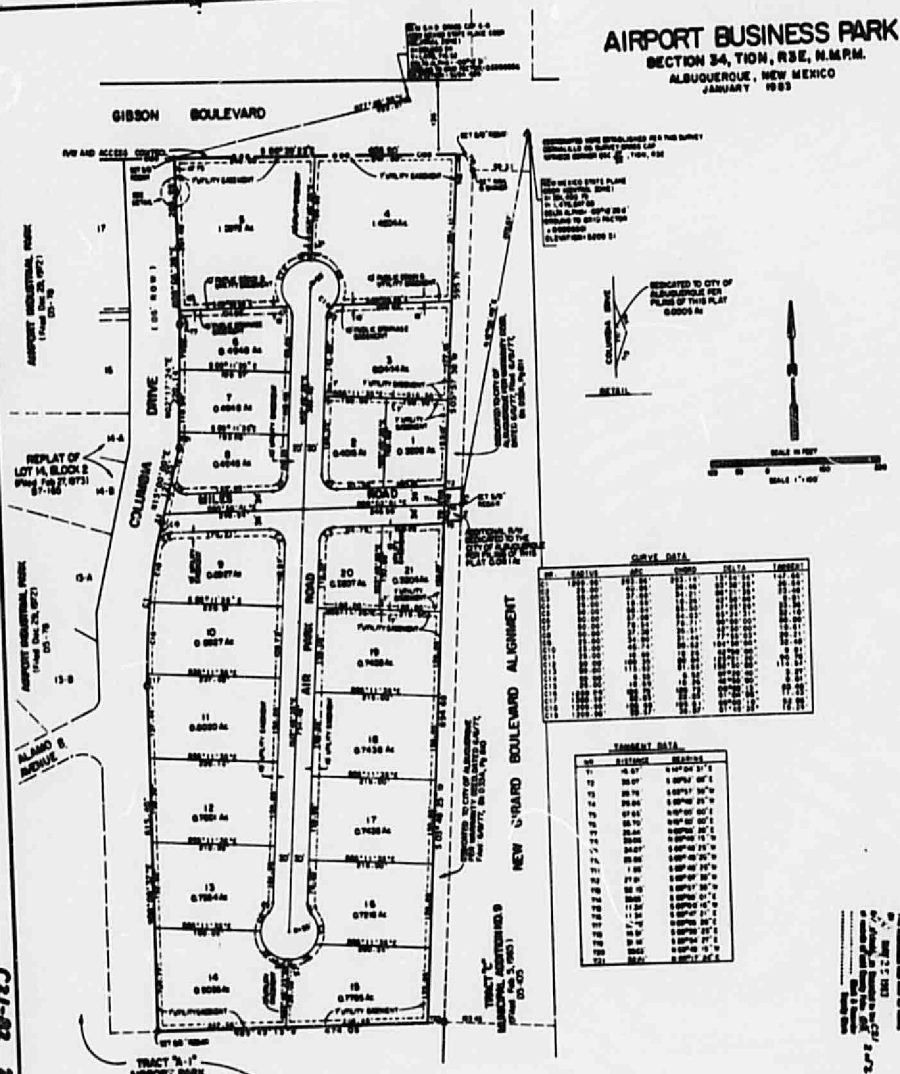
AIRPORT BUSINESS PARK

SECTION 34, T10N, R3E, N.M.P.M.

ALBUQUERQUE, NEW MEXICO

JANUARY 1983

C21-82 2 of 2



C21-82 2 of 2

SHEET 2 OF 2 SHEETS

JOB No 21570

UNDEVELOPED DRAINAGE (OFF-SITE BASINS)

Basin	Area (ac.)	Length (Ft.)	Top Elev. (Ft.)	Bottom Elev. (Ft.)	Slope (Ft./Ft.)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR 6 Hr. Rain Volume (in.)	100 YEAR I/6 Hr. Rain (in./hr.)	100 YEAR Peak Flow Rate Q (cfs)	100 YEAR Runoff Volume (ac. Ft.)	10 YEAR 6 Hr. Rain Volume (in.)	10 YEAR I/6 Hr. Rain (in./hr.)	10 YEAR Peak Flow Rate Q (cfs)	10 YEAR Runoff Volume (ac. Ft.)
A	10.51	1353	316	298	.0133	10.6	B	24	.45	2.83	4.82	22.80	.93	1.54	3.17	14.98	.61
B	3.71	800	318	304	.0175	6.37	B	19	.43	2.35	4.97	7.93	.31	1.54	3.27	5.21	.20
REF.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

References:

1,2,3,4,5 Basin areas, lengths, top and bottom elevations and slopes from Plate 1 & 2.

6. Tc by Kirpich formula $T_c = .0078 \frac{\text{Length}^{0.77}}{\text{Slope}^{0.385}}$ (10 minutes minimum)

7. See Soils Map Plate 31, 41 and Text.

8. By area computation.

9. DPM Plate 22.2 C-1

10, 14 DPM Plate 22.2 D-1

11, 15 DPM Plate 22.2 D-2

12, 16 Rational Formula Q = CIA

13, 17 Rational Formula $V = \frac{\text{Rainfall} \times C \times A}{12}$

PROJECT NAME Airport Business Park SHEET 3 OF 12

PROJECT NO. 41052 BY KRA DATE 5/7/84

SUBJECT CH'D DMW DATE 5/7/84

(V)

UNDEVELOPED DRAINAGE (PONDS)

Basin	Area (ac.)	Length (Ft.)	Top Elev. (Ft.)	Bottom Elev. (Ft.)	Slope (Ft./Ft.)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR 6 Hr. Rain Volume (in.)	100 YEAR I/6 Hr Rain (in./hr.)	100 YEAR Peak Flow Rate Q (cfs)	100 YEAR Runoff Volume (ac.-ft.)	10 YEAR 6 Hr. Rain Volume (in.)	10 YEAR I/6 Hr. Rain (in./hr.)	10 YEAR Peak Flow Rate Q (cfs)	10 YEAR Runoff Volume (ac.-ft.)
1,2,3	2.16	—	—	—	—	10	B	0	.34	2.35	4.97	3.64	.144	1.54	3.27		
4	1.77	—	—	—	—	10	B	0	.34	2.35	4.97	2.99	.118	1.54	3.27		
5	1.32	—	—	—	—	10	B	0	.34	2.35	4.97	2.23	.088	1.54	3.27		
6	.50	—	—	—	—	10	B	0	.34	2.35	4.97	.84	.033	1.54	3.27		
7	.49	—	—	—	—	10	B	0	.34	2.35	4.97	.83	.033	1.54	3.27		
8	.49	—	—	—	—	10	B	0	.34	2.35	4.97	.83	.033	1.54	3.27		
9	.59	—	—	—	—	10	B	0	.34	2.35	4.97	1.00	.039	1.54	3.27		
10	.59	—	—	—	—	10	B	0	.34	2.35	4.97	1.00	.039	1.54	3.27		
11	.64	—	—	—	—	10	B	0	.34	2.35	4.97	1.08	.043	1.54	3.27		
12	.74	—	—	—	—	10	B	0	.34	2.35	4.97	1.25	.049	1.54	3.27		
Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

References:

1,2,3,4,5 Basin areas, lengths, top and bottom elevations and slopes from Plate 1-12.

6. Tc by Kirpich formula $T_c = .0078 \frac{\text{Length}^{0.77}}{\text{Slope}^{0.385}}$ (10 minutes minimum)

7. See Soils Map Plate 31-41 and Text.

8. By area computation.

9. DPM Plate 22.2 C-1

10,14 DPM Plate 22.2 D-1

11,15 DPM Plate 22.2 D-2

12,16 Rational Formula Q = CIA

13,17 Rational Formula $V = \frac{\text{Rainfall} \times C \times A}{12}$

PROJECT NAME Airport Business Park SHEET 4 OF 12

PROJECT NO. 41052 BY KEA DATE 5/7/1984

SUBJECT CH'D DWW DATE 5/7/84

(V)

UNDEVELOPED DRAINAGE (PONDS)

Basin	Area (ac.)	Length (ft.)	Top Elev. (ft.)	Bottom Elev. (ft.)	Slope (ft./ft.)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR: 6 Hr. Rain Volume (in.)	100 YEAR: I/6 Hr Rain (in./hr.)	100 YEAR: Peak Flow Rate Q (cfs)	100 YEAR: Runoff Volume (ac.-ft.)	10 YEAR: 6 Hr. Rain Volume (in.)	10 YEAR: I/6 Hr. Rain (in./hr.)	10 YEAR: Peak Flow Rate Q (cfs)	10 YEAR: Runoff Volume (ac.-ft.)
13	.69	—	—	—	—	10	B	0	.34	2.35	4.97	1.17	.046	1.54	3.27		
14	.81	—	—	—	—	10	B	0	.34	2.35	4.97	1.37	.054	1.54	3.27		
15	1.21	—	—	—	—	10	B	0	.34	2.35	4.97	2.04	.081	1.54	3.27		
16	1.08	—	—	—	—	10	B	0	.34	2.35	4.97	1.82	.072	1.54	3.27		
17	.70	—	—	—	—	10	B	0	.34	2.35	4.97	1.18	.047	1.54	3.27		
18	1.00	—	—	—	—	10	B	0	.34	2.35	4.97	1.69	.067	1.54	3.27		
19	1.15	—	—	—	—	10	B	0	.34	2.35	4.97	1.94	.077	1.54	3.27		
20	.285	—	—	—	—	10	B	0	.34	2.35	4.97	.482	.019	1.54	3.27		
21	.78	—	—	—	—	10	B	0	.34	2.35	4.97	1.32	.052	1.54	3.27		
Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

References:

1,2,3,4,5 Basin areas, lengths, top and bottom elevations and slopes from Plate 12.

6. Tc by Kirpich formula $T_c = .0078 \frac{\text{Length}^{0.77}}{\text{Slope}^{0.385}}$ (10 minutes minimum)

7. See Soils Map Plate 3 & 4 and Text.

8. By area computation.

9. DPM Plate 22.2 C-1

10,14 DPM Plate 22.2 D-1

11,15 DPM Plate 22.2 D-2

12,16 Rational Formula Q = CIA

13,17 Rational Formula $V = \frac{\text{Rainfall} \times C \times A}{12}$

PROJECT NAME Airport Business Park SHEET 5 OF 12

PROJECT NO. 41052 BY KRA DATE 5/7/82

SUBJECT CH'D DWW DATE 5/17/82

DEVELOPED DRAINAGE (SEE PLATES 3 & 4)

Basin	Area (ac.)	Length (ft.)	Top Elev. (ft.)	Bottom Elev. (ft.)	Slope (ft./ft.)	Time of Concentration	Soil Group	% Impervious	Runoff Coefficient, C	100 YEAR 6 Hr. Rain Volume (in.)	100 YEAR I/6 Hr Rain (in./hr.)	100 YEAR Peak Flow Rate Q (cfs)	100 YEAR Runoff Volume (ac.-ft.)	10 YEAR 6 Hr. Rain Volume (in.)	10 YEAR I/6 Hr. Rain (in./hr.)	10 YEAR Peak Flow Rate Q (cfs)	10 YEAR Runoff Volume (ac.-ft.)
C	.87	—	—	—	—	10	B	51	.58	2.35	4.97	2.51	.099	1.54	3.27	1.65	.066
D	.43	—	—	—	—	10	B	90	.86	2.35	4.97	2.05	.081	1.54	3.2	1.35	.063
E	1.08	—	—	—	—	10	B	70	.69	2.35	4.97	3.70	.146	1.54	3.27	2.43	.095
F	1.98	—	—	—	—	10	B	63	.65	2.35	4.97	6.40	.252	1.54	3.27	4.21	.171
G	.39	—	—	—	—	10	B	0	.34	2.35	4.97	.66	.026	1.54	3.27	.43	.017
Ref.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

References:

1,2,3,4,5 Basin areas, lengths, top and bottom elevations and slopes from Plate 1 & 2.

6. T_c by Kirpich formula $T_c = .0078 \frac{\text{Length}^{0.77}}{\text{Slope}^{0.385}}$ (10 minutes minimum)

7. See Soils Map Plate 31.41 and Text.

8. By area computation.

9. DPM Plate 22.2 C-1

10, 14 DPM Plate 22.2 D-1

11, 15 DPM Plate 22.2 D-2

12, 16 Rational Formula $Q = CIA$

13, 17 Rational Formula $V = \frac{\text{Rainfall} \times C \times A}{12}$

PROJECT NAME Airport Business Park SHEET 6 OF 12

PROJECT NO. 41052 BY KRA DATE 5.7.84

SUBJECT CH'D DWW DATE 5/7/84

* Required Pond Volumes

Lot	100 YR 6 HR STORM Volume (ac-ft)	Volume (ft^3)
1, 2, 3	.144	6,273
4	.118	5,140
5	.088	3,833
6	.033	1,437
7	.033	1,437
8	.033	1,437
9	.039	1,699
10	.039	1,699
11	.043	1,873
12	.049	2,134
13	.046	2,004
14	.054	2,352
15	.081	3,528
16	.072	3,136
17	.047	2,047
18	.067	2,919
19	.077	3,354
20	.019	828
21	.052	2,265

* Volumes calculated are for the interim drainage solution and do not involve developed conditions.

Flows From Discharge Pipes in Ponds

Orifice Equation

$$Q = CA\sqrt{2gh}$$

$C = .6$

$A = .087$ ft (diameter of pipe 4")

$g = 32.2$ ft/sec^2

$h =$ head on pipe (pond depth − .17')

$$Q = .419\sqrt{h}$$

pond	h (ft)	Q ft³/sec	
15	1.1	.435	3.2 cfs
16	1.3	.483	
17	1.8	.567	
18	1.3	.483	
19	.8	.382	
20	1.3	.483	
21	.8	.382	
1, 2, 3	1.3	.483	1.0 cfs
4	1.3	.483	

Flows from Pond Discharge Pipes

Pond	Depth (h)	Q (ft^3/sec)	
5	.8	.375	3.0 cfs
6	2.8	.701	
7	1.8	.567	
8	1.3	.483	
9	1.3	.483	
10	.8	.375	
11	2.8	.701	2.7 cfs
12	1.8	.567	
13	2.8	.701	
14	2.8	.701	

Total Flow Discharging to Columbia Inlets

ponds - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, 21

basins - B, C, D, E, F

$$= 3.0 + 3.2 + 7.9 + 2.5 + 2.1 + 3.7 + 6.4$$
$$= 29.8 \text{ cfs}$$

Flows in Concrete Rundown

The flows reaching the rundown come from six sources:

1. Basin E - 25% of the discharge from this portion of Air Park Road is assumed to flow across Miles Road. The rest is diverted at the Miles Road and Air Park Road intersection, and flows down Miles Road to Columbia Drive. (see plates 3 & 4)
2. Basin D - 25% of the runoff on this section of Miles Road is assumed to be diverted to Air Park Road. The rest is assumed to stay in Miles Road.
3. Off-site basin B - 25% of this runoff is diverted to Air Park Road along with Basin D. (see plate 1)
4. Basin C - 100% of the runoff from this basin discharges through the rundown.
5. Discharge pipes from ponds 15, 16, 17, 18, 19, 20, 21 are assumed to pass 50% of their discharge to the rundown. The rest of the runoff is diverted down Miles Road.
6. Discharge pipes from ponds 1, 2, 3, and 4 pass 100% of their discharge to the rundown.

The following are the numerical values for the items discussed on the previous page. (The numbers were taken from sheets 3-6)

Items #	Total Discharge (cfs)	Percentage Reading Random	Discharge (cfs) Reading Random
1, 2, 3	13.68	25	3.4
4	2.51	100	2.5
5	3.2	25	.8
6	1.0	100	1.0
		Total	7.7 cfs

Width of Opening

$$Q = C L H^{3/2}$$

$Q = 7.7$ cfs/sec $C = 3.2$ $H = .67$ ft

$L = 4.4$ ft

We are using 9 ft so OK

Depth of Flow in Channel

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$S = .0477$

$n = .013$

$A = 2 \cdot 9$

$R = \frac{9}{2 2 + 9}$

$Q = 7.7$ cfs

depth (ft) = .13

Velocity (ft/sec) = 6.4

Froude number = 3.1