White Tanks FRS No. 3
Outfall Channel Final Design
FCD 2009C012 - SURVEY REPORT

Prepared for:
Flood Control District of Maricopa County
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April 2010

Prepared by:

Hoskin • Ryan Consultants, Inc.
creative engineering solutions

JACOBS

COOPER AERIAL

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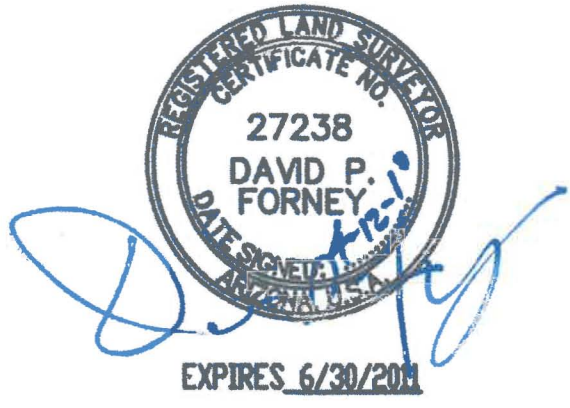


1 INTRODUCTION

Hoskin-Ryan Consultants, Inc., has been contracted by the Flood Control District of Maricopa County (District) to prepare aerial mapping, photogrammetry, and survey for the White Tanks FRS No. 3 (FRS#3) Outfall Channel project. The aerial mapping and photogrammetry was conducted by Cooper Aerial Surveys Co.

The District is in the process of performing rehabilitation to FRS#3, including a new Principal Spillway that discharges adjacent to the Beardsley Canal. The project provides a channel along the Jackrabbit Trail corridor, to convey the Principal Spillway flows from FRS#3 to FRS#4 (Figure 1). The outfall channel will extend south from the Principal Spillway at FRS#3 to the existing FRS#4 inlet channel north of McDowell Road, and lie within the Town of Buckeye and unincorporated Maricopa County.

The goals of the project include:

- Provide an outfall for the FRS#3 Principal Spillway flows.
- Intercept and convey the 100-year flood flows reaching the channel to the planned outfall at FRS#4.
- Reduce the effective FEMA 100-year floodplain along Jackrabbit Trail.
- Accommodate the future widening of Jackrabbit Trail.
- Design the facilities to complement the existing and planned future setting through implementation of context sensitive planning and design
- Provide an opportunity to implement trail linkage as part of the Maricopa County Regional Trail System.

The existing FRS#4 inlet channel is a concrete-lined channel which extends from south of Interstate 10 to north of McDowell Road. North of the existing concrete-lined channel, the existing Jackrabbit Channel and Wash are a series of unlined channels and ditches of varying dimensions and capacities. Between Missouri Avenue and the Bethany Home Road alignment, natural drainage patterns continue across the Jackrabbit Trail alignment from west to east. North of the Bethany Home Road alignment to FRS#3, the predominant land slope is to the east, towards the Beardsley Canal.

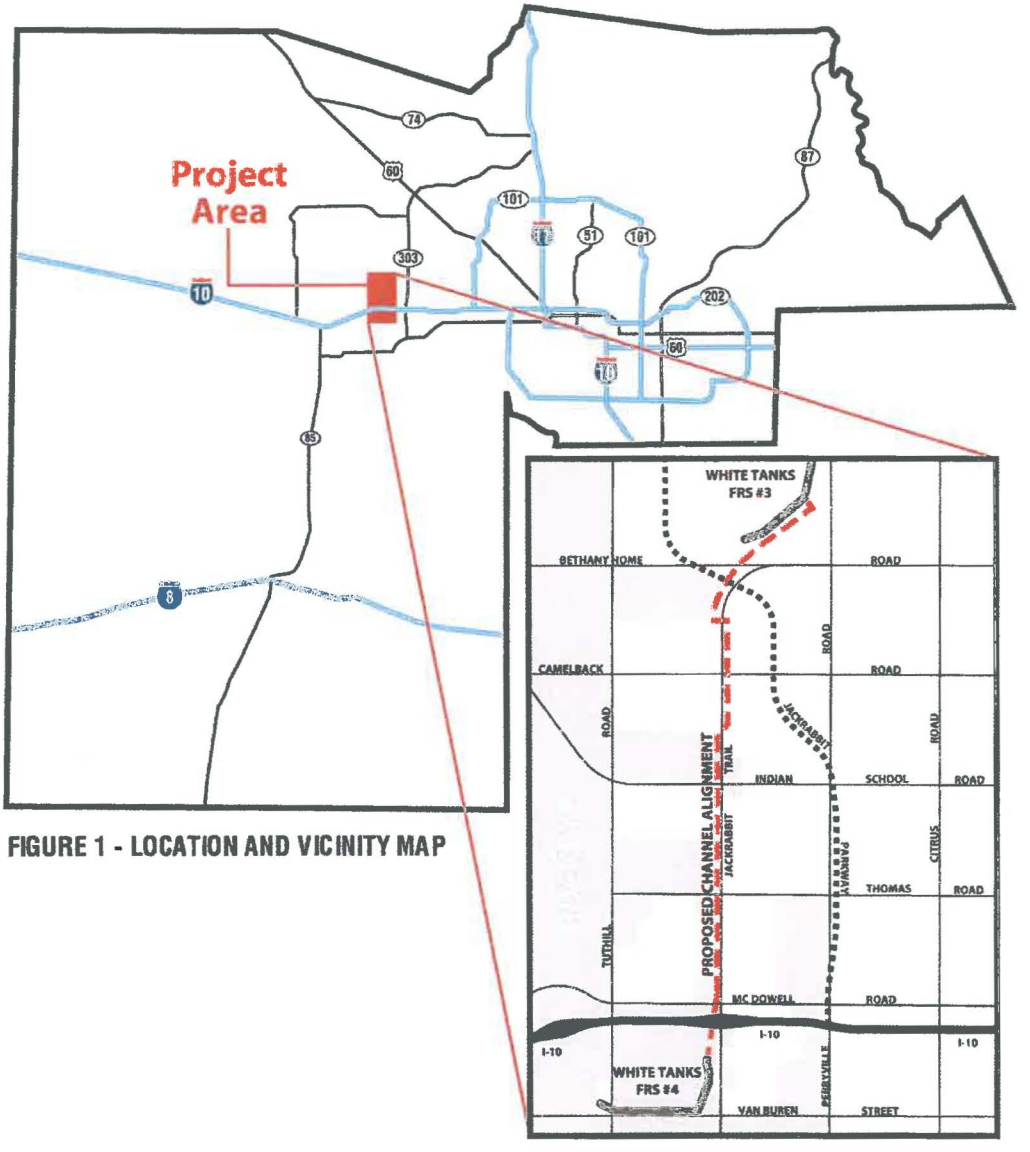


FIGURE 1 - LOCATION AND VICINITY MAP

The purpose of the Survey Report is to explain the process by which the data was collected and the results of the findings.

1.1 Overview of Survey Procedure

The Project Control is based on the Arizona State Plane Coordinate System (AZSPC) and the Record of Survey used to establish this control is the Maricopa County Geodetic Densification and Cadastral Survey (GDACS) recorded in Book 638 of Maps, Page 33, Maricopa County Records and Book 652 of Maps, Page 22, Maricopa County Records for Horizontal Control. The Vertical Control is based on a prior survey of White Tanks FRS#4 and the Benchmarks set in association with that project.

The area of the mapping and the requirements of the District dictated the number of Sections which needed to be surveyed, this includes 14 Sections in 2 Townships (Township 1 North, Range 2 West & Township 2 North, Range 2 West) making a total of 75 Section/Quarter Corners surveyed. All the existing sectional control was observed and tied to the aerial control panel points used for aerial mapping. No sectional control was set during this survey. This survey is for construction design purposes and does not represent a boundary survey. No independent research was conducted in relation to the boundary of the area surveyed.

2 Data Collection

The data was collected with Trimble GPS equipment models 5700, 5800 and R8. The base point was located in the "Jack Rabbit Estates Subdivision" approximately 4.3 miles from the Project Benchmark, located at the south end of the White Tanks #4 dam.

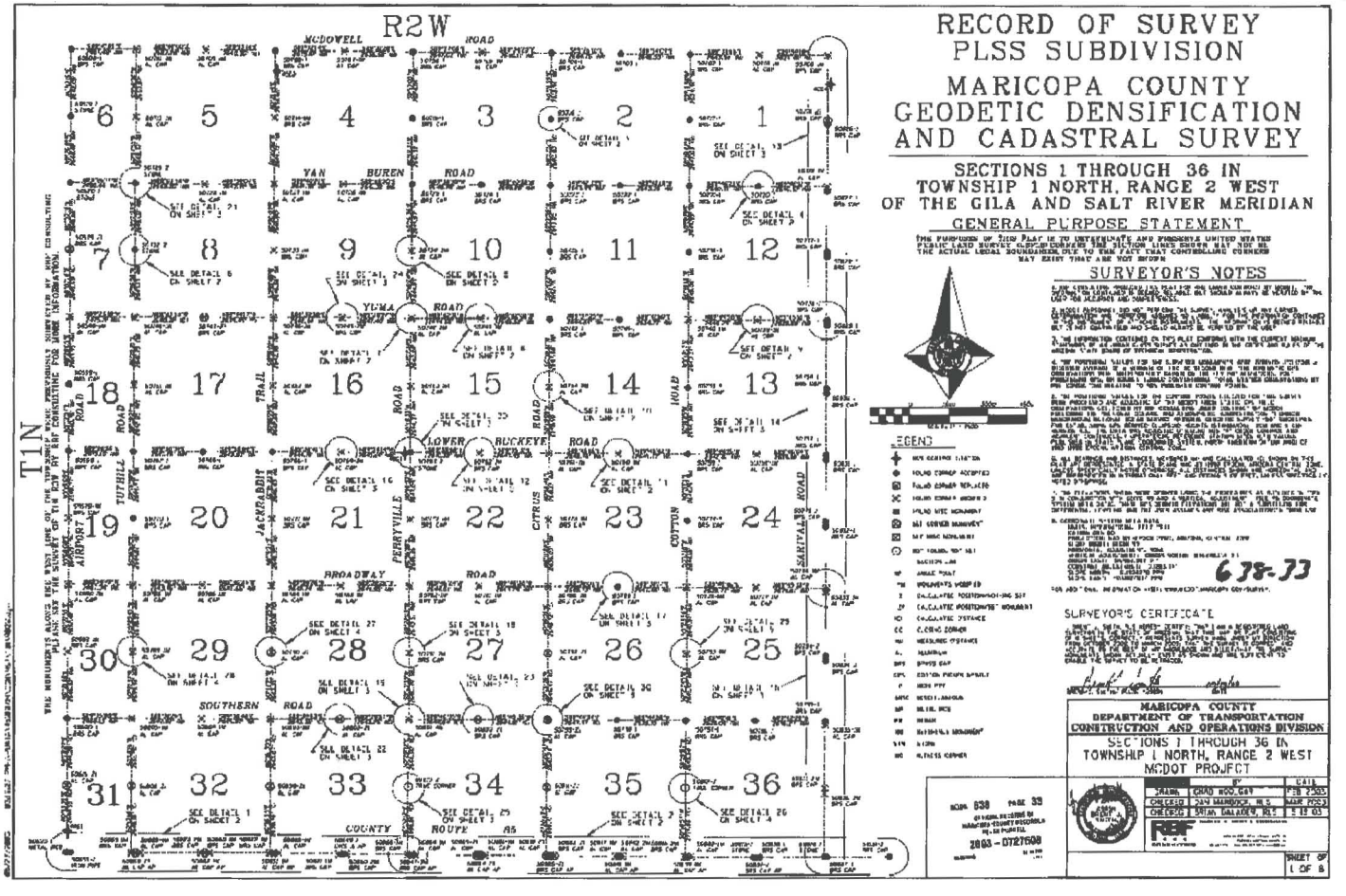
The calibration was based on the GDACS for horizontal position of sectional control and the vertical is based on the Benchmark, Maricopa County Department of Transportation Control Point

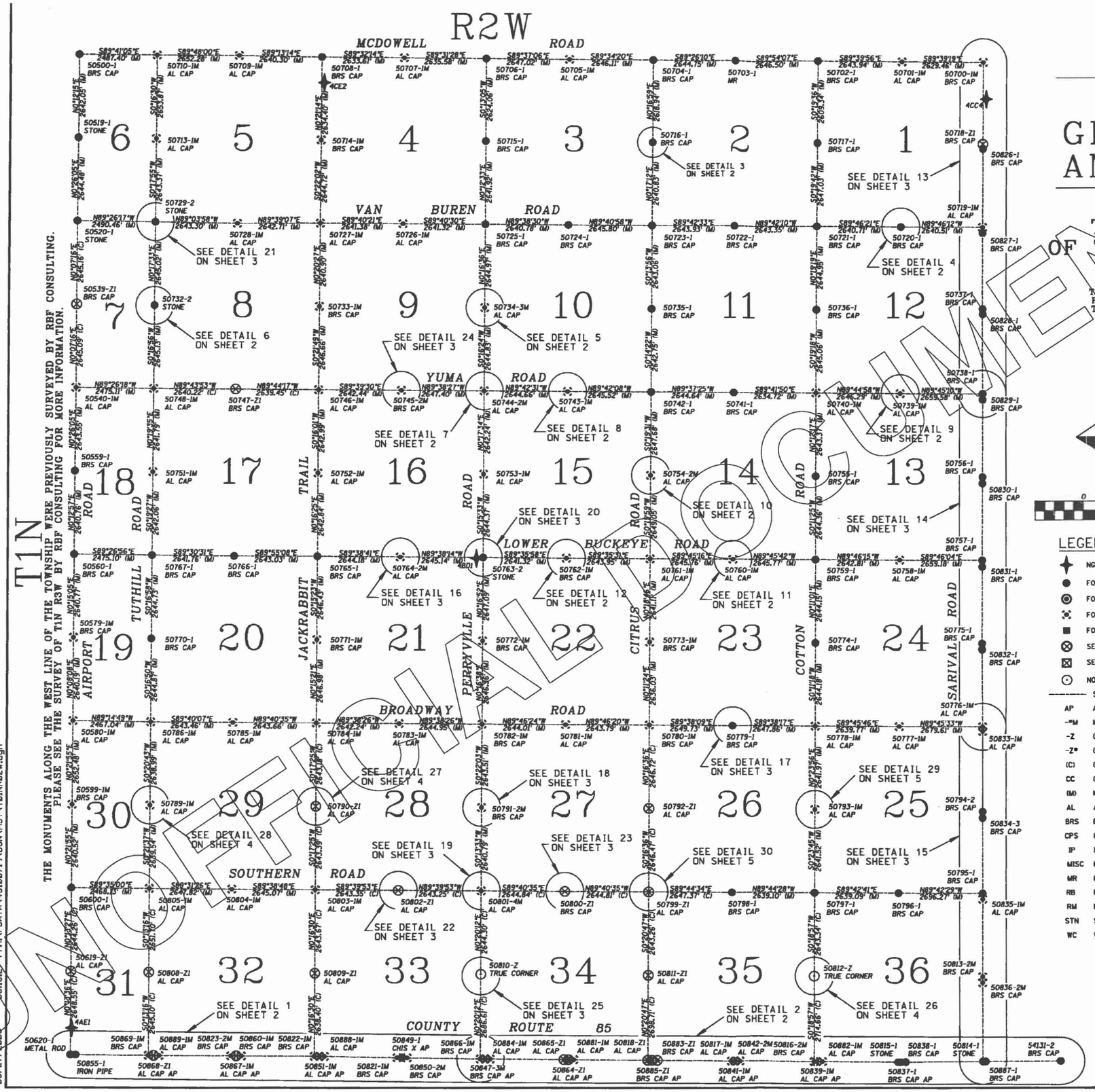
WT-4, with a published elevation of 1146.30 feet.

All field data has been collected on the Arizona State Plane Coordinate System NAD83 (North American Datum 1983) and realized to NAVD88 (North American Vertical Datum 1988) using GEOID03. All data was collected using two observations consisting of 180 epoch duration each at least 4 hrs apart to maximize the availability of optimal satellite configuration. For the purposes of engineering design and construction the field data and resulting DTM have been scaled to ground distances with a Grid to Ground Scaling factor of 1.00011, inversely to convert from Ground to Grid the factor used is 0.999890012.

2.1 GDACS – Geodetic Densification and Cadastral Survey

Sheet 1 of the GDACS recorded in Book 638 of maps, Page 33 MCR.





RECORD OF SURVEY
PLSS SUBDIVISION

MARICOPA COUNTY GEODETIC DENSIFICATION AND CADASTRAL SURVEY

SECTIONS 1 THROUGH 36 IN TOWNSHIP 1 NORTH, RANGE 2 WEST OF THE GILA AND SALT RIVER MERIDIAN

GENERAL PURPOSE STATEMENT

THE PURPOSES OF THIS PLAT IS TO DETERMINATE AND PRESERVE UNITED STATES PUBLIC LAND SURVEY (USPLS) CORNERS. THE SECTION LINES SHOWN MAY NOT BE THE ACTUAL LEGAL BOUNDARIES, DUE TO THE FACT THAT CONTROLLING CORNERS MAY EXIST THAT ARE NOT SHOWN.

0 1500 3000 4500

SCALE: 1" = 1500'

LEGEND

- NGS CONTROL STATION
- FOUND CORNER ACCEPTED
- FOUND CORNER REPLACED
- FOUND CORNER MODIFIED
- FOUND MISC MONUMENT
- SET CORNER MONUMENT
- SET MISC MONUMENT
- NOT FOUND, NOT SET
- SECTION LINE

AP	ANGLE POINT
-*M	MONUMENTS MODIFIED
-Z	CALCULATED POSITION/NOTHING SET
-Z*	CALCULATED POSITION/SET MONUMENT
(C)	CALCULATED DISTANCE
CC	CLOSING CORNER
(M)	MEASURED DISTANCE
AL	ALUMINUM
BRS	BRASS CAP
CPS	COTTON PICKER SPINDLE
IP	IRON PIPE
MISC	MISCELLANEOUS
MR	METAL ROD
RB	REBAR
RM	REFERENCE MONUMENT
STN	STONE
WC	WITNESS CORNER

SURVEYOR'S NOTES

1. RBF CONSULTING PRODUCED THIS PLAT FOR AND UNDER CONTRACT BY MCDOT. THE INFORMATION CONTAINED IS DEEMED RELIABLE, BUT SHOULD ALWAYS BE VERIFIED BY THE USER FOR ACCURACY AND COMPLETENESS.

2. MCDOT PERSONNEL DID NOT PERFORM THE SURVEY, ANALYSIS OR ANY CORNER DETERMINATION AND THEREFORE ASSUMES NO LIABILITY FOR THE INFORMATION CONTAINED IN THIS INSTRUMENT OR ATTACHED INSTRUMENTS. THE INFORMATION IS DEEMED RELIABLE BUT IS NOT GUARANTEED AND SHOULD ALWAYS BE VERIFIED BY THE USER.

3. THE INFORMATION CONTAINED ON THIS PLAT CONFORMS WITH THE CURRENT MINIMUM STANDARDS OF AN URBAN CLASS SURVEY AS OUTLINED IN THE CODES AND RULES OF THE ARIZONA STATE BOARD OF TECHNICAL REGISTRATION.

4. THE POSITIONAL VALUES FOR THE SURVEYED MONUMENTS WERE DERIVED UTILIZING A WEIGHTED AVERAGE OF A MINIMUM OF TWO 90 SECOND REAL TIME KINEMATIC GPS OBSERVATIONS WITH INDEPENDENTLY GAINED ON THE FLY INITIALIZATIONS, POST PROCESSING GPS, OR DOUBLE TURNED CONVENTIONAL TOTAL STATION OBSERVATIONS BY RBF CONSULTING RELATIVE TO NGS PUBLISHED CONTROL POINTS.

5. THE POSITIONAL VALUES FOR THE CONTROL POINTS UTILIZED FOR THIS SURVEY WERE PROCESSED AND ADJUSTED BY THE MCDOT FROM STATIC GPS FIELD OBSERVATIONS COLLECTED BY RBF CONSULTING UNDER CONTRACT BY MCDOT FOLLOWING THE "NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION TECHNICAL MEMORANDUM NATIONAL OCEAN SERVICE NATIONAL GEODETIC SURVEY -58" GUIDELINES FOR ESTABLISHING GPS-DERIVED ELLIPSOID HEIGHTS (STANDARDS: 2CM AND 5 CM) VERSION 4.3. THE DATA WAS ADJUSTED UTILIZING NGS "A" ORDER CONTROL AND ADJACENT CONTINUOUSLY OPERATERING REFERENCE STATION SITES WITH VALUES PUBLISHED IN STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM (NAD) OF 1983 (1992 EPOCH), ARIZONA CENTRAL ZONE.

6. ALL BEARINGS AND DISTANCES, MEASURED (M) AND CALCULATED (C) SHOWN ON THIS PLAT ARE REPRESENTED IN STATE PLANE NAD 83 (1992 EPOCH), ARIZONA CENTRAL ZONE, UNLESS SPECIFICALLY NOTED OTHERWISE. ALL DISTANCES SHOWN ARE HORIZONTAL AND ARE REPRESENTED IN INTERNATIONAL FEET AND DECIMALS OF FEET, UNLESS SPECIFICALLY NOTED OTHERWISE.

7. THE ELEVATIONS SHOWN WERE DERIVED USING THE PROCEDURES AS OUTLINED IN ITEM 5 IN CONJUNCTION WITH GEOID 99 AND A VERTICAL ADJUSTMENT. (SEE #8 COORDINATE SYSTEM META DATA). THESE GPS DERIVED ELEVATIONS ARE NOT A SUBSTITUTE FOR DIFFERENTIAL LEVELING AND THE USER ASSUMES ANY RISK ASSOCIATEDWITH THEIR USE.

8. COORDINATE SYSTEM META DATA
   UNITS: INTERNATIONAL FEET (IFT)
   DATUM: GRS-80
   PROJECTION: NAD 83 (EPOCH 1992), ARIZONA, CENTRAL ZONE
   GEOID MODEL: GEOID 99
   HORIZONTAL ADJUSTMENT: NONE
   VERTICAL ADJUSTMENT: ORIGIN NORTH: 876748.214 IFT
   ORIGIN EAST: 816963.987 IFT
   CONSTANT ADJUSTMENT: 0.1253 IFT
   SLOPE NORTH: -0.1908278 PPM
   SLOPE EAST: -0.0027077 PPM

638-33

FOR ADDITIONAL INFORMATION VISIT: WWW.MCDOT.MARICOPA.GOV/SURVEY.

SURVEYOR'S CERTIFICATE

I, BRENT J. SMITH, RLS HEREBY CERTIFY; THAT I AM A REGISTERED LAND SURVEYOR IN THE STATE OF ARIZONA; THAT THIS MAP OR PLAT CONSISTING OF 8 SHEETS, CORRECTLY REPRESENTS SURVEY MADE UNDER MY DIRECTION FROM OCTOBER 2002 TO MARCH 2003; THAT THE SURVEY IS CORRECT AND ACCURATE TO THE BEST OF MY KNOWLEDGE AND BELIEF; THAT THE SURVEY MONUMENTS SHOWN ACTUALLY EXIST AS SHOWN AND ARE SUFFICIENT TO ENABLE THE SURVEY TO BE RETRACED.

BRENT J. SMITH, R.L.S. #29891 — DATE 03/19/03

BOOK 638 PAGE 33
OFFICIAL RECORDS OF MARICOPA COUNTY RECORDER HELEN PURCELL
2003-0727608
06/06/2003 02:52 PM

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION CONSTRUCTION AND OPERATIONS DIVISION

SECTIONS 1 THROUGH 36 IN TOWNSHIP 1 NORTH, RANGE 2 WEST
MCDOT PROJECT

29891 BRENT J. SMITH ARIZONA U.S.A.

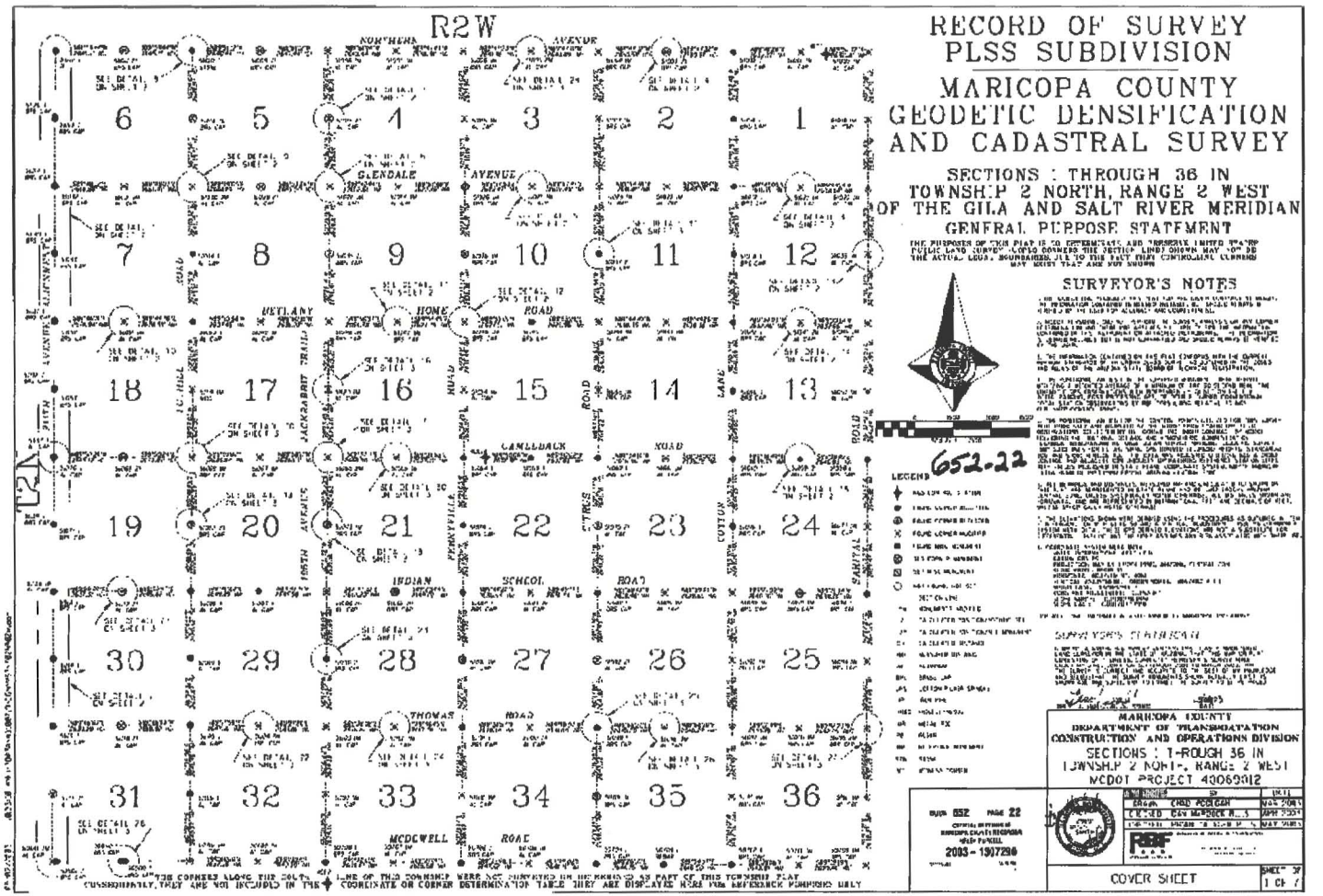
	BY	DATE
DRAWN	CHAD WOOLGAR	FEB 2003
CHECKED	DAN MARDOCK, RLS	MAR 2003
CHECKED	BRIAN DALAGER, RLS	5-19-03

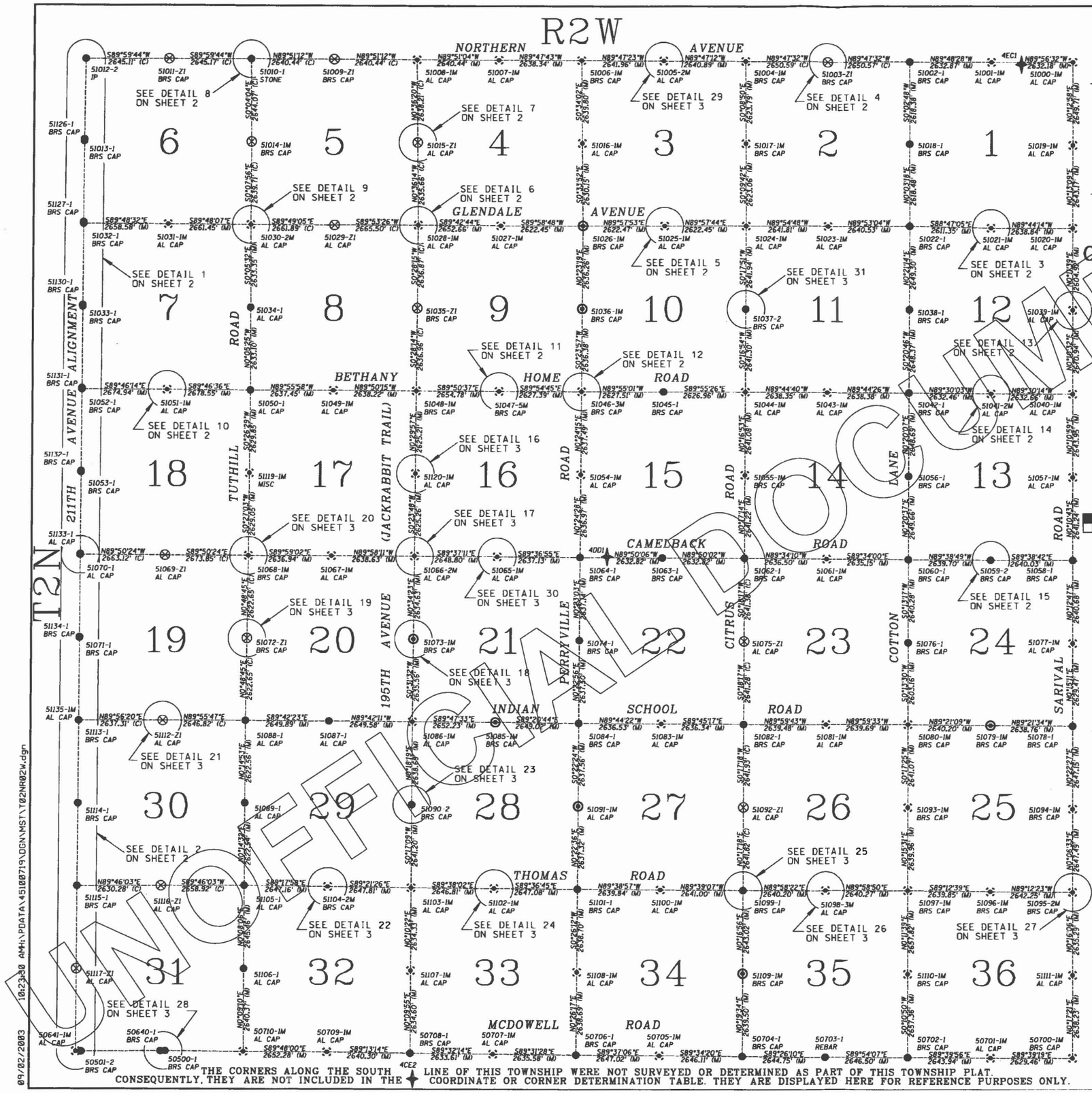
RBF CONSULTING — PLANNING & DESIGN & CONSTRUCTION
10005 NORTH 30TH AVENUE, SUITE 100 PHOENIX, ARIZONA 85051-7030
602.487.2300 • FAX: 602.487.2301 • www.RBF.com

SHEET OF 1 OF 8

05/27/2003 03:16:27 PM H:\PDATA\45100719\DGN\MST\T01NR02W.dgn

Sheet 1 of the GDACS recorded in Book 652 of maps. Page 22 MCR.





THE CORNERS ALONG THE SOUTH LINE OF THIS TOWNSHIP WERE NOT SURVEYED OR DETERMINED AS PART OF THIS TOWNSHIP PLAT. CONSEQUENTLY, THEY ARE NOT INCLUDED IN THE COORDINATE OR CORNER DETERMINATION TABLE. THEY ARE DISPLAYED HERE FOR REFERENCE PURPOSES ONLY.

09/02/2003 10:23:30 AM H:\PDATA\45100719\DGN\MSI\T02NR02W.dgn

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UNOFFICIAL DOCUMENT

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MARICOPA COUNTY ARIZONA

0 1500 3000 4500
SCALE: 1" = 1500'

652-22

LEGEND

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- FOUND CORNER ACCEPTED
- FOUND CORNER REPLACED
- FOUND CORNER MODIFIED
- FOUND MISC MONUMENT
- SET CORNER MONUMENT
- SET MISC MONUMENT
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BRENT J. SMITH, R.L.S. #29891 — DATE 4/28/03

BOOK 652 PAGE 22
OFFICIAL RECORDS OF MARICOPA COUNTY RECORDER HELEN PURCELL
2003 – 1307296
09/17/2003 04:10 PM

MARICOPA COUNTY
DEPARTMENT OF TRANSPORTATION
CONSTRUCTION AND OPERATIONS DIVISION

SECTIONS 1 THROUGH 36 IN TOWNSHIP 2 NORTH, RANGE 2 WEST
MCDOT PROJECT 40069012

REGISTERED LAND SURVEYOR 29891 BRENT J. SMITH ARIZONA U.S.A.

	BY	DATE
DRAWN	CHAD WOOLGAR	MAR 2003
CHECKED	DAN MARDOCK R.L.S.	APR 2003
CHECKED	BRIAN DALAGER R.L.S.	MAY 2003

RBF CONSULTING — PLANNING & DESIGN & CONSTRUCTION
5050 NORTH 40TH AVENUE, SUITE 100
PHOENIX, ARIZONA 85019-7930
(602) 957-2000 • FAX (602) 957-2001 • www.RBF.com

COVER SHEET

SHEET OF 1 OF 7

Below is a list of the GDACS points used in this survey, including the calculated center points.

50715_1	894450.39	533859.54	1030.72	N33°27'27.28"	W112°27'41.11"	"FD 3"" MCHD BC IN HH 0.35' DN
50725_1	891808.36	533849.90	1014.37	N33°27'01.14"	W112°27'41.06"	"FD 3"" MCHD BC IN HH 0.45' DN
50726_1M	891823.34	531208.49	1023.84	N33°27'01.15"	W112°28'12.23"	"FD 1/2"" RB 0.15' DN. SET 2""
50727_1M	891838.44	528567.03	1032.97	N33°27'01.16"	W112°28'43.41"	"FD 1"" IP IN HH 0.4' DN. SET
50728_1M	891822.38	525924.24	1038.89	N33°27'00.86"	W112°29'14.60"	"FD 1/2"" RB FL. SET 2"" MCDOT
50729_1	891866.86	523279.72	1046.21	N33°27'01.15"	W112°29'45.81"	"FD 1/2"" RB W/O ID 0.2' DN"
50729_2	891865.46	523281.17	1046.05	N33°27'01.14"	W112°29'45.80"	"FD STN 0.5' DN MARKED ""CARVE
51006_1M	928719.17	534001.22	1219.45	N33°33'06.33"	W112°27'41.56"	"FD 1"" IP 0.8' DN. SET 1/2""
51007_1M	928728.60	531362.77	1236.10	N33°33'06.29"	W112°28'12.73"	"FD 1/2"" RB FL. SET 2"" MARIC
51008_1M	928735.45	528722.20	1249.85	N33°33'06.21"	W112°28'43.94"	"FD 1/2"" RB FL. SET 2"" MARIC
51009_Z1	928742.27	526081.64	1280.32	N33°33'06.14"	W112°29'15.14"	"SET 1/2"" ROUND SSTL METAL ROD
51010_1	928749.02	523441.10	1313.35	N33°33'06.06"	W112°29'46.34"	"FD STN 0.8' UP MARKED ""5 NOT
51010_2	928749.42	523441.04	1313.01	N33°33'06.06"	W112°29'46.34"	"FD 3/4"" RB W/ NO ID 0.2' UP"
51014_1M	926104.82	523444.22	1281.89	N33°32'39.90"	W112°29'46.13"	"FD 1"" IP BENT TIED AT GROUND
51015_1	926093.05	528769.39	1231.58	N33°32'40.07"	W112°28'43.21"	"FD 1"" IP 0.15' UP W/ NO ID NO
51015_Z1	926097.26	528750.17	1238.01	N33°32'40.11"	W112°28'43.44"	"SET 1/2"" RB W/ 2"" MARICOPA C
51016_1M	926079.37	534027.36	1199.73	N33°32'40.22"	W112°27'41.08"	"FD 1"" IP 0.3' DN. SET 2"" MA
51026_1M	923449.22	534053.27	1184.19	N33°32'14.20"	W112°27'40.61"	"FD 1 1/2"" IRON BAR 0.4' DN.
51027_1M	923448.30	531430.69	1196.78	N33°32'14.05"	W112°28'11.60"	"FD 3/4"" IP 0.15' DN. SET 2""
51028_1M	923461.62	528777.94	1215.81	N33°32'14.04"	W112°28'42.94"	"FD 1"" ROUND IRON METAL ROD 0.
51028_2	923461.59	528778.21	1216.36	N33°32'14.04"	W112°28'42.94"	"FD STN 0.8' UP NO MARKING NOT
51029_Z1	923456.50	526112.32	1233.09	N33°32'13.84"	W112°29'14.43"	"SET 1/2"" RB W/ 2"" MARICOPA C

51030_1	923461.41	523475.98	1257.42	N33°32'13.75"	W112°29'45.58"	"FD 1/2"" RB W/ 1"" PLAS CAP FL
51030_2M	923464.99	523450.31	1257.02	N33°32'13.78"	W112°29'45.88"	"FD 4"" AL CAP STAMPED ""T2NR2W
51034_1	920831.51	523454.54	1257.90	N33°31'47.73"	W112°29'45.66"	"FD 4"" IP 0.1' UP W/ 2"" AL CA
51035_Z1	920824.71	528756.27	1185.87	N33°31'47.95"	W112°28'43.03"	"SET 1/2"" ROUND SSTL METAL ROD
51036_1M	920812.89	534035.38	1165.72	N33°31'48.11"	W112°27'40.66"	"FD 1"" IP 0.5' DN. REPLACED W
51046_1	918176.34	534062.00	1154.73	N33°31'22.03"	W112°27'40.18"	FD 60d NL 0.3' DN NOT STAMPED
51046_2	918140.09	534061.58	1153.92	N33°31'21.67"	W112°27'40.19"	"FD 3/4"" RB W/ 1 1/4"" CAP AGE
51046_3M	918176.44	534017.02	1155.51	N33°31'22.03"	W112°27'40.72"	"FD 1"" ROUND IRON METAL ROD 0.
51047_1	918105.33	531463.84	1166.85	N33°31'21.19"	W112°28'10.87"	"FD 1 1/4"" IP 0.1' UP W/ 1 1/4
51047_2	918145.70	531435.80	1169.35	N33°31'21.59"	W112°28'11.20"	"FD 3/4"" RB W/ 1 1/4"" PLAS CA
51047_3	918255.33	531465.05	1168.92	N33°31'22.67"	W112°28'10.87"	"FD 1 1/4"" IP 0.1' UP W/ 1 1/4
51047_4	918147.31	531389.16	1169.53	N33°31'21.60"	W112°28'11.75"	"FD 1/2"" RB W/TAG FL STAMPED "
51047_5M	918180.46	531389.51	1169.48	N33°31'21.93"	W112°28'11.75"	"FD 1"" IP 0.2' DN. SET 3"" MC
51048_1M	918187.71	528734.61	1193.48	N33°31'21.86"	W112°28'43.11"	"FD 1"" RB 0.6' DN. SET 3"" MC
51049_1M	918195.20	526096.28	1229.20	N33°31'21.79"	W112°29'14.28"	"FD 1/2"" RB FL SET 2"" MARI
51050_1	918198.28	523458.70	1271.34	N33°31'21.68"	W112°29'45.43"	"FD 4"" IP FL W/ 2"" AL CAP STA
51054_1M	915538.89	533998.41	1144.78	N33°30'55.93"	W112°27'40.77"	"FD 1/2"" RB 0.2' DN. SET 2""
51064_1	912901.86	533979.65	1134.43	N33°30'29.84"	W112°27'40.83"	"FD 3"" MCDOT BC IN HH 0.7' DN.
51065_1M	912919.57	531342.44	1153.62	N33°30'29.88"	W112°28'11.98"	"FD 1"" IP FL. SET 1/2"" RB W/
51065_2	912919.96	531342.02	1153.82	N33°30'29.88"	W112°28'11.98"	FD 60d NL FL NOTE- NL HAS WAS

51066_1	912937.44	528709.84	1186.61	N33°30'29.91"	W112°28'43.07"	"FD 1/2"" RB W/ NO ID FL"
51066_2M	912937.16	528693.57	1186.38	N33°30'29.91"	W112°28'43.26"	"FD 1/2"" RB 0.2' DN. SET 2""
51067_1M	912938.56	526054.81	1223.88	N33°30'29.78"	W112°29'14.43"	"FD 1/4"" RB 0.1' DN. SET 2""
51068_1M	912939.30	523417.75	1264.26	N33°30'29.64"	W112°29'45.57"	"FD 1"" ROUND SSTL METAL ROD 0.
51068_2	912869.76	523416.75	1263.83	N33°30'28.96"	W112°29'45.58"	"FD 1/2"" RB W/ 1"" PLAS CAP FL
51072_1	910353.24	523381.20	1233.60	N33°30'04.06"	W112°29'45.83"	"FD 4"" IP 0.15' UP W/ 2"" AL C
51072_Z1	910316.78	523380.56	1237.46	N33°30'03.70"	W112°29'45.84"	"SET 1/2"" ROUND SSTL METAL ROD
51073_1M	910302.53	528667.22	1170.76	N33°30'03.84"	W112°28'43.41"	"FD CPS FL. REPLACED W/ 1/2""
51073_2	910302.32	528684.18	1170.72	N33°30'03.84"	W112°28'43.20"	FD PK NL FL
51074_1	910264.65	533961.97	1119.37	N33°30'03.75"	W112°27'40.88"	"FD 3"" MCDOT BC IN HH 0.7' DN.
51084_1	907627.08	533944.33	1111.91	N33°29'37.65"	W112°27'40.92"	"FD 3"" MCDOT BC IN HH 0.65' DN
51085_1M	907657.35	531295.38	1135.83	N33°29'37.81"	W112°28'12.20"	"FD RRS. REPLACED W/ 1/2"" ROU
51086_1M	907666.95	528643.04	1162.45	N33°29'37.77"	W112°28'43.52"	"FD 1 1/4"" IP 0.9' DN. SET 1/
51087_1	907680.67	525993.37	1185.44	N33°29'37.76"	W112°29'14.81"	"FD 4"" IP 0.2' UP W/ 2"" AL CA
51088_1	907694.27	523343.38	1213.87	N33°29'37.75"	W112°29'46.10"	"FD 4"" IP 2.4' DN W/ 2"" AL CA
51089_1	905071.59	523332.02	1198.43	N33°29'11.80"	W112°29'46.07"	"FD 4"" IP 0.3' DN W/ 2"" AL CA
51090_1	905028.20	528629.05	1144.97	N33°29'11.66"	W112°28'43.52"	"FD 1 1/4"" IP 0.3' DN W/ NO ID
51090_2	905028.17	528628.98	1145.74	N33°29'11.66"	W112°28'43.52"	"FD 3"" MCDOT BC FL NOT STAMPED
51091_1M	904989.45	533927.17	1100.79	N33°29'11.55"	W112°27'40.96"	"FD CPS. REPLACED W/ 1/2"" RB
51101_1	902352.06	533909.82	1084.46	N33°28'45.46"	W112°27'41.00"	"FD 3"" MCDOT BC IN HH 0.45' DN
51102_1M	902369.96	531262.68	1106.66	N33°28'45.50"	W112°28'12.26"	"FD 1/2"" RB 0.1' DN. SET 2""

51102_2	902445.06	531263.08	1103.99	N33°28'46.24"	W112°28'12.26"	"FD 1 1/4"" IP 0.15' UP W/ 1 1/
51102_3	902295.13	531262.34	1105.82	N33°28'44.76"	W112°28'12.25"	"FD 1 1/4"" IP FL W/ 1 1/4"" PL
51103_1M	902386.88	528615.80	1125.17	N33°28'45.53"	W112°28'43.51"	"FD 3/4"" RB IN HH 0.5' DN. SE
51104_1	902385.31	525939.25	1144.66	N33°28'45.37"	W112°29'15.11"	"FD 1"" IP 0.2' UP W/ NO ID"
51104_2M	902416.59	525968.03	1144.45	N33°28'45.68"	W112°29'14.77"	"FD 1 1/2"" IP 0.1' DN. SET 1/
51105_1	902448.96	523320.94	1174.78	N33°28'45.85"	W112°29'46.02"	"FD 4"" AL CAP 0.3' DN STAMPED
51106_1	899803.38	523314.71	1138.93	N33°28'19.68"	W112°29'45.92"	"FD 4"" IP 0.2' DN W/ IP IS 4""
51107_1M	899752.43	528607.85	1102.33	N33°28'19.46"	W112°28'43.43"	"FD 1 1/4"" IP 0.3' DN. SET 2"
51108_1M	899713.31	533889.71	1071.45	N33°28'19.35"	W112°27'41.08"	"FD 1/2"" RB 0.1' DN. SET 2""
51119_1M	915568.39	523438.44	1282.78	N33°30'55.66"	W112°29'45.50"	MISC.
51120_1M	915562.48	528711.74	1188.13	N33°30'55.88"	W112°28'43.22"	"FD 1"" IP. SET 1/2"" RB W/ 2"
51120_2	915552.90	528711.64	1188.06	N33°30'55.79"	W112°28'43.22"	"FD 1"" PIPE W/ NO ID 0.2' DN"
WT3 BM1	927140.05	530970.44	1221.95	N33°32'50.55"	W112°28'17.27"	wt frs 3 grid
WT3 BM2	926042.25	530878.07	1217.63	N33°32'39.68"	W112°28'18.29"	wt frs 3 grid
WT4 BM1	891940.66	523345.12	1046.30	N33°27'01.89"	W112°29'45.05"	9/16" SS ROD DRILLED & DOMED IN
WT4 BM2	891912.62	527835.02	1037.50	N33°27'01.85"	W112°28'52.05"	9/16" SS ROD DRILLED & DOMED IN

2.2 FIELD DATA COLLECTED

Control: Horizontal

Observations were taken on all existing Section Corners, Quarter Corners and Center of Section monuments, within the calibration area.

Control: Vertical

Vertical control was based on the Maricopa County Department of Transportation Benchmark WT-4, a 9/16" Stainless Steel Rod drilled & domed in handhole 6.5' deep with carsonite marker, Elevation=1046.3'. Its general vicinity is approximately 100' Northeasterly of the Southwest Corner of Section 5, Township 1 North, Range 2 West. It is also located within the Southwesterly corner of the White Tanks #4 dam property. There were independent static observations performed on the WT-4 Control Point as well as unrelated NGS and Maricopa County benchmarks to check the validity of the benchmark.

Control: Aerial Panels

Fifty (50) Aerial Panels were set and observations taken on the center points. These positions were observed using the same techniques as the horizontal control, 2 observations of 180 epoch duration at least 4 hours apart.

Along with the fifty (50) listed Aerial panels there were six (6) "Blind Panels" set to check the accuracy of the aerial topography, this will be discussed in more detail within the summary provided by Cooper Aerial Surveys Co.

Control: Cross Sections for Aerial Topography Checks

Cross sections were run along the corridors (Jack Rabbit Trail & Beardsley Canal) of the project area. These cross sections consisted of 5 epoch observations collected at 1320 foot intervals, 1000 feet in width, with no more than 100 feet between observations. The observations were processed against the surface created from the DTM (Digital Terrain Model) and the results were purported in a statistical error report at a 95% confidence level. These checks were performed by the Maricopa County Flood Control District Survey Department and Cooper Aerial Surveys Co., these checks were performed prior to the release of the aerial topography.

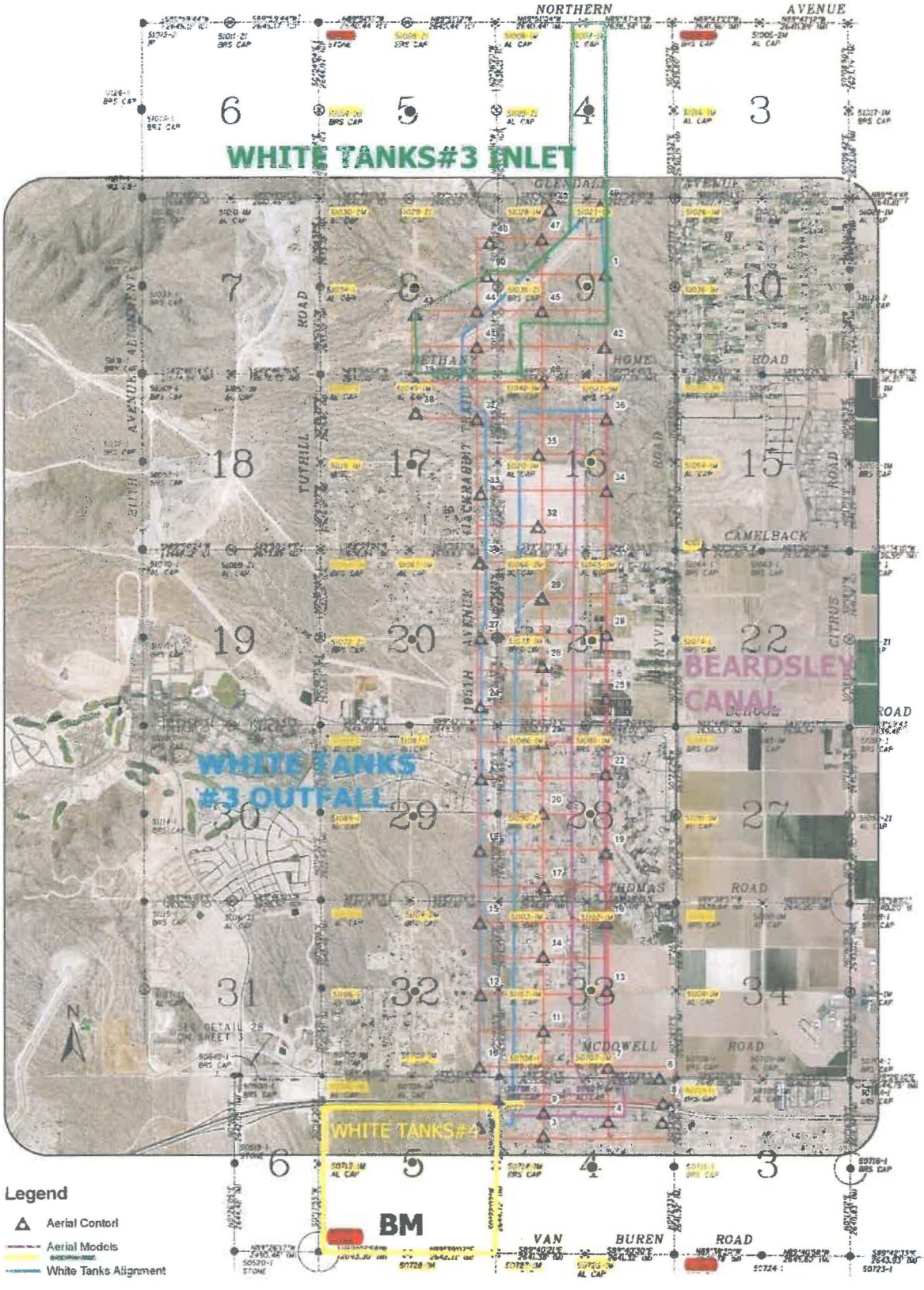
Detail Survey Areas

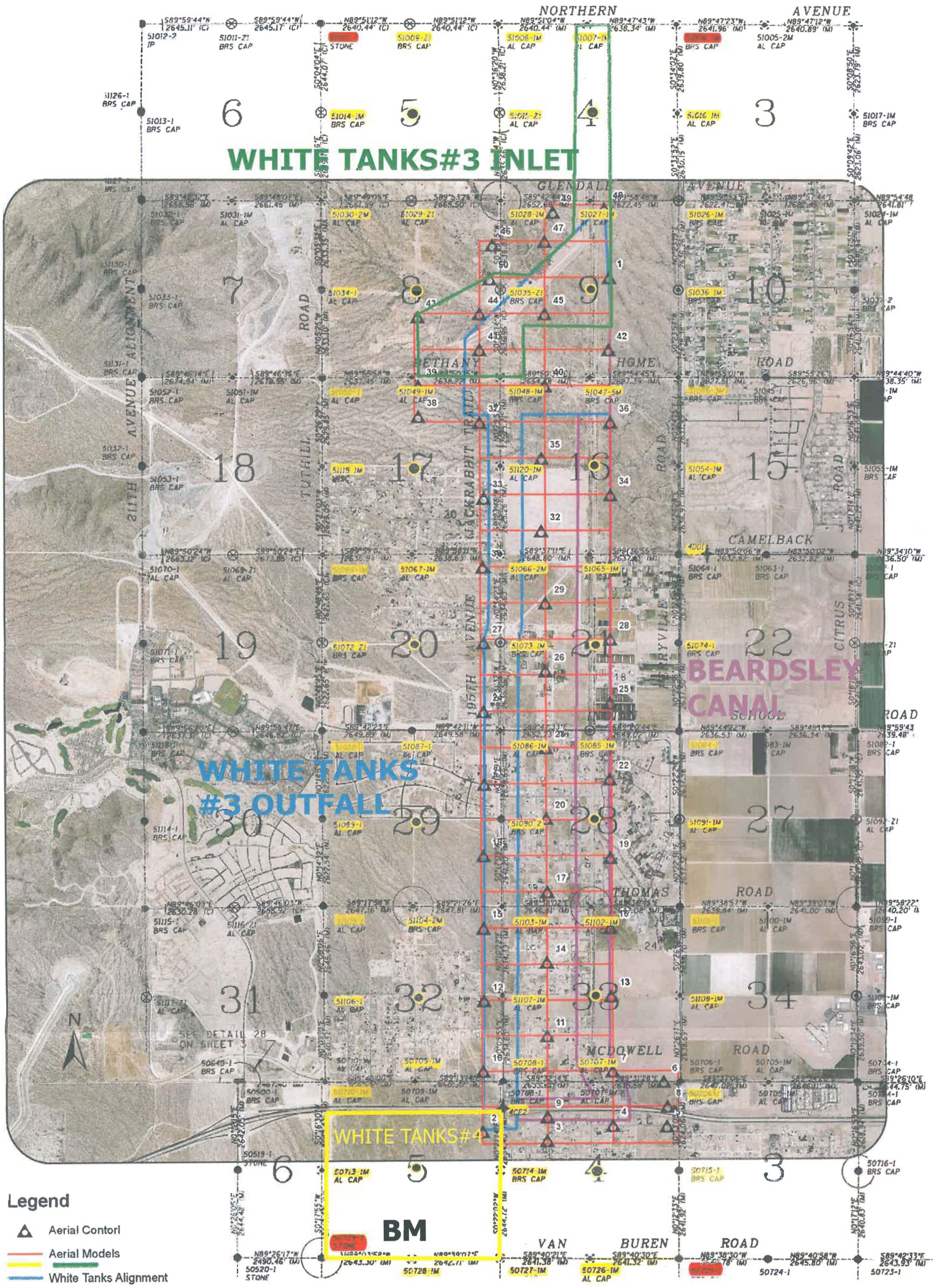
HRC Survey performed detailed Topographic Surveys on areas as designated by the HRC engineering department to supplement the aerial topography. These Surveys were performed with Total Stations and three wire levels in lieu of the GPS systems due to their inherent vertical accuracy. These surveys were typically conducted at structure crossings and street intersections as well as areas with walls and/or domiciles.

Utility Surveys

HRC Survey collected observations on the utility locating paint marks as well as the reference markers set for Potholing, which were then used to supplement the aerial mapping.

Aerial Panel and Control Layout Exhibit (Not To Scale)




NORTHERN AVENUE
GLENDALE AVENUE
BETHANY HOME ROAD
CAMELBACK ROAD
THOMAS ROAD
MCDOWELL ROAD
VAN BUREN ROAD
ALIGNMENT ROAD
TUTHILL ROAD
JACKRABBIT TRAIL
195TH AVENUE
CITRUS ROAD
WHITE TANKS#3 INLET
BEARDSLEY CANAL
WHITE TANKS #3 OUTFALL
WHITE TANKS#4
BM
SEE DETAIL 28 ON SHEET 3
N
Legend
Aerial Contorl
Aerial Models
White Tanks Alignment

Results:

The results of the observations are listed below and the error data has been computed using the following NSSDA (National Standard for Spatial Data Accuracy) Standards as shown below.

Federal Geographic Data Committee — FGDC-STD-007.3-1998
Geospatial Positioning Accuracy Standards
Part 3: National Standard for Spatial Data Accuracy
Appendix 3-A (normative): Accuracy Statistics

EXPLANATORY COMMENTS

1. Horizontal Accuracy

Let:

$RMSE_x = sqrt[\sum(x_{data,i} - x_{check,i})^2/n]$
$RMSE_y = sqrt[\sum(y_{data,i} - y_{check,i})^2/n]$

where:
$x_{data,i}$, $y_{data,i}$ are the coordinates of the i th check point in the dataset
$x_{check,i}$, $y_{check,i}$ are the coordinates of the i th check point in the independent source of higher accuracy
n is the number of check points tested
i is an integer ranging from 1 to n

Horizontal error at point i is defined as $sqrt[(x_{data,i} - x_{check,i})^2 + (y_{data,i} - y_{check,i})^2]$. Horizontal RMSE is:

$RMSE_r = sqrt[\sum((x_{data,i} - x_{check,i})^2 + (y_{data,i} - y_{check,i})^2)/n]$
$= sqrt[RMSE_x^2 + RMSE_y^2]$

Case 1: Computing Accuracy According to the NSSDA when $RMSE_x = RMSE_y$

If $RMSE_x = RMSE_y$,
$RMSE_r = sqrt(2*RMSE_x^2) = sqrt(2*RMSE_y^2)$
$= 1.4142*RMSE_x = 1.4142*RMSE_y$

It is assumed that systematic errors have been eliminated as best as possible. If error is normally distributed and independent in each the x- and y-component and error, the factor 2.4477 is used to compute horizontal accuracy at the 95% confidence level (Greenwalt and Schultz, 1968). When the preceding conditions apply, $Accuracy_r$, the accuracy value according to NSSDA, shall be computed by the formula:

$Accuracy_r = 2.4477 * RMSE_x = 2.4477 * RMSE_y$
$= 2.4477 * RMSE_r/1.4142$
$Accuracy_r = 1.7308 * RMSE_r$

Case 2: Approximating circular standard error when $RMSE_x \neq RMSE_y$

If $RMSE_{min}/RMSE_{max}$ is between 0.6 and 1.0 (where $RMSE_{min}$ is the smaller value between $RMSE_x$ and $RMSE_y$ and $RMSE_{max}$ is the larger value), circular standard error (at 39.35% confidence) may be approximated as $0.5*(RMSE_x + RMSE_y)$ (Greenwalt and Schultz, 1968). If error is normally distributed and independent in each the x- and y-component and error, the accuracy value according to NSSDA may be approximated according to the following formula:

$$Accuracy_r = 2.4477 * 0.5 * (RMSE_x + RMSE_y)$$

2. Vertical Accuracy

Let:

$$RMSE_z = sqrt[\sum(z_{data_i} - z_{check_i})^2/n]$$

where

z_{data_i} is the vertical coordinate of the i th check point in the dataset.
z_{check_i} is the vertical coordinate of the i th check point in the independent source of higher accuracy
n = the number of points being checked
i is an integer from 1 to n

It is assumed that systematic errors have been eliminated as best as possible. If vertical error is normally distributed, the factor 1.9600 is applied to compute linear error at the 95% confidence level (Greenwalt and Schultz, 1968). Therefore, vertical accuracy, $Accuracy_z$, reported according to the NSSDA shall be computed by the following formula:

$$Accuracy_z = 1.9600 * RMSE_z$$

Table 1 Those items in RED are outliers to the data set and are believed to be instances of monument replacement.

GDACS	DIFF NORTH	DIFF EAST	DIFF ELEV.	(DIFF NORTH)^2	(DIFF EAST)^2	SUM(DIFF)^2 H	(DIFF)^2 V	RMSE H	RMSE V	NSSDA H	NSSDA V
51009_Z1	-0.098	-0.151	0.338	0.010	0.023	0.032	0.114	0.180	0.338	0.311	0.662
51008_1M	-0.009	-0.158	0.292	0.000	0.025	0.025	0.086	0.158	0.292	0.274	0.573
51007_1M	-0.099	-0.112	0.284	0.010	0.013	0.022	0.081	0.149	0.284	0.259	0.557
51016_1M	0.066	-0.138	0.983	0.004	0.019	0.023	0.966	0.153	0.983	0.264	1.927
51015_Z1	-0.088	-0.032	0.181	0.008	0.001	0.009	0.033	0.094	0.181	0.162	0.355
51014_1M	-0.073	-0.112	0.363	0.005	0.013	0.018	0.131	0.134	0.363	0.231	0.711
51028_1M	-0.020	-0.166	0.182	0.000	0.028	0.028	0.033	0.168	0.182	0.290	0.357
51027_1M	0.000	-0.152	0.177	0.000	0.023	0.023	0.031	0.152	0.177	0.263	0.346
51026_1M	0.009	-0.118	0.254	0.000	0.014	0.014	0.064	0.119	0.254	0.206	0.497
51036_1M	0.027	-0.160	0.192	0.001	0.025	0.026	0.037	0.162	0.192	0.280	0.377
51035_Z1	0.095	0.141	-0.295	0.009	0.020	0.029	0.087	0.170	0.295	0.295	0.578
51034_1	-0.044	-0.088	-0.040	0.002	0.008	0.010	0.002	0.098	0.040	0.170	0.077
51050_1	-0.075	-0.114	0.394	0.006	0.013	0.019	0.155	0.136	0.394	0.235	0.772
51049_1M	-0.074	-0.044	0.306	0.006	0.002	0.008	0.094	0.087	0.306	0.150	0.601
51048_1M	0.032	-0.124	0.232	0.001	0.015	0.016	0.054	0.128	0.232	0.221	0.456
51047_5M	-0.238	-0.040	-0.032	0.056	0.002	0.058	0.001	0.241	0.032	0.417	0.063
51046_3M	-0.006	-0.032	-0.104	0.000	0.001	0.001	0.011	0.032	0.104	0.056	0.204
51054_1M	0.026	-0.176	0.996	0.001	0.031	0.031	0.992	0.177	0.996	0.307	1.952
51120_1M	-0.043	-0.079	0.277	0.002	0.006	0.008	0.077	0.090	0.277	0.156	0.543
51119_1M	-0.013	-0.052	0.149	0.000	0.003	0.003	0.022	0.053	0.149	0.093	0.292
51068_1M	-0.057	-0.047	0.265	0.003	0.002	0.005	0.070	0.074	0.265	0.128	0.520
51067_1M	-0.004	-0.007	0.179	0.000	0.000	0.000	0.032	0.008	0.179	0.014	0.351
51066_2M	-0.014	-0.054	0.301	0.000	0.003	0.003	0.091	0.055	0.301	0.096	0.590
51074_1	-0.079	-0.024	0.428	0.006	0.001	0.007	0.183	0.083	0.428	0.143	0.839
51084_1	-0.011	-0.002	0.457	0.000	0.000	0.000	0.209	0.011	0.457	0.019	0.897
51085_1M	-0.038	-0.013	0.153	0.001	0.000	0.002	0.023	0.040	0.153	0.070	0.300
51086_1M	-0.064	-0.025	0.112	0.004	0.001	0.005	0.013	0.069	0.112	0.119	0.220
51087_1	0.200	0.012	0.194	0.040	0.000	0.040	0.038	0.200	0.194	0.346	0.380
51088_1	-0.012	0.024	0.146	0.000	0.001	0.001	0.021	0.027	0.146	0.047	0.285
51089_1	0.313	-0.296	-0.443	0.098	0.088	0.186	0.196	0.432	0.443	0.747	0.868
51090_1	-0.038	-0.055	0.933	0.001	0.003	0.004	0.870	0.067	0.933	0.116	1.829
51092_1M	-0.010	0.047	0.152	0.000	0.002	0.002	0.023	0.049	0.152	0.084	0.298
51101_1	-0.071	-0.054	0.569	0.005	0.003	0.008	0.324	0.089	0.569	0.153	1.115
51102_1M	-0.071	0.052	0.019	0.005	0.003	0.008	0.000	0.088	0.019	0.153	0.036
51103_1M	-0.031	-0.022	0.101	0.001	0.001	0.001	0.010	0.038	0.101	0.066	0.197
51104_2M	-0.083	0.073	0.123	0.007	0.005	0.012	0.015	0.110	0.123	0.191	0.242
51105_1	-0.059	0.069	0.168	0.003	0.005	0.008	0.028	0.091	0.168	0.157	0.329
51107_1M	-0.068	0.024	0.228	0.005	0.001	0.005	0.052	0.071	0.228	0.124	0.447
51108_1M	0.014	0.024	0.148	0.000	0.001	0.001	0.022	0.028	0.148	0.048	0.290
50706_1	-0.050	0.030	0.415	0.003	0.001	0.003	0.172	0.059	0.415	0.101	0.813
50715_1	-0.091	0.062	0.335	0.008	0.004	0.012	0.112	0.110	0.335	0.190	0.657
50714_1M	0.058	0.054	0.167	0.003	0.003	0.006	0.028	0.079	0.167	0.137	0.326
50713_1M	-0.051	0.112	6.988	0.003	0.013	0.015	48.832	0.123	6.988	0.213	13.696
50728_1M	-0.040	0.082	-0.430	0.002	0.007	0.008	0.185	0.091	0.430	0.158	0.843
50727_1M	-0.033	0.078	0.310	0.001	0.006	0.007	0.096	0.084	0.310	0.145	0.607
51028_1M	0.033	-0.031	0.213	0.001	0.001	0.002	0.045	0.045	0.213	0.078	0.417
AVERAGE TOTAL								**0.107**	**0.436**	**0.184**	**0.854**

Table 2 Error report with outliers excluded.

GDACS	DIFF NORTH	DIFF EAST	DIFF ELEV.	(DIFF NORTH)^2	(DIFF EAST)^2	SUM(DIFF)^{2}H	(DIFF)^2 V	RMSE H	RMSE V	NSSDA H	NSSDA V
51009_Z1	-0.098	-0.151	0.338	0.010	0.023	0.032	0.114	0.180	0.338	0.311	0.662
51008_1M	-0.009	-0.158	0.292	0.000	0.025	0.025	0.086	0.158	0.292	0.274	0.573
51007_1M	-0.099	-0.112	0.284	0.010	0.013	0.022	0.081	0.149	0.284	0.259	0.557
51015_Z1	-0.088	-0.032	0.181	0.008	0.001	0.009	0.033	0.094	0.181	0.162	0.355
51014_1M	-0.073	-0.112	0.363	0.005	0.013	0.018	0.131	0.134	0.363	0.231	0.711
51028_1M	-0.020	-0.166	0.182	0.000	0.028	0.028	0.033	0.168	0.182	0.290	0.357
51027_1M	0.000	-0.152	0.177	0.000	0.023	0.023	0.031	0.152	0.177	0.263	0.346
51026_1M	0.009	-0.118	0.254	0.000	0.014	0.014	0.064	0.119	0.254	0.206	0.497
51036_1M	0.027	-0.160	0.192	0.001	0.025	0.026	0.037	0.162	0.192	0.280	0.377
51035_Z1	0.095	0.141	-0.295	0.009	0.020	0.029	0.087	0.170	0.295	0.295	0.578
51034_1	-0.044	-0.088	-0.040	0.002	0.008	0.010	0.002	0.098	0.040	0.170	0.077
51050_1	-0.075	-0.114	0.394	0.006	0.013	0.019	0.155	0.136	0.394	0.235	0.772
51049_1M	-0.074	-0.044	0.306	0.006	0.002	0.008	0.094	0.087	0.306	0.150	0.601
51048_1M	0.032	-0.124	0.232	0.001	0.015	0.016	0.054	0.128	0.232	0.221	0.456
51047_5M	-0.238	-0.040	-0.032	0.056	0.002	0.058	0.001	0.241	0.032	0.417	0.063
51046_3M	-0.006	-0.032	-0.104	0.000	0.001	0.001	0.011	0.032	0.104	0.056	0.204
51120_1M	-0.043	-0.079	0.277	0.002	0.006	0.008	0.077	0.090	0.277	0.156	0.543
51119_1M	-0.013	-0.052	0.149	0.000	0.003	0.003	0.022	0.053	0.149	0.093	0.292
51068_1M	-0.057	-0.047	0.265	0.003	0.002	0.005	0.070	0.074	0.265	0.128	0.520
51067_1M	-0.004	-0.007	0.179	0.000	0.000	0.000	0.032	0.008	0.179	0.014	0.351
51066_2M	-0.014	-0.054	0.301	0.000	0.003	0.003	0.091	0.055	0.301	0.096	0.590
51074_1	-0.079	-0.024	0.428	0.006	0.001	0.007	0.183	0.083	0.428	0.143	0.839
51084_1	-0.011	-0.002	0.457	0.000	0.000	0.000	0.209	0.011	0.457	0.019	0.897
51085_1M	-0.038	-0.013	0.153	0.001	0.000	0.002	0.023	0.040	0.153	0.070	0.300
51086_1M	-0.064	-0.025	0.112	0.004	0.001	0.005	0.013	0.069	0.112	0.119	0.220
51087_1	0.200	0.012	0.194	0.040	0.000	0.040	0.038	0.200	0.194	0.346	0.380
51088_1	-0.012	0.024	0.146	0.000	0.001	0.001	0.021	0.027	0.146	0.047	0.285
51089_1	0.313	-0.296	-0.443	0.098	0.088	0.186	0.196	0.432	0.443	0.747	0.868
51092_1M	-0.010	0.047	0.152	0.000	0.002	0.002	0.023	0.049	0.152	0.084	0.298
51102_1M	-0.071	0.052	0.019	0.005	0.003	0.008	0.000	0.088	0.019	0.153	0.036
51103_1M	-0.031	-0.022	0.101	0.001	0.001	0.001	0.010	0.038	0.101	0.066	0.197
51104_2M	-0.083	0.073	0.123	0.007	0.005	0.012	0.015	0.110	0.123	0.191	0.242
51105_1	-0.059	0.069	0.168	0.003	0.005	0.008	0.028	0.091	0.168	0.157	0.329
51107_1M	-0.068	0.024	0.228	0.005	0.001	0.005	0.052	0.071	0.228	0.124	0.447
51108_1M	0.014	0.024	0.148	0.000	0.001	0.001	0.022	0.028	0.148	0.048	0.290
50706_1	-0.050	0.030	0.415	0.003	0.001	0.003	0.172	0.059	0.415	0.101	0.813
50715_1	-0.091	0.062	0.335	0.008	0.004	0.012	0.112	0.110	0.335	0.190	0.657
50714_1M	0.058	0.054	0.167	0.003	0.003	0.006	0.028	0.079	0.167	0.137	0.326
50728_1M	-0.040	0.082	-0.430	0.002	0.007	0.008	0.185	0.091	0.430	0.158	0.843
50727_1M	-0.033	0.078	0.310	0.001	0.006	0.007	0.096	0.084	0.310	0.145	0.607
51028_1M	0.033	-0.031	0.213	0.001	0.001	0.002	0.045	0.045	0.213	0.078	0.417
AVERAGE TOTAL								**0.105**	**0.234**	**0.181**	**0.458**

Table 3

WHITE TANKS #3 OUTFALL CROSS-SECTION RESIDUALS		
RMSE	NSSDA RMSE*1.96	X-SECTION NUMBER
0.151	0.296	1
0.176	0.344	2
0.211	0.413	3
0.164	0.320	4
0.206	0.404	5
0.152	0.298	6
0.211	0.414	7
0.229	0.450	8
0.227	0.445	9
0.235	0.460	10
0.280	0.549	11
0.332	0.650	12
0.294	0.576	13
0.156	0.306	14
0.255	0.499	15
0.270	0.529	16
0.250	0.490	17
0.158	0.310	18
0.140	0.275	19
0.475	0.932	20
0.213	0.418	21
0.349	0.683	22
0.233	0.457	AVERAGE

Table 4

BEARDSLEY CANAL CROSS-SECTION RESIDUALS		
RMSE	NSSDA RMSE*1.96	X-SECTION NUMBER
0.202	0.395	1
0.271	0.532	2
0.352	0.691	3
0.319	0.626	4
0.293	0.574	5
0.669	1.311	6
0.289	0.567	7
0.289	0.566	8
0.405	0.793	9
0.162	0.318	10
0.426	0.836	11
0.344	0.675	12
0.199	0.390	13
0.224	0.438	14
0.438	0.575	15
0.333	0.653	16
0.333	0.641	17
0.327	0.478	18
0.244	0.607	19
0.310	0.524	20
0.267	0.295	21
0.319	0.595	AVERAGE

Appendix A: Jacobs Summation

Jacobs Engineering Survey Report

Jacobs was tasked with the layout and data collection of the 50 aerial panels and 6 blind panels per Cooper Aerial's flight plan, as well as collect cross-sectional topo data for mapping verification.

The data was collected using NAD 83 State Plane Central Zone grid coordinates recorded in Maricopa County's Record of Survey PLSS Subdivision (GDACS) book 652, page 22 and book 638, page 33. Independent static observations were made to verify the geodetic data provided on GDACS surveys. Elevations where provided based on NAVD 88 datum using the Maricopa County Department of Transportation control point WT-4, having and elevation of 1146.30 feet.

The panel positions and cross-sectional mapping verification topo were collected using RTK GPS. The equipment used to collect the data was Trimble TSC-2 data collectors and Trimble R8 GPS receivers. Panel locations and elevations were determined by multiple three minute observations. Mapping verification topo was collected on 1320 foot intervals, 1000' feet in width, with no more than 100' feet between points. The cross-sectional data was collected using 5 second observations.

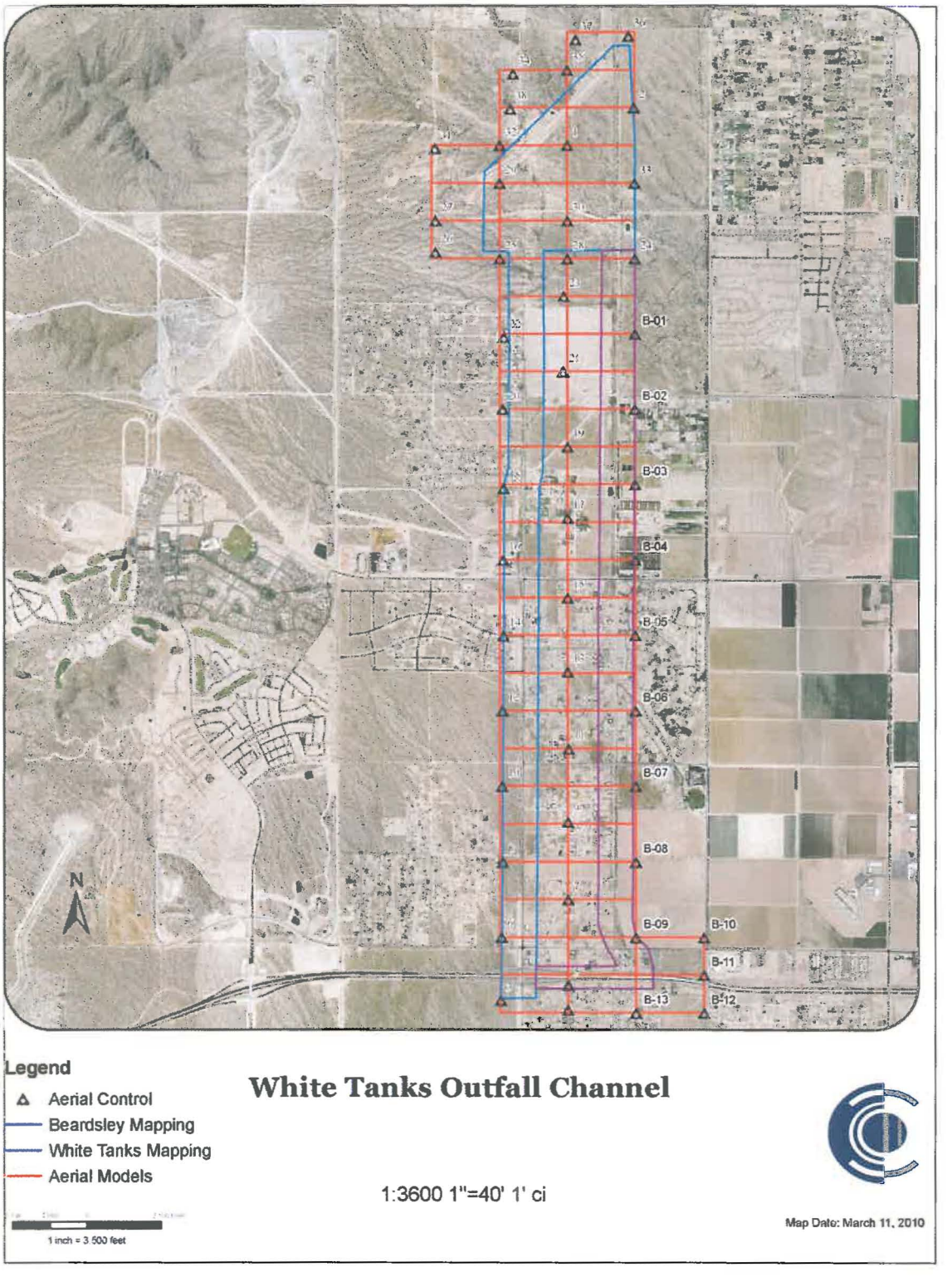
REGISTERED LAND SURVEYOR
CERTIFICATE NO.
36171
VINCENT F.
NECHERO
Date Signed 01-05-10
ARIZONA, U.S.A.
Expires 06/30/10

Appendix B: Cooper Summation

Cooper Aerial Photogrammetry Report

- Aerial Photography
  - All aerial photography was acquired using our Cessna Stationair Turbo 206 that is equipped with our Leica RC-30 photogrammetric FMC camera system. The camera was calibrated by the USSG in August 2009 and they reported our AWAR to be 106.
  - All photography was acquired at a photo scale of 1"=300' (1:3600) using AGFA color film.
  - All photography was acquired on Sunday November 15, 2009.
  - All film was processed by HAS Images in Dayton, OH.
  - All film was scanned into digital format at 10 microns using our Leica DSW 700 photogrammetric scanner.
- Photogrammetry
  - All photogrammetric products were compiled using our Cardinal VrOne/VrTwo softcopy workstations
  - All mapping was compiled to meet/exceed FEMA & NSSDA mapping standards for a 1"=40' map with a 1' contour interval.

Please refer the attached map on the next page that depicts the control layout and the photo coverage


B-01
B-02
B-03
B-04
B-05
B-06
B-07
B-08
B-09
B-10
B-11
B-12
B-13
N
Legend
Aerial Control
Beardsley Mapping
White Tanks Mapping
Aerial Models
1 inch = 3,500 feet
White Tanks Outfall Channel
1:3600 1"=40' 1' ci
Map Date: March 11, 2010

Point comparison report

Project : GPS (9000)

User name	ragsdalemh	**Date & Time**	8:48:12 AM 12/7/2009
Coordinate System	US State Plane 1983	**Zone**	Arizona Central 0202
Project Datum	NAD 1983 (Conus)		
Vertical Datum	NAVD-88	**Geoid Model**	Arizona Subset geoid 2003
Coordinate Units	International feet		
Distance Units	International feet		
Height Units	International feet		

First point	Second point	Horiz dist (ft)	Vert dist (ft)	Delta North (ft)	DeltaEast (ft)
351	251	0.123	0.115	-0.122	0.014
352	252	0.084	-0.004	-0.023	0.081
353	253	0.147	-0.167	0.139	0.048
354	254	0.134	0.141	-0.076	0.111
355	255	0.126	-0.009	0.068	0.106
356	256	0.140	-0.048	-0.066	0.124