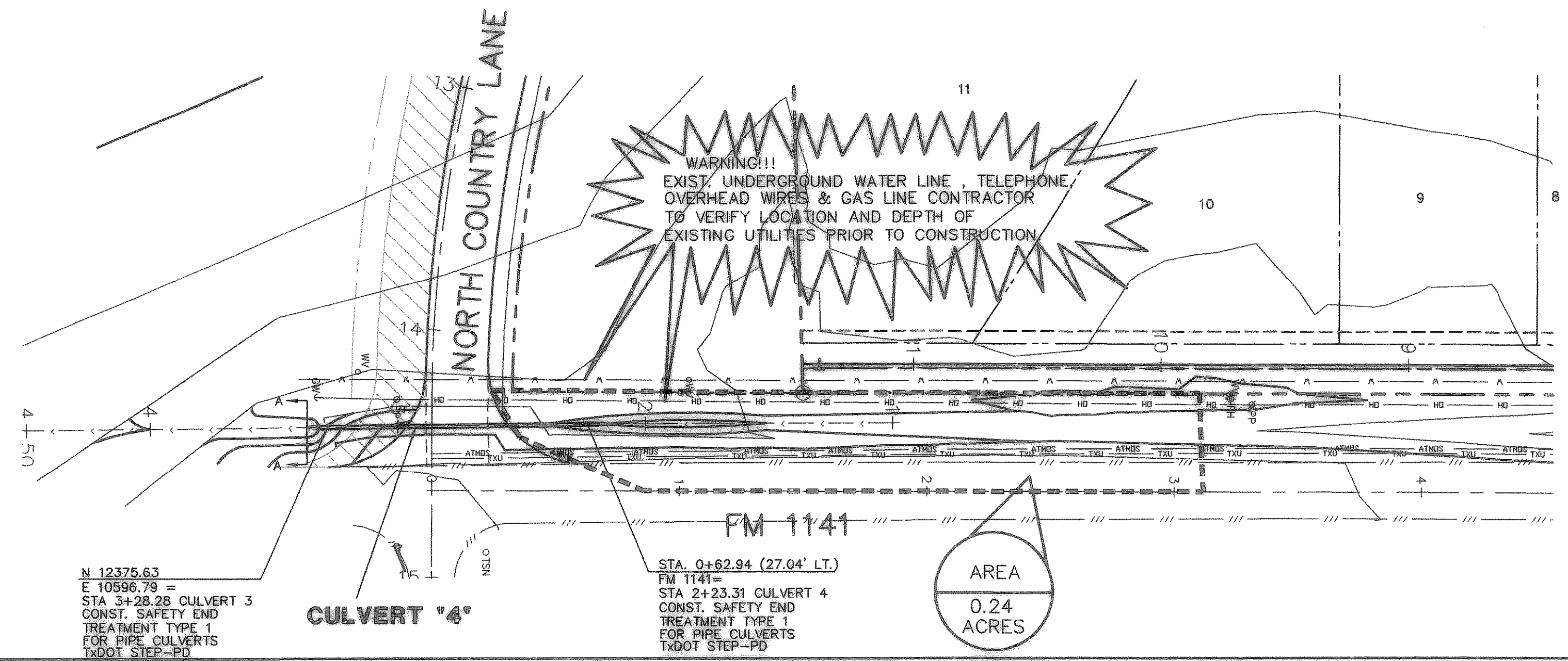


**LEGEND 1**

TC	TOP OF CURB
TP	TOP OF PAVEMENT
CR	CURB RETURN
FL	FLOW LINE
2	STREET STATION
⊕	HANDICAP RAMP @ STREET & STREET INTERSECTION
⊕	HANDICAP RAMP @ STREET & ALLEY INTERSECTION
→	FLOW ARROWS
⊙	EXISTING CONCRETE PAVEMENT
—	ASPHALT PAVING
742	PROPOSED CONTOUR LINE
742	EXISTING CONTOUR LINE
PP	POWER POLE
MH	MANHOLE
WV	WATER VALVE
TP	TELEPHONE PEDESTAL
WM	WATER METER
FH	FIRE HYDRANT
LP	LIGHT POLE
CO	CLEAN OUT
AC	AIR CONDITIONER
TV	CABLE BOX
SB	SIGNAL BOX
SP	SIGNAL POLE
SN	SIGN
SS	SANITARY SEWER
W	WATER LINE
OH	OVERHEAD POWER LINES
EBOX	ELECTRICAL BOX
TXU	TEXAS UTILITIES
SWB	SOUTH WESTERN BELL
GAS	GAS LINE
RCP	REINFORCED CONCRETE PIPE
TSN	TRAFFIC SIGNS
WMH	WATER MANHOLE
TMK	TELEPHONE MARKER
WMK	WATER MARKER
GMK	GAS MARKER



AS BUILT  
 To the best of our knowledge "Winkelmann and Associates, Inc." hereby states that this plan is "As-Built". The information is based on surveying conducted at the site and modification information provided by "the Contractor".  
*W. Naemuddin Khan* 9/25/07  
 WINKELMANN & ASSOCIATES, INC. DATE

APPROVED

REVISION

DATE

NO.

**Winkelmann & Associates, Inc.**  
 CIVIL ENGINEERS & SURVEYORS  
 670 MILLER PLAZA, SUITE 100  
 DALLAS, TEXAS 75205  
 (972) 988-7266 FAX

**CULVERT DESIGN CALCULATIONS**

CULVERT LOCATION: DALTON RANCH, ROCKWALL, TEXAS

LENGTH, L: 105.00 FT DESIGN STORM FREQ. 100-YR

ROUGHNESS COEFF. n: 0.012 MAX. VEL. 12.0 ft/sec

TAILWATER: 0.56' D.S. CHANNEL WIDTH: TRIANGULAR

ENTRANCE DESCRIPTION: 5 DESIGN DISCHARGE: 1.18 cfs

RDWY. ELEV. 570.99 U.S. CULV. F.L. 568.07

U.S. CULV. F.L. 568.07 D.S. CULV. F.L. 567.54

DIFFERENCE: 2.52' DIFFERENCE: 0.53'

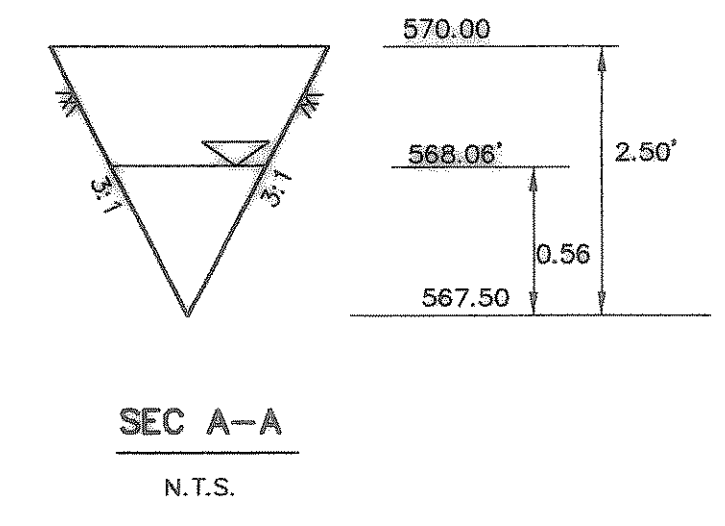
REQ'D. FREEBOARD: 1.0 FT. CULV. SLOPE, S<sub>0</sub> = 0.53% = 0.50%

ALLOW. HEADWATER: 1.92' FT. S<sub>0</sub> = 0.53% = 0.50%

**DOWNSTREAM CHANNEL CALCULATIONS**

Q<sub>100</sub> = 1.18 cfs  
 n = 0.035  
 SIDE SLOPE (RT) = 3:1  
 SIDE SLOPE (LT) = 3:1  
 LONGITUDINAL SLOPE = 0.50%  
 DEPTH OF FLOW = 0.56 ft  
 AVERAGE VELOCITY = 1.25 fps

Trial Area of Opening	Channel Width "W" (feet)	T.A.C (sq. ft.)	DEPTH RANGE D.R.		POSSIBLE CULVERT SIZES					INLET CONTROL (Using Figure 26)				OUTLET CONTROL (Using Figure 28 & 30)								The Greater Controlling Head Water (Inlet or Outlet) (feet)	SELECTED CONDUIT SIZE			
			T.A.C	AHW	Try Diameter "D" (inch)	No. Openings	Pipe Dia. "D" (inch)	Total Culvert Area "A <sub>c</sub> " (sf)	"Q" Each Opening (c.f.s.)	Entrance Type	Case No.	HW/D (figure 26)	HW (feet)	Entrance Coeff. K <sub>e</sub>	CASE III HW = H + TW - L X S <sub>0</sub> (feet)				CASE IV HW = H + h <sub>0</sub> - L X S <sub>0</sub> (feet)							
			W	(feet)	(inch)		(inch)	(sf)	(c.f.s.)					"H" (figure 28)	"TW" (feet)	L X S <sub>0</sub> (feet)	"HW" (feet)	"H" (figure 28)	h <sub>0</sub> = d <sub>c</sub> + D/2 (figure 30)	d <sub>c</sub> + D/2 (feet)	"TW" (feet)			h <sub>0</sub> (feet)	L X S <sub>0</sub> (feet)	"HW" (feet)
0.94	TRIANGULAR	-	1.52	18"	1	18"	1.77	1.18	5	I	0.26	0.39	0.20	0.86	0.56'	0.53	0.89	0.86	0.41	0.96	0.56	0.96	0.53	1.29	1.29' (OUTLET)	18" RCP



Q<sub>100</sub> = (C)(I)(A)      Q<sub>100</sub> = (0.50)(9.80)(0.24)

C = 0.50      Q<sub>100</sub> = 1.18 c.f.s.

I = 9.80

A = 0.24

AREA = 0.24 AC  
 Q<sub>100</sub> = 1.18 c.f.s.  
 n = 0.035  
 S = 0.05%  
 d = 0.56'  
 V<sub>average</sub> = 1.25 ft/sec  
 Q<sub>cap</sub> = 19.14 c.f.s.

NOTE: FIG. 26, 28 & 30 ARE THE NOMOGRAPHS OF BUREAU OF PUBLIC ROADS, JAN. 1963, PAGE NO. G-26, G-28, G-30

**BENCHMARK 1** USGS Monument-stamped Boren 1986  
 Located approximately 1.25 miles east of Rockwall at the Rockwall Municipal Airport, in the north end of a circular grass area at the end of a taxiway.  
 ELEVATION = 574.17

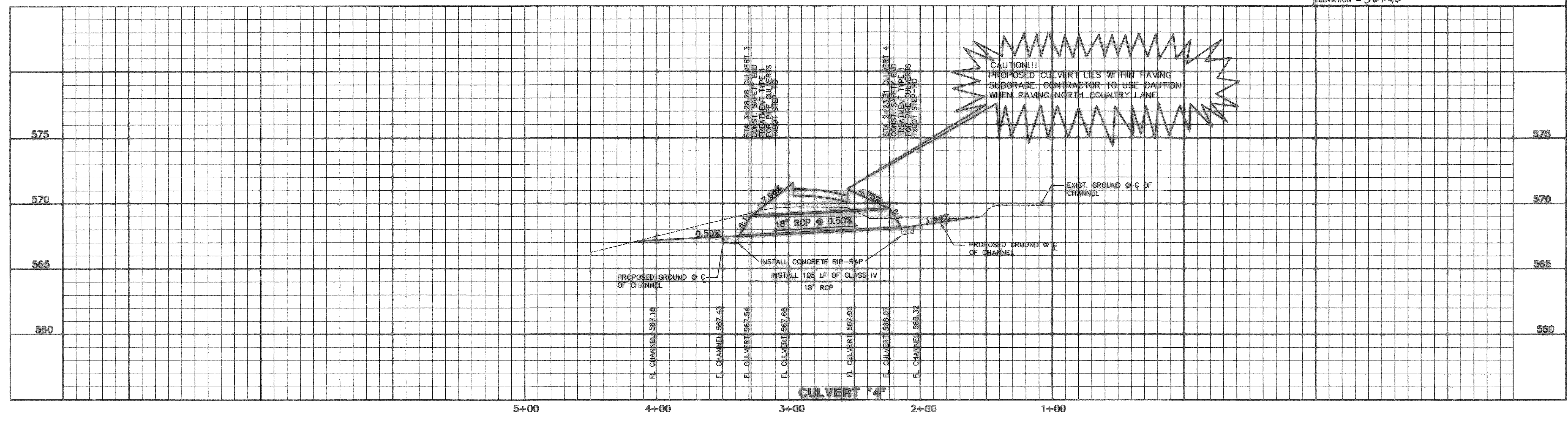
**BENCHMARK 2** USGS Monument-5" cap stamped N 1495/1986  
 Located 24.6 feet west of the center of a paved road leading to the Rockwall Municipal Airport, 16.4 feet south of a utility pole with a transformer and light, 2 feet west of the north leg of a sign. Access to datum point is through a 5 inch logo cap.  
 ELEVATION = 567.44

CONSTRUCTION PLANS WERE PREPARED UNDER THE RESPONSIBLE SUPERVISION OF M.D. NAIM UDDIN KHAN, REGISTERED PROFESSIONAL ENGINEER NO. 87776.

THE SEAL APPEARING ON THIS DOCUMENT WAS AUTHORIZED BY M.D. NAIM UDDIN KHAN, P.E. #87776

JOHN M. GLASS SURVEY ABSTRACT No. 88  
 CITY OF ROCKWALL, TEXAS  
 ROCKWALL COUNTY, TEXAS  
 D R HORTON  
 4366 MILLER ROAD, SUITE A  
 ROWLETT, TEXAS 75088  
 214-607-4244

**CULVERT PLAN, PROFILE & CALCULATIONS**  
**CULVERT 4**



Scale: 1" = 40'  
 Date: 09/08/06  
 Designed By: RS  
 Drawn By: RS  
 Checked By: NK  
 File: 40709CUL.DWG View: CUL4  
 Project No.: 40709.00

G:\0709\eng\40709CUL.dwg 08/20/06 4:30:08 PM, me