

**Culvert Calculator Report**  
Driveway Culvert

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	672.07 ft	Headwater Depth/Height	0.78
Computed Headwater Elev	672.06 ft	Discharge	48.74 cfs
Inlet Control HW Elev	672.03 ft	Tailwater Elevation	671.00 ft
Outlet Control HW Elev	672.06 ft	Control Type	Outlet Control

Grades			
Upstream Invert	670.50 ft	Downstream Invert	670.24 ft
Length	62.00 ft	Constructed Slope	0.003023 ft/ft

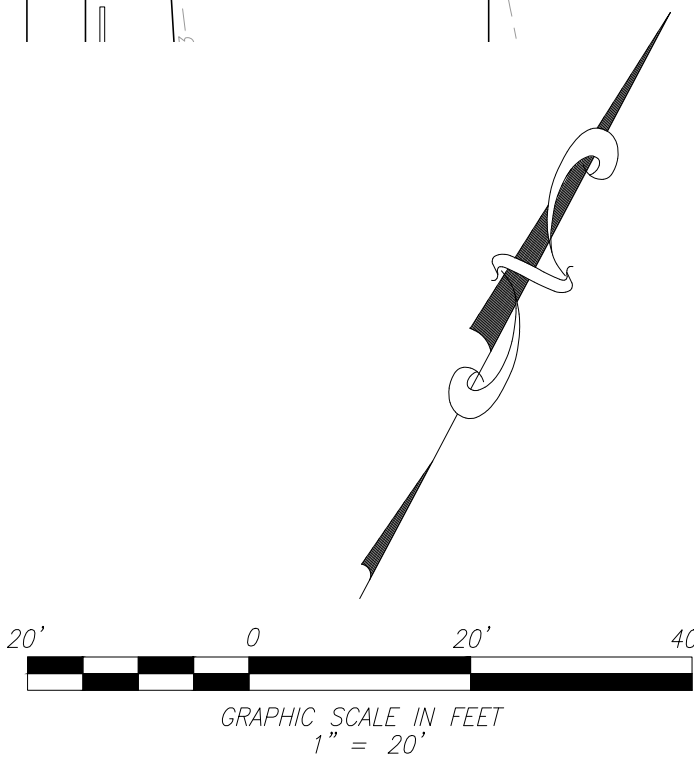
Hydraulic Profile			
Profile	M2	Depth, Downstream	0.97 ft
Slope Type	Mild	Normal Depth	1.15 ft
Flow Regime	Subcritical	Critical Depth	0.97 ft
Velocity Downstream	5.50 ft/s	Critical Slope	0.004837 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.00 ft
Section Size	3 x 2 ft	Rise	2.00 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev	672.06 ft	Upstream Velocity Head	0.36 ft
Ke	0.20	Entrance Loss	0.07 ft

Inlet Control Properties			
Inlet Control HW Elev	672.03 ft	Flow Control	Unsubmerged
Inlet Type	90° headwall w/45° bevels	Area Full	18.0 ft²
K	0.49500	HDS S Chart	10
M	0.69700	HDS S Scale	2
C	0.03140	Equation Form	2
Y	0.82000		

Project Engineer: sam@hanna-se.com  
CulvertMaster v10.3 [10:03 00:03]  
09/21/23 10:25:57@ Bentley Systems, Incorporated    Hanna Surveying And Engineering, LLC    Hasted Methods Solution Center    Watertown, CT 06795 USA    +1-203-755-1666    Page 1 of 1



**SITE LEGEND**

- PROPERTY LINE
- EASEMENT
- CURB AND GUTTER
- ASPHALT
- EXISTING OVERHEAD ELECTRIC
- EXISTING UNDERGROUND ELECTRIC
- EXISTING SANITARY SEWER
- EXISTING WATER
- EXISTING GAS
- EXISTING STORM SEWER
- EXISTING CONTOUR
- EXISTING FENCE
- PROPOSED WATER LINE
- PROPOSED SEWER LINE
- PROPOSED WATER/IRRIGATION METER
- PROPOSED SANITARY SEWER MANHOLE

**FLOOD PLAIN NOTE:**  
ACCORDING TO THE INFORMATION SHOWN ON THE NATIONAL FLOOD INSURANCE PROGRAM (NFIP) "FLOOD INSURANCE RATE MAP" (FIRM), COMMUNITY PANEL NO. 48251C0350J, REVISED DECEMBER 04, 2012, NONE OF THIS PROPERTY APPEARS TO LIE WITHIN THE "SPECIAL FLOOD HAZARD AREA (SFHA) - AS DEFINED BY THE U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, FEDERAL INSURANCE ADMINISTRATION, OR THE FEDERAL EMERGENCY MANAGEMENT AGENCY.

**NOTE:**  
CONTRACTOR TO CALL TEXAS 811 PRIOR TO ANY ON-SITE EXCAVATION. CONTRACTOR TO VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UTILITIES, BOTH THOSE SHOWN AND NOT SHOWN ON THESE PLANS, PRIOR TO BEGINNING ANY CONSTRUCTION/EXCAVATION AND NOTIFY ENGINEER OF ANY DISCREPANCIES IMMEDIATELY. EXISTING UTILITIES SHOWN ON THESE PLANS ARE BASED ON A COMBINATION OF FIELD SURVEY DATA, UTILITY OWNER RECORD DRAWINGS.

- STANDARD UTILITY NOTES – WATER LINE:**
- ALL CONSTRUCTION SHALL BE IN STRICT ACCORDANCE WITH THE STANDARDS OF THE CITY OF GRANDVIEW AND GOVERNED BY THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
  - TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION APPROVAL MUST BE OBTAINED PRIOR TO CONSTRUCTION IN THE STATE HIGHWAY RIGHT-OF-WAY.
  - STREET CUT PERMIT (ISSUED BY PUBLIC WORKS DEPARTMENT) IS REQUIRED BEFORE CUTTING ANY CITY STREET.
  - ALL WATER METERS SHALL BE SIZED AND INSTALLED BY CITY PERSONNEL.
  - FIRE HYDRANTS SHALL BE LOCATED OUTSIDE OF SIDEWALK.
  - WHERE EXISTING UTILITIES OR SERVICE LINES ARE CUT, BROKEN OR DAMAGED, THE CONTRACTOR SHALL REPLACE OR REPAIR THE UTILITIES OR SERVICE LINES WITH THE SAME TYPE OF ORIGINAL MATERIAL AND CONSTRUCTION OR BETTER, UNLESS OTHERWISE SHOWN OR NOTED ON THE PLANS, AT HIS OWN COST AND EXPENSE. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AT ONCE OF ANY CONFLICTS IN GRADES AND ALIGNMENTS.
  - ALL EXCAVATIONS, TRENCHING AND SHORING OPERATIONS SHALL COMPLY WITH THE REQUIREMENTS OF THE US DEPARTMENT OF LABOR, "CONSTRUCTION SAFETY AND HEALTH REGULATIONS", AND ANY AMENDMENTS OR REVISIONS THERETO.
  - ADEQUATE MEASURES SHALL BE TAKEN TO PREVENT EROSION, IN THE EVENT THAT SIGNIFICANT EROSION OCCURS AS A RESULT OF CONSTRUCTION, THE CONTRACTOR SHALL RESTORE THE ERODED AREA TO ORIGINAL CONDITION.
  - THE CONTRACTOR SHALL RESTORE ALL AREAS DISTURBED BY CONSTRUCTION TO THE ORIGINAL CONDITION OF BETTER. RESTORED AREAS INCLUDE, BUT ARE NOT LIMITED TO TRENCH BACKFILL, SIDE SLOPES, FENCES, CULVERT PIPES, DRAINAGE DITCHES, DRIVEWAYS, PRIVATE YARDS AND ROADWAYS.
  - ALL WATER LINES SHALL BE PVC PIPE CONFORMING TO ANWWA STANDARD C-900 SDR-18 MINIMUM, WITH NSF SEAL, PRESSURE TESTED AND DISINFECTED IN ACCORDANCE WITH NCTCOG STANDARD SPECIFICATIONS. WATER MAINS TO HAVE A MINIMUM OF 42" COVER TO TOP OF PIPE. SERVICE LINE CONNECTORS SHALL BE COMPRESSION STYLE WITH STAINLESS STEEL TUBE LINERS.
  - ALL WATER LINES TO BE INCASED IN SAND. BACKFILL SHALL BE NATIVE MATERIAL COMPACTED TO 95% STANDARD PROCTOR DENSITIES.
  - SERVICE LOCATIONS TO BE STAMPED ON CURB WITH 2" HIGH LETTER "W".
  - ALL WATER SERVICE LINES TO BE 1" SDR-9 CLASS 250 POLYBUTYLENE UNLESS OTHERWISE NOTED.
  - UTILITY CONTRACTOR TO FURNISH AND INSTALL WATER METER BOXES AFTER THE PAVING CONTRACT HAS BEEN COMPLETED.
  - CURB STOPS SHOULD BE TESTED FOR LEAKAGE AND FULL FLOW WHEN THE SYSTEM IS PRESSURE TESTED.
  - ALL FIRE HYDRANT ASSEMBLIES TO BE EQUIPPED WITH A 6" GATE VALVE AND BOX. ALL VALVES AND FIRE HYDRANTS TO BE PER CITY SPECIFICATIONS. HYDRANTS TO BE PAINTED AS FOLLOWS: 2 COATS "FIRE ENGINE" RED OVER SHOP PRIME COAT FOR BARREL AND TWO COATS OF WHITE OVER PRIME COAT FOR BONNET AND END CAPS.
  - ANY WATER VALVES LOCATED WITHIN PAVEMENT AREAS SHALL BE ADJUSTED TO FINAL GRADE BY THE PAVING CONTRACTOR. THE PAVING CONTRACTOR SHALL CONSTRUCT A TYPICAL CONCRETE BLOCK OUT PER CITY OF GRANDVIEW STANDARD DETAILS.
  - EACH FIRE HYDRANT TEE OFF OF MAIN LINE WILL UTILIZE A MJ VALVE OFF OF AN ANCHOR TEE.
  - EACH 6" GATE VALVE ON LEAD LINE TO A FIRE HYDRANT SHALL BE MJ AND ATTACHED DIRECTLY TO AN ANCHOR TEE.
  - 2'x2' CONCRETE BLOCK IS REQUIRED AROUND GATE VALVES.
- STANDARD UTILITY NOTES – SEWER LINE:**
- ALL CONSTRUCTION SHALL BE IN STRICT ACCORDANCE WITH THE STANDARDS OF THE CITY OF GRANDVIEW AND GOVERNED BY THE NORTH CENTRAL TEXAS COUNCIL OF GOVERNMENTS STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.
  - TEXAS DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION APPROVAL MUST BE OBTAINED PRIOR TO CONSTRUCTION IN THE STATE HIGHWAY RIGHT-OF-WAY.
  - STREET CUT PERMIT (ISSUED BY PUBLIC WORKS DEPARTMENT) IS REQUIRED BEFORE CUTTING ANY CITY STREET.
  - WHERE EXISTING UTILITIES OR SERVICE LINES ARE CUT, BROKEN OR DAMAGED, THE CONTRACTOR SHALL REPLACE OR REPAIR THE UTILITIES OR SERVICE LINES WITH THE SAME TYPE OF ORIGINAL MATERIAL AND CONSTRUCTION OR BETTER, UNLESS OTHERWISE SHOWN OR NOTED ON THE PLANS, AT HIS OWN COST AND EXPENSE. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE ENGINEER AT ONCE OF ANY CONFLICTS IN GRADES AND ALIGNMENTS.
  - ALL EXCAVATIONS, TRENCHING AND SHORING OPERATIONS SHALL COMPLY WITH THE REQUIREMENTS OF THE US DEPARTMENT OF LABOR, "CONSTRUCTION SAFETY AND HEALTH REGULATIONS", AND ANY AMENDMENTS OR REVISIONS THERETO.
  - ADEQUATE MEASURES SHALL BE TAKEN TO PREVENT EROSION, IN THE EVENT THAT SIGNIFICANT EROSION OCCURS AS A RESULT OF CONSTRUCTION, THE CONTRACTOR SHALL RESTORE THE ERODED AREA TO ORIGINAL CONDITION.
  - THE CONTRACTOR SHALL RESTORE ALL AREAS DISTURBED BY CONSTRUCTION TO THE ORIGINAL CONDITION OR BETTER. RESTORED AREAS INCLUDE, BUT ARE NOT LIMITED TO TRENCH BACKFILL, SIDE SLOPES, FENCES, CULVERT PIPES, DRAINAGE DITCHES, DRIVEWAYS, PRIVATE YARDS AND ROADWAYS.
  - SANITARY SEWER LINES SHALL BE SDR-35, PVC PIPE. ONE JOINT OF SDR-26 SHALL BE INSTALLED CENTERED UNDER ALL PROPOSED STORM DRAIN PIPE OR WATER LINE CROSSINGS.
  - PIPE SHALL BE BEDDED IN CLASS II, OR BETTER, MATERIAL AS DEFINED IN ASTM D-2321, AND PLACED AS DIRECTED THEREIN. BACKFILL SHALL BE ONSITE MATERIAL COMPACTED TO 95% STANDARD PROCTOR DENSITIES.
  - AFTER COMPLETION OF ALL TESTING (I.E. MANDREL & AIR) CONTRACTOR SHALL PERFORM A TELEVISION INSPECTION AND PROVIDE THE VIDEO ON A THUMB DRIVE TO THE PUBLIC WORKS DEPARTMENT. DEFLECTION TESTING SHALL BE PERFORMED AS SPECIFIED IN THE SPECIAL CONDITIONS.
  - A 2" HIGH LETTER "S" SHALL BE STAMPED ON THE CURB TO MARK THE LOCATION OF THE SEWER SERVICES.
  - ALL SEWER MANHOLES SHALL BE 4- FEET IN DIAMETER IN ACCORDANCE WITH STANDARD CITY OF GRANDVIEW DETAILS UNLESS OTHERWISE NOTED.
  - CONTRACTOR TO PLACE A 3/4" PLYWOOD FALSE BOTTOM IN ALL SANITARY SEWER MANHOLES BEFORE PAVING CONTRACTOR COMMENCES WORK.
  - RIM ELEVATIONS OF PROPOSED SANITARY SEWER MANHOLES IN STREETS ARE TO BE CONSTRUCTED 18" BELOW FINAL FINISHED GRADES BY UTILITY CONTRACTOR AND ADJUSTED BY PAVING CONTRACTOR TO FINISHED GRADE AT TIME OF PAVING. EACH SHALL HAVE A TYPICAL CONCRETE BLOCK-OUT CONSTRUCTED PER CITY OF GRANDVIEW STANDARD DETAILS.
  - ALL TRENCHES SHALL BE COMPACTION TESTED AT THE RATE OF ONE TEST PER 300 L.F. OF TRENCH PER LIFT. LIFTS SHALL BE NO GREATER THAN 12" LOOSE. TESTS SHALL BE STAGGERED SO THAT TESTS OF ADJACENT LIFTS ARE NOT DIRECTLY OVER PREVIOUS LIFT. IF THE DISTANCES BETWEEN MANHOLES EXCEED 300 L.F. A MINIMUM OF 2 TESTS PER LIFT SHALL BE TAKEN. THE TESTING LAB SHALL PROVIDE THE LOCATION OF ALL RESULTS ON A PLAN AND PROFILE SHEET PRIOR TO TRENCH ACCEPTANCE.
  - CONTRACTOR TO VERIFY ELEVATION OF EXISTING SEWER CONNECTION PRIOR TO INSTALLATION OF ANY PROPOSED SEWER IMPROVEMENTS.

**REVISIONS**

#	REVISION	DATE

DEVELOPER/OWNER:  
ROBERT TATE  
2824 W. 7TH  
STREET/SUITE 100  
FORT WORTH, TX 76107

**WATER & SEWER PLAN**

1.535 ACRES COMMERCIAL DEVELOPMENT OUT OF THE DAVIS ADDITION LOT 32R1, BLOCK 5 802 E. CRINER STREET CITY OF GRANDVIEW JOHNSON COUNTY, TEXAS

**HANNA SURVEYING & ENGINEERING LLC.**  
REGISTERED PROFESSIONAL ENGINEER  
109945  
AUGUST 14, 2024  
JUNE 14, 2024  
23-788  
SHEET NUMBER  
C-6.0  
13 OF 21

HANNA SURVEYING AND ENGINEERING, LLC.  
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ENGINEERING FIRM NUMBER F-22119  
SURVEYING FIRM NUMBER 10194633