

PHASE I GEOLOGICAL FAULT INVESTIGATION
CITY OF HOUSTON WATER LINE
REPLACEMENT IN
KICKERILLO AREA
WBS NO. S-000035-0185-3
HOUSTON, TEXAS

REPORT NO. 1140194602

Prepared for:

JONES AND CARTER, INC.
Houston, Texas

Submitted by:

GEOTEST ENGINEERING, INC.
Houston, Texas

December 20, 2013

Key Map Nos. 488 H, M and 489 E, J



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Report No. 1140194602

December 20, 2013

Mr. David Warner, P.E.
Jones and Carter, Inc.
8701 New Trails Drive, Suite 200
The Woodlands, Texas 77381

**Reference: Phase I Geological Fault Investigation
City of Houston Water Line Replacement in
Kickerillo Area
WBS No. S-000035-0185-3
Houston, Texas**

Dear Mr. Warner:

We are pleased to present our final Phase I geological fault investigation report for the above referenced project. A draft Phase I Geological Fault Investigation report was submitted to you on November 29, 2013. This final report supersedes all previously submitted reports, transmittals, etc. for the referenced project. This study was authorized by Jones and Carter, Inc. on October 3, 2013 by accepting Geotest Engineering, Inc. (Geotest) Proposal No. 1140337699 dated September 19, 2013.

We appreciate this opportunity to be of service to you. If you have any questions regarding the report, or if we can be of further service to you, please call us.

Very truly yours,
GEOTEST ENGINEERING, INC.
TBPE Registration No. F-410

Naresh Kolli, P.E.
Assistant Project Manager

Kuo-Chiang "Frank" Lin, P.E.
Sr. Vice President



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EXECUTIVE SUMMARY

A Phase I Geological Fault Study was performed for the design and construction of the proposed water line replacement in the Kickerillo Area in Houston, Texas. The project calls for the design and construction of water lines replacement in Kickerillo Area in Houston, Texas. The proposed water lines replacement in Kickerillo Area is approximately 33,270 linear feet with new waterline size ranging from 4 to 8 inches in diameter. The anticipated maximum depth of new water lines range from 6 to 15 feet. Based on available information, a known surface fault, Long Point fault, which is downthrown to southeast, may cross the project area at six locations along White Wing Lane, Rancho Bauer Drive, Apple Tree Lane, Cindywood Drive, Carol Crest Road and at the intersection of Kellywood Lane and Clear Springs Drive. However, most of the crossing at these locations are inferred portions of the Long Point Fault and are not well defined.

The purpose of this study was to identify and possibly map the fault crossing at each identified street in or near the project area. The study included a further review of available published and unpublished literature on Long Point Fault, a site reconnaissance and performance of surface surveys and preparation of a phase I geological fault study report. The principle findings of this study are given below.

- The vertical elevation offset by the Long Point Fault appears to be between about 0.5 to 1 foot. The ground deformation zone associated with the Long Point Fault appears to be from about 25 to 40 feet.
- The historical vertical movement rates reported for the Long Point Fault have been somewhere between 1 and 1.5 inches per year. Based on the available information, the average vertical movement rate for Long Point fault is about 0.27 inches/year (based on Dr. Carl Norman's installed benchmarks).
- Possible fault zones of Long Point Fault with respect to the project alignments are provided in Section 5.

1.0 INTRODUCTION

1.1 Project Description

A Phase I Geological Fault Study was performed for the design and construction of the proposed water line replacement in the Kickerillo Area in Houston, Texas. The project calls for the design and construction of water lines replacement in Kickerillo Area in Houston, Texas. A vicinity map is presented on Figure 1. The proposed water lines replacement in Kickerillo Area is approximately 33,270 linear feet with new waterline size ranging from 4 to 8 inches in diameter. The anticipated maximum depth of new water lines range from 6 to 15 feet. The proposed water lines will generally be constructed by pipe augering. Based on available information, a known surface fault, Long Point fault, which is downthrown to southeast, may cross the project area at six locations along White Wing Lane, Rancho Bauer Drive, Apple Tree Lane, Cindywood Drive, Carol Crest Road and at the intersection of Kellywood Lane and Clear Springs Drive. However, most of the crossing at these locations are inferred portions of the Long Point Fault and are not well defined.

1.2 Purpose and Scope

The purpose of this study was to identify and possibly map the fault crossing at each identified street in or near the project area for the design and construction of the proposed water line replacement in Kickerillo area. The scope of this investigation consisted of the following:

- Literature review including further review of readily available published geological information and previous fault studies of Long Point Fault in the general area.
- Review of historical aerial photographs and U.S.G.S. topographic maps.
- Perform a field reconnaissance to identify any evidences such as failures in structures and ground disturbances that identify the potential fault crossing.

- Conduct a survey of the existing ground elevations profiles across the potential fault crossings.
- Prepare a Phase I geological fault report summarizing our findings, conclusions and recommendations.

2.0 FAULTING IN HOUSTON AREA

2.1 General

A fault is commonly defined as a break and displacement of various soil or rock layers of the earth due to subsurface movements. Within the Gulf Coastal Plain of Texas and Louisiana, several faults are known to exist and these faults have resulted in broken ground surfaces, broken pavements, and damage to buildings and other structures.

The U.S. Geological Survey has mapped over 150 separate faults totaling more than 140 miles in length in the Houston area. It is estimated that at least 50 other surface faults have been recognized in the area; their locations have either not been published or have been published at a scale not suitable for general use. Many more faults do not extend to the surface.

A fault may be inactive along all or part of its length, which means there is either no recent observable movement of the surface along the fault trace, or the fault does not extend to the surface. Any fault that has been broken or displaced man-made structures is considered to be active. The vertical movement of typical active faults averaged over a number of years ranges from about 0.25 inch to more than 1.0 inch per year. Horizontal movement is generally about one-fourth to one-half the vertical movement. These surface movements generally occur in a band of significant width. The width of the movement zone varies with each fault and along a particular fault, and it may increase with increasing displacement. When active, faults in the Houston area move intermittently by a "Creep" process that precludes violent movements, such as earthquakes, resulting from faults that pass through hard rock (Reference 1).

2.2 Long Point Fault

The Long Point fault extends northeastward about 10.3 miles from the vicinity of Eldridge Parkway and Whittington Drive in the southwest Houston to a point near Hempstead Highway and Dacoma Street. The ground moves downward from northwest to southeast along the length of the Long Point Fault. Based on observations of the fault where it crosses many streets along its length, it

appears to be no component of differential ground movement in a horizontal direction parallel to the fault trace. In geologic terms, it is a strictly normal-slip fault. The fault trace at ground level is not a strength line. Its overall trend is N 65 E, but locally the trend ranges from due north to due east.

The fault surface dips (slopes downward) to the southeast, steeply at ground level, but at progressively lesser angles at depth. No subsurface data are available to determine the dip angle at shallow depths anywhere within the Kickerillo Area, but a reasonable estimate, based on measurements near the intersection of West Sam Houston Parkway South and the Katy Freeway, the dip angle would be in the range of 67 to 77 degrees.

Repeated measurements of elevation profiles across tens of Houston-area faults show that the central parts of a fault tend to be most active. Toward the end of a fault, rates of differential ground movement become vanishingly small. The center of the Long Point fault is near Gessner Drive at Westview Drive.

3.0 GEOLOGIC DATA REVIEW

3.1 Literature Review

Published maps of the faults in the Houston area and unpublished information from our files show that Long Point fault cross the project area at several locations. The Houston Sheet of Geologic Atlas of Texas (1982) (Reference 2) shows a fault that corresponds to the Long Point fault passing through the vicinity of the project area.

3.2 Aerial Photographs

The review of aerial photographs, features that may indicate the presence of fault include tonal variations in vegetation, areas of standing water, certain patterns in rice field levees and contour plowing and certain drainage patterns. Such surface features may have curvilinear character and may manifest themselves in alignments that form linear expressions. These linear features by themselves do not necessarily prove that a fault is present, but allow for more effective topographic map review.

A series of seven (7) aerial photographs of the project area for the years 1944 to 2009 were reviewed. The review of aerial photographs indicated that the project area was developed to residential area between the years 1953 and 1978. The aerial photographs of 1944 and 1957 indicate some evidence of color shading which may be indicative of Long Point Fault. The aerial photographs are presented on Figures 2.1 through 2.7.

3.3 Topographic Maps

The topographic maps (Reference 3) from years 1915, 1970, 1982 and 1995 for Hedwig Village and Hellendahl quadrangle were reviewed for the project area. Based on the review, no obvious lineaments were observed on these maps for the project area. The topographic maps are presented on Figures 3.1 through 3.4.

4.0 FIELD RECONNAISSANCE AND ELEVATION PROFILES

4.1 Field Reconnaissance

The field reconnaissance was conducted on October 30, 2013 to check for evidence of surface faulting such as offsets in roads and structures as well as topographic scarps. During the field reconnaissance, all the streets within the project area were examined for cracks that would be indicative of possible faulting.

The Long Point fault was found to cross the northeastern portion of the project area and to be in proximity to the USGS delineation of it. Based on the literature review it was noticed that the projection or inferred portion of Long Point Fault crosses White Wing Lane, Apple Tree Lane, Rancho Bauer Drive, Cindywood Drive, Carolcrest Drive and at the intersection of Kellywood Lane and Clearspring Drive. The field evidence for the Long Point fault consists of abrupt elevation differences in street surfaces which are accompanied by visible fault scarps in adjacent residential yards. Often times, the Long Point fault is more clearly visible outside the project area and accompanied by a higher density of cracks in the pavement and street curbs as well as an abrupt change in slope. Houses sitting on top of the fault or extending pathway into its deformation zone frequently show signs of past ground movement such as cracked and patched masonry.

The streets in the study area and surrounding areas were walked and numerous areas were examined in detail on buildings and streets. An evidence of Long Point crossing was observed northeast of the study area along Memorial Drive near the intersection of West Forest Drive. At this location the minor crack in the pavement and change in the ground elevation was observed. The existing pavement failure was observed along West Forest Drive near the intersection of Ramblewood Drive and along Ramblewood Drive north of Apple Tree Lane.

The Long Point Fault was not clear in the project area and the locations of the fault crossings were based on the projection of the fault. No obvious signs of fault crossing were observed along White Wing Lane. Some cracks in the houses were observed on the houses near the Apple Tree Lane and Cindywood Drive (14215 Cindywood). The existing pavement structures were fairly recent, hence no visible anomalies of the fault crossings were seen in the pavement along Carol Crest and Kellywood Lane. The site photographs are presented on Figures 4.1 through 4.3.

4.2 Elevation Profiles

Elevation profiles were developed from field measurements of relative elevations across a fault scarp. The field measurements of surface elevation were performed by Civil Corp, U.S., Inc. The purpose of elevation profiles was to help define various characteristics of the fault which include: the location of the scarp and fault trace and ground deformation zone width. Ideally, the profile lines are oriented as perpendicular to the fault as practicable and are generally centered on the fault. However, due to the angle of the fault crossing the street, the elevation profiles were taken both sides of the base line on each street. The elevations were taken at 2.5 feet intervals along from 0 to 50 feet and thereafter 5 foot intervals from 50 to 100 feet on either side of the best guessed point of fault trace. The horizontal distance axis on the elevation profiles shows the stationing along each street.

Twelve (12) elevation profiles were developed for the project area, and they were placed at the Long Point fault's intersection with White Wing Lane, Apple Tree Lane, Rancho Bauer Drive, Cindywood Drive, Carolcrest Drive, Kellywood Lane and Clear Spring Drive. Because of the fault's angle of intersection with the street centerlines is acute, two profiles on both sides of each street were taken to determine the possible angle of crossing for the fault. Due to the fact that the paved streets are fairly new, the elevations shot may not reflect the actual fault scarp height and deformation zone width. The elevation profiles are presented on Figures 5.1 through 5.12.

5.0 FAULT CHARACTERIZATION

5.1 Fault Maps

A fault map was prepared for each street in the project area where it was intersected by the Long Point Fault. Based on the evidence on houses with visible cracks (wherever is applicable), the published fault map (Reference 4) in the area and interpretation of the information obtained from survey profiles presented on Figures 5.1 through 5.12, the fault zones were developed and are presented on Figures 6.1 through 6.6.

There are seven (7) streets of concern along the project area, where the Long Point Fault crosses the project alignment. The locations of each street where fault zone intersection with water line are given below.

Street	Possible Fault Zone Intersection Station No.
White Wing Lane	28+31 – 28+91
Rancho Bauer Drive	27+12 – 27+81
Apple Tree Lane	3+00 – 3+50
Cindywood Drive	South Alignment 2+79 – 3+32 North Alignment 3+63 – 4+41
Carolcrest Street	20+51 – 21+07
Kellywood Lane	12+91 – 13+50
Clear Spring Drive	0+95 – 1+62

5.2 Fault Movement Rate

The Long Point fault is about 10.3 miles in length and it is known to be very active in the past. The historical vertical movement rates reported for the Long Point fault have been somewhere between 1 and 1.5 inches per year. Based on the available information (Reference 5), the average

vertical movement rate for Long Point fault is about 0.27 inches/year (based on Dr. Carl Norman's installed bench marks).

6.0 FINDINGS AND RECOMMENDATIONS

6.1 Findings

- Based on our study of the surface surveys, aerial photographs and available information from U.S. Geological Survey, we believe that Long Point fault, which is downthrown to southeast, cross the project area at six locations along White Wing Lane, Rancho Bauer Drive, Apple Tree Lane, Cindywood Drive, Carol Crest Road and at the intersection of Kellywood Lane and Clear Springs Drive.
- The vertical elevation offset by the Long Point fault appears to be between about 0.5 to 1 foot. The ground deformation zone associated with the Long Point fault appears to be from about 25 to 40 feet.
- The historical vertical movement rates reported for the Long Point fault have been somewhere between 1 and 1.5 inches per year. Based on the available information, the average vertical movement rate for Long Point fault is about 0.27 inches/year (based on Dr. Carl Norman's installed bench marks).

6.2 Recommendations

Since fault movements are deep-seated, they cannot be stopped or prevented. This means the facilities built near the fault should consider the possibility of future fault movement in their design and location. It is recommended that the water line design should consider both vertical and horizontal displacement within the identified fault hazard zone. The average vertical movement rate of 0.27 inches per year should be taken into consideration for the expected life of water line that crosses through the fault hazard zones.

7.0 LIMITATIONS

The findings and recommendations in this report are based on our review of available documents and geological investigation techniques. All conclusions are qualified by the fact that no excavations or borings were made and no geophysical surveys or loggings were conducted. Additionally, shallow soil conditions, vegetative cover, new construction and development, slow fault movement rates and repair of previously existing fault damage are circumstances that may obscure fault-related features.

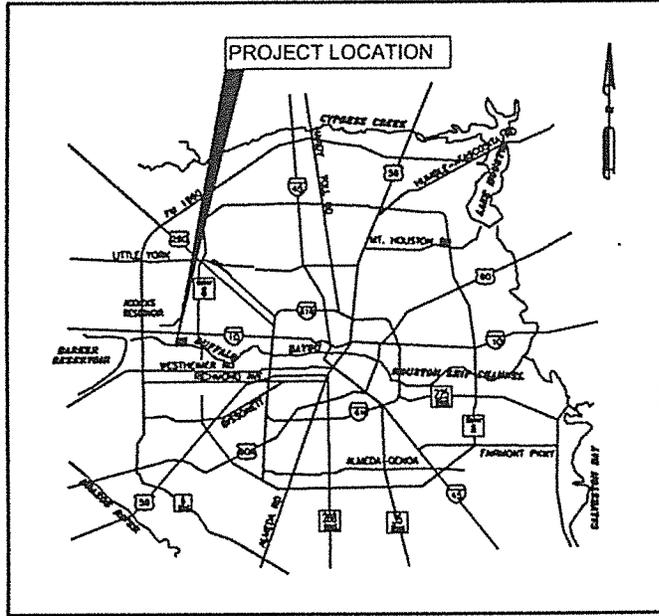
This report has been prepared for the exclusive use of City of Houston, Texas, and Jones and Carter, Inc. for the Water Line Replacement in Kickerillo Area in Houston, Texas. This report shall not be reproduced without the written permission of Geotest Engineering, Inc., The City of Houston or Jones and Carter, Inc.

8.0 REFERENCES

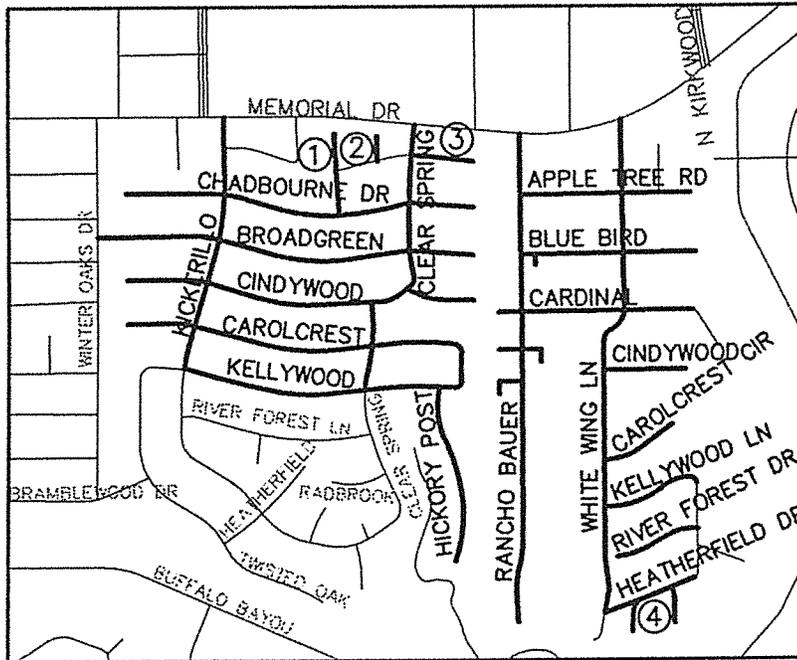
1. 2-D Resistivity Imaging Investigation of Long Point, Katy-Hockley, Tomball and Pearland Faults, Houston, Texas by Mustafa Saribudak, Environmental Geophysics Associates.
2. Geologic Atlas of Texas, Houston Sheet, Bureau of Economic Geology, University of Texas at Austin, Revised 1982.
3. Hedwig Village and Hillendahl, Texas 7.5 minute Topographic Quadrangle Map, U.S. Geological Survey, 1915, 1970, 1982 and 1995.
4. Faults in parts of North-central and Western Houston Metropolitan Area, Texas by Earl R. Verbeck, Karl W. Ratzlaff and Vel S. Clanton 1979.
5. Phase I & III Geologic Fault Investigation for City of Houston Water Line Replacement in the Westchester I Area, Terrain Solutions, Inc., Project No. 1302L-04, March 26, 2013.

ILLUSTRATIONS

	<u>Figure</u>
Vicinity Map	1
Aerial Photographs	2.1 thru 2.7
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Fault Maps	6.1 thru 6.6



LOCATION MAP



KICKERILLO
PROJECT LOCATION

KEY MAP NO.: 488H, M & 489 E, J

VICINITY MAP

Job No. 1140194602

Project Alignment

2009
Scale 1" = 700'

FIGURE 2.1



Job No. 1140194602

Project Alignment



1999
Scale 1" = 700'

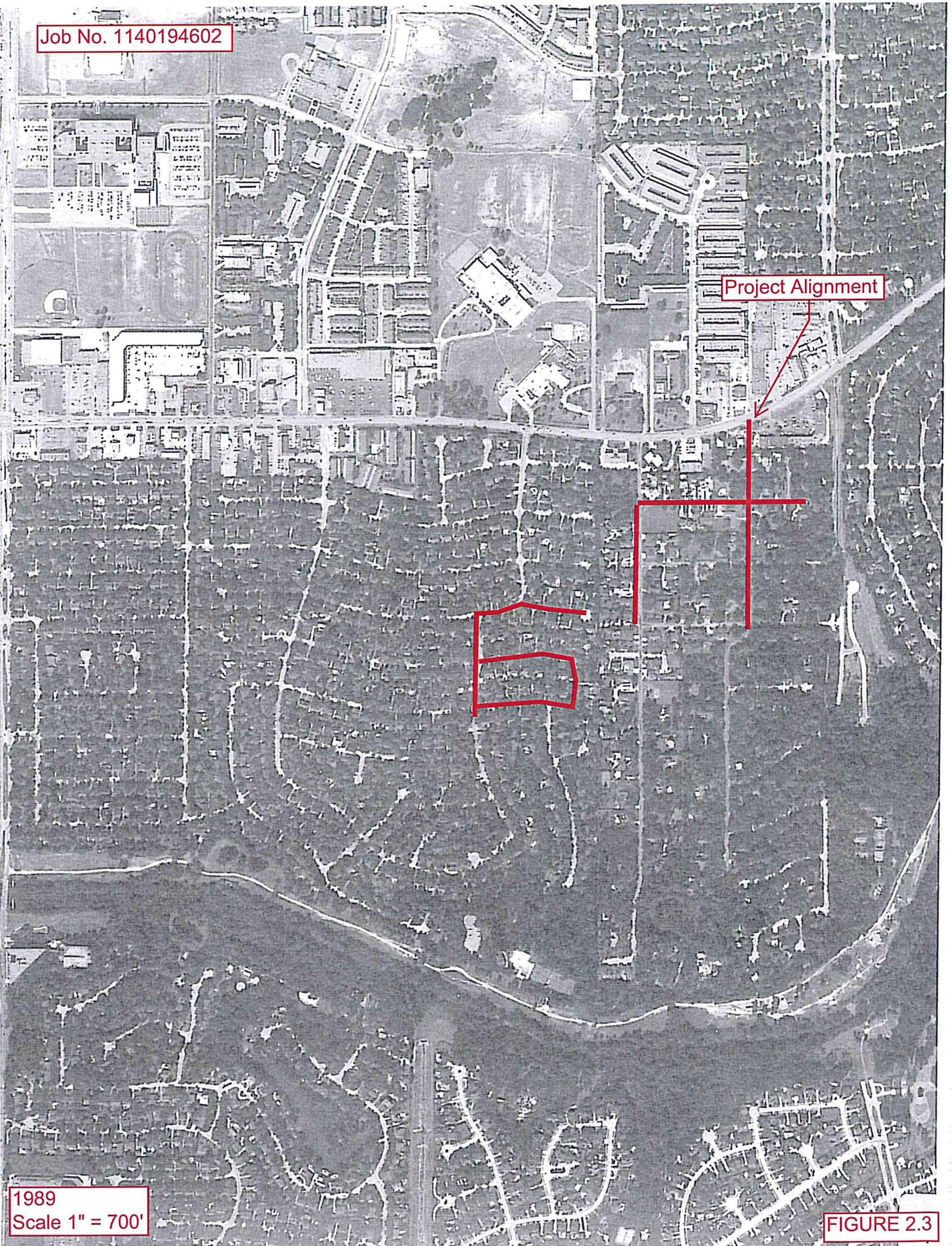
FIGURE 2.2

Job No. 1140194602

Project Alignment

1989
Scale 1" = 700'

FIGURE 2.3



Job No. 1140194602

Project Alignment



1978
Scale 1" = 700'

FIGURE 2.4

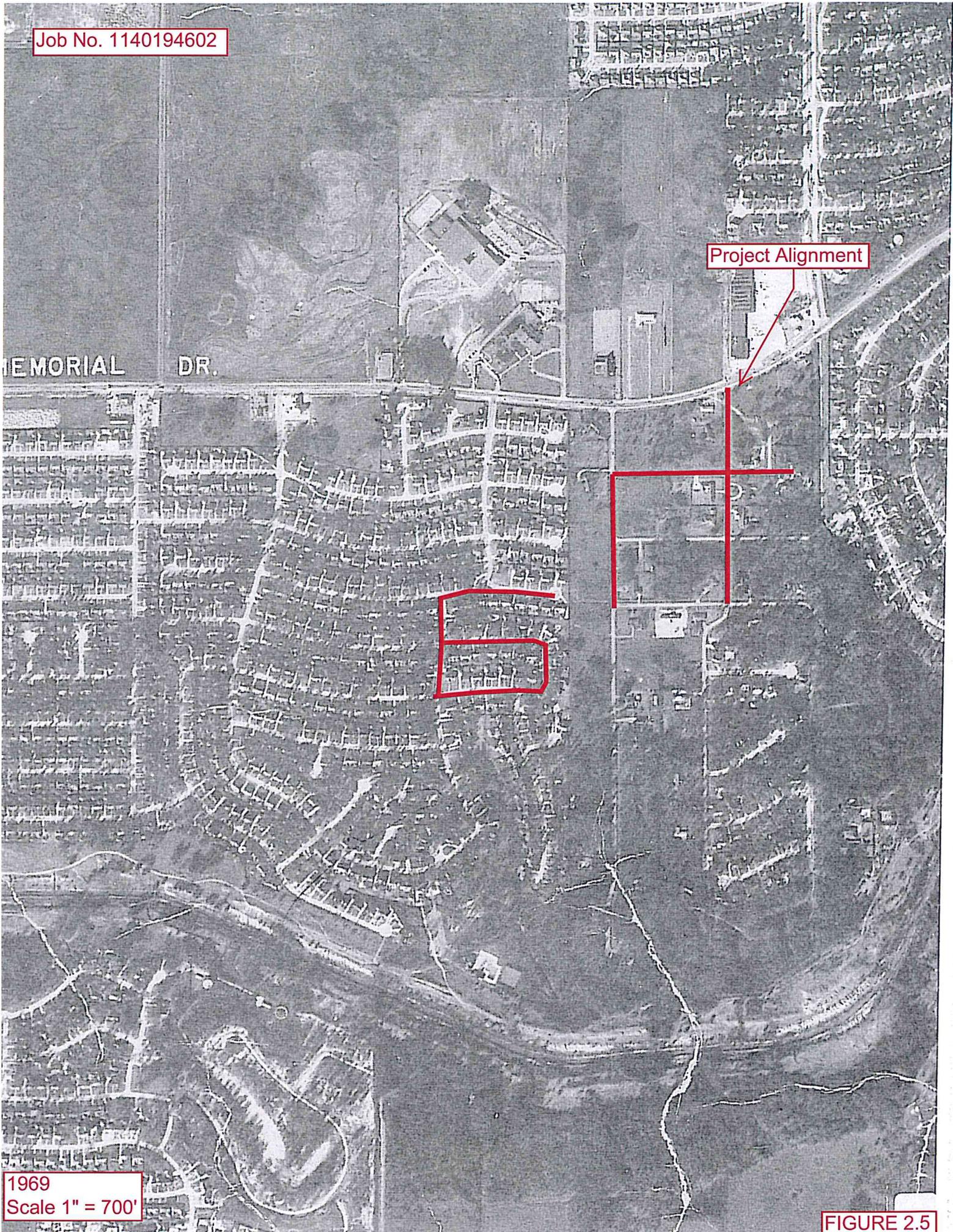
Job No. 1140194602

MEMORIAL DR.

Project Alignment

1969
Scale 1" = 700'

FIGURE 2.5



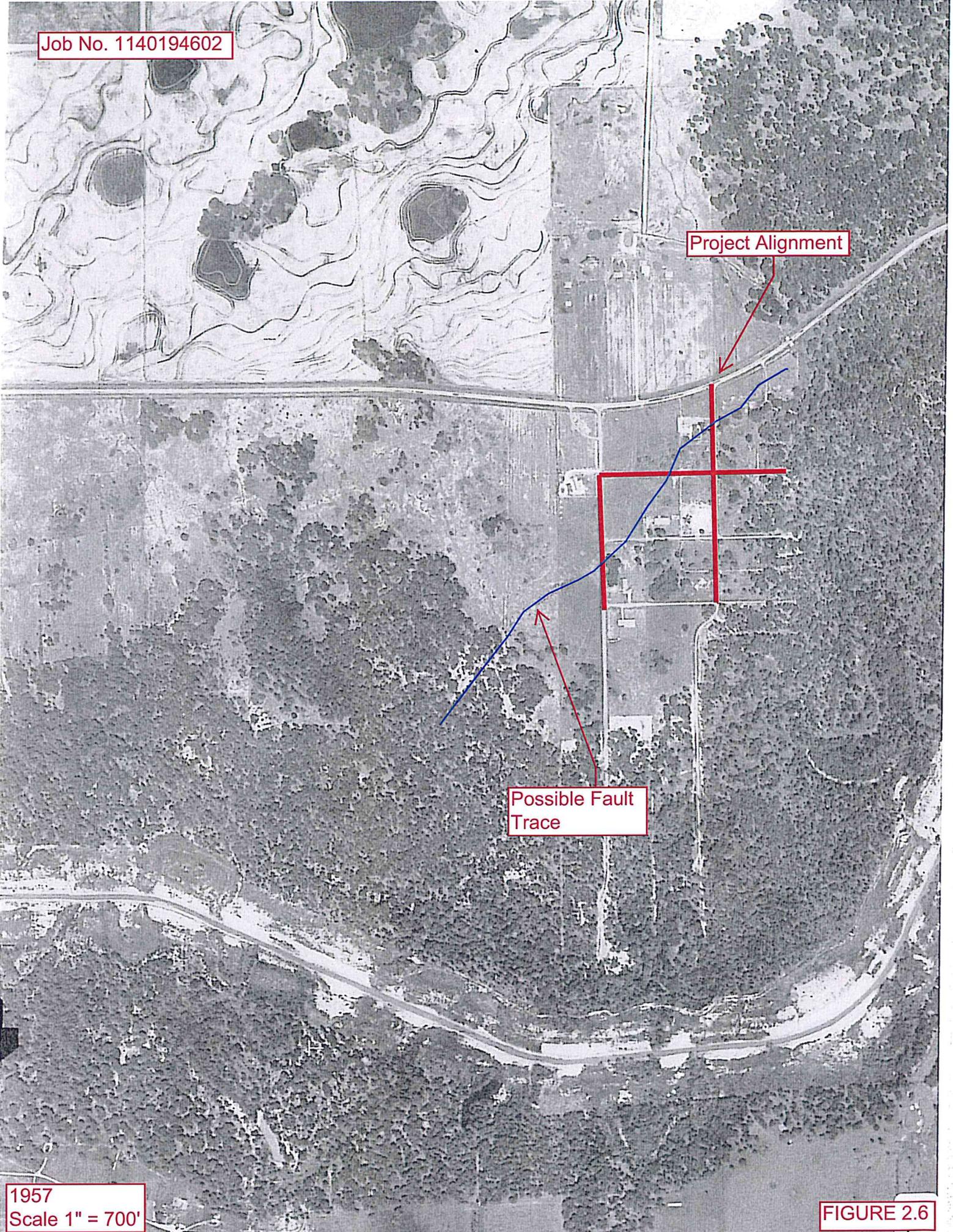
Job No. 1140194602

Project Alignment

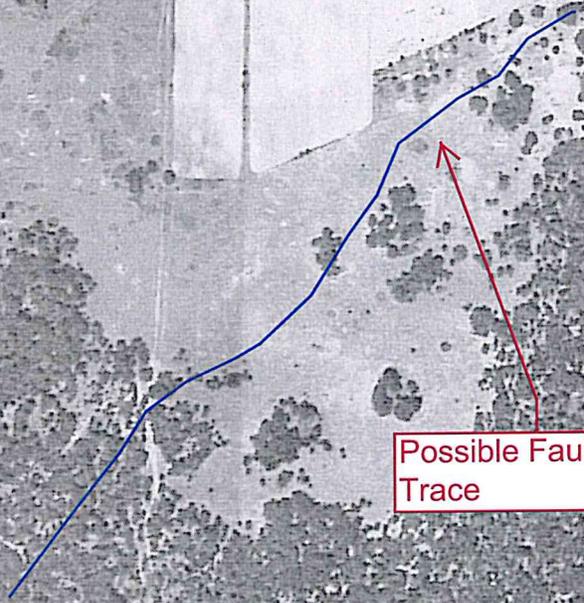
Possible Fault Trace

1957
Scale 1" = 700'

FIGURE 2.6



Job No. 1140194602

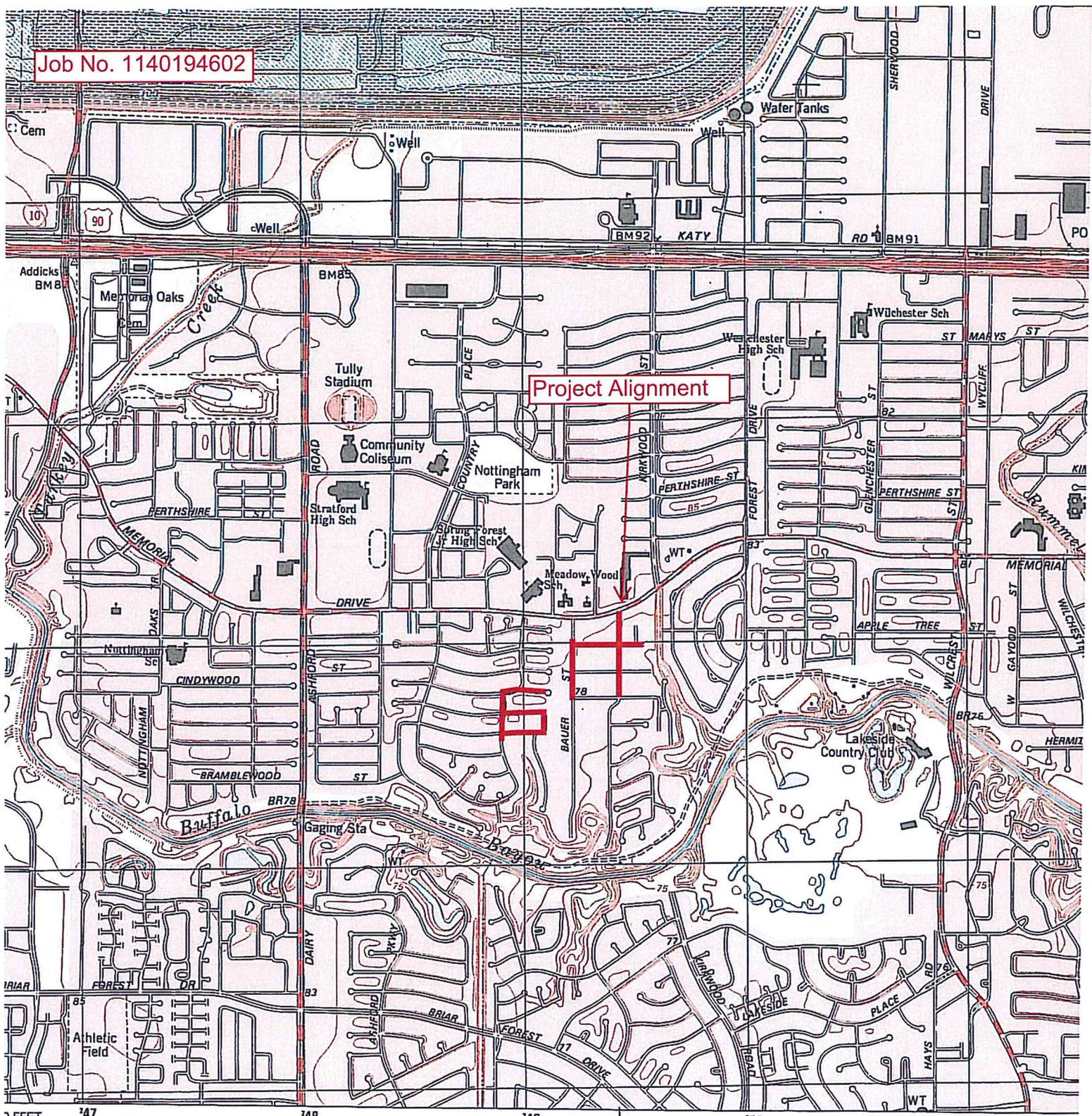


Possible Fault Trace

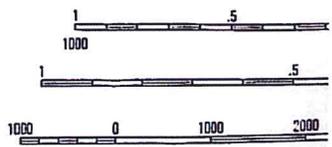
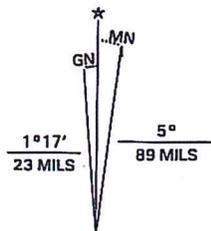
1944
Scale 1" = 700'

FIGURE 2.7

Job No. 1140194602



United States Geological Survey
 dated 1976. Planimetry derived from imagery
 control current as of 1976
 datum of 1983 (NAD 83). Projection and
 Universal Transverse Mercator, zone 15
 Texas Coordinate System of 1983
 datum of 1927 (NAD 27) is shown by dashed
 lines of the shift between NAD 83 and NAD 27
 sections are obtainable from National Geodetic
 software
 verified 1976
 shaded light-blue pattern are subject to
 change and current as of 1976
 residence area



UTM GRID AND 1999 MAGNETIC NORTH
 DECLINATION AT CENTER OF SHEET

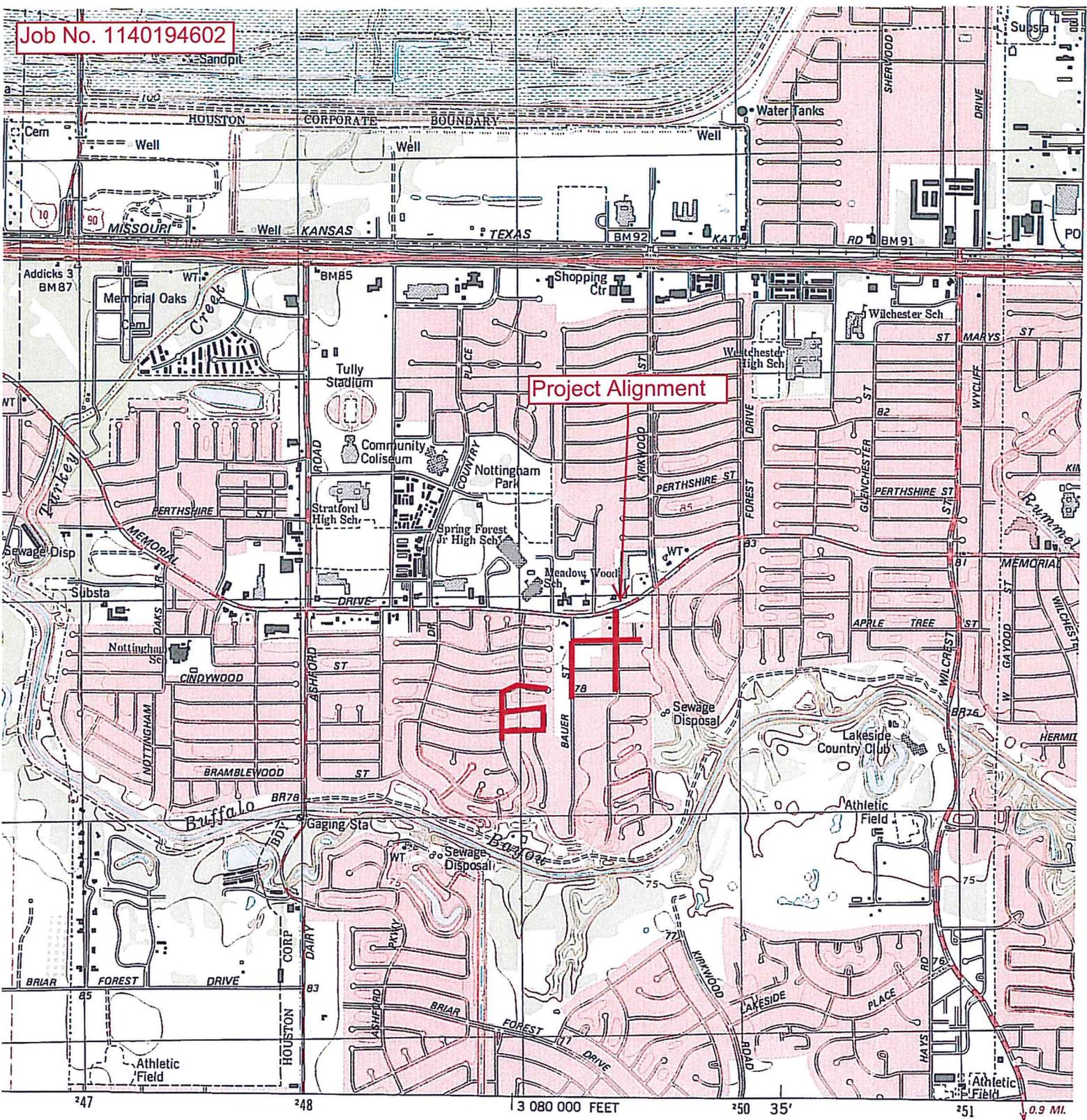
TO CC

FIGURE 3.1

JUL 00 REC'D

PROPERTY OF U.S. GOVERNMENT

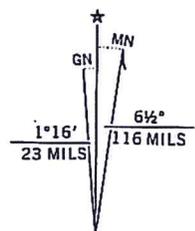
Job No. 1140194602



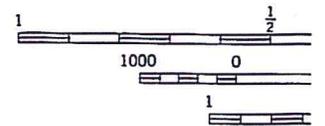
ed, and published by the Geological Survey

and NOS/NOAA

Photogrammetric methods from aerial photographs
 field checked 1976. Map edited 1982
 10,000-foot grid ticks: Texas
 NAD 83, south central zone (Lambert conformal conic)
 UTM grid, Transverse Mercator grid, zone 15
 North American datum
 UTM grid North American Datum 1983
 projection lines 20 meters south and
 north shown by dashed corner ticks
 Dashed lines indicate selected fence lines
 Dashed areas in which only landmark buildings are shown
 Areas with dashed light-blue pattern are subject



UTM GRID AND 1982 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



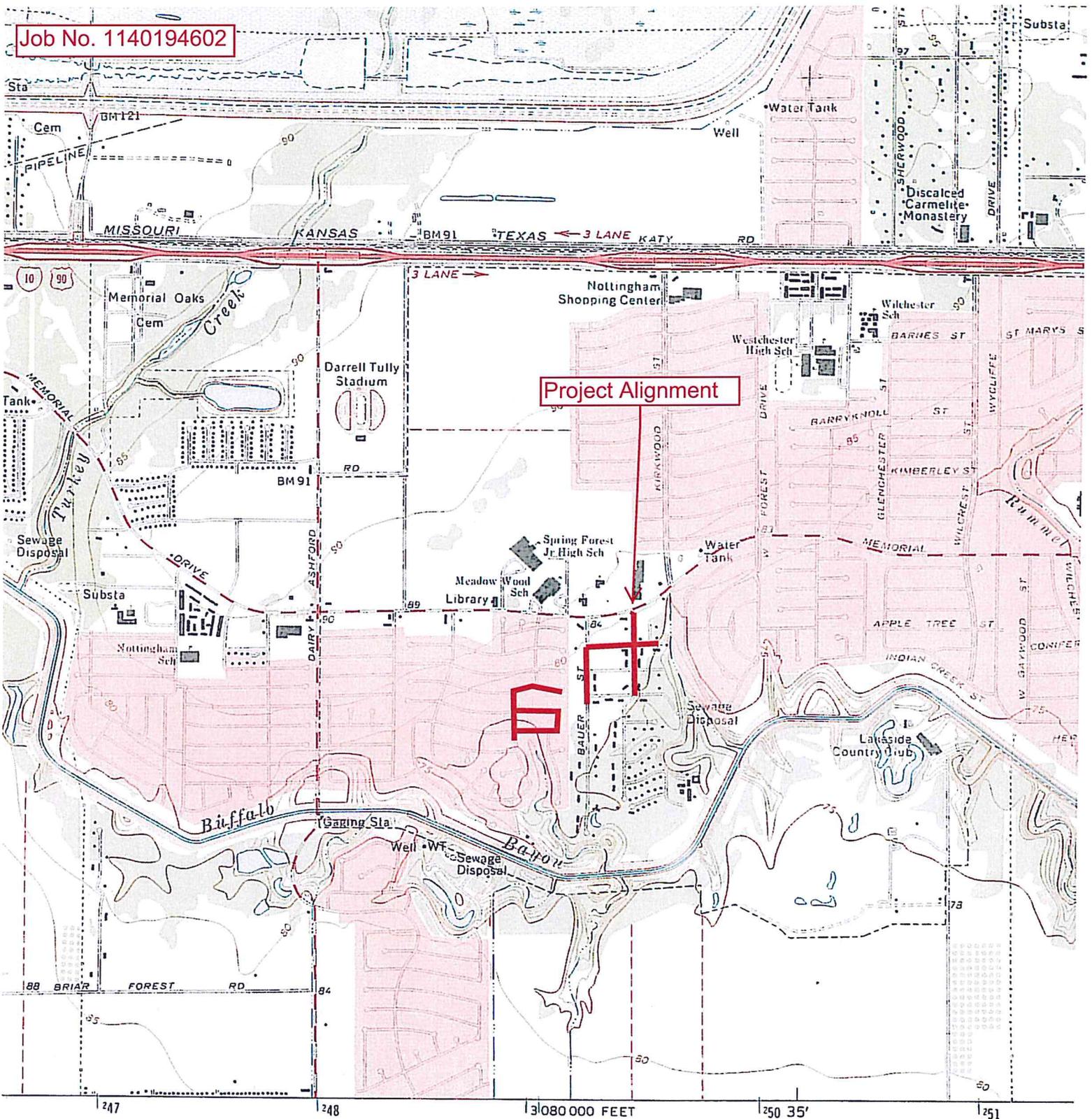
NA

FIGURE 3.2

FOR SALE BY U.S. GEOLOGICAL SURVEY
A FOLDER

A portion of this map lies within a subsidence area

Job No. 1140194602



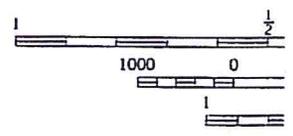
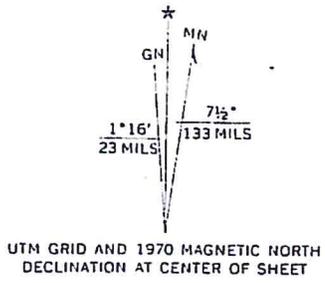
ited, and published by the Geological Survey
 GS and USC&GS

photogrammetric methods from aerial photographs
 Topography enlarged from 1:62 500-scale map of
 angle dated 1955. Topography by planetable surveys.
 1970. Supersedes Hillendahl map dated 1915

ection. 1927 North American datum
 rid based on Texas coordinate system,
 zone
 niversal Transverse Mercator grid ticks,
 n in blue

ates areas in which only landmark buildings are shown
 rd lines indicate selected fence lines

Project Alignment

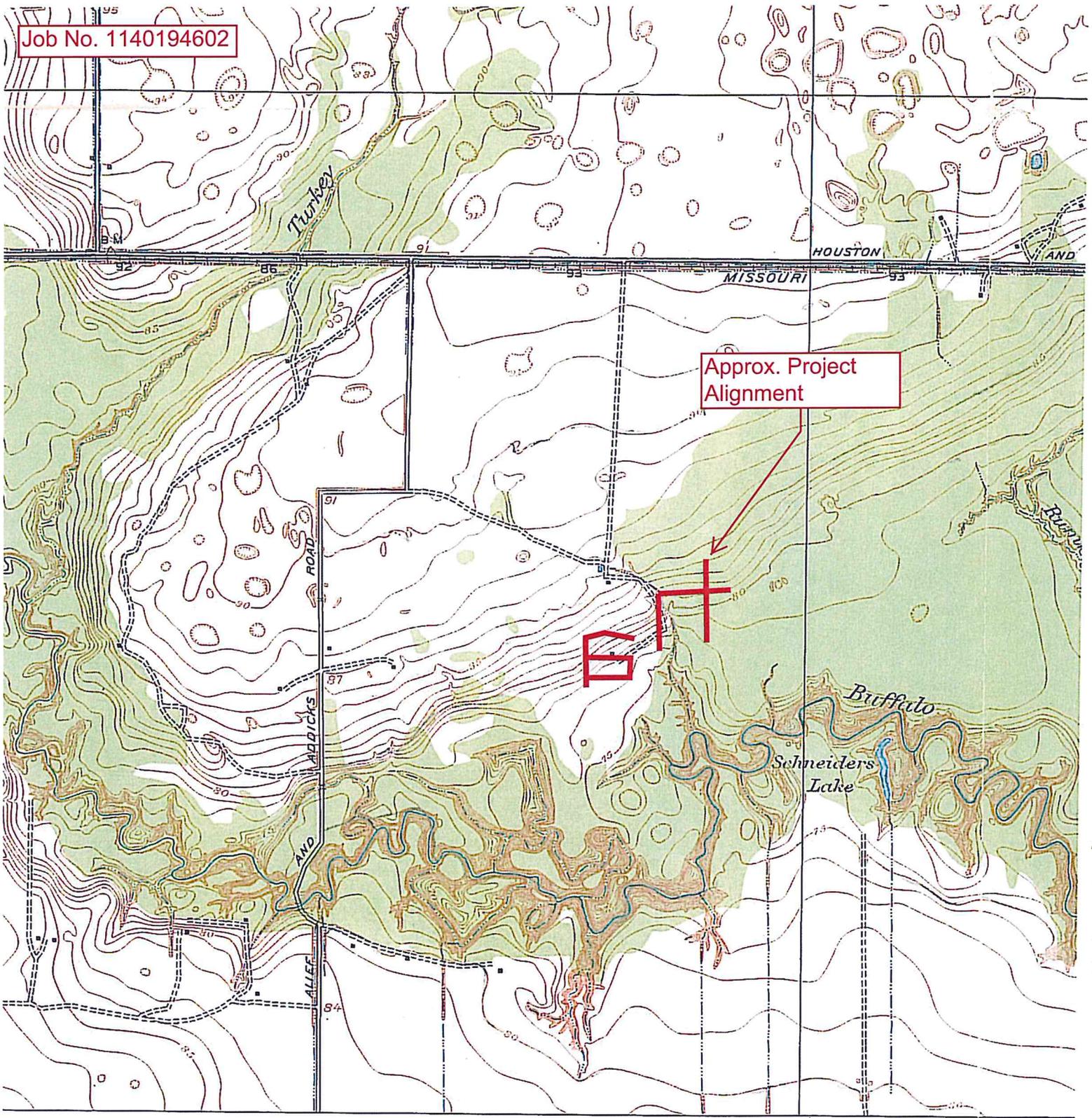


UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

FIGURE 3.3

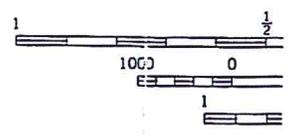
FOR SALE BY U. S. A FOLDER

Job No. 1140194602



35'

all, Chief Geographer.
um, Geographer in charge.
y by C.H.Birdseye, E.R.Bartlett,
s, W.B.Lewis, and F.A.Danforth.
· U.S.Coast and Geodetic Survey.
, and R.R.Monbeck.
in 1915.



COOPERATION WITH HARRIS COUNTY.

FIGURE 3.4

FOR SALE BY U.S.
A FOLDER DE



Visible Long Point Fault crossing at Memorial Drive outside the project area.



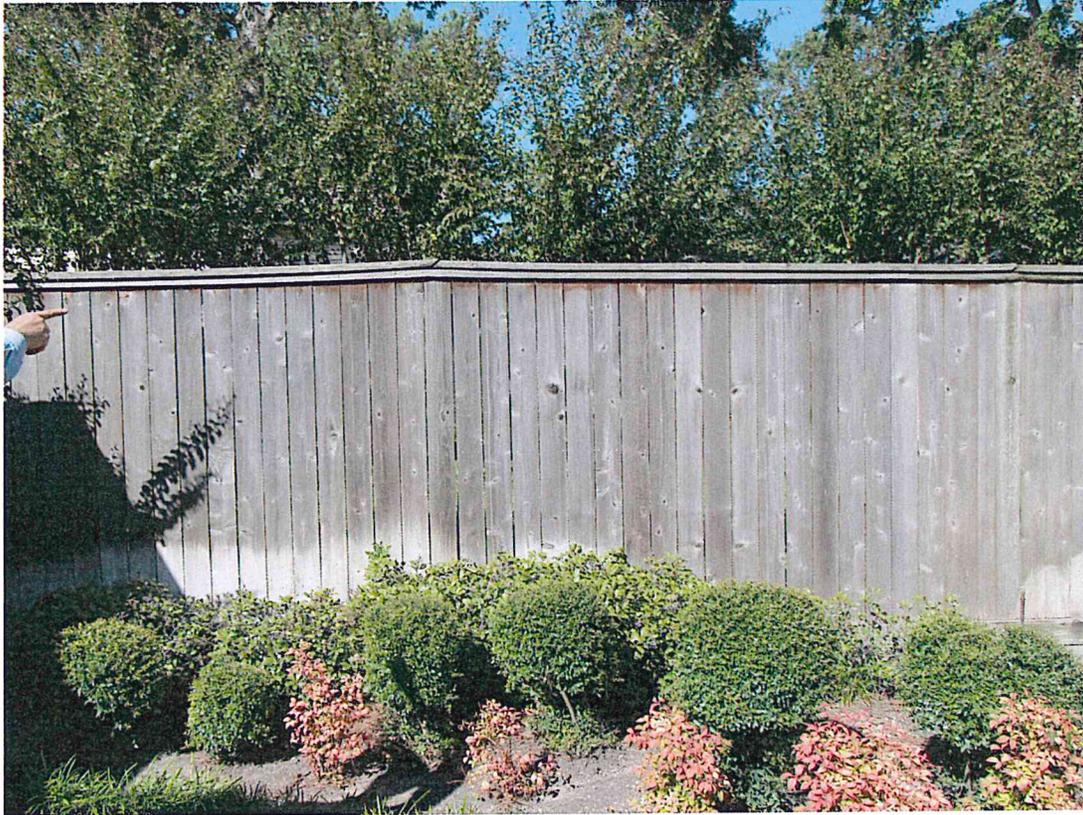
Visible Long Point Fault at West Forest Drive outside the project area.



Cracking in the house near the intersection of Rancho Bauer and Apple Tree Lane.



Distressed house due to fault crossing at 14215 Cindywood Drive.

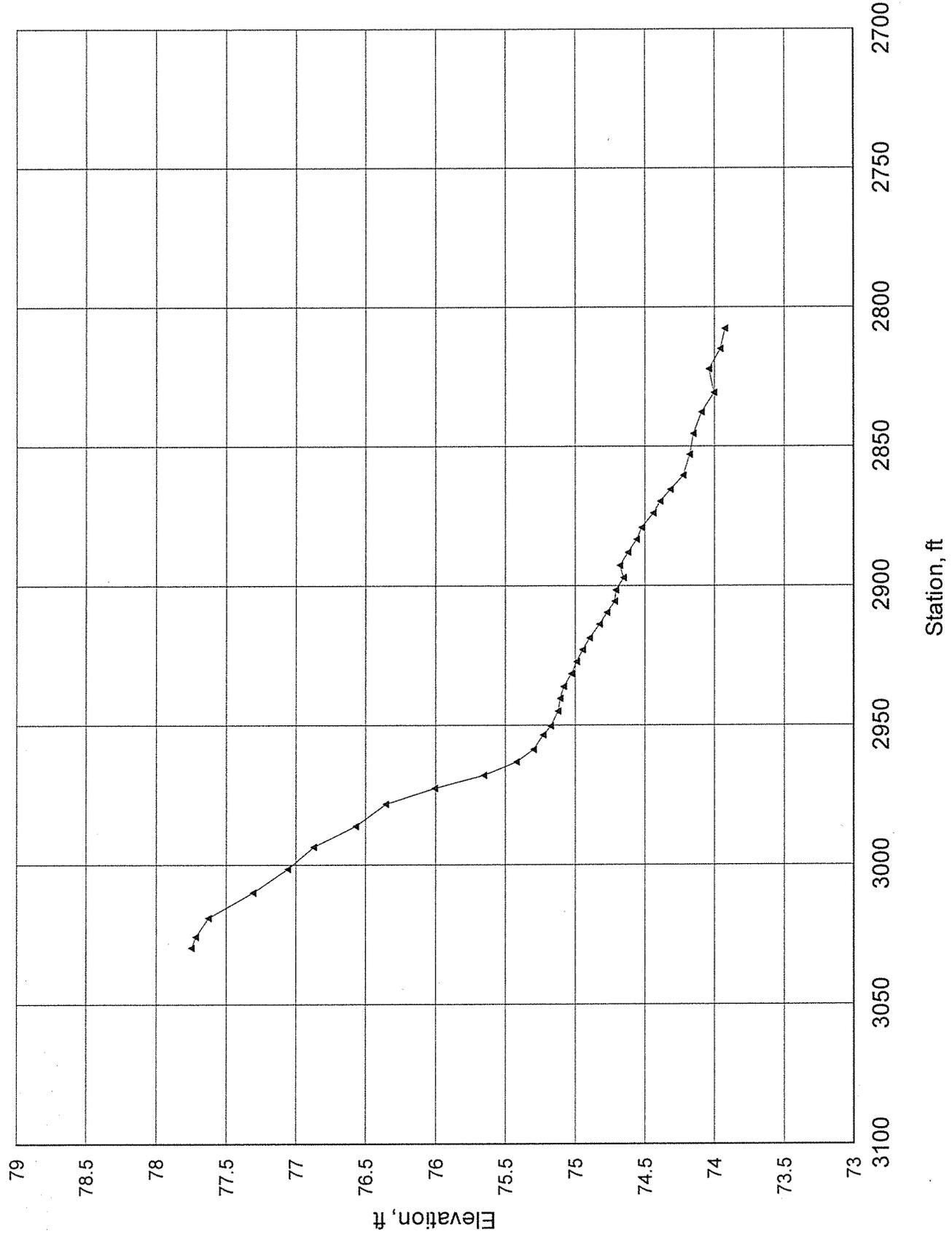


Failure in the fence due to fault crossing near Cardcrest Drive.

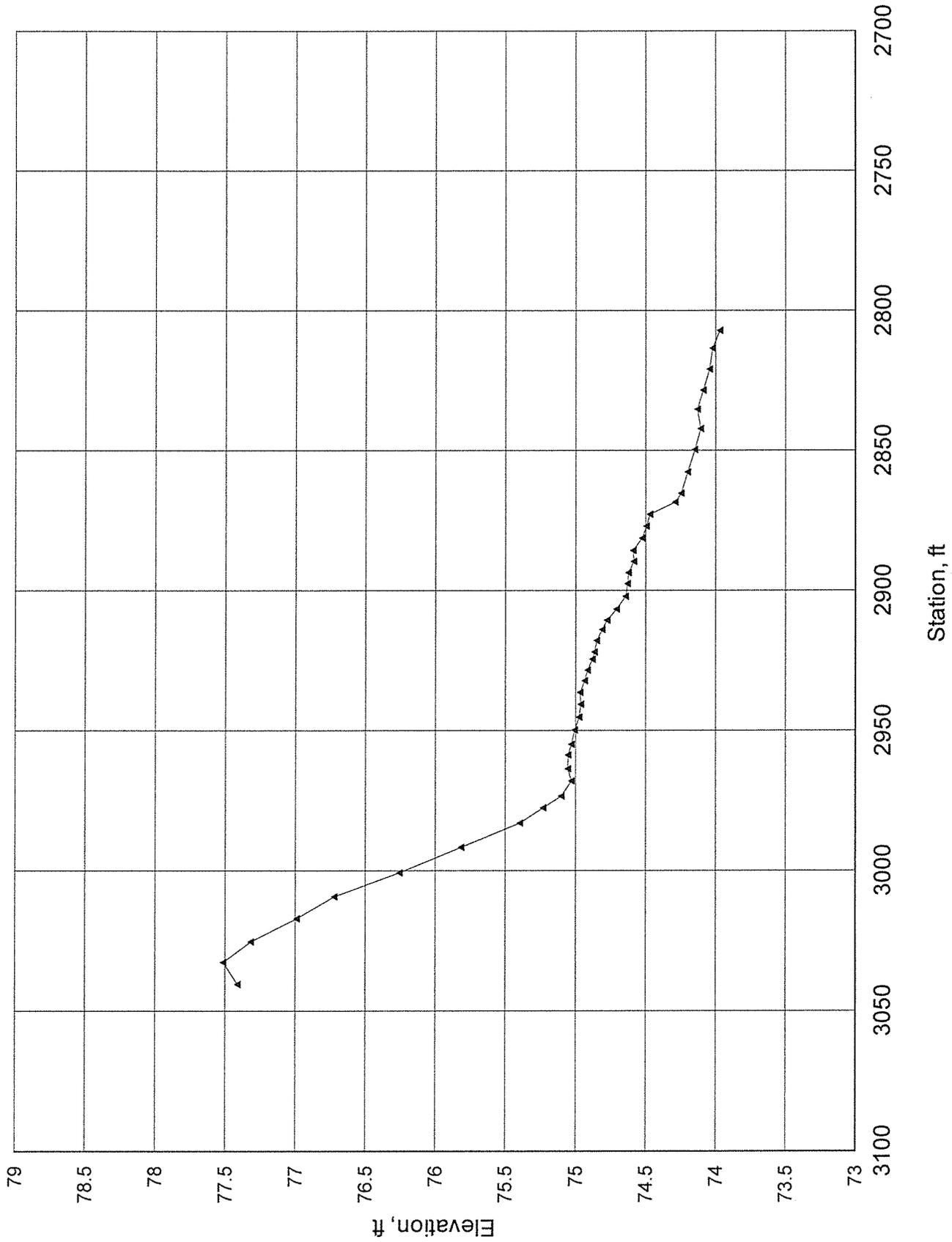


Failures in the curb along Carolcrest Drive due to fault crossing.

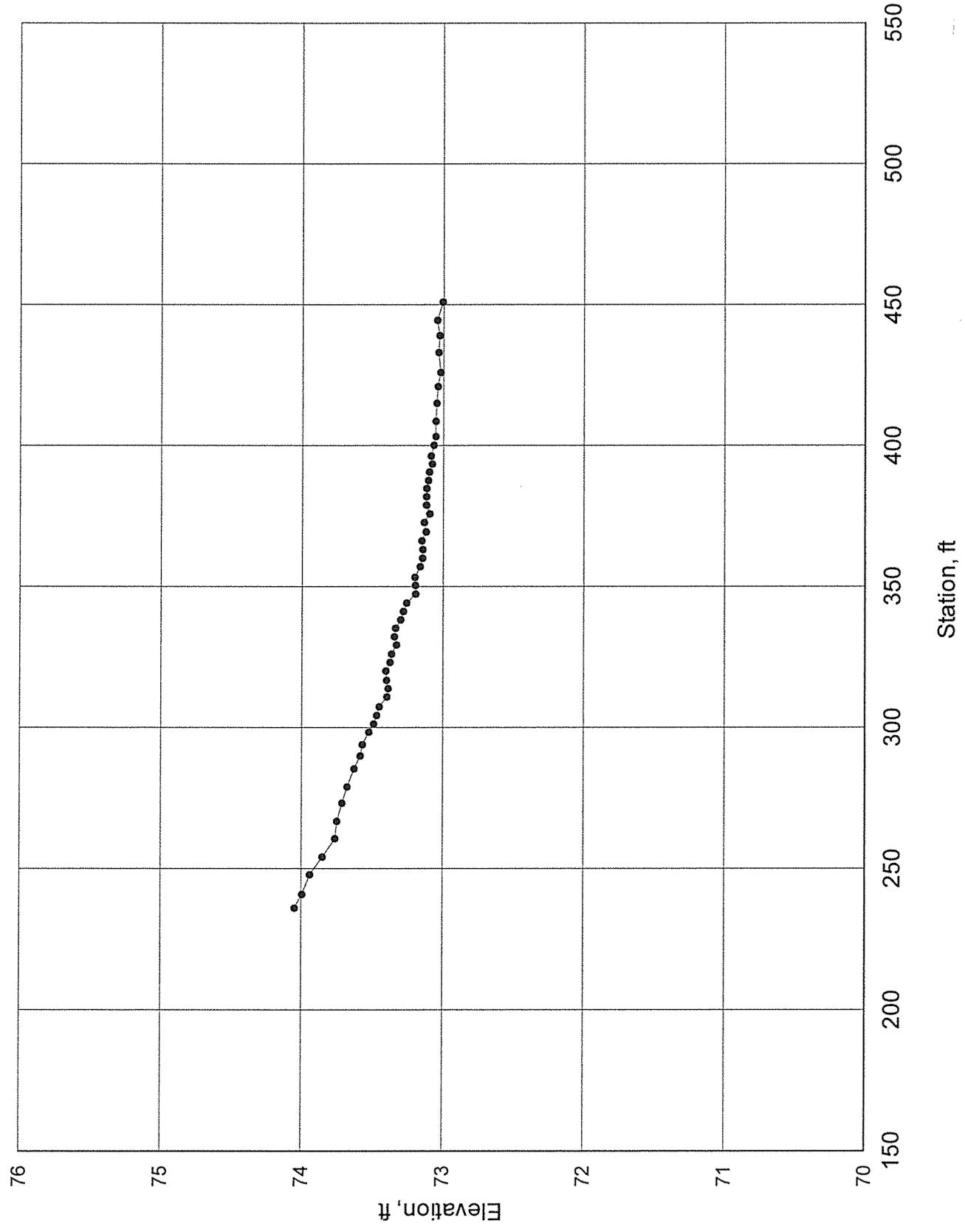
WHITEWHING LANE - WEST



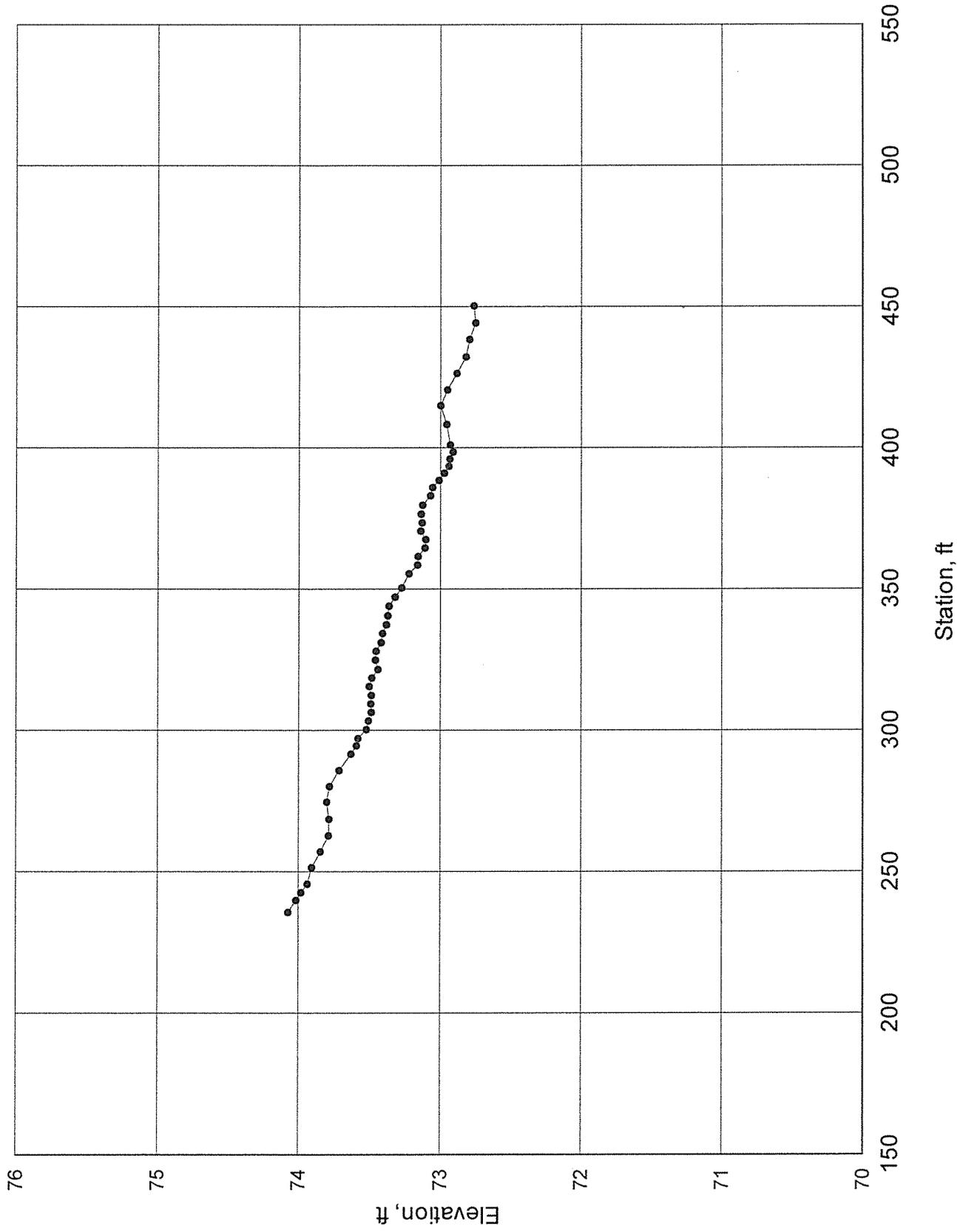
WHITEWHING LANE - EAST



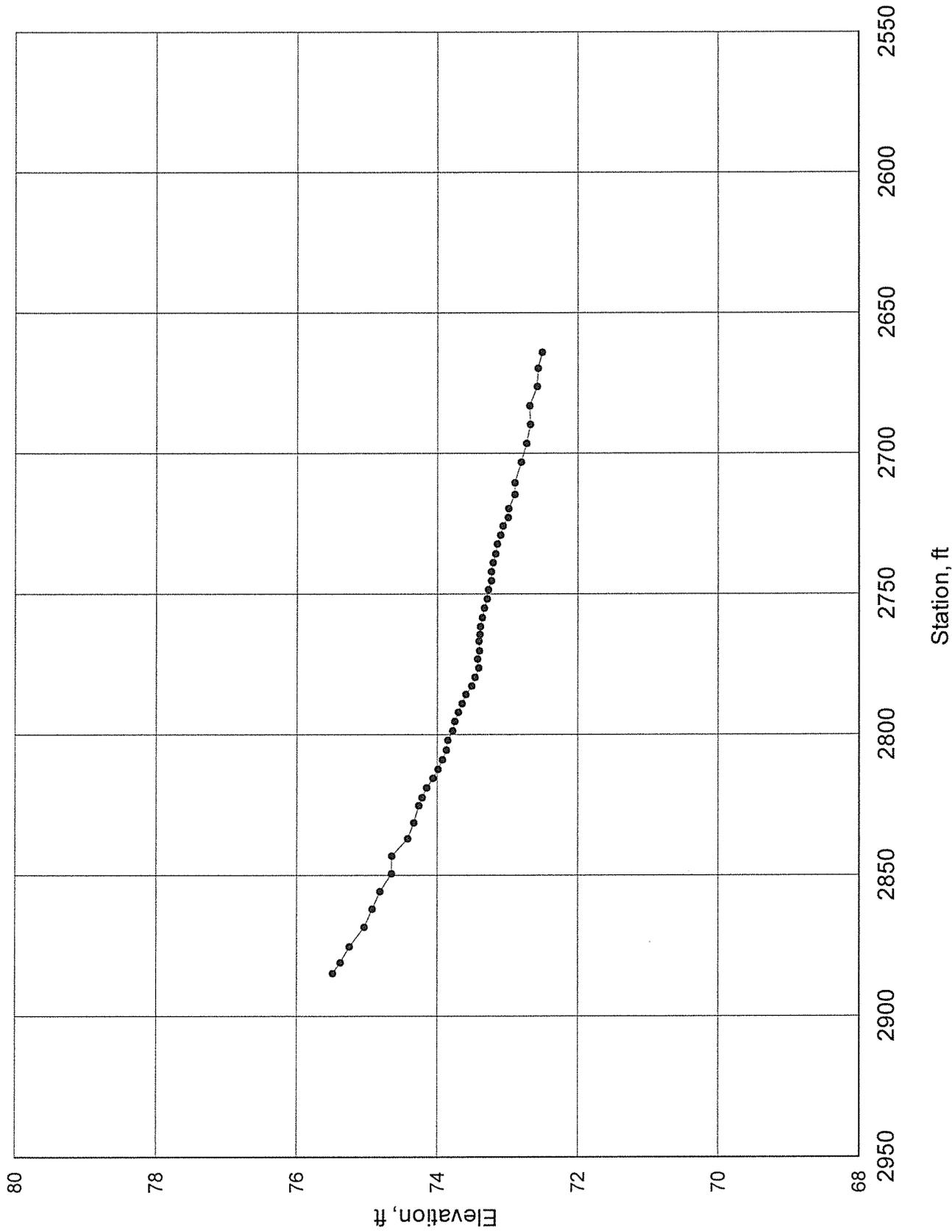
APPLE TREE-NORTH



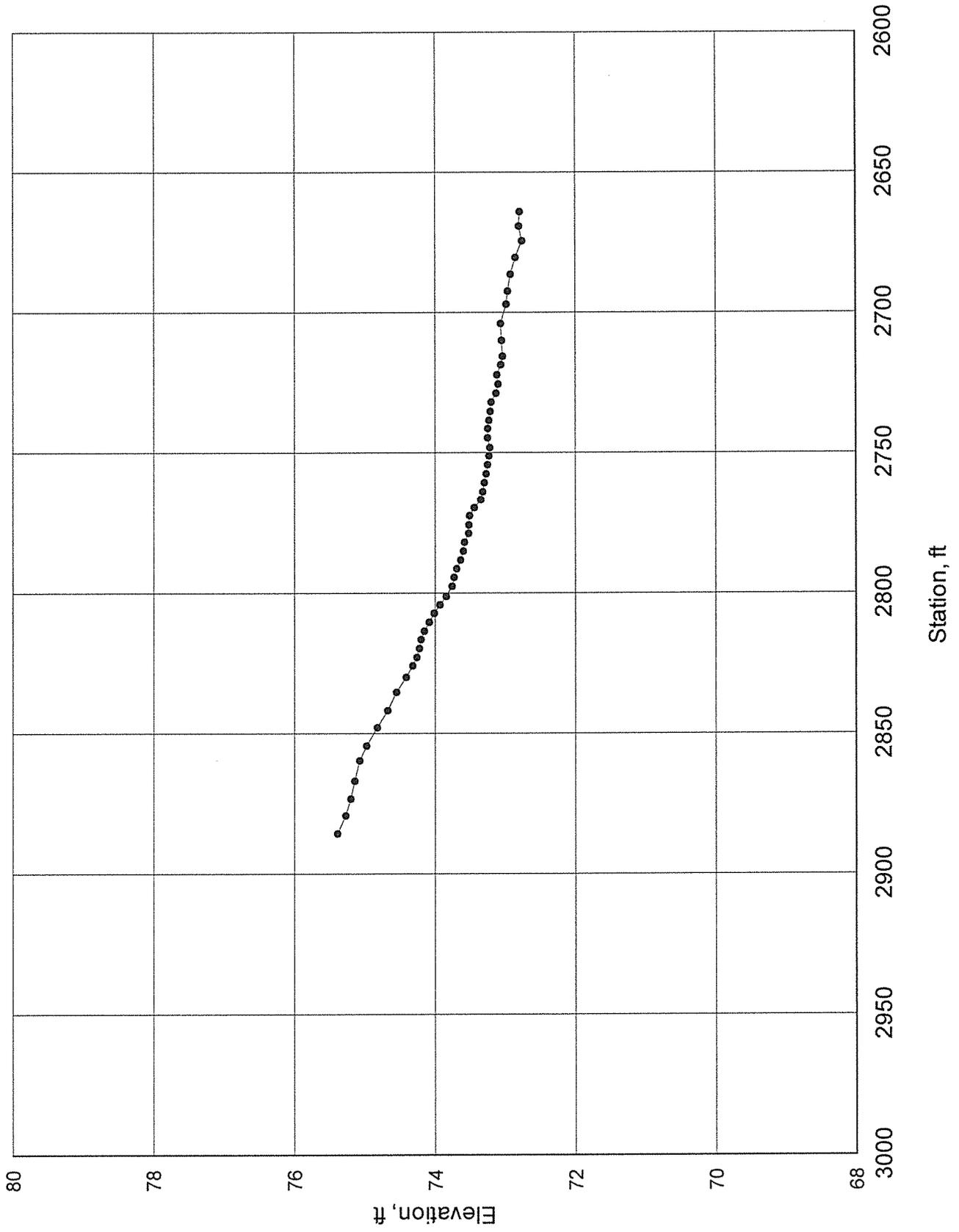
APPLE TREE-SOUTH



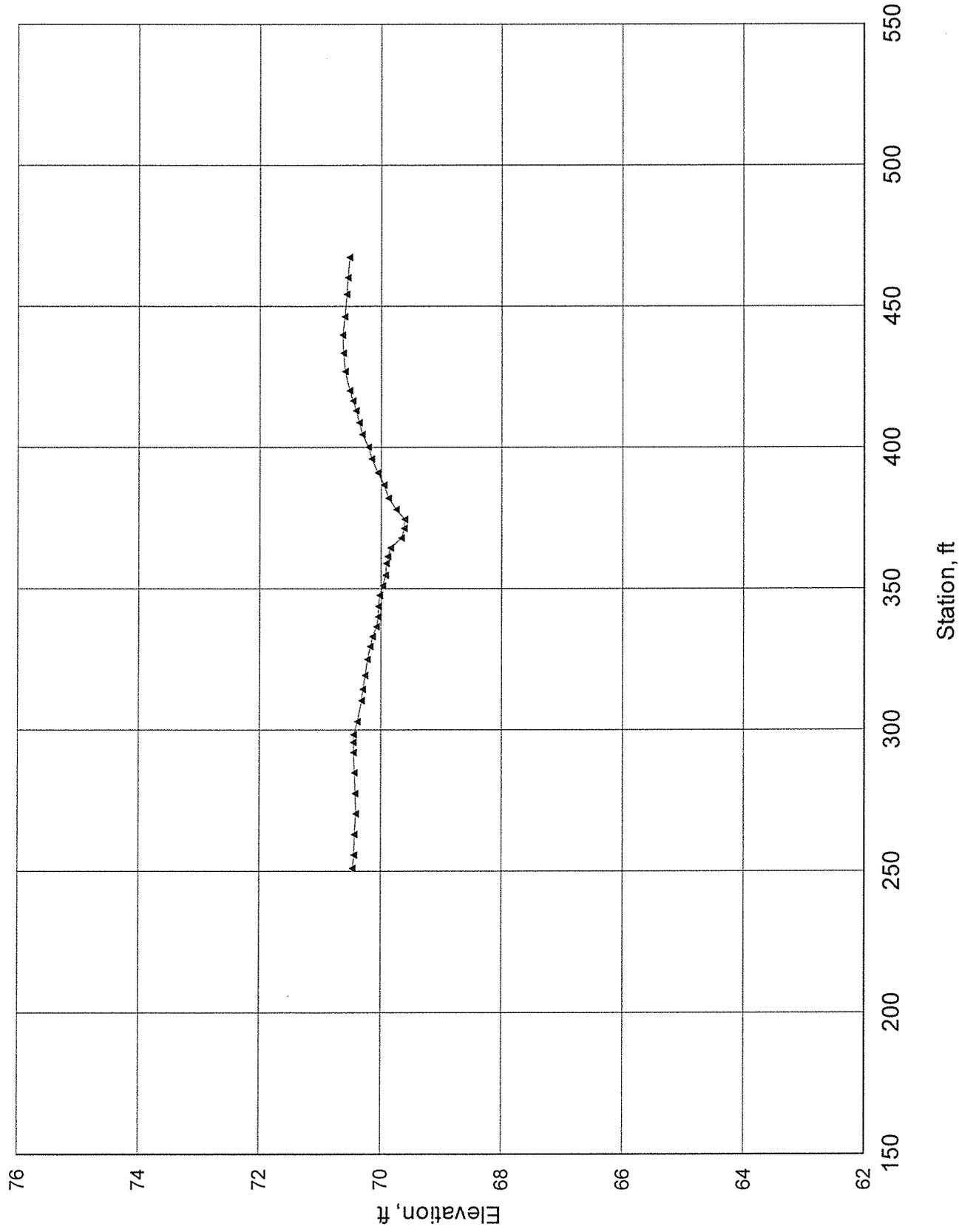
RANCHOBAUER-EAST



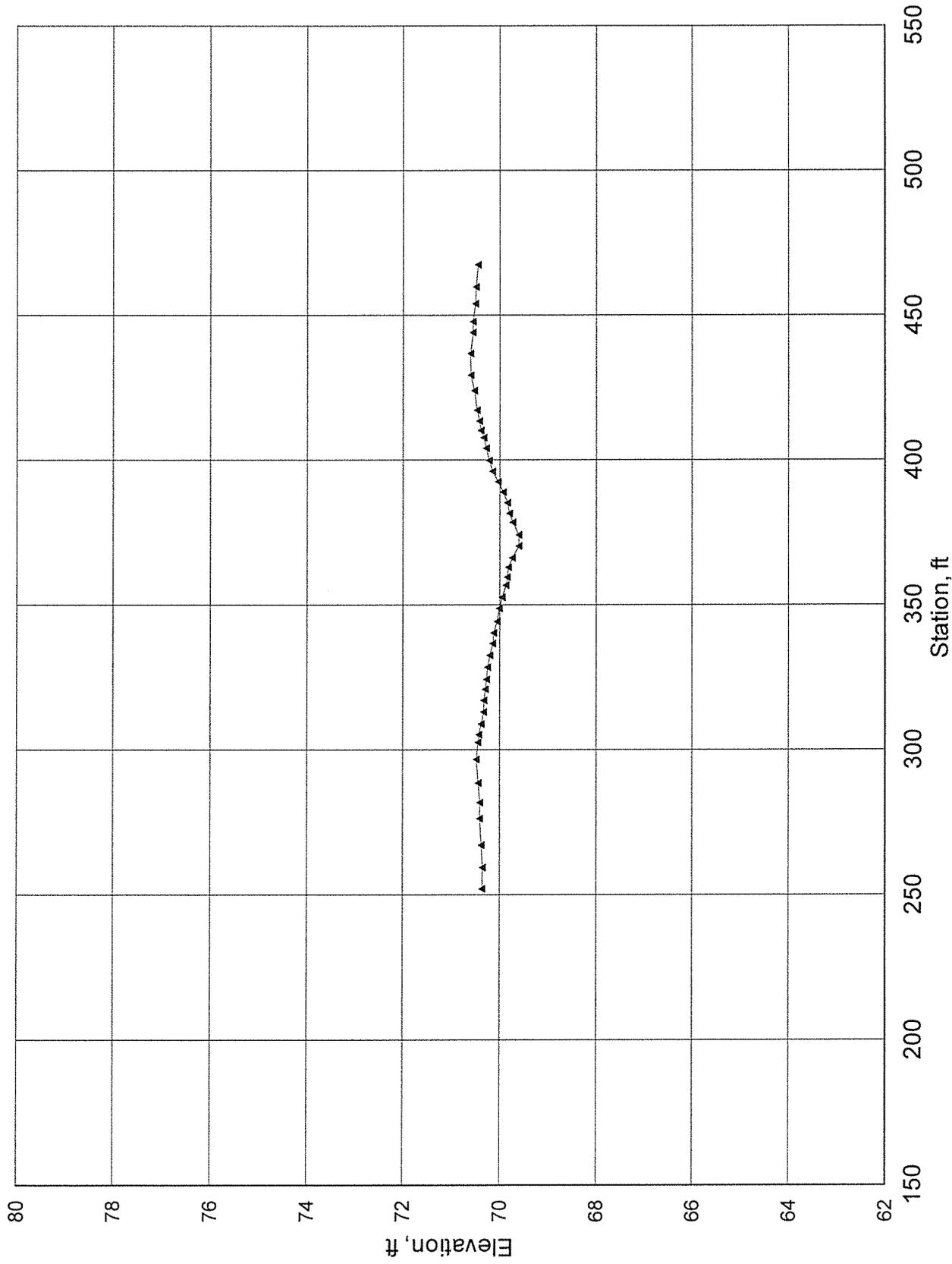
RANCHOBAUER-WEST



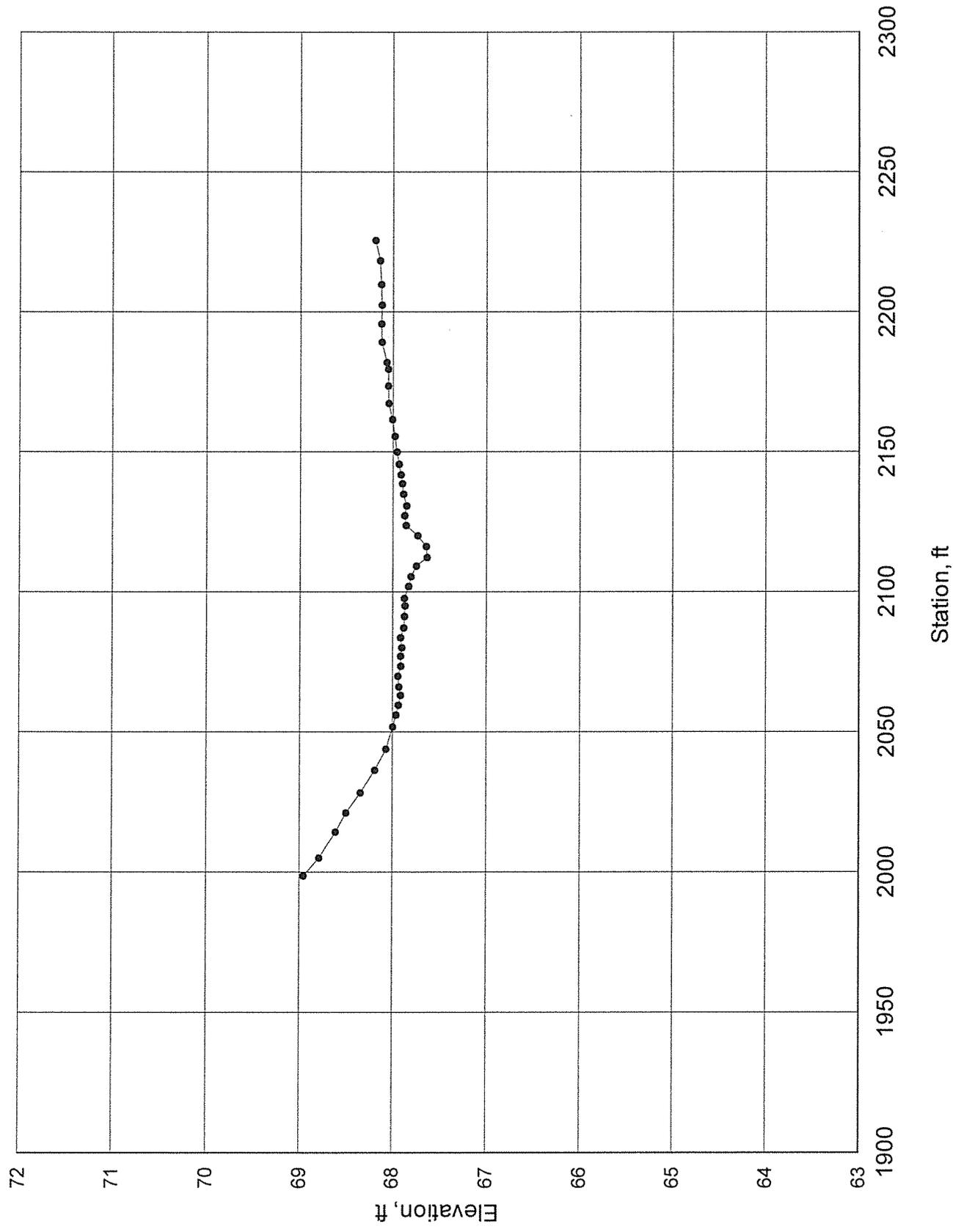
CINDYWOOD-SOUTH



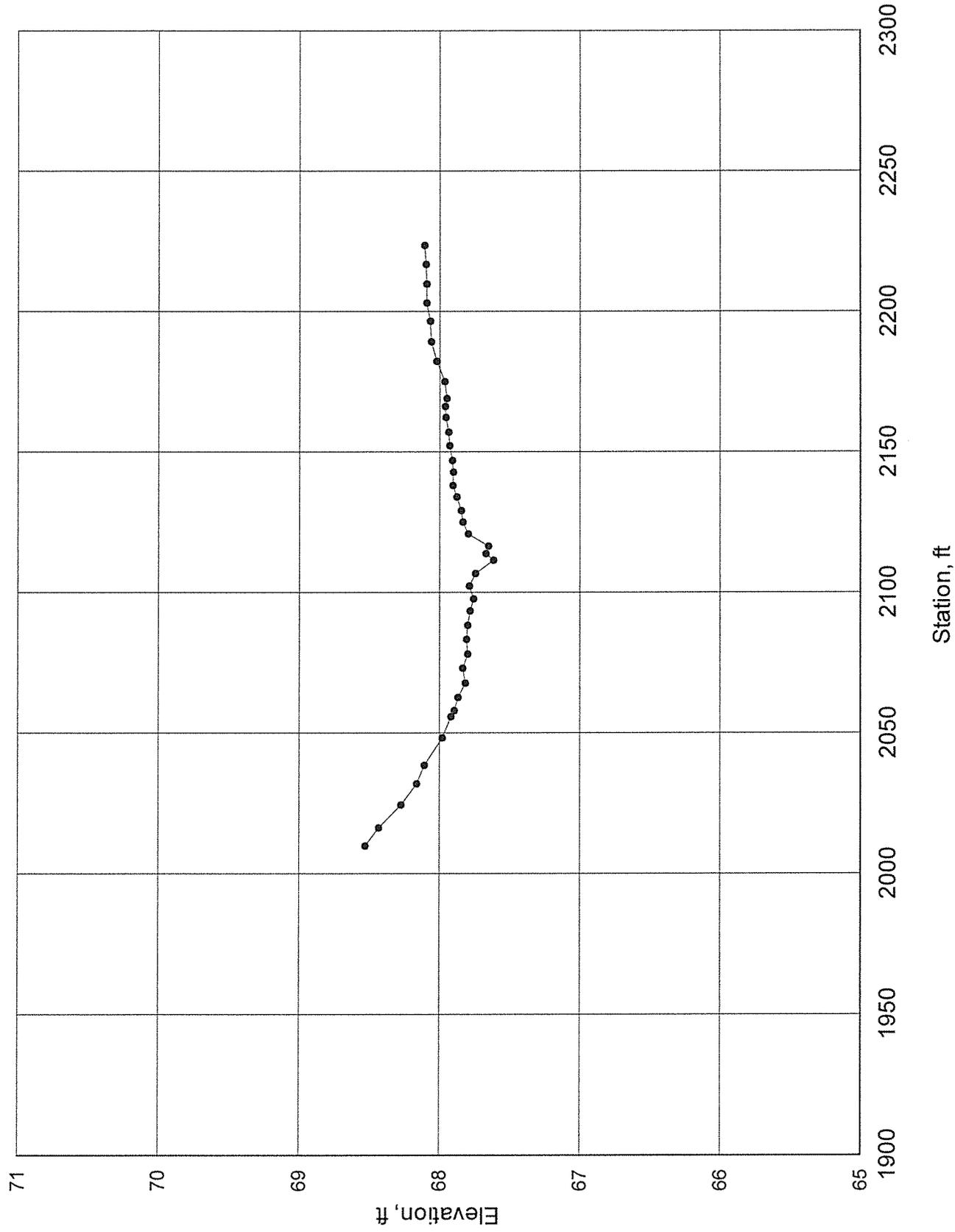
CINDYWOOD-NORTH



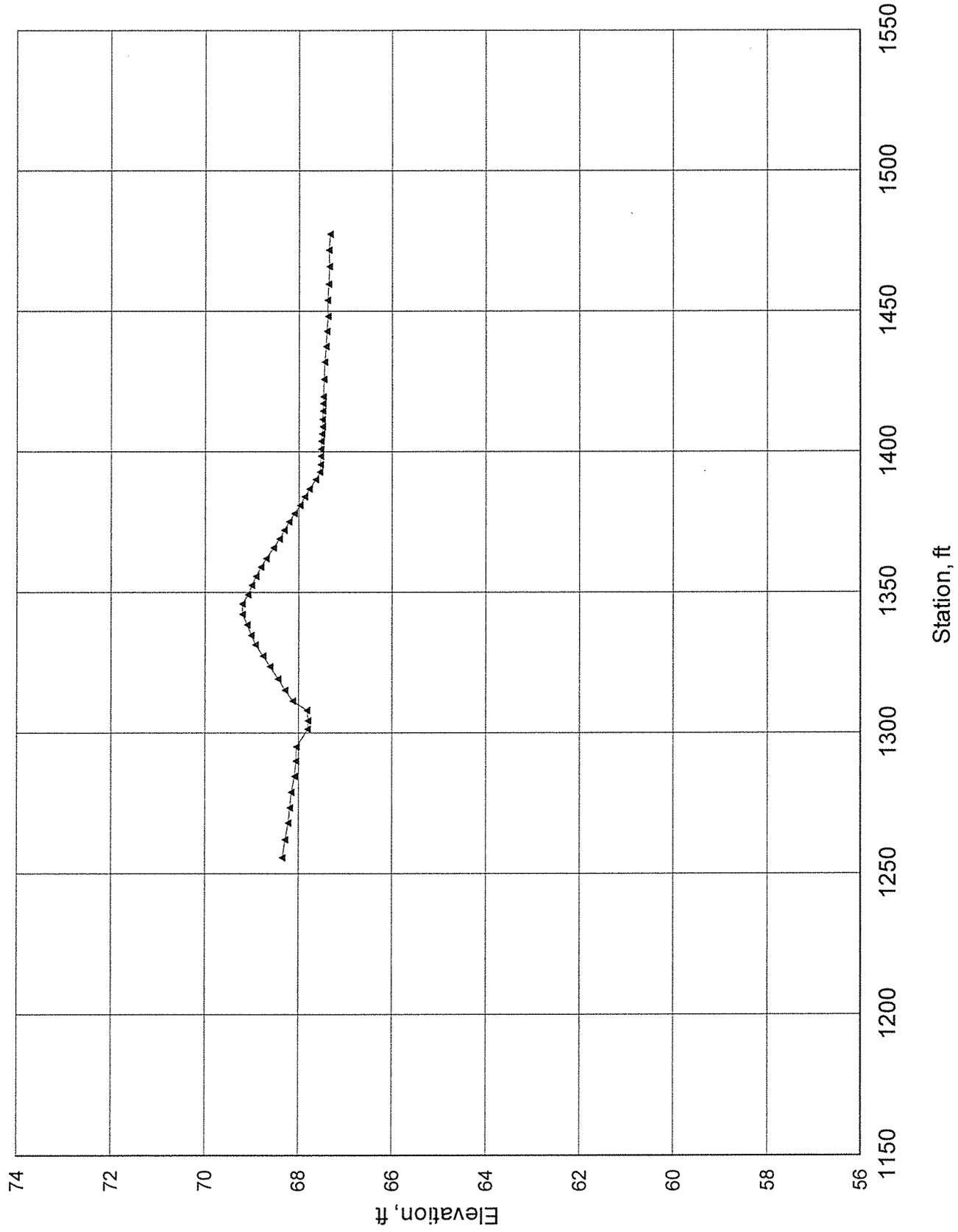
CAROLCREST-NORTH



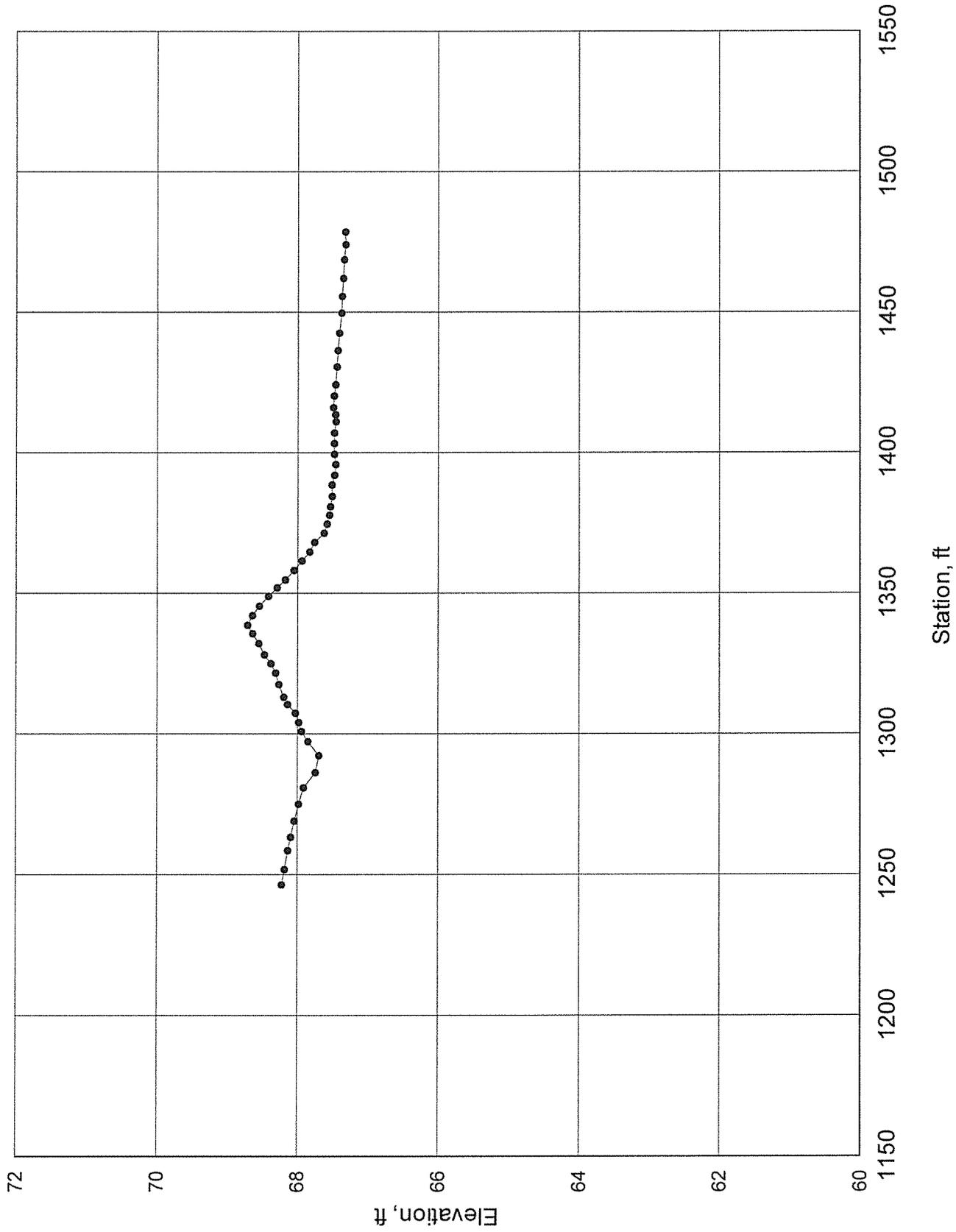
CAROLCREST-SOUTH

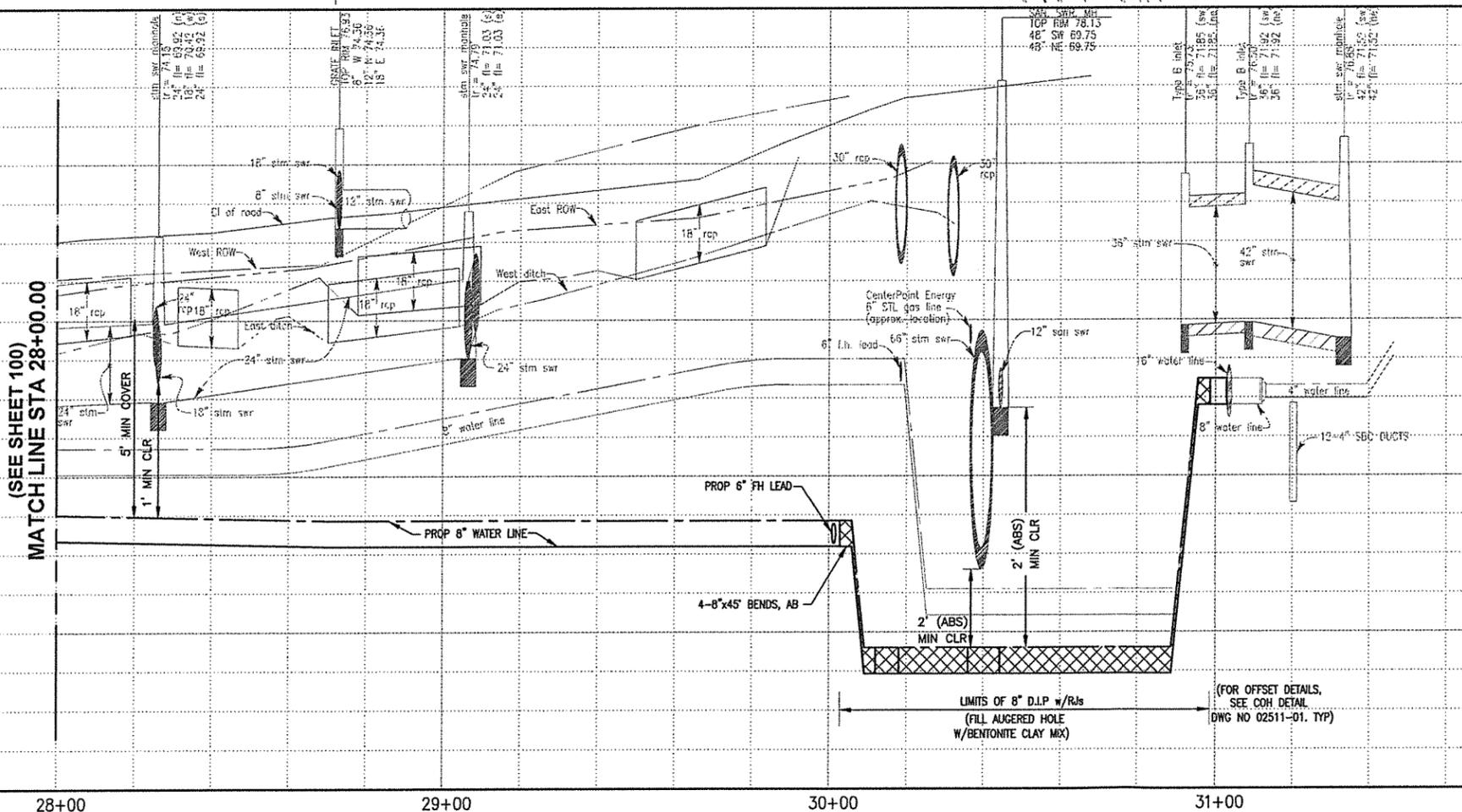
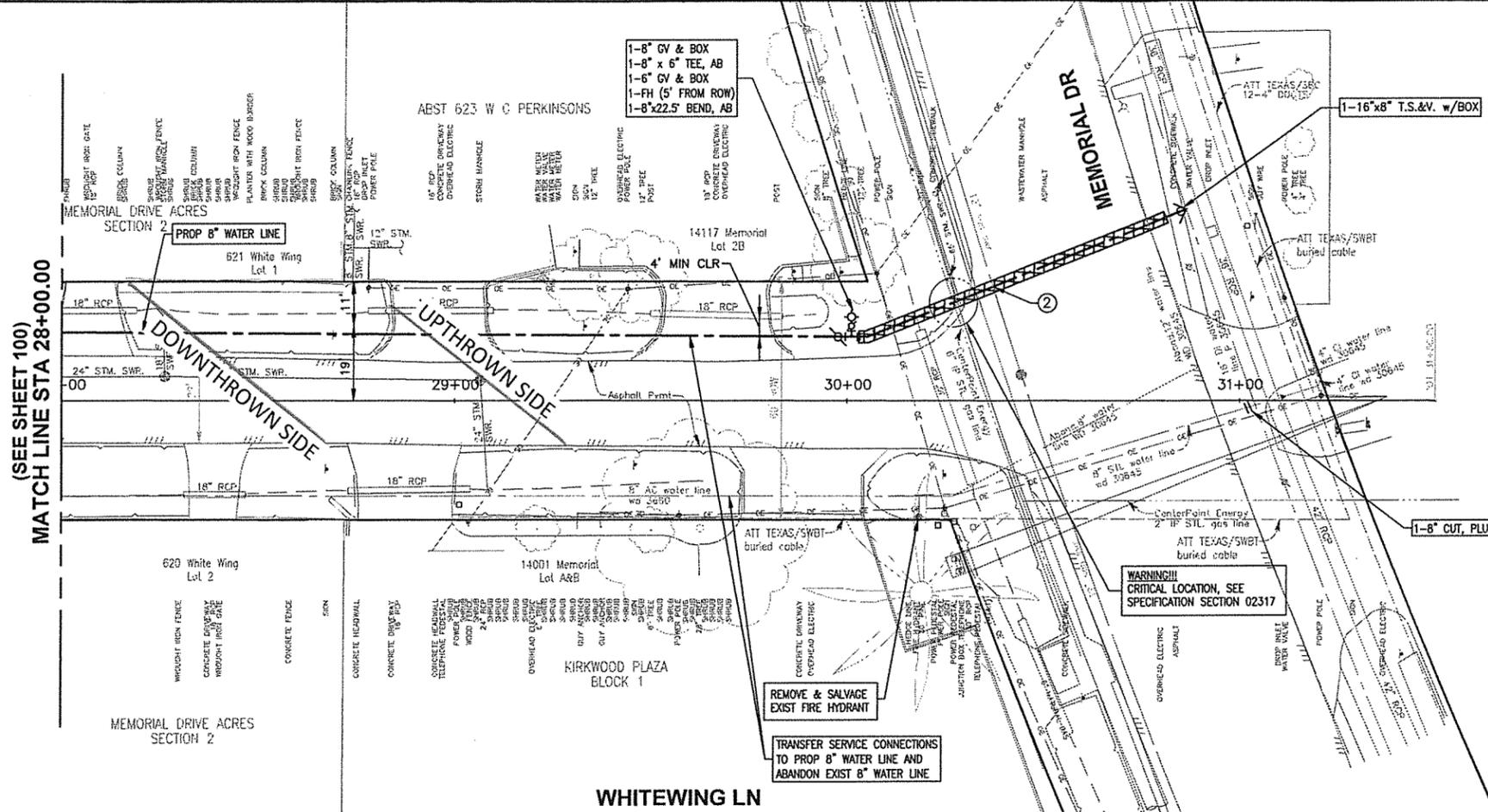


KELLYWOOD-NORTH



KELLYWOOD-SOUTH





BENCHMARK:
CITY OF HOUSTON MARKER 210175. FROM THE INTERSECTION OF MEMORIAL DRIVE AND NORTH KIRKWOOD DRIVE, TRAVEL SOUTH ON KIRKWOOD DRIVE TO BRIDGE OVER BUFFALO BAYOU. MONUMENT IS LOCATED ON EAST SIDE OF BRIDGE

EL=77.37
HORIZONTAL DATUM:NAD83, TEXAS SOUTH CENTRAL 4204
VERTICAL DATUM: NAVD88, 2001 ADJUSTMENT, GEOID99 (CONUS)

TBM 7(CONTROL POINT 7) - 5/8" I.R. W/CAP LOCATED AT THE SOUTHEAST INTERSECTION AT MEMORIAL DR AND WHITE WING LN.
BASELINE: WHITE WING LANE
STATION: 30+07.11 OFFSET: 24.23
ELEVATION=75.59'

LEGEND:

- PROPOSED RJ WATER LINE
- PROPOSED RJ DIP WATER LINE
- CRITICAL LOCATE AS PER STD SPEC 02317
- APPROXIMATE LOCATION OF PAVEMENT REPAIR AS PER COH STD DETAILS.

FOR KEYNOTES SEE SHEET 3.

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT ENERGY AT 713-207-2222.

NOTICE:
FOR YOUR SAFETY, YOU ARE REQUIRED BY TEXAS LAW TO CALL 811 AT LEAST 48 HOURS BEFORE YOU DIG SO THAT UNDERGROUND LINE CAN BE MARKED. THIS VERIFICATION DOES NOT FULFILL YOUR OBLIGATION TO CALL 811.

VERIFICATION OF PRIVATE UTILITY LINES

Date:
CenterPoint Energy/Natural Gas Facilities Verification ONLY
(This signature verifies that you have shown CNP Natural Gas lines correctly - not to be used for conflict verification) (Gas service lines are not shown)
Signature valid for six months.

Date:
CenterPoint Energy/UNDERGROUND Electrical Facilities Verification ONLY
(This signature verifies existing underground facilities - not to be used for conflict verification.)
Signature valid for six months.

Date:
Approved for AT&T Texas/SWBT underground conduit facilities only.
SIGNATURE VALID FOR ONE YEAR

JC JONES & CARTER, INC.
ENGINEERS • PLANNERS • SURVEYORS
Texas Board of Professional Engineers Registration No. F-439
6335 Gulton Dr., Suite 100 Houston, Texas 77081 (713) 777-5337

KIT Professionals, Inc.
Engineers • Planners • Construction Managers
255 West Loop Dr., Suite 600
Houston, Texas 77027
Phone: (713) 774-8400, Fax: (713) 774-4147
TXPE Firm Registration No. F-4091

DATE: SEPT 2013 CHECKED BY: SP
DESIGNED BY: YS DRAWN BY: J/SS

SURVEYED BY: CIVILCORP
FB NO. P-5798

THESE PLANS ARE PRELIMINARY AND ARE BEING ISSUED FOR REVIEW BY PUBLIC AGENCIES AND OTHER PRELIMINARY PURPOSES. WHEN ISSUED IN FINAL FORM

BY THE RESPONSIBLE ENGINEER:
KIT Professionals, Inc.
SRKANTH PUNUKULA, P.E.
TEXAS REGISTRATION NO.: 88614
SEPTEMBER, 2013

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

**WATER LINE REPLACEMENT
IN KICKERILLO AREA**

WHITEWING LN
STA 28+00 TO 31+50

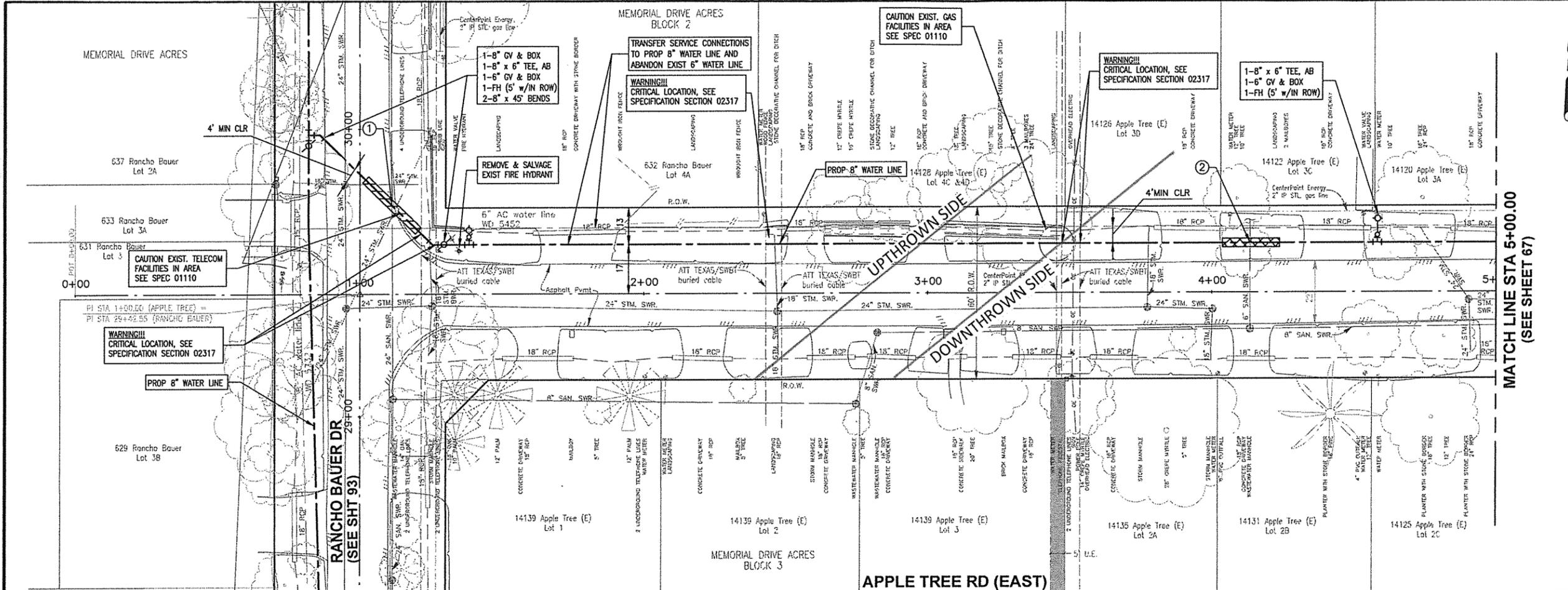
WBS NO.
S-000035-0185-4

DRAWING SCALE
VERT. 1"=2' HORIZ. 1"=20'

CITY OF HOUSTON, PM
MUMTAZ BAG P.E.

SHEET NO. 101 OF 147

FIGURE 6.1



BENCHMARK:
 CITY OF HOUSTON MARKER 210175, FROM THE INTERSECTION OF MEMORIAL DRIVE AND NORTH KIRKWOOD DRIVE, TRAVEL SOUTH ON KIRKWOOD DRIVE TO BRIDGE OVER BUFFALO EAST YOW. MONUMENT IS LOCATED ON EAST SIDE OF BRIDGE

EL=77.37
 HORIZONTAL DATUM:NAD83, TEXAS SOUTH CENTRAL 4204
 VERTICAL DATUM: NAVD88, 2001 ADJUSTMENT, GEOID99 (CONUS)

TBM 21(CONTROL POINT 24) - 5/8" I.R. W/CAP LOCATED AT THE WEST INTERSECTION OF APPLE TREE LN AND RANCHO BAUER DR.
 BASELINE: APPLE TREE LN
 STATION: 0+86.76 OFFSET: 7.98
 ELEVATION=75.98'

LEGEND:

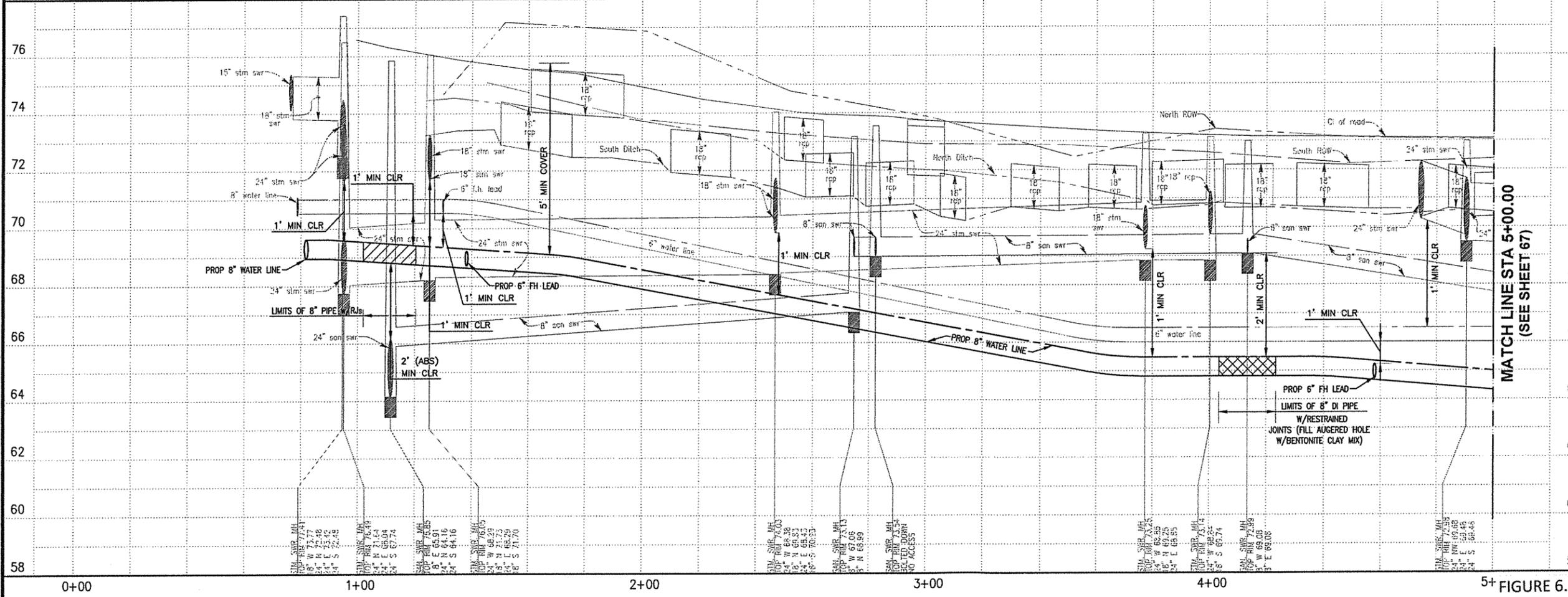
- PROPOSED RJ WATER LINE
- PROPOSED RJ DIP WATER LINE
- CRITICAL LOCATE AS PER STD SPEC 02317
- APPROXIMATE LOCATION OF PAVEMENT REPAIR AS PER COH STD DETAILS.

FOR KEYNOTES SEE SHEET 3.

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT ENERGY AT 713-207-2222.

NOTICE:
 FOR YOUR SAFETY, YOU ARE REQUIRED BY TEXAS LAW TO CALL 811 AT LEAST 48 HOURS BEFORE YOU DIG SO THAT UNDERGROUND LINE CAN BE MARKED. THIS VERIFICATION DOES NOT FULFILL YOUR OBLIGATION TO CALL 811.

VERIFICATION OF PRIVATE UTILITY LINES



Date: _____
 CenterPoint Energy/Natural Gas Facilities Verification ONLY
 (This signature verifies that you have shown CNP Natural Gas lines correctly - not to be used for conflict verification) (Gas service lines are not shown)
 Signature valid for six months.

Date: _____
 CenterPoint Energy/UNDERGROUND Electrical Facilities Verification ONLY
 (This signature verifies existing underground facilities - not to be used for conflict verification.)
 Signature valid for six months.

Date: _____
 Approved for AT&T Texas/SWBT underground conduit facilities only.
 SIGNATURE VALID FOR ONE YEAR

JC JONES & CARTER, INC.
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 Texas Board of Professional Engineers Registration No. F-439
 6335 Gulfton Dr., Suite 100 Houston, Texas 77081 (713) 777-5337

KIT Professionals, Inc.
 Challenging Challenges
 Engineers • Planners • Construction Managers
 2525 West Loop Dr., Suite 500
 Houston, Texas 77042
 Phone: (713) 843-8100 Fax: (713) 843-4147
 TSP# Reg. Registration No. F-4091

DATE: SEPT 2013 CHECKED BY: SP
 DESIGNED BY: YS DRAWN BY: JH/SS

SURVEYED BY: CIVILCORP
 FB NO. P-5798

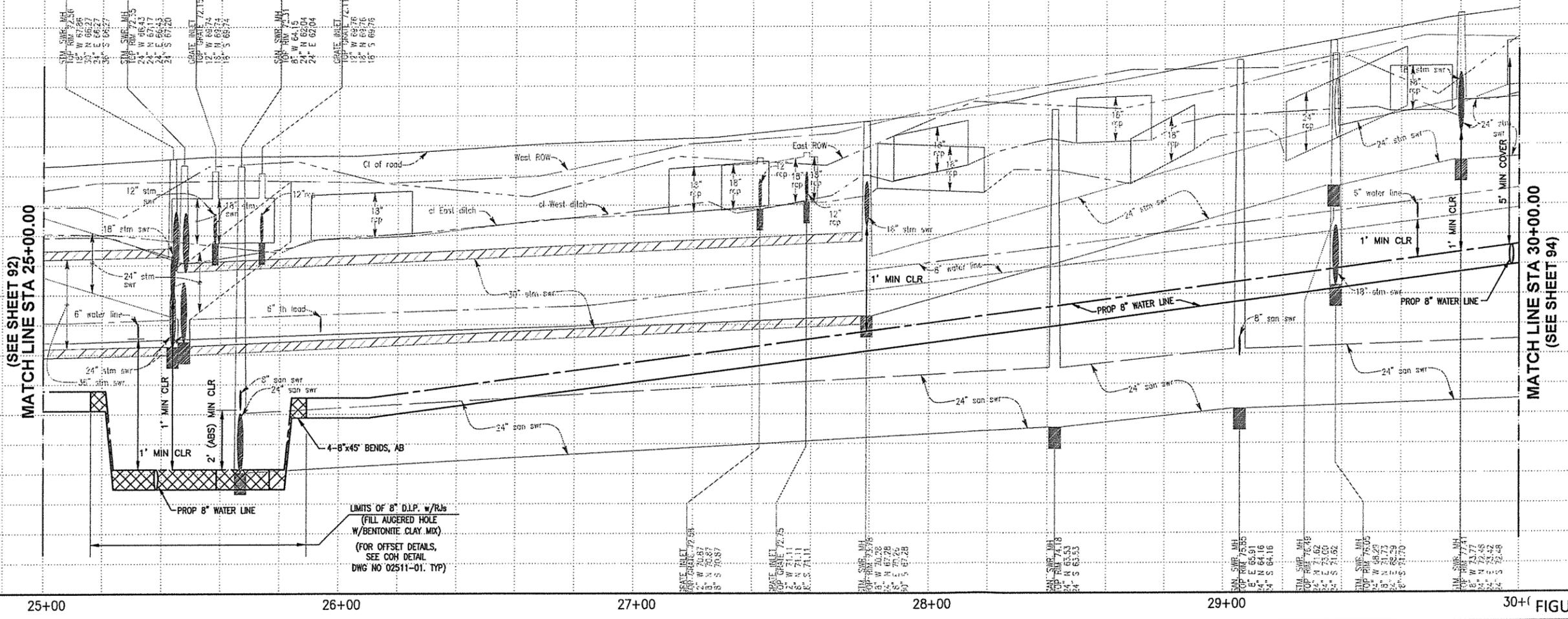
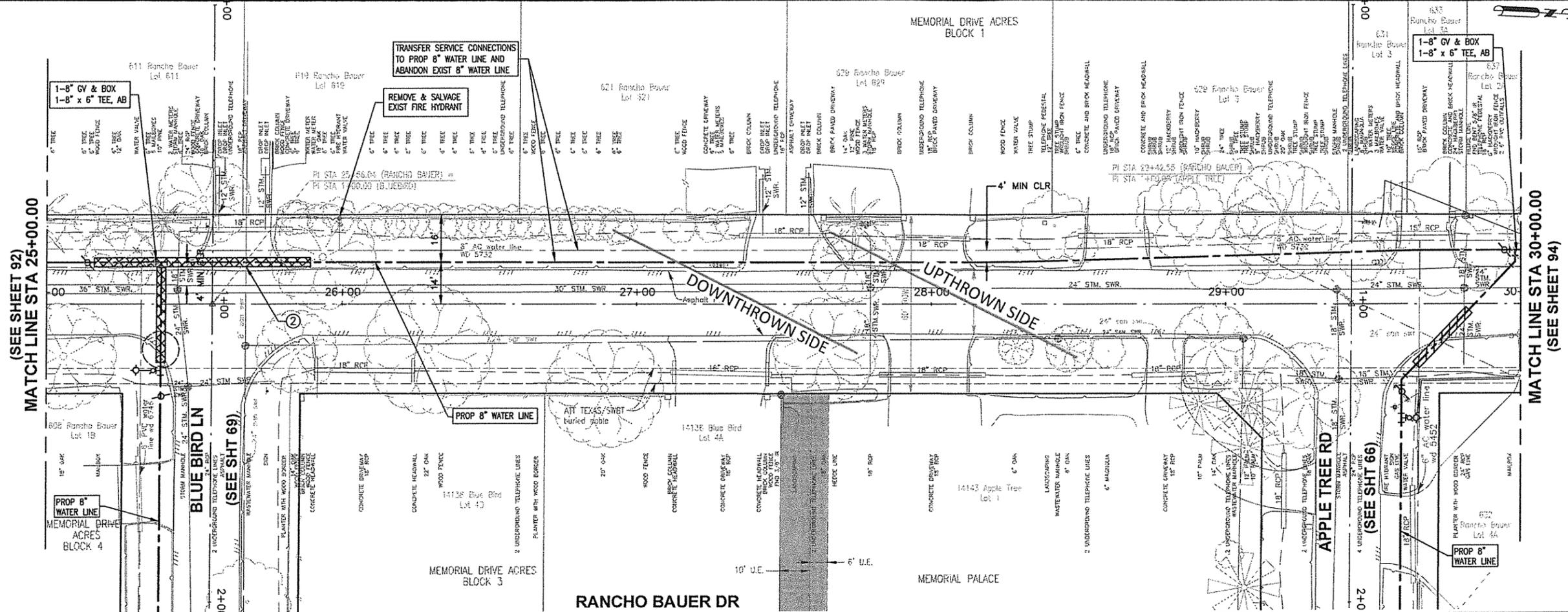
SEPTEMBER, 2013

CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

**WATER LINE REPLACEMENT
 IN KICKERILLO AREA**

**APPLE TREE RD (EAST)
 STA 0+00 TO 5+00**

WBS NO.	S-000035-0185-4
DRAWING SCALE	VERT. 1"=2' HORIZ. 1"=20'
CITY OF HOUSTON, PM	MUMTAZ BAIG P.E.
SHEET NO. 66 OF 147	



BENCHMARK:
 CITY OF HOUSTON MARKER 210175, FROM THE INTERSECTION OF MEMORIAL DRIVE AND NORTH KIRKWOOD DRIVE, TRAVEL SOUTH ON KIRKWOOD DRIVE TO BRIDGE OVER BUFFALO BAYOU. MONUMENT IS LOCATED ON EAST SIDE OF BRIDGE

EL=77.37
 HORIZONTAL DATUM: NAD83, TEXAS SOUTH CENTRAL 4204
 VERTICAL DATUM: NAVD88, 2001 ADJUSTMENT, GEOID99 (CONUS)

TBM 21 (CONTROL POINT 24) - 5/8" I.R. W/CAP LOCATED AT THE WEST INTERSECTION OF APPLE TREE LN AND RANCHO BAUER DR.
 BASELINE: APPLE TREE LN
 STATION: 0+86.76 OFFSET: 7.98 ELEVATION=75.98*

TBM 22 (CONTROL POINT 25) - 5/8" I.R. W/CAP LOCATED AT THE SOUTHEAST INTERSECTION OF RANCHO BAUER DR AND BLUE BIRD LN.
 BASELINE: BLUE BIRD LN
 STATION: 1+17.61 OFFSET: 21.30 ELEVATION=71.91*

LEGEND:

- PROPOSED RJ WATER LINE
- PROPOSED RJ DIP WATER LINE
- CRITICAL LOCATE AS PER STD SPEC 02317
- APPROXIMATE LOCATION OF PAVEMENT REPAIR AS PER COH STD DETAILS.

FOR KEYNOTES SEE SHEET 3.

NOTICE:
 TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT ENERGY AT 713-207-2222.

FOR YOUR SAFETY, YOU ARE REQUIRED BY TEXAS LAW TO CALL 811 AT LEAST 48 HOURS BEFORE YOU DIG SO THAT UNDERGROUND LINE CAN BE MARKED. THIS VERIFICATION DOES NOT FULFILL YOUR OBLIGATION TO CALL 811.

VERIFICATION OF PRIVATE UTILITY LINES

Date: _____
 CenterPoint Energy/Natural Gas Facilities Verification ONLY
 (This signature verifies that you have shown CNP Natural Gas lines correctly - not to be used for conflict verification) (Gas service lines are not shown)
 Signature valid for six months.

Date: _____
 CenterPoint Energy/UNDERGROUND Electrical Facilities Verification ONLY
 (This signature verifies existing underground facilities - not to be used for conflict verification)
 Signature valid for six months.

Date: _____
 Approved for AT&T Texas/SWBT underground conduit facilities only.
 SIGNATURE VALID FOR ONE YEAR

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 ENGINEERS • PLANNERS • SURVEYORS
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 6335 Gulton Dr., Suite 100 Houston, Texas 77081 (713) 777-5337

KIT Professionals, Inc.
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BY THE RESPONSIBLE ENGINEER:
 KIT Professionals, Inc.
 SRINATH PUNURULA, P.E.
 TEXAS REGISTRATION NO. 86614
 SEPTEMBER, 2013

CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

WATER LINE REPLACEMENT IN KICKERILLO AREA

**RANCHO BAUER DR
 STA 25+00 TO 30+00**

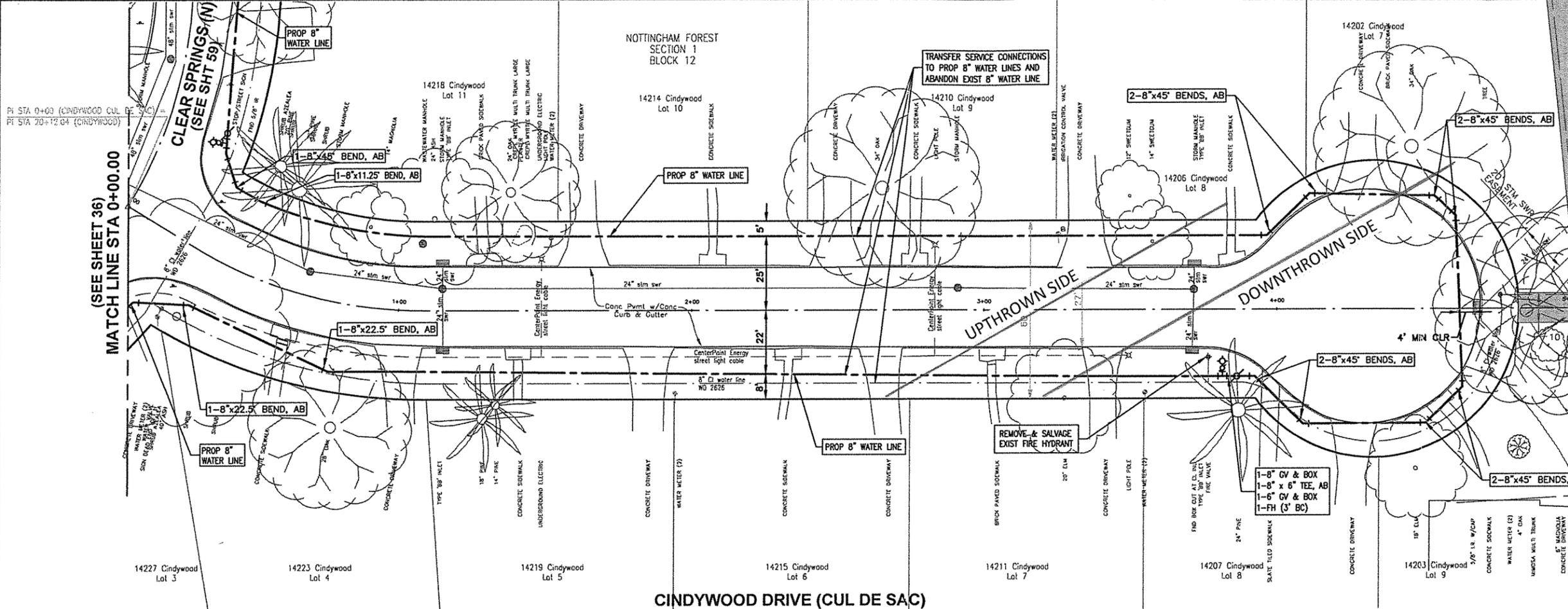
WBS NO.
 S-000035-0185-4

DRAWING SCALE
 VERT. 1"=2' HORIZ. 1"=20'

CITY OF HOUSTON, PM
 MUMTAZ BAIG P.E.

SHEET NO. 93 OF 147

FIGURE 6.3



BENCHMARK:

CITY OF HOUSTON MARKER 210175. FROM THE INTERSECTION OF MEMORIAL DRIVE AND NORTH KIRKWOOD DRIVE, TRAVEL SOUTH ON KIRKWOOD DRIVE TO BRIDGE OVER BUFFALO BAYOU. MONUMENT IS LOCATED ON EAST SIDE OF BRIDGE

EL=77.37
 HORIZONTAL DATUM: NAD83, TEXAS SOUTH CENTRAL 4204
 VERTICAL DATUM: NAVD83, 2001 ADJUSTMENT, GEOID99 (CONUS)
 TBM 29 (CONTROL POINT 33) - 5/8" I.R. W/CAP LOCATED AT THE NORTHEAST INTERSECTION OF CLEAR SPRING DR AND CINDYWOOD DR.
 STATION: 0+24.76 OFFSET: 30.45 ELEVATION=73.96'

TBM 30 (CONTROL POINT 34) - 5/8" I.R. W/CAP LOCATED AT THE SOUTHEAST SIDE OF CINDYWOOD DR AT ADDRESS 14203 CINDYWOOD DR.
 STATION: 4+64.74 OFFSET: 25.79 ELEVATION=70.97'

LEGEND:

- PROPOSED RJ WATER LINE
- PROPOSED RJ DIP WATER LINE
- CRITICAL LOCATE AS PER STD SPEC 02317
- APPROXIMATE LOCATION OF PAVEMENT REPAIR AS PER COM STD DETAILS.

FOR KEYNOTES SEE SHEET 3.

NOTICE:

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL CENTERPOINT ENERGY AT 713-207-2222.

VERIFICATION OF PRIVATE UTILITY LINES

Date: _____
 CenterPoint Energy/Natural Gas Facilities Verification Only
 (This signature verifies that you have shown CHP Metered Gas lines correctly - not to be used for conflict verification) (Gas service lines are not shown)
 Signature valid for six months.

Date: _____
 CenterPoint Energy/UNDERGROUND Electrical Facilities Verification ONLY
 (This signature verifies existing underground facilities - not to be used for conflict verification.)
 Signature valid for six months.

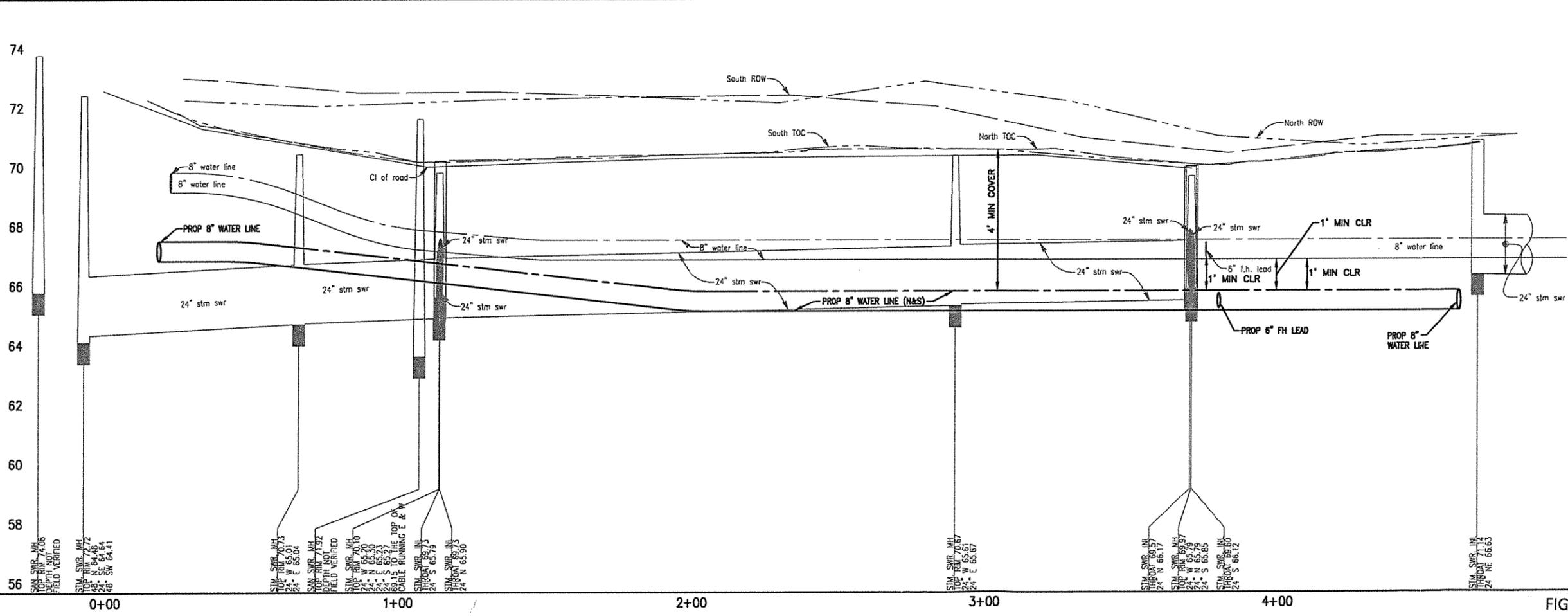
Date: _____
 Approved for AT&T Texas/SWB/T underground conduit facilities only.
 SIGNATURE VALID FOR ONE YEAR

JC JONES & CARTER, INC.
 ENGINEERS • PLANNERS • SURVEYORS
 Texas Board of Professional Engineers Registration No. P-439
 6335 Gulton Dr., Suite 100 Houston, Texas 77081 (713) 777-5337

KIT Professionals, Inc.
 Challenging Challenges...
 Engineers • Planners • Construction Managers
 2223 Westover Dr., Suite 800
 Houston, Texas 77042
 Phone: (713) 234-0700 Fax: (713) 234-0747
 TSP# Form Registration No. 1-4991

DATE: SEPT 2013 CHECKED BY: SP
 DESIGNED BY: YS DRAWN BY: JY/SS
 SURVEYED BY: CIVILCORP

BY THE RESPONSIBLE ENGINEER:
 RESPONSIBLE ENGINEER:
 KIT Professionals, Inc.
 SINGHAATH PUNJIBOLA, P.E.
 TEXAS REGISTRATION NO.: 06814
 SEPTEMBER, 2013



CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

WATER LINE REPLACEMENT IN KICKERILLO AREA

CINDYWOOD DR. (CUL DE SAC) STA 0+00 TO 5+00

WBS NO. S-000035-0185-4

DRAWING SCALE

VERT. 1"=2' HORIZ. 1"=20'

CITY OF HOUSTON, PM

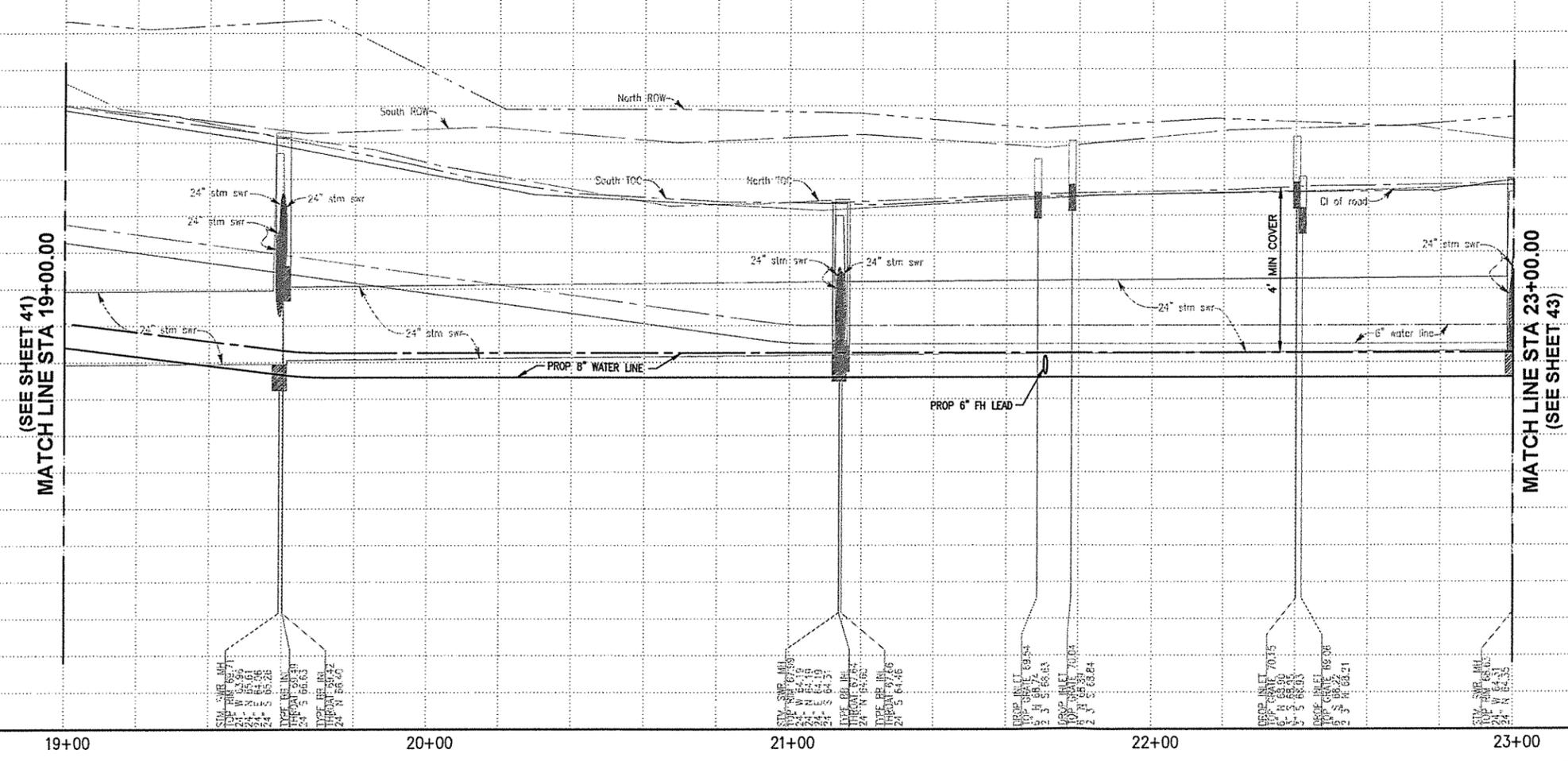
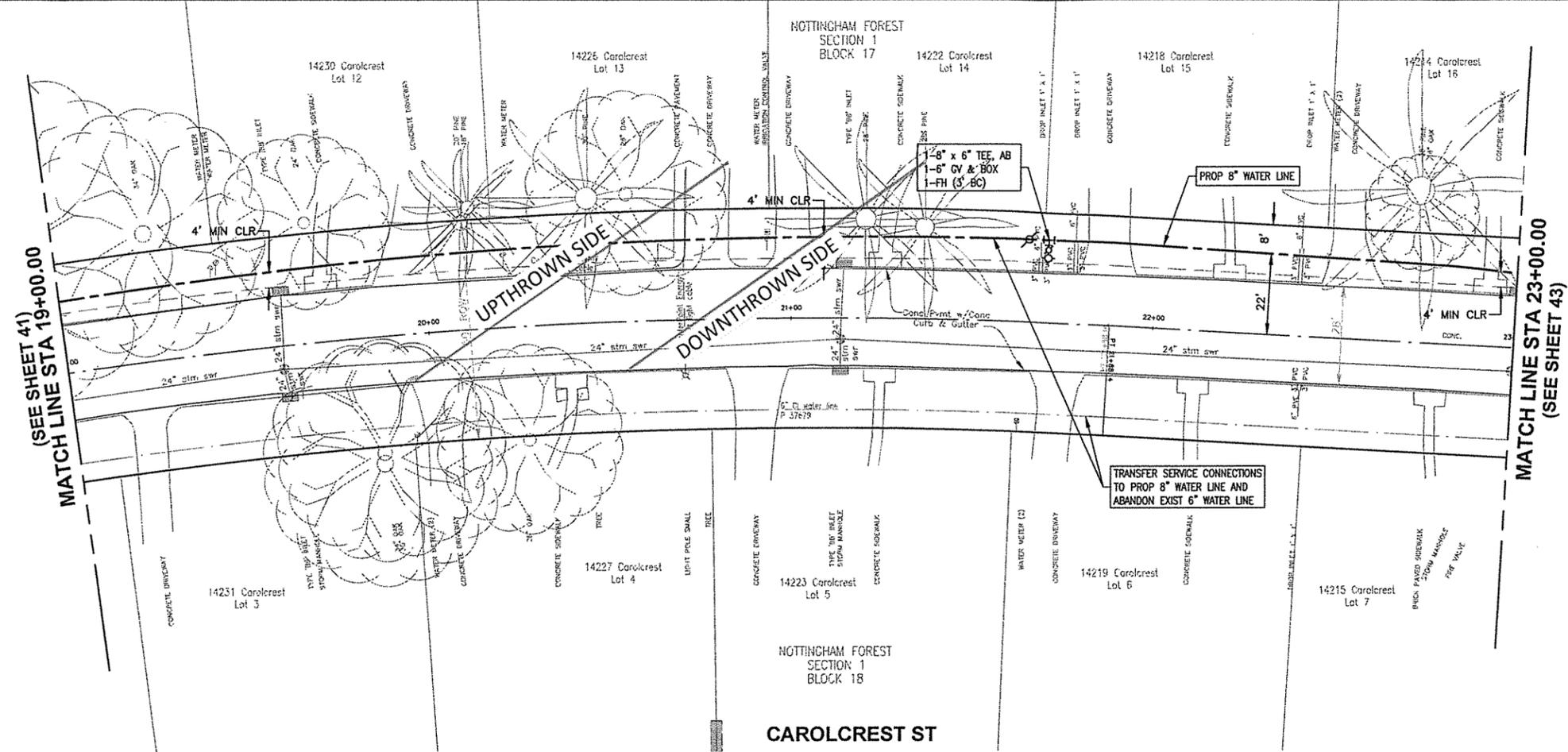
MUMTAS BAG P.E.

SHEET NO. 37 OF 147

R:\32_M&B\1101\PROJ\3.2_CAD\3.2.3_Civil\VP_Cindywood_Circle.dwg

90% SUBMITAL

FIGURE 6.4



BENCHMARK:
 CITY OF HOUSTON MARKER 210175, FROM THE INTERSECTION OF MEMORIAL DRIVE AND NORTH KIRKWOOD DRIVE, TRAVEL SOUTH ON KIRKWOOD DRIVE TO BRIDGE OVER BUFFALO BAYOU. MONUMENT IS LOCATED ON EAST SIDE OF BRIDGE

EL=77.37
 HORIZONTAL DATUM: NAD83, TEXAS SOUTH CENTRAL 4204
 VERTICAL DATUM: NAVD88, 2001 ADJUSTMENT, GEOID99 (CONUS)

TBM 34 (CONTROL POINT 38) - 5/8" I.R. W/CAP LOCATED AT THE NORTHEAST INTERSECTION OF CLEAR SPRING DR AND CAROLCREST DR.
 BASELINE: CAROLCREST DR
 STATION: 17+81.17 OFFSET: -35.28
 ELEVATION=74.59'

TBM 37 (CONTROL POINT 41) - 5/8" I.R. W/CAP LOCATED IN FRONT OF ADDRESS 14210 CAROLCREST DR ON THE NORTHEAST TURN.
 BASELINE: CAROLCREST DR
 STATION: 23+41.03 OFFSET: -18.32
 ELEVATION=69.69'

LEGEND:

- PROPOSED RJ WATER LINE
- PROPOSED RJ DIP WATER LINE
- CRITICAL LOCATE AS PER STD SPEC 02317
- APPROXIMATE LOCATION OF PAVEMENT REPAIR AS PER COH STD DETAILS.

FOR KEYNOTES SEE SHEET 3.

TO ARRANGE FOR LINES TO BE TURNED OFF OR MOVED, CALL 811 AT LEAST 48 HOURS BEFORE YOU DIG. SO THAT CENTERPOINT ENERGY AT 713-207-2222.

NOTICE:

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VERIFICATION OF PRIVATE UTILITY LINES

Date: _____

CenterPoint Energy/Natural Gas Facilities Verification ONLY
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 Signature valid for six months.

Date: _____

CenterPoint Energy/UNDERGROUND Electrical Facilities Verification ONLY
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Date: _____

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 6335 Gullfong Dr., Suite 100 Houston, Texas 77081 (713) 777-5337

KIT Professionals, Inc.
 Challenging Challenges...
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 3205 Westover Dr., Suite 600
 Houston, Texas 77042
 Phone: (713) 784-4700, Fax: (713) 784-4747
 TPEE Firm Registration No. F-4991

DATE: SEPT 2013 CHECKED BY: SP
 DESIGNED BY: YS DRAWN BY: JV/SS

SURVEYED BY: CIVILCORP
 FB NO. P-5798

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BY THE RESPONSIBLE ENGINEER:
 RESPONSIBLE ENGINEER:
 KIT Professionals, Inc.
 SRKANTH PINJURGA, P.E.
 TEXAS REGISTRATION NO.: 88614
 SEPTEMBER, 2013

CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING

**WATER LINE REPLACEMENT
 IN KICKERILLO AREA**

**CAROLCREST ST
 STA 19+00 TO 23+00**

WBS NO.
 S-000035-0185-4

DRAWING SCALE
 VERT. 1"=2' HORIZ. 1"=20'

CITY OF HOUSTON, PM
 MUMTAZ BAG P.E.

SHEET NO. 42 OF 147

FIGURE 6.5

