

OUTLET STRUCTURE BUOYANCY CALCULATIONS

Calculate Bottom Thickness Required to Resist Uplift Forces on Fully Submerged Structure

Design outlet structures for a minimum factor of safety of 1.2 to resist uplift from hydrostatic force.

OUTLET STRUCTURE DATA

Pond #	Outlet Pipe Dia.	Top of Weir Elev.	Outlet Pipe Inv. Elev.	Height Inv. to Top
1	42"	5141.0	5132.5	8.5'
2	48"	5144.5	5136.9	7.6'
3	42"	5147.5	5142.0	5.5'
4	42"	5151.9	5146.3	5.6'
5	48"	5164.0	5159.0	5.0'
6	36"	5176.0	5169.0	7.0'

Assume a worst case situation where the entire structure including the trash rack is submerged and the trash rack is completely plugged.

- Calculate net uplift from trash rack portion of the structure.

Total volume enclosed between the top of the rack and the top of the concrete structure:

$$V = (2.33 \div 6) \{7.75^2 + [({7.75 + 2.33} \div 2)^2]\} + 2.75^2 = 65.72 \text{ CF}$$

Weight of the steel:

1¼" Pipe:	83.0 LF	@ 3.2 LB/LF =	265.6 LB
½" x 3" Bar:	19.5 LF	@ 5.1 LB/FT =	99.5 LB
3" x 5" Angle:	31.0 LF	@ 8.2 LB/LF =	254.2 LB
3" x 3" Angle:	8.5 LF	@ 4.9 LB/LF =	<u>41.7 LB</u>
Total Weight =			661.0 LB

Net submerged vertical force of the trash rack:

$$(65.7 \times 62.4) - 661.0 = 3,440 \text{ lbs of uplift}$$

- Calculate net uplift per vertical foot of concrete structure:

$$\text{Total volume enclosed: } V = 8 \times 8 \times 1 = 64 \text{ cf}$$

$$\text{Weight of the concrete: } W = 29.3 \times 0.67 \times 150 = 2,944.7 \text{ lbs}$$

- Net submerged vertical force per vertical ft.:

$$(64 \times 62.4) - 2,944.7 = 1,048.9 \text{ lbs/VF}$$

- Calculate volume of submerged concrete required to resist 120 lbs of vertical force (100 LB of uplift plus factor of safety)

$$120 \div (150 - 62.4) = 1.37 \text{ cf}$$

- Calculate volume of concrete fill above pipe invert

$$V = (6.67^2 \times 0.5) \div 2 = 11.12 \text{ CF}$$

- Calculate volume of concrete per vertical foot of floor

$$V = 8 \times 8 \times 1 = 64 \text{ CF}$$

FLOOR THICKNESS CALCULATION

$$T = [(((F_t + h [F_s]) \div 100) \times 1.37) + V_c - 11.12] \div 64$$

T = Required floor thickness below outlet pipe invert

F_t = Net uplift force from trash rack volume

F_s' = Net uplift force per vertical foot of concrete structure

F_s'' = Total net uplift force on the concrete structure

V_c = Volume of concrete displaced by pipe

h = Height of structure (pipe invert to top)

Pond #	h (ft)	F_t (lbs)	F_s' (lbs)	F_s'' (lbs)	Total Net Uplift (lbs)	V_c (cf)	T (ft)
1	8.5	3,440	1,048.9	8,915.6	12,355.6	6.45	2.57
2	7.6	3,440	1,048.9	7,971.6	11,411.6	8.42	2.40
3	5.5	3,440	1,048.9	5,769.0	9,209.0	6.45	1.90
4	5.6	3,440	1,048.9	5,873.8	9,313.8	6.45	1.92
5	5.0	3,440	1,048.9	5,244.5	8,684.5	8.42	1.82
6	7.0	3,440	1,048.9	7,342.3	10,782.3	4.73	2.21

APPENDIX J

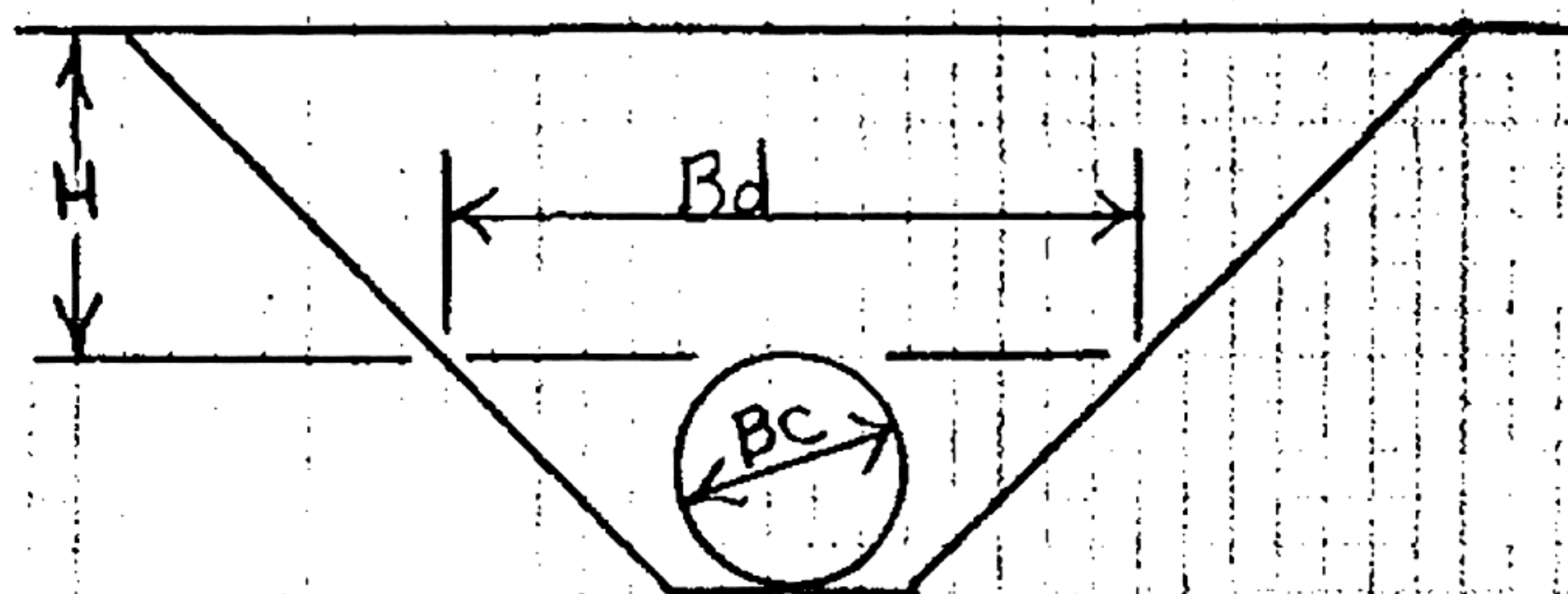
**STORM DRAIN PIPE CLASS AND BEDDING DESIGN
CALCULATIONS**

10131 Coors Rd., NW, Suite H-7
Albuquerque, New Mexico 87114
(505) 898-8021
FAX (505) 898-8501

Project Name Unset Diversion
Project No. _____ Date _____
Subject Pipe Class & Bedding Check
By VSF Sheet 1 of _____

Assumptions

- 1:1 Trench Side Slopes
- Unit Weight of back fill = 120 lb/cf
- Class "B" bedding Bf = 1.9


$$BC = 3.6'$$

$$H = 13 - 3.6 = 9.4'$$

$$Bd = 3.6 + 3.6(2)(1) = 10.8$$

$$H = 6 - 3.6 = 2.4$$

$$Bd = \quad " \quad " \quad = 10.8$$

- From Table 24-A The transition width for both bury conditions is less than the calculated B_d for the condition.

$H = 9.4$ Backfill Load = 5,068 lbs / lf

$$H = 2.4 \quad \text{Backfill load} = 2,394 \text{ lbs/lf}$$

Above loads are for 100 lbs/cf material - Adjust for 120 lbs/cf material

$$5068 \times 1.2 = 6,082 \text{ lbs/lf}$$

$$2394 \times 1.2 = 2873 \text{ lbs/lf}$$

- From table 45 Live load $H = 9.4' = 330 \text{ lbs/lf}$
 $H = 2.4' = 1802 \text{ lbs/lf}$

$$- D \cdot \text{load} = D \cdot 0.01 = \frac{W_L + W_E}{B_f \times p} \times F.S. \quad \text{FOR REP F.S.} = 1$$

For $H = 9.4'$ $D_{0.01} = \frac{330 + 6082}{1.9 \times 3} = 1,125 \text{ lbs/lf I.D.}$

$$\text{For } H = 2.4 \quad D_{0.01} = \frac{1802 + 2394}{1.9 \times 3} = 737 \text{ lbs / lf I.D.}$$

From ASTM C76 For class III Pipe D 0.01 = 1350 lbs/ft I.D.

CLASS III PIPE IS O.K. @ both MIN & Max bury

Easterling & Associates, Inc.

10131 Coors Rd., NW, Suite H-7
Albuquerque, New Mexico 87114
(505) 898-8021
FAX (505) 898-8501

Project Name Unser Diversion
Project No. _____ Date _____
Subject _____

By _____ Sheet 2 of _____

Check 42" dia Pipe

$$B_c = 4.3'$$

$$\text{Max bury} = 14' \quad H = 14 - 4.3 = 9.7' \quad B_d = 4.3 + 4.3(2 \times 1) = 12.9'$$

- From Table 24-A The design trench will be wider than the transition width Use the maximum Backfill load

$$\text{Backfill load} = 6034 \text{ lbs/lf}$$

The above load is for 100 lbs/cf - Adjust the load for 120 lbs/cf material $6034 \times 1.2 = 7240 \text{ lbs/lf}$

$$\text{- From table 45 Live load} = 370 \text{ lbs/lf}$$

$$\text{- D-load} = D_{0.01} = \frac{370 + 7240}{1.9 \times 3.5} = 1145 \text{ lbs/lf I.D.}$$

$1145 < 1350$ Class III Pipe is O.K.

Check 48 dia Pipe

$$B_c = 4.83'$$

$$\text{Max bury} = 14' \quad H = 14 - 4.83 = 9.2' \quad B_d = 4.83 + 4.83(2) = 14.5'$$

- From Table 24-A The design trench will be wider than the transition width. Use the maximum backfill load.

$$\text{Backfill load} = 10,328 \text{ lb/lf at } 100 \text{ lbs/cf}$$

$$\text{Adjust for } 120 \text{ lbs/cf material } 10,328 \times 1.2 = 12,394 \text{ lbs/lf}$$

$$\text{- From Table 45 Live Load} = 410 \text{ lbs/lf}$$

$$\text{- } D_{0.01} = \frac{410 + 12,394}{1.9 \times 4.0} = 1,684 \text{ lbs/lf I.D.} < 1350$$

From ASTM C76 For Class IV Pipe $D_{0.01} = 2000 \text{ lbs/lf I.D.}$

Class IV Pipe is required

AGREEMENT FOR DESIGN, CONSTRUCTION AND
CONSTRUCTION ENGINEERING SERVICES FOR
DRAINAGE IMPROVEMENTS REQUIRED BY THE WEST I-40 DMP BETWEEN
98TH AND LA PRESA INCLUDING THE DIVERSION OF THE MIREHAVEN
ARROYO

THIS AGREEMENT ("AGREEMENT") is made and entered into this 24 day of April, 2014, by and between the ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL AUTHORITY, (AMAFCA), a political subdivision of the State of New Mexico, and I-40 SOUTH, LLC, (I-40 SOUTH), a Limited Liability Company, collectively referred to as the "PARTIES".

RECITALS:

1. **WHEREAS**, by an Agreement entitled "Agreement for Atrisco Business Park Storm Water Improvements" dated as of July 16, 1993 AMAFCA, the City of Albuquerque ("City") and certain land owners, including landowners identified as the KVA group, four (4) of whom are now the sole members of I-40 SOUTH (the "1993 Agreement") agreed upon the construction, operation and maintenance of certain Stormwater Drainage Facilities, all as set forth in the 1993 Agreement; and

2. **WHEREAS**, The 1993 Agreement in the Eighth Whereas clause stated as follows:

"WHEREAS, although the construction, operation and maintenance of the Unser Diversion will provide no present benefits to the Lands of KVA the Unser Diversion will ultimately provide, at such time as the KVA Lands are developed, benefits to the KVA Lands"

and a portion of the KVA Lands as identified in the 1993 Agreement are now owned by I-40 SOUTH; and

3. **WHEREAS**, the 1993 Agreement in the seventeenth Whereas clause stated as follows:

"WHEREAS, AMAFCA's long-range plans anticipate that between the years 1995 and 2000 it will commence the construction of a drainage channel presently identified as the West Bluff Channel which is to be located on the north side of I-40 (the "West Bluff Channel")"

4. **WHEREAS**, as required by the 1993 Agreement, the KVA group conveyed certain real property to AMAFCA to be utilized for the Unser Diversion consisting of approximately 6.4 acres in fee and also granted Slope Easements consisting of approximately 7.2 acres, all without compensation to the KVA group; and
5. **WHEREAS**, one of the Slope Easements granted pursuant to the 1993 agreement is identified as Slope Easement For Floodway and Storm Drainage Works dated October 26, 1995 and filed for record in the Bernalillo County Clerk's office on November 15, 1996 in Book 9630, Pages 6226-6234 as Document No. 96124873 (the "SLOPE EASEMENT"); and
6. **WHEREAS**, pursuant to the 1993 agreement, the SLOPE EASEMENT was granted on the condition that if and when it was not required for drainage purposes, it would be vacated at no charge or expense to the Grantors, and that the vacation thereof would be evidenced by a quitclaim deed, disclaimer or other appropriate document; and
7. **WHEREAS**, on June 29, 2000, the AMAFCA Board of Directors adopted the West I-40 Drainage Management Plan (West I-40 DMP (2000)) that identified regional and local drainage infrastructure; and
8. **WHEREAS**, the West I-40 DMP was modified in 2006 to address master planned areas north of I-40 and west of Unser Boulevard including the Atrisco Terrace. This drainage analysis, the West I-40 DMP (2006) was reviewed by AMAFCA and adopted by the AMAFCA Board of Directors on November 16, 2006 via Resolution 2006-9; and
9. **WHEREAS**, AMAFCA has coordinated with the New Mexico Department of Transportation to install permanent drainage infrastructure associated with the I-40 Corridor from Central to Coors including the I-40 West Central Interchange to 98th Street Interchange, and the West Central Interchange (I-40 and Paseo del Volcan/Central Ave.); and

10. **WHEREAS**, AMAFCA has completed construction of La Presa Dam west of Unser Boulevard, and as identified in the West I-40 DMP (2006); and

11. **WHEREAS**, the West I-40 diversion (identified in the seventeenth Whereas clause of The 1993 Agreement as the West Bluff Channel) described in the West I-40 DMP (2006) is complete but includes a temporary trunk storm water diversion facility between 98th Street and La Presa Dam along the I-40 corridor; and

12. **WHEREAS**, the West I-40 DMP identifies flows south of I-40 along the Mirehaven Arroyo (“South Portion of the Mirehaven Arroyo”) between 98th Street and La Presa Dam; and

13. **WHEREAS**, AMAFCA completed the Amole-Hubbell Drainage Master Plan Update (2013) which identified flows from the “South Portion of the Mirehaven Arroyo” that cause an over topping condition of the existing Coors North South pond, a flood control facility owned and operated by the City of Albuquerque; and

14. **WHEREAS**, drainage improvements between 98th Street and La Presa Dam are required to cut off flows to the “South Portion of the Mirehaven Arroyo” that will benefit both public and private interests, such that a collaborative effort will be necessary to fund, design and construct the drainage improvements, known as the PROJECT, in a timely manner; and

15. **WHEREAS**, AMAFCA Resolution 1982-4 Cost-Sharing with Land Owners, provides for the private sector to share in the cost of flood control facilities; and

16. **WHEREAS**, recognizing the value of completing the West I-40 Diversion, AMAFCA has programmed funds for a cost-shared project to replace the temporary facility with permanent infrastructure identified in the 2013 AMAFCA Project Schedule; and

17. **WHEREAS**, the AMAFCA Board of Directors, at its Regular Meeting of February 27, 2014, considered the cost-sharing concept and directed staff to proceed with the necessary cost share agreements; and

18. **WHEREAS**, AMAFCA and I-40 SOUTH have negotiated funding in the amount of Two Hundred Thirty Thousand Dollars (\$230,000.00) and phasing for the design and construction of temporary and permanent infrastructure (a) to cut off flows from the Mirehaven Arroyo north of I-40 (the “North Portion of the Mirehaven Arroyo”) to the “South Portion of the Mirehaven Arroyo” and (b) divert said flows to La Presa Dam thereby eliminating all flows from the north of I-40 to the “South Portion of the Mirehaven Arroyo”; and

19. **WHEREAS**, once flood flows are controlled and diverted from the North Portion of the Mirehaven Arroyo to La Presa Dam, AMAFCA agrees to (a) immediately notify the City of Albuquerque’s Flood Plain Manager that flows in the Mirehaven Arroyo have been terminated and diverted to La Presa Dam and (b) proceed to remove the flood plain associated with the South Portion of the Mirehaven Arroyo through a Letter of Map Revision (“LOMR”).

NOW THEREFORE, in consideration of the covenants contained herein, THE PARTIES AGREE AS FOLLOWS:

Section One – Purpose of Agreement: The Purpose of the AGREEMENT is to:

1.1 Define responsibilities of the PARTIES for the funding, design, construction, and construction engineering of the PROJECT, and the timing of such responsibilities. The PROJECT includes drainage improvements required by the West I-40 DMP (2006) and the diversion of flows in the Mirehaven Arroyo into the La Presa Dam, the termination of flows into the Mirehaven Arroyo south of I-40 and cause to be submitted a Letter of Map Revision (“LOMR”) to eliminate the flood plain associated with the Mirehaven Arroyo south of I-40.

1.2 Define the PROJECT as two packages to be designed and constructed by AMAFCA. The PROJECT is as shown on Exhibit A and includes the following:

TEMPORARY DIVERSION PACKAGE

- a. The design and construction of an interim diversion of the Mirehaven Arroyo into La Presa Dam within the temporary channel north and adjacent to I-40 between Unser Boulevard and 98th Street, within AMAFCA fee-right-of-way.
- b. Submit notification to the City of Albuquerque's Flood Plain Manager of the termination of flow in the Mirehaven Arroyo South of I-40 and the diversion of such flow into La Presa Dam.

PERMANENT DRAINAGE IMPROVEMENTS PACKAGE

- a. The design and construction of a permanent conveyance channel located on AMAFCA fee right-of-way north of I-40 between La Presa Dam and 98th Street.
 - i. The design will include a permanent structure to plug the box culvert that crosses I-40 to ensure the diversion of the Mirehaven Arroyo to La Presa Dam and to ensure the termination of flow in the Mirehaven Arroyo south of I-40.
 - ii. The design will address the additional flow from the North Portion of the Mirehaven Arroyo into La Presa Dam along the West I-40 Diversion Channel.
 - iii. The design will comply with the West I-40 DMP (2006).
- b. Submission of LOMR (Letter of Map Revision) to FEMA for the PROJECT.

1.3 Identify I-40 SOUTH's lump sum cash contributions to the PROJECT and establish the provisions for the timing of payments to be made to AMAFCA by I-40 SOUTH.

1.4 Identify AMAFCA's contribution to the design and construction of the PROJECT.

Section Two – I-40 SOUTH Agrees to:

2.1 Provide funding in the total amount of Two Hundred Thirty Thousand Dollars (\$230,000.00) for the PROJECT as follows:

- a. Ten Thousand Dollars (\$10,000.00) for the cost of design and construction of the TEMPORARY DIVERSION PACKAGE, which sum shall be paid within five (5) calendar days after execution of this AGREEMENT by the PARTIES.
- b. One Hundred Thousand Dollars (\$100,000.00) for the Permanent Drainage Improvements Package by AMAFCA, which sum shall be paid within ninety (90) days after execution of this AGREEMENT by the PARTIES.
- c. One Hundred Twenty Thousand Dollars (\$120,000.00), which sum shall be paid within seven (7) years after execution of this AGREEMENT by the PARTIES.

2.2 Provide a temporary drainage easement or other acceptable form of security interest to AMAFCA over/in Tract 6 of the Avalon Subdivision, Unit 5, which shall continue in full force and effect until such time as total payment for the PROJECT is received by AMAFCA.

Section Three – AMAFCA Agrees to:

3.1 Engage an On-Call Engineer to design and certify the TEMPORARY DIVERSION of the North Portion of the Mirehaven Arroyo into La Presa Dam, which design shall be completed within ten (10) calendar days of the execution of this AGREEMENT by the Parties.

3.2 Engage an On-Call Contractor to construct the TEMPORARY DIVERSION, which work will be completed within forty (40) calendar days of the execution of this AGREEMENT by the PARTIES.

3.3 Within five (5) days after receipt of the letter of acceptance from the On-Call Engineer that the Interim Diversion of the Mirehaven Arroyo has been completed and certifying that the TEMPORARY DIVERSION is constructed per the design, notify the City of Albuquerque's Flood Plain Manager that the Mirehaven Arroyo has been diverted into the La Presa Dam, and that there is no longer a need for the SLOPE EASEMENT (referred to in Recital No. 5 and No. 6).

3.4 Cause to be submitted to FEMA a Letter of Map Revision ("LOMR") to have the flood plain which exists because of the Mirehaven Arroyo south of I-40 removed. AMAFCA will strive to submit the LOMR no later than July 31, 2014 and will endeavor to remove the flood plain associated with the Mirehaven Arroyo south of I-40 on the I-40 SOUTH properties south of I-40 (Tracts 4, 5 and 6) no later than July 31, 2017.

3.5 Maintain all permanent and interim drainage improvements constructed on AMAFCA right-of-way and temporary drainage easements.

3.6 Provide the design for the PERMANENT DRAINAGE IMPROVEMENTS PACKAGE associated with the West I-40 DMP (2006) between 98th Street and La Presa Dam. AMAFCA estimates that this work will be in the amount of approximately Three Hundred Thousand Dollars (\$300,000.00).

3.7 Provide construction management and contract for the construction of the PERMANENT DRAINAGE IMPROVEMENTS PACKAGE associated with the West I-40 DMP (2006) between 98th Street and La Presa Dam. It is agreed that AMAFCA will exercise its best efforts to complete the PERMANENT DRAINAGE IMPROVEMENTS PACKAGE by December 31, 2017. AMAFCA estimates that this work will be in the amount of approximately Two Million Three Hundred Thousand Dollars (\$2,300,000.00).

3.8 Send letter of completion of the PERMANENT DRAINAGE IMPROVEMENTS PACKAGE to I-40 SOUTH within thirty (30) days after the permanent drainage improvements have been completed.

3.9 Quit claim to I-40 SOUTH the drainage easement or other security interest accepted by AMAFCA from I-40 SOUTH over Tract 6 of the Avalon Subdivision, Unit 5, within Sixty (60) days after total payment for the PROJECT is received by AMAFCA.

3.10 AMAFCA will use best efforts to partner with other public agencies that will benefit from the completion of the permanent drainage facilities between Unser Boulevard and 98th Street to construct said facilities in a timely manner as funding becomes available.

Section Four – Both Parties Agree:

4.1 This AGREEMENT is not intended, by any of its provisions or any part of the AGREEMENT, to create in the public, or any member thereof, a third-party beneficiary or to authorize anyone not a party to this AGREEMENT to maintain a suit for wrongful death, bodily and/or personal injury to person, damage to property, and/or any other claim(s) whatsoever pursuant to the provisions of this AGREEMENT.

4.2 By entering into this AGREEMENT, the PARTIES shall not be responsible for liability incurred as a result of the other PARTY's acts or omissions in connection with this AGREEMENT. Any liability incurred in connection with this AGREEMENT is subject to the immunities and limitations of the New Mexico Tort Claims Act, NMSA 1978, Sections 41-4-1, et seq., (as amended). This paragraph is intended only to define the liabilities between the PARTIES hereto and it is not intended to modify, in any way, the PARTIES' liabilities as governed by common law or the New Mexico Tort Claims Act. AMAFCA and its "public employees" as defined in the New Mexico Tort Claims Act, do not waive sovereign immunity, do not waive any defense and/or do not waive any

limitation of liability pursuant to law. No provision in this AGREEMENT modifies and/or waives any provision of the New Mexico Tort Claims Act.

4.3 This AGREEMENT incorporates all the agreements, covenants, and understandings between the PARTIES hereto concerning the subject matter hereof, and all such covenants, agreements and understandings have been merged into this written AGREEMENT. No prior agreements or understandings concerning the subject matter hereof, verbal or otherwise, of the PARTIES or their agents shall be valid or enforceable unless embodied in this AGREEMENT. Performance of all duties and obligations herein shall conform with and do not contravene any state, local, or Federal statutes, regulations, rules, or ordinances. All notices with respect to this AGREEMENT shall be in writing and shall be delivered personally, sent via confirmed fax, or sent postage prepaid by United States Certified Mail, return receipt requested, to the addresses set forth below or such other addresses as hereafter specified in writing by one Party to the other:

I-40 SOUTH LLC
P.O. Box AA
Albuquerque, NM87103
Attn: Thomas F. Keleher

Albuquerque Metropolitan Arroyo
Flood Control Authority
2600 Prospect Ave. NE
Albuquerque, NM 87107

Attn: Executive Engineer

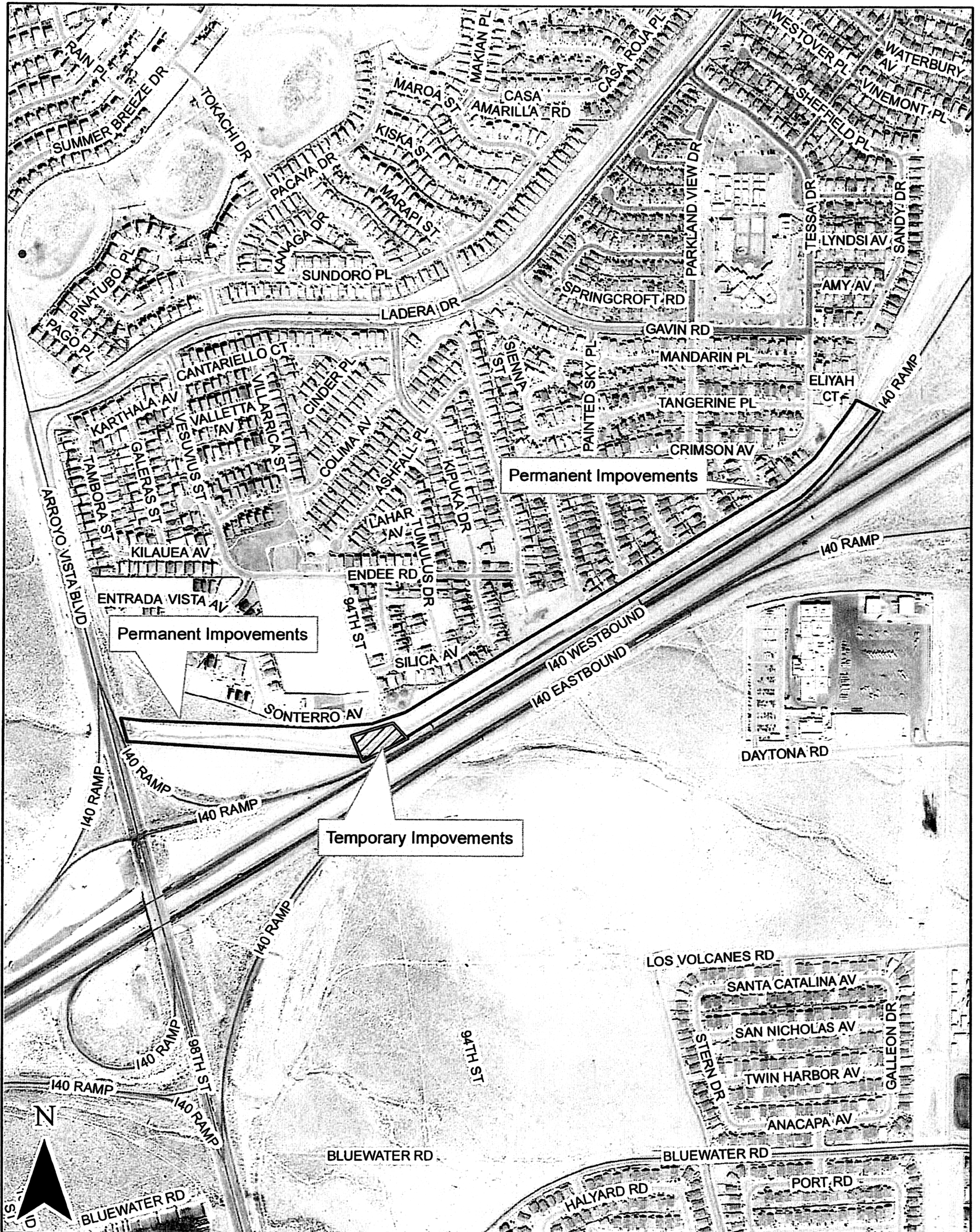
4.4 This AGREEMENT shall not take effect until executed by both of the PARTIES hereto.

4.5 In the event that any portion of this AGREEMENT is determined to be void, unconstitutional or otherwise unenforceable, the remainder of this AGREEMENT shall remain in full force and effect.

4.6 Disputes under this AGREEMENT will be referred to binding arbitration under the provisions of the New Mexico Uniform Arbitration Act.

4.7 This AGREEMENT shall not be altered, modified, or amended except by an instrument in writing and executed by the PARTIES hereto.

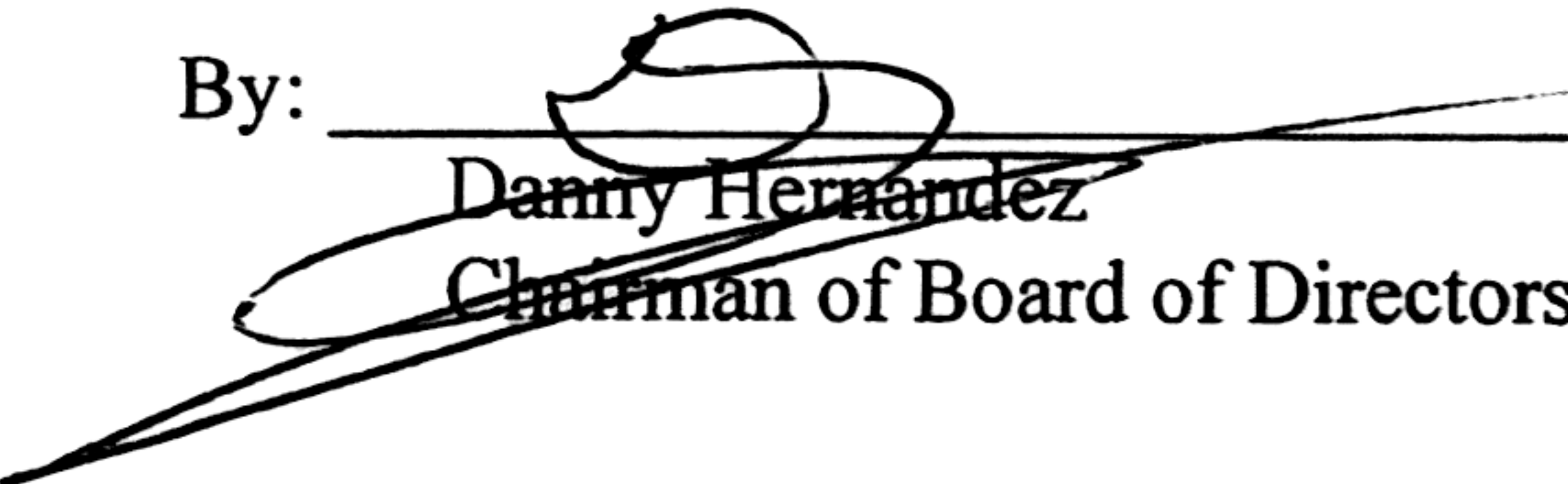
EXHIBIT A



4.8 SUCCESSORS AND ASSIGNS. This AGREEMENT and the rights, interests, and obligations hereunder shall be binding upon and shall inure to the benefit of the PARTIES hereto and their respective successors and assigns. Any assignment shall be acknowledged by letter signed by the assignor and the assignee. A copy of said letter shall be provided to AMAFCA.

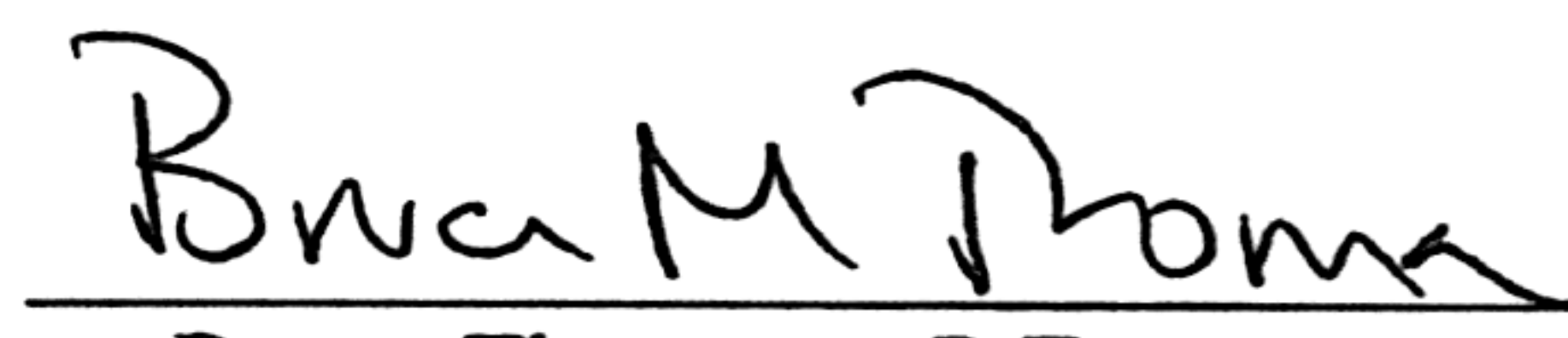
IN WITNESS WHEREOF, the PARTIES have set their hands and seals this day and year set forth below.

**ALBUQUERQUE METROPOLITAN ARROYO FLOOD CONTROL
AUTHORITY**

By: 
Danny Hernandez
Chairman of Board of Directors

Date: 4/24/14

ATTEST:

By: 
Bruce Thomson, P.E.
Secretary/Treasurer

Date: 4/24/14

I-40 SOUTH, LLC,

By: 
Thomas F. Keleher
Manager

Date: 4-22-14