## 2. Report Review and Field Inspection

### 2.1 Drainage

Existing drainage reports were collected from the City of Albuquerque to determine the extent of the previously constructed Avenida Cesar Chavez storm drain improvements. In 1994, a report entitled "Stadium Boulevard Storm Drainage Improvements Engineering Analysis Report" (EAR) was prepared by Bohannan-Huston, Inc. for the City of Albuquerque and serves as a basis for this report. The EAR addressed flooding issues along Stadium Boulevard (currently known as Avenida Cesar Chavez), primarily at its intersection with University Boulevard. The report indicated that the Avenida Cesar Chavez storm drain improvements were intended to intercept flows from the planned Yale Boulevard storm drain, Buena Vista storm drain, overland and surcharged storm sewer flows from University Boulevard, overland flow from Santa Clara Avenue, and flows from Avenida Cesar Chavez east of the South Diversion channel. The report proposed the construction of an 84" diameter storm drain beginning at Yale Boulevard and extending west along Avenida Cesar Chavez increasing in size to an 108" diameter storm drain before it transitions into a trapezoidal channel at its confluence with the South Diversion Channel. The construction of this system was confirmed through as-built plans obtained from the City of Albuquerque.

Upon review of the post-project flow rates found in the EAR, a field review of the project site was performed to determine if any additional improvements had been made that would affect runoff patterns proposed in the original report. Storm drain as-built plans were also collected for the properties and storm drain networks contributing to the Avenida Cesar Chavez storm drain network to aid in developing a basin map for the project area. The following changes were noted from the EAR.

1. A total of 6 additional Type "A" inlets (3 northbound and 3 southbound) have been built as part of the Stadium Boulevard Improvements Project.
2. Improvements to the Langham storm drain network (5 inlets) have been constructed to further reduce flows reaching the existing transverse drainage inlet.

A map showing offsite and roadway basins contributing to the Avenida Cesar Chavez storm drain network can be seen in **Exhibit 1** in **Appendix A** of this report.

### 2.2 Crossing Structure

2.1.1 Description

The design plans for the existing Avenida Cesar Chavez structure over the South Diversion Channel were obtained from the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA). The existing structure plans are dated 1971. The structure consists of a reinforced concrete "U" channel, with a steel grate superstructure, and reinforced concrete sidewalk. The clear span between the channel walls is 11 feet 4 inches. The width perpendicular to the roadway is 100 feet 9 inches, which includes two 7-foot, 4-inch wide sidewalks. This width provides room for pipe railings along the outside of the structure.

The superstructure has 22 steel "I" girders, type 12 WF 27. The girders are approximately 12 inches deep at 4-foot spacing. The girders support a 5-inch thick steel grate deck, which allows for through drainage. The beams are past repairs is visible, as described previously. In addition, a piece of steel plate from the past repairs was seen at the bottom of the channel.

While no immediate safety concerns were observed, the structure will require ongoing, frequent maintenance if no improvements are made. The noise from the deck indicates that significant grate movement is occurring under traffic loads, which may result in fatigue of the connections to the beams. With drainage through the deck, the beams and the concrete seats will continue to deteriorate.

## 3. HYDROLOGY

The design flood for this assessment is the 100-year recurrence interval storm based on the "City of Albuquerque's Development Process Manual" (DPM). ArcGIS, version 10.1 was used to prepare the drainage basin map for this assessment. Aerial photos along with City of Albuquerque 2-foot interval contours were used to delineate drainage basins contributing to the analysis area. Future developed land usage estimates are based on the current City of Albuquerque GIS Data Website. The 100-year rainfall data for the analysis area was obtained from the DPM. The Rational Method was used to perform peak flow calculation for this assessment based on the 6-hour storm duration per the DPM. Peak flow rate calculations can be found in Appendix B. The following land treatment assumptions were made:

- Areas that fell under the land use category "Vacant/Other" were analyzed as fully developed properties and were assumed to be 90% land treatment D and 10% land treatment C.
- Areas that fell under the land use category "Parks/Recreational" appeared to be paved parking areas, or sports complex buildings and were assumed to be primarily land treatment C and D. Aerial photos were used to determine percent impervious values.

See Exhibit 2 in Appendix A for a Land Use Map of the Project.

### 3.1 Flow Analysis

The EAR indicates that with the construction of the recommended drainage improvements, the overland flow reaching the transverse drainage inlet has decreased from 810 cfs to 40 cfs. In an effort to confirm the current amount of flow reaching the transverse drainage inlet, an analysis of the capacity of the existing inlets along Avenida Cesar Chavez from University Boulevard to Langham was performed.

According to the original EAR, inlets constructed along University Boulevard and Avenida Cesar Chavez, east of University Boulevard, intercept all overland flow. Therefore, analysis of the previously constructed Avenida Cesar Chavez storm drain system was limited to west of the University Boulevard/Avenida Cesar Chavez intersection. Analysis points AP1 and AP2 were defined for eastbound and westbound Avenida Cesar Chavez, and flows were computed and distributed to the existing inlets. As-built plans indicated that City of Albuquerque Type "A" inlets were used on Avenida Cesar Chavez and a combination of City of Albuquerque Type "A" and Type "Double C" inlets were used on Langham. Existing roadway slopes for Avenida Cesar Chavez and Langham were taken from as-built plans or calculated based on City of Albuquerque contours. Analysis indicates that a total of 25.1 cubic feet per second (cfs) currently reaches the transverse drainage inlet (19.8 cfs at AP1 and 5.3 cfs at AP2). The decrease in flow reaching the transverse inlet can be attributed to the construction of the Langham storm drain improvements as well as to the addition of the 6 inlets to the Avenida Cesar Chavez storm drain network. Drainage inlet analysis calculations can be found in Appendix B.

The conveyance capacity of Avenida Cesar Chavez was checked based on the hydraulic design criteria found in the DPM. The DPM indicates that flow depths in the event of a 100-year design discharge may not exceed 0.2 feet above curb height and shall be contained within the right-of-way (ROW). It was determined that City of Albuquerque standards are met for the 100-year design discharge.

### 3.2 South Diversion Channel Analysis

The South Diversion Channel Hydrologic and Hydraulics Review (yet to be published) was completed by Easterling & Associates Inc. using the Hydrologic Engineering Center River Analysis System (HEC-RAS). A copy of the analysis was obtained from AMAFCA, and it indicated that the 100-year water surface elevation does not reach the low chord. Flows in the South Diversion Channel and the hydraulic capacity of the existing crossing structure will not be affected by replacement of the steel grate superstructure.

## 4. Existing Structure Analysis

The existing crossing structure was analyzed to assess its suitability for rehabilitation and replacement of the existing steel deck. Based on the analysis, the existing structure can be modified to extend its service life and to address the current safety and maintenance issues associated with the steel deck.

The structure was analyzed per the AASHTO Standard Specifications for Highway Bridges, 17th Edition. Analysis assumptions were based on the design plans, obtained from AMAFCA, and engineering judgment. Assumptions included:

- Soils
  - Type: Medium-dense sand
  - Angle of Internal Friction: 34 degrees
  - Density: 120 pounds per cubic foot (pcf)
  - Horizontal Earth Pressure: Active case, Rankine formula
  - Allowable Bearing Pressure: 2,000 pounds per square foot (psf)
- Concrete
  - Compressive Strength ($f'_c$): 3,000 pounds per square inch (psi)
- Reinforcing Steel
  - Yield Strength ($f_y$): 40,000 psi

The structure was analyzed as a simple frame using the STAAD.Pro V8i computer program, version 20.08.07.20. Moment and shear were checked at critical locations for two cases, with and without bracing of the vertical walls by the existing deck. The results are shown in Table 1 on the following page.

mentioned in the previous paragraph. An analysis was performed to determine what effect diverting this flow to the Stadium Boulevard storm drain project would have on drainage flows in University Boulevard. The Stadium Boulevard project has additional capacity at Buena Vista Drive.

The AHYMO model of the Stadium Boulevard project in-place was revised to include a 48" diversion pipe to Stadium Boulevard. Three different AHYMO models for three conditions were run in order to determine the effects of the diversion. Table 5 summarizes the modeling results for the three conditions analyzed.

**TABLE 5**

**100-YEAR STORM PEAK DISCHARGES (IN CFS) FOR THREE CONDITIONS**

| | | Pre-Project Conditions | Post-Project With Diversion | Post-Project No Diversion |
|---|---|---|---|---|
| Coal & University | SD | 127 | 66 | 127 |
| | OL | 213 | 0 | 41 |
| Stadium & University | SD | 127 | 127[1] | 127 |
| | OL | 625 | 240[2] | 325[2] |
| Subbasin BB-2 | OL | 260 | 230 | 230 |
| Residual flow from APBB4 | OL | 250 | 150 | 150 |
| Stadium & SDC | SD | 0 | 1,340 | 1,290 |
| | OL | 875 | 40 | 55 |
| SDC just down-stream of Stadium | OL | 1,570 | 2,090 | 2,050 |

SD = Storm drain flow; OL = Overland flow

[1]Assumes that OL from Subbasin BB-2 enters the 48" SD in University Boulevard.
[2]Flow will be intercepted by the number of new catch basins constructed along University Boulevard and Stadium Boulevard.

Comparison of the results in the above table shows that the diversion does have a beneficial effect on flows into University Boulevard. The next step in the analysis was subject Avenida Cesar Chavez DI Assessment

## Basin A.

A = 1.56 B = 2.28 C = 3.14 D = 4.70
Rainfall zone 2

Area = 0.97 acres

* vacant land = 0.022 acres

D = 0.022 acres

Note: vacant land in Basin A appears to be a paved road + sidewalk.

* commercial services = 0.97 - .022 = 0.95

D = 0.90 (0.95 acres) = 0.86 acres

C = 0.95 - 0.86 = 0.09 acres.

Total D = 0.022 + 0.86 = 0.88 acres Total C = 0.09 acres.

$Q_p$ = 4.70(0.88) + 3.14(0.09) = **4.42 cfs**

## Basin B

Area = 7.5 acres

* commercial services = 5.1 acres.

D = 0.90(5.1) = 4.59 acres. C = 5.1 - 4.59 = 0.51 acres.

* vacant land = 0.52 acres

D = 0.52 acres.

* public/institutional. = 7.5 - 5.1 - 0.52 = 1.88 acres.

D = 0.90(1.88) = 1.69

C = 1.88 - 1.69 = 0.19

Note: lands that fall under the public/institution category were analyzed a commercial services.

Total D = 4.59 + 0.52 + 1.69 = 6.8 Total C = 0.51 + 0.19 = 0.7

$Q_p$ = 4.70(6.8) + 3.14(0.70) = **34.16 cfs**

# PARSONS BRINCKERHOFF Computation Sheet



made by
date
checked by
date

subject

## Basin C

Area = 1.98 acres

* Public / Institutional = 0.85 acres

D = 0.90 (0.85) = 0.77 acres  C = 0.85 − 0.77 = 0.085 acres.

* vacant land = 1.98 − 0.85 = 1.13 acres.

D = 1.13

Total D = 0.77 + 1.13 = 1.9 acres.  Total C = 0.085 acres.

$Q_P = 4.70(1.9) + 3.14(0.085) = $ **9.2 cfs.**

Note: Vacant land in Basins D, E, + F was analyzed as fully developed per COA instruction.

## Basin D

Area = 1.62 acres

* vacant land = 1.62 acres

D = 0.90(1.62) = 1.46  C = 0.162

$Q_P = 4.70(1.46) + 3.14(.162) = $ **7.37 cfs.**

## Basin E

Area = 5.25 acres.

* vacant land = 5.25 acres

D = 0.9(5.25) = 4.73  C = 0.525

$Q_P = 4.7(5.25) + 3.14(.525) = $ **26.32 cfs.**

## Basins I − Y

Note: all basins are treatment D

| | I | J | K | L | M | N | O | P | Q | R | S | T | U | V |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 0.42 | 0.05 | 0.68 | 0.05 | 0.05 | 0.39 | 0.20 | 0.15 | 0.07 | 0.09 | 0.22 | 0.25 | .06 | 0.83 |
| Qp | 1.97 | 0.24 | 3.2 | 0.24 | 0.24 | 1.83 | 0.94 | 0.71 | 0.33 | 0.42 | 1.03 | 1.18 | 0.28 | 3.9 |

| | W | X | Y |
|---|---|---|---|
| A | .06 | .06 | 0.55 |
| Qp | 0.28 | 0.28 | 2.59 |

## Basin Z

Area = 0.51

D = 0.36 acres  C = 0.51 − 0.36 = 0.15

$Q_P = 4.70(0.36) + 3.14(0.15) = $ **2.16 cfs.**

# PARSONS BRINCKERHOFF Computation Sheet



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## Basin AA

Arua = 0.85 acres

C = 0.85 acres

$Q_p = 3.14(0.85) = 2.67$ cfs

## Basin BB

Arua = 0.83

* Multi Family (attached)

$D = 0.70(0.83) = 0.58$ acres    $C = 0.83 - 0.58 = 0.25$ acres

$Q_p = 4.70(0.58) + 3.14(0.25) = 3.51$ cfs

## Basin CC

Arua = 0.04

* Multi Family (attached)

$D = 0.70(0.04) = 0.03$    $C = 0.01$

$Q_p = 4.70(.03) + 3.14(0.01) = 0.17$ cfs

## Basin DD

Arua = 0.06

$D = 0.7(0.06) = 0.04$    $C = 0.02$

$Q_p = 4.7(0.04) + 3.14(0.02) = 0.25$ cfs

## Basin EE

Arua = 0.62 acres.    $D = 0.7(0.62) = 0.43$    $C = 0.19$

$Q_p = 4.7(0.43) + 3.14(0.19) = 2.62$ cfs

# PARSONS BRINCKERHOFF Computation Sheet



made by

date

checked by

date

subject

## Basin H

Area = 0.49 acres

D = 0.49 acres

$Q_p = 4.70(0.49) = \underline{\underline{2.3 \text{ cfs}}}$

## Basin G

Area = 0.42 acres

D = 0.42 acres

$Q_p = 4.70(0.42) = \underline{\underline{1.97 \text{ cfs}}}$

## Basin F

Area = 2.88 acres

* vacant land = 2.88 acres

$D = 0.90(2.88) = 2.59$ $C = 0.288$

$Q_p = 4.7(2.59) + 3.14(.288) = \underline{\underline{13.08 \text{ cfs}}}$

9.03602

**PARSONS BRINCKERHOFF** Computation Sheet

 33677

made by KVC
date 6-18-13
checked by FHO
date 6-19-13

subject Avenida Cesar Chavez Inlet Assessment
WB ACC

Inlet 1

I = intercepted
B = bypass

Basin A + Basin I = 4.42 + 1.97 = 6.39 cfs

I = 4.53 cfs    B = 1.86 cfs

Inlet 2

Basin J + Inlet 1 B = 0.24 + 1.86 = 2.1 cfs

I = 1.98    B = 0.12 cfs

Inlet 3

Basin C + Inlet 2 B = 9.2 + 0.12 = 9.32 cfs

I = 5.82 cfs    B = 3.50 cfs

Inlet 4

Basin K + Basin D + Inlet 3 B = 3.2 + 7.37 + 3.50 = 14.07 cfs

I = 7.65 cfs    B = 6.42 cfs

Inlet 5

Basin L + Inlet 4 B = 0.24 + 6.42 = 6.66 cfs

I = 4.70 cfs    B = 1.96 cfs

Inlet 6

Basin M + Inlet 5 B = 0.24 + 1.96 = 2.2 cfs

I = 2.08 cfs    B = 0.12 cfs

subject

Inlet 7.

Basin N + Basin E + Inlet 6 B = 1.83 + 26.32 + 0.12 = 28.27cfs

I = 11.33cfs B = 16.94 cfs

Inlet 17

Basin F + Basin G = 13.08 + 1.97 = 15.05 cfs

I = 8.05 cfs B = 7.00 cfs

Inlet 18

Bypass Inlet 17 = 7.00 cfs

I = 5.05 cfs B = 1.95 cfs

Inlet 19

Basin H = 2.3 cfs.

I = 2.13 cfs B = 0.17 cfs.

Inlet 20

Inlet 19 Bypass = 0.17 cfs

I = 0.17 cfs B = 0 cfs.

WB ACC @ South Diversion Channel

Basin O + Inlet 7 B + Langham Bypass

0.94 + 16.94 + 1.95 = 19.82 cfs

subject Avenida Cesar Chavez Inlet Assessment.
EB ACC

Inlet 8

Basin P = 0.71cfs.

I = 0.71cfs B = 0cfs.

Inlet 9

Basin Q + Inlet 8B = 0.33 + 0 = 0.33cfs.

I = 0.33cfs B = 0 cfs

Inlet 10

Basin R = 0.42cfs.

I = 0.42cfs B = 0cfs.

Inlet 11

Basin S = 1.03cfs.

I = 1.03cfs B = 0 cfs.

Inlet 12

Basin T = 1.18cfs

I = 1.18cfs. B = 0cfs.

Inlet 13

Basin U = 0.28cfs.

I = 0.28cfs B = 0 cfs.

**PARSONS BRINCKERHOFF** Computation Sheet

| | |
|---|---|
| page | 2 of 2 |
| made by | KVC |
| date | 6-18-13 |
| checked by | |
| date | |

33677

subject

Inlet 14

Basin V + Basin Z + Basin AA + Basin BB = 3.9 + 2.16 + 2.67 + 3.51 = 12.24 cfs.

I = 7.01 cfs B = 5.23 cfs

Inlet 15.

Basin W + Basin CC + Inlet 14 B = 0.28 + 0.17 + 5.23 = 5.68 cfs

I = 4.22 cfs B = 1.46 cfs

Inlet 16

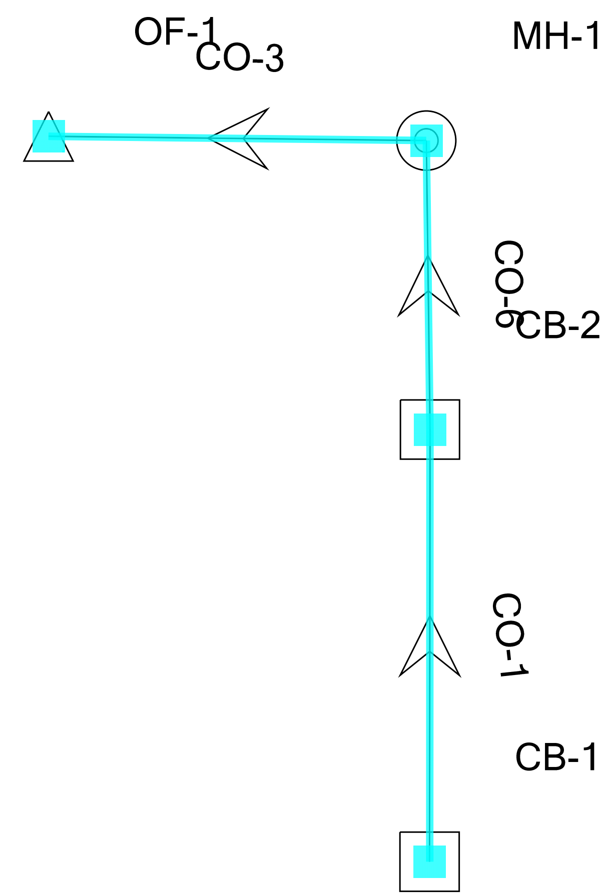
Basin X + Basin DD + Inlet 15 B = 0.28 + 0.25 + 1.46 = 1.99 cfs

I = 1.91 cfs B = 0.08 cfs.

EB ACC @ South Diversion Channel

Basin Y + Basin EE + Inlet 16 B = 2.59 + 2.62 + 0.08 = 5.29 cfs.

Scenario: Base



## Profile Report
## Engineering Profile - Profile - 1 (ACC.stc)