

PRELIMINARY DRAINAGE REPORT

For

Wise Farms
Erie, Colorado

Prepared for:

**Jasper Land Investments, LLC
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Prepared by:

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Mark Scheurer, P.E., CFM**

December 2016

ENGINEER CERTIFICATION for WISE FARMS

Engineer's Certification

"I hereby certify that this **Phase II Drainage Report** for the design of **Wise Farms** was prepared by me (or under my direct supervision) in accordance with the provisions of the *Town of Erie Standards and Specifications for Design and Construction* for the owners thereof. I understand that the Town of Erie does not and will not assume liability for drainage facilities designed by others, including the designs presented in this report."

Mark Scheurer
Registered Professional Engineer
State of Colorado No. **48988**

Town Acceptance

This report has been reviewed and found to be in general compliance with the *Town of Erie Standards and Specifications for Design and Construction* and other Town requirements. **THE ACCURACY AND VALIDITY OF THE ENGINEERING DESIGN, DETAILS, DIMENSIONS, QUANTITIES, AND CONCEPTS IN THIS REPORT REMAINS THE SOLE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.**

Accepted by: _____
Deputy Public Works Director

Date



TABLE OF CONTENTS

I. GENERAL LOCATION AND DESCRIPTION 1
 A. Location..... 1
 B. Description of Property 1
II. DRAINAGE BASINS 2
 A. Major Basin Description 2
 B. Sub-Basin Description..... 2
III. DRAINAGE DESIGN CRITERIA..... 5
 A. Development Design Criteria..... 5
 B. Hydrological Criteria..... 6
 C. Hydraulic Criteria..... 6
 D. Adaptations from Criteria..... 7
IV. DRAINAGE FACILITY DESIGN..... 7
 A. General Concept..... 7
 B. Specific Details 8
V. SUMMARY 9
VI. REFERENCES 10
VII. APPENDIX..... 11

The following narrative details the drainage concept associated with Wise Farms, a 169-acre residential development south of and adjacent to Jasper Road and west of North 119th Street in Erie, Colorado.

I. GENERAL LOCATION AND DESCRIPTION

A. Location

Wise Farms is located adjacent to and south from Jasper Road, and west of North 119th Street in Erie, Colorado. It is part of the northeast one quarter of section 14, Township 1 North Range 69 West of the 6th principle meridian, Town of Erie, Boulder County, and State of Colorado. Boulder Creek lies north of Wise Farms, and Coal Creek lies to the east. The confluence of the two drainageways is northeast of the property. There are no major drainageways within or adjacent to the property, however there is an irrigation ditch running from west to east across the north portion of the site. An RTD right-of-way bisects the site, running east-west. For more detail of the surrounding streets and subdivisions see the enclosed Vicinity Map in the appendix.

B. Description of Property

The 169 acre “Wise Farms” project is proposed as a residential subdivision, with a mixture of parks, open space, and various sized residential single family detached lots. The project is located adjacent to and south of Jasper Road and west of North 119th Street in Erie, Colorado.

The northern portion of the site is bisected by the Lower Boulder Ditch South Platte Supply Canal, and an RTD right-of-way is located between the northern and southern portions of the property. An electrical transmission line easement also traverses the southern half of the site.

The undeveloped parcel of land lying south of the RTD right-of-way has topography that slopes to the north, toward the railroad tracks with grades in the range of 5.0%. The northern portion of the site is relatively flat, with several areas of natural depressions and apparent wetland-like areas that have been classified by the USACOE as non-jurisdictional. The slope of the natural terrain in this region of the project ranges as flat as 0.3%.

Initial research indicates the predominant hydrologic soils type for the project as type “B” Ascalon sandy loam and Manter sandy loam. A soils map is shown in the Appendix of this report.

The existing site's land use is agricultural and consists of several houses and ancillary buildings along Jasper Road. One set of houses and buildings are located in the northwest corner of the site, adjacent to Jasper Road. The other set of houses and buildings are located in the middle of the property along the northern boundary; adjacent to Jasper Road. The intent is to leave the houses and ancillary buildings in-place.

II. DRAINAGE BASINS

A. Major Basin Description

The site and contributing areas will be divided into two major basins, the North and South basins. The South Basin is located to the south of the Railroad Transportation District (RTD) right-of-way and will drain to Pond 340, located in the northwest corner of the drainage basin and adjacent to the RTD right-of-way. The South Basin consists of a mixture of well sites, open space and large single family residential, detached lots. A well site is located in the west-central portion of the southern portion of the property. The Leyner Cottonwood Ditch runs along the southern boundary of the South Basin in the adjacent undeveloped parcel and will not be impacted by this project.

The North Basin is located to the north of the RTD right-of-way and will drain to Pond 370, located in the northwest corner of the basin. The North Basin consists of a mixture of parks, open space, and various sized single family residential, detached lots. Both Ponds 340 and 370 will work in conjunction with each other to provide water quality volume and 100-year detention volume. The Lower Boulder Ditch South Platte Supply Canal runs along the southern boundary of the North Basin and will not be impacted by this project.

The project site is located on Flood Insurance Rate Map (FIRM) panel 08013C0437 J [Ref. 7] dated December 18, 2012. The map shows that the entire project site lies within "Zone X" which is described as an area determined to be outside the 500-year floodplain limits or shallow flooding areas with average depths of less than one foot or drainage areas less than one square mile. A FIRMette of the project area is provided in the Appendix.

Sub-Basin Description

The contributory area is historically divided into six sub-basins and two offsite basins. Sub-basins 110, 115, and 120 comprise the southern portion of project site that are conveyed to Pond 340, located south of the RTD right-of-way. Sub-basin 145 and 150 comprises northern portion of the site. Basin 130, 140 and 160 follow historic drainage patterns and drain to Pond 370. The minor drainage basins are discussed on the following page.

Sub-Basin 110 (7.1 Acres) is located south east of the site. Flow from the site is conveyed overland to Design Point A1, from where it travel westwards towards Pond 340 through a grass swale.

Sub-Basin 115A (6.8 Acres) is located south east of the site. Flow from the site generally drains to curb and gutter and is conveyed by the street to Design Point B1. From there, it travel westwards towards Design Point B2.

Sub-Basin 115B (4.8 Acres) is located south east of the site. Flow from the site generally drains to curb and gutter and is conveyed by the street to Design Point B2. From there, it travel westwards towards sump-inlets at Design Point C6.

Sub-Basin 115C (2.1 Acres) is located south east of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to Design Point B3. From there, it is conveyed westwards towards sump-inlets at Design Point B4.

Sub-Basin 115D (3.4 Acres) is located south of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to Design Point B4. From there, it is piped to Pond 340 through Design Point 1.

Sub-Basin 120A (1.81 Acres) is located south east of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to Design Point C1. From there, it is conveyed to Design Point C3.

Sub-Basin 120B (5.8 Acres) is located south of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to Design Point C2. From there, it is conveyed to Design Point C4.

Sub-Basin 120C (4.2 Acres) is located south west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to Design Point C3. From there, it is conveyed to on-grade Inlets at Design Point C5.

Sub-Basin 120D (7.1 Acres) is located south west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to Design Point C4. From there, it is conveyed to sump Inlets at Design Point B4.

Sub-Basin 120E (6.4 Acres) is located south west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to on-grade inlets at Design Point C5. From there it is piped to Design Point 2.

Sub-Basin 120F (4.4 Acres) is located south west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to sump Inlets at Design Point C6. From there, it is piped to Design Point 2 and eventually to Pond 340.

Sub-Basin 120G (1.8 Acres) is located south west of the site. Flow from the site is conveyed overland to Pond 340.

Sub-Basin 120H (3.29 Acres) is located south west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to sump Inlet at Design Point C7. From there, it is piped to Design Point A-1 and eventually to Pond 340.

Sub-basin 130 (15.9 Acres) is located in the southern portion of the project that is not tributary to Pond 340. Runoff from the site generally sheetflows to the existing low point located along the RTD right-of-way.

Sub-basin 140 (8.9 Acres) is located north of and between the RTD right-of-way and the Lower Boulder Ditch. Currently no development is proposed on this basin. Most of the site runoff sheetflows to Lower Boulder Ditch following historic drainage pattern.

Sub-Basin 145A (4.4 Acres) is located north east of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to sump inlets at Design Point 3. From there it is piped to Design Point 4 and eventually to Pond 370.

Sub-Basin 145B (4.6 Acres) is located north east of the site. Flow from site is generally conveyed overland to designated wet area.

Sub-Basin 150A (2.0 Acres) is located north east of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to sump inlets at Design Point 3. From there it is piped to Design Point 4 and eventually to Pond 370.

Sub-Basin 150B (4.7 Acres) is located north east of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to sump inlets at Design Point E2. From there it is piped to Design Point 4 and ultimately to Pond 370.

Sub-Basin 150C (4.7 Acres) is located north west of the site. Flow from generally drains to curb and gutter and is conveyed by the street to sump inlet at Design Point E3. From there it is piped to Design Point 5 and ultimately to Pond 370.

Sub-Basin 150D (4.7 Acres) is located north west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to sump inlet at Design Point E4. From there it is piped to Design Point 5 and ultimately to Pond 370.

Sub-Basin 150E (4.7 Acres) is located north west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to Design Point E5. From there it travels eastwards to sump Inlet at Design Point E4.

Sub-Basin 150F (4.7 Acres) is located north west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to sump inlet at Design Point E6. From there it is piped northwards to Design Point E8.

Sub-Basin 150G (4.7 Acres) is located north west of the site. Site consists of the back of the lots. An underdrain is proposed that will carry the flow to sump inlet at design point E7.

Sub-Basin 150H (4.7 Acres) is located north west of the site. Flow from site generally drains to curb and gutter and is conveyed by the street to sump inlet at Design Point E8. From there it is piped northwards to Design Point 5.

Sub-Basin 150I (1.8 Acres) is located north of the site. Flow from site is conveyed overland to Pond 370.

Sub-Basin 150J (4.7 Acres) is located north west of the site. Site consists of the back of the lots. An underdrain is proposed that will carry the flow to area inlet at design point E10. The inlet will directly discharge into the Pond 370.

Sub-Basin 160 (4.7 Acres) is located north west of the site. Currently there is no development proposed on this basin. Flow from site will continue westerly by sheetflow to the wet area, where it will be retained.

III. DRAINAGE DESIGN CRITERIA

A. Development Design Criteria

The technical criteria outlined in Section 800, Storm Drainage Facilities of the “*Standards and Specifications for Design and Construction of Public Improvements, Town of Erie*” [Ref. 1]. Since no report outline was specified, the Preliminary Drainage Report criteria from the “*Boulder County Storm Drainage Criteria Manual*” [Ref. 2] was utilized for the report sequencing. Additionally, the “*Urban Storm Drainage Criteria Manual, Vol. 1, 2, and 3*” (USCDM) [Ref. 3] was used for ancillary design criteria.

No known previous studies have been prepared for this project site. It does however lie within the area of study (Basins 614 and 615) for the “*Erie Outfall Systems Plan – Preliminary Design*” [Ref. 4].

Site runoff south of the Lower Boulder Ditch South Platte Supply Canal is designed to mitigate impacts to the existing RTD ROW track and said channel. There are two hydraulically disconnected wet areas at the low points in the northern portion of the site. Both of these locations are essentially left in-place, but the tributary area to both has been reduced. The existing residence near the eastern wetland area does not appear to be impacted by the retention taking place at this wet area. As the tributary area has been reduced, this residence should not be adversely impacted. Additionally, a berm is being implemented to the south and west of the residence to prevent the Pond 370 detention storage's backwater effect from flooding the residence. Lastly, the existing runoff for the project area north of the Lower Boulder Ditch South Platte Supply Canal is essentially retained. The "Agreement - Drainage, Utility and Access Easements – Road Right of Way Dedication" [Ref. 5] allows for a release rate from the project site to the wetlands area to the north of Jasper Road of up to 1.0 cfs per acre. Though the site is primarily Type B Hydrologic Soils, this report adheres to the maximum allowable release rate of 1.0 cfs per acre as the historic basins generate more than 1.0 cfs per acre, and the aforementioned Agreement allows for this rate.

B. Hydrological Criteria

The project site's hydrology design was primarily evaluated with the Urban Drainage and Flood Control District's CUHP 2005 version 1.4.2. Catchments were input as outlined in the USCDM [Ref. 3]. The 2-year rainfall event will be utilized to evaluate minor storm and 100-year event for major. The 2-year and 100-year, 1 hour rainfall depths are 1.01 inch and 2.7 inch respectively. Additionally, Colorado Urban Hydrograph Procedure software was utilized in order to output to SWMM software rather than implementing the sequential detention procedure detailed in the "*Standards and Specifications for Design and Construction of Public Improvements, Town of Erie*" [Ref. 1].

C. Hydraulic Criteria

The Environmental Protection Agency's SWMM5 version 5.1 was primarily utilized for hydraulic evaluation of the project site. This software was utilized to route the 100-year hydrographs developed in the CUHP 1.4.2 design noted above. The 5 sub-basins were routed to two detention ponds – Pond 340 and 370. Detention volumes are preliminarily designed to accommodate the allowable release rate of 1 cfs/acre. Since the two ponds are in series, Pond 370 is designed to account for the tributary area to Pond 340 in its allowable release rate consideration. The minor storm events will be accommodated in these ponds as detailed in the USDCM's Full Spectrum Detention design guidelines [Ref. 3]. The provided 100-year volume includes Excess Urban Runoff Volume (EURV) and Water Quality Control Volume (WQCV). Due to the area and grading constraints associated with Pond 340, it will release at greater than 1 cfs/acre. Pond 370 will accommodate the extra detention necessary to adhere to the 1 cfs/acre release rate that contributes to the downstream properties.

D. Adaptations from Criteria

Colorado Urban Hydrograph Procedure software was utilized in order to output to SWMM software rather than implementing the sequential detention procedure detailed in the “*Standards and Specifications for Design and Construction of Public Improvements, Town of Erie*” [Ref. 1].

IV. DRAINAGE FACILITY DESIGN

A. General Concept

The storm drainage design concept envisioned for this project will follow the parameters set forth in the “*Agreement - Drainage, Utility and Access Easements – Road Right of Way Dedication*” [Ref. 5] between the Wise Homestead LLC, the County of Boulder, and the Town of Erie, dated January 25, 2001. Said agreement recognizes that the historic drainage from the area contemplated as this Wise Farms development did drain onto the property to the north of Jasper, purchased by Boulder County. It further recognizes and anticipates that the runoff from the Wise Farms development area would be designed to discharge into the existing wetland areas on the County parcels north of Jasper Road. While precise details of this design were unknown at the time of the agreement, the agreement contemplated on-site detention on the Wise Farms project site to release at the rate of 1.0 cfs per acre.

The proposed drainage concept for this Wise Farms project follows those parameters set forth in the aforementioned agreement. The site is contemplated to be divided into two major drainage basins by the RTD right-of-way. Detention will be provided on each of these two major basins.

The northerly 47 acre basin will drain overland and through a series of storm sewer systems, and swales located in the streets and tracts of the development, to a detention facility – Pond 370 – located along Jasper Road in the northwest corner of the site. This approximately 3.9 acre-foot pond will accommodate stormwater detention. The site development may be phased, and the area north of the RTD right-of-way will have to be constructed first. Until the area south of the RTD right-of-way is developed, the design release rate from this northern detention facility of approximately 46 cfs will be conveyed via storm drain under Jasper Road, to the wetland area north of Jasper Road described in the agreement discussed previously.

The southern 59 acre basin is primarily proposed as a larger lot, single-family development and is being accounted for in the design of the northern half of the site. The southern basin will drain overland and through a series of storm drainage systems and swales located in the streets and tracts of the development to the southerly pond, located south of the rail corridor. Based on anticipated future design, approximately 3.4 acre-feet of detention storage will accommodate a portion of the 100-year detention volume. This pond discharges at 1.5 cfs/acre due to the limited area of the tract containing the pond. Pond 370 overdetains the excess release to attain the 1.0 cfs/acre allowable release from the site. The release rate of approximately 74.7 cfs will be conveyed by pipe under the railroad and under the Lower Boulder Ditch, and continue in the pipe to the south side of Jasper Road, where it will contribute to the northern detention pond.

The combined discharge from the two major onsite basins will cross under Jasper Road via a culvert, to the west of the two wetland areas discussed in the aforementioned agreement. This discharge will be limited to the 1.0 cfs as specified in the agreement, which represents the historic 100-year discharge from the Wise Farms parcel.

Emergency overflow from the future, southern detention pond (Pond 340) will follow the historic route northerly to the Lower Boulder Ditch South Platte Supply Canal. Emergency overflow from the northern detention facility (Pond 370) will be intercepted by a secondary outlet structure to convey the flows under Jasper Road, which again outfalls to the wetlands areas on the County open space property to the north.

All storm drainage facilities will be designed to meet the Criteria of the Urban Drainage and Flood Control District, the Town of Erie, and the United States Army Corps of Engineers relative to the impacts to jurisdictional wetlands. The design will also adhere to the requirements of the aforementioned agreement between the Wise Homestead, LLC, the County of Boulder, and the Town of Erie.

B. Specific Details

The detained release from Pond 340 is piped under the Lower Boulder Ditch South Platte Supply Canal, Conduit 240, which will likely require boring under it and will be confirmed with the final design. The northern portion of the site has hydraulically disconnected/non-jurisdictional wet areas, which could be removed, but are primarily left in-place. The tributary area has, however, been reduced. There is an existing residence and historic mill site that will be left in place. A berm will be provided in the final design to direct developed runoff around the residence and to prevent the Pond 370 backwater from inundating the residence. Lastly, there is currently no outfall to the north, and the existing Jasper Road is

elevated several feet above the site. The proposed outfall will likely incorporate a shallow box culvert (likely a 4' rise) to provide adequate cover on Jasper Road.

Pond 340 accommodates the southern portion of the site as detailed in the General Concept portion of this report. Pond 370 accommodates the remainder of the proposed development, again, as detailed in the General Concept portion of this report. Due to the minimal slope in the northern portion of the site, this pond may be designed per the Constructed Wetlands Basin pond criteria as outlined in the *USCDM* [Ref. 3]. Both ponds will be detailed with the final drainage report for this site, and they will be maintained by the Home Owner's Association or Metropolitan District for Wise Farms.

V. SUMMARY

A. Compliance with Standards

The preceding narrative was prepared as outlined in the Preliminary Drainage Report criteria from the "*Boulder County Storm Drainage Criteria Manual*" [Ref. 2]. The associated preliminary design was prepared as outlined in Section 800, Storm Drainage Facilities of the "*Standards and Specifications for Design and Construction of Public Improvements, Town of Erie*" [Ref. 1]. Additionally, the "*Urban Storm Drainage Criteria Manual, Vol. 1, 2, and 3*" (USCDM) [Ref. 3] was used for ancillary design criteria.

The project site comprised portions of Basins 614 and 615 in the "*Erie Outfall Systems Plan – Preliminary Design*" [Ref. 4]. The proposed design generally complies with this OSP.

B. Drainage Concept

The proposed site provides two detention ponds for the proposed development. The developed runoff and outfall per the "*Agreement - Drainage, Utility and Access Easements – Road Right of Way Dedication*" [Ref. 5], which allows the project site to outfall to the wetlands area to the north of Jasper Road. The two non-jurisdictional wet areas, the existing residence, and the historic mill site will remain in-place. One storm crossing for each of the RTD ROW and of the Lower Boulder Ditch South Platte Supply Canal is required to convey developed runoff throughout the site.

VI. REFERENCES

1. **Standards and Specifications for Design and Construction of Public Improvements, Town of Erie**, Town of Erie, March 1969, Vol. 1&2 revised 2001, Vol. 3 revised Oct. 2005.
2. **Boulder County Storm Drainage Criteria Manual**, WRC Engineering, Inc., July 1984.
3. **Urban Storm Drainage Criteria Manual, Volumes 1,2,3**, Urban Drainage and Flood Control District, prepared by Urban Drainage and Flood Control District and CH2MHill, March 1969, Vol. 1&2 revised 2001, Vol. 3 revised Oct. 2005.
4. **Erie Outfall Systems Plan – Preliminary Design**, Love and Associates, Inc., May 2001.
5. **“Agreement - Drainage, Utility and Access Easements – Road Right of Way Dedication**, The Wise Homestead LLC, the County of Boulder, and the Town of Erie, January 25, 2001.
6. **USDA NRCS Soil Survey**, retrieved 05-24-2008 from www.usda.gov
7. **Map Number 08013C0437J**, Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, Boulder County and Unincorporated Areas, Colorado Panel 437 of 615.

APPENDICES

A. EXCERPTS FROM REFERENCES

SOILS MAPS
FIRM EXHIBITS
EXCERPTS FROM ADJACENT
STUDIES FIGURES, TABLES, AND
GRAPHS

B. SUB-BASIN HYDROLOGY

BASIN LAND USE - SWMM
BASIN LAND USE - INLET DESIGN
POND SIZING
DESIGN - SF2 & SF3
INLET DESIGN

C. HYDRAULIC COMPUTATION

CUHP/SWMM ANALYSES
CUHP/SWMM SCHEMATIC
100-YEAR CUHP INPUT / OUTPUT
100-YEAR SWMM INPUT/OUTPUT

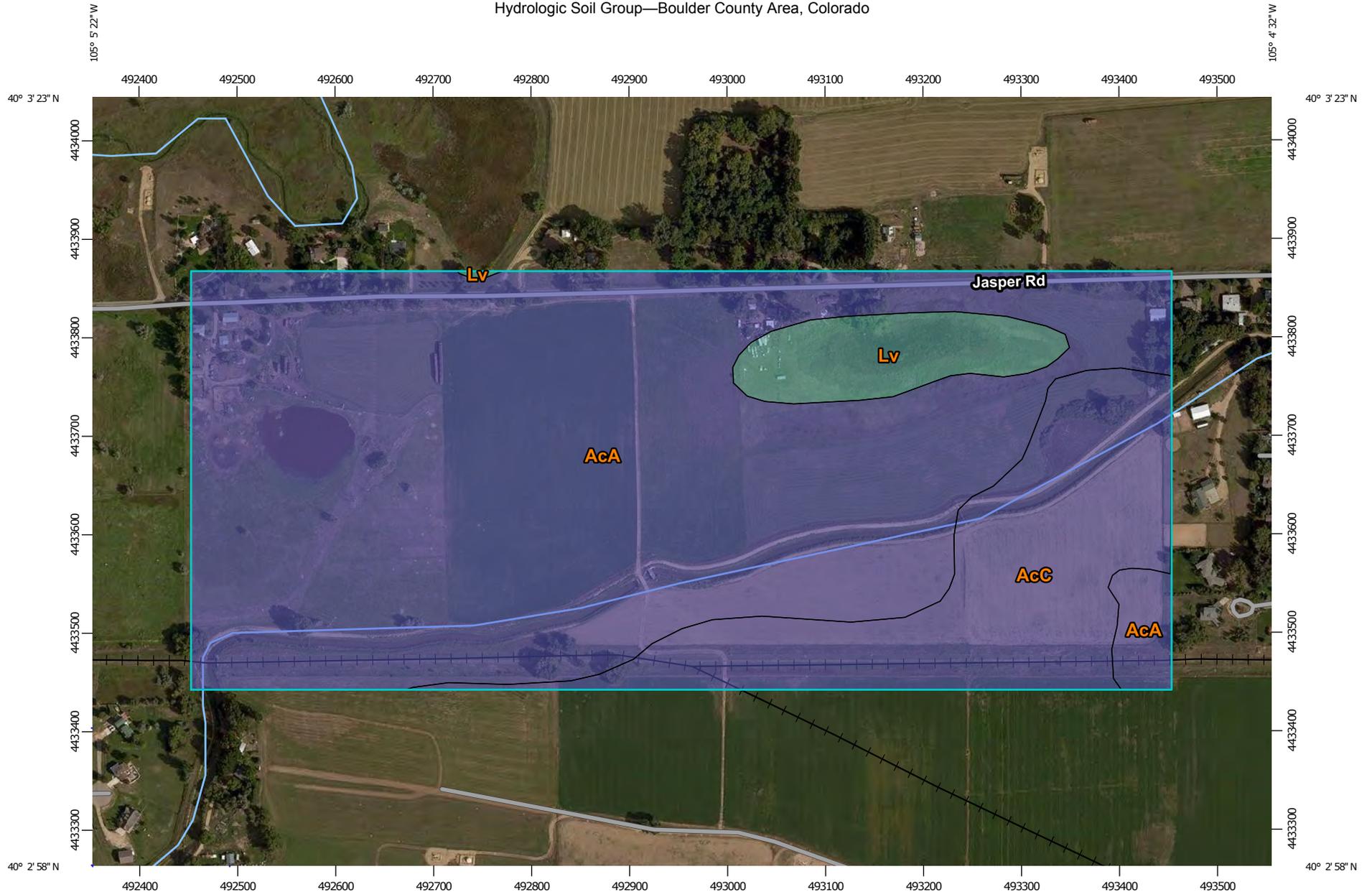
D. SWALE DESIGN

E. DRAINAGE MAPS

A. EXCERPTS FROM REFERENCES

SOILS MAPS
FIRM EXHIBITS
EXCERPTS FROM ADJACENT STUDIES
FIGURES, TABLES, AND GRAPHS
DRAINAGE, UTILITY, ROW
EASEMENT

Hydrologic Soil Group—Boulder County Area, Colorado



Map Scale: 1:5,500 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Boulder County Area, Colorado
 Survey Area Data: Version 12, Sep 22, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 30, 2014—Sep 18, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Boulder County Area, Colorado (CO643)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AcA	Ascalon sandy loam, 0 to 3 percent slopes	B	79.9	75.7%
AcC	Ascalon sandy loam, 3 to 5 percent slopes	B	19.8	18.8%
Lv	Loveland soils	C	5.8	5.5%
Totals for Area of Interest			105.6	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

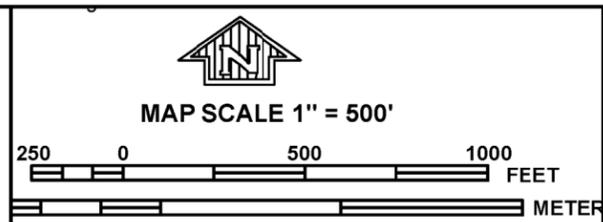
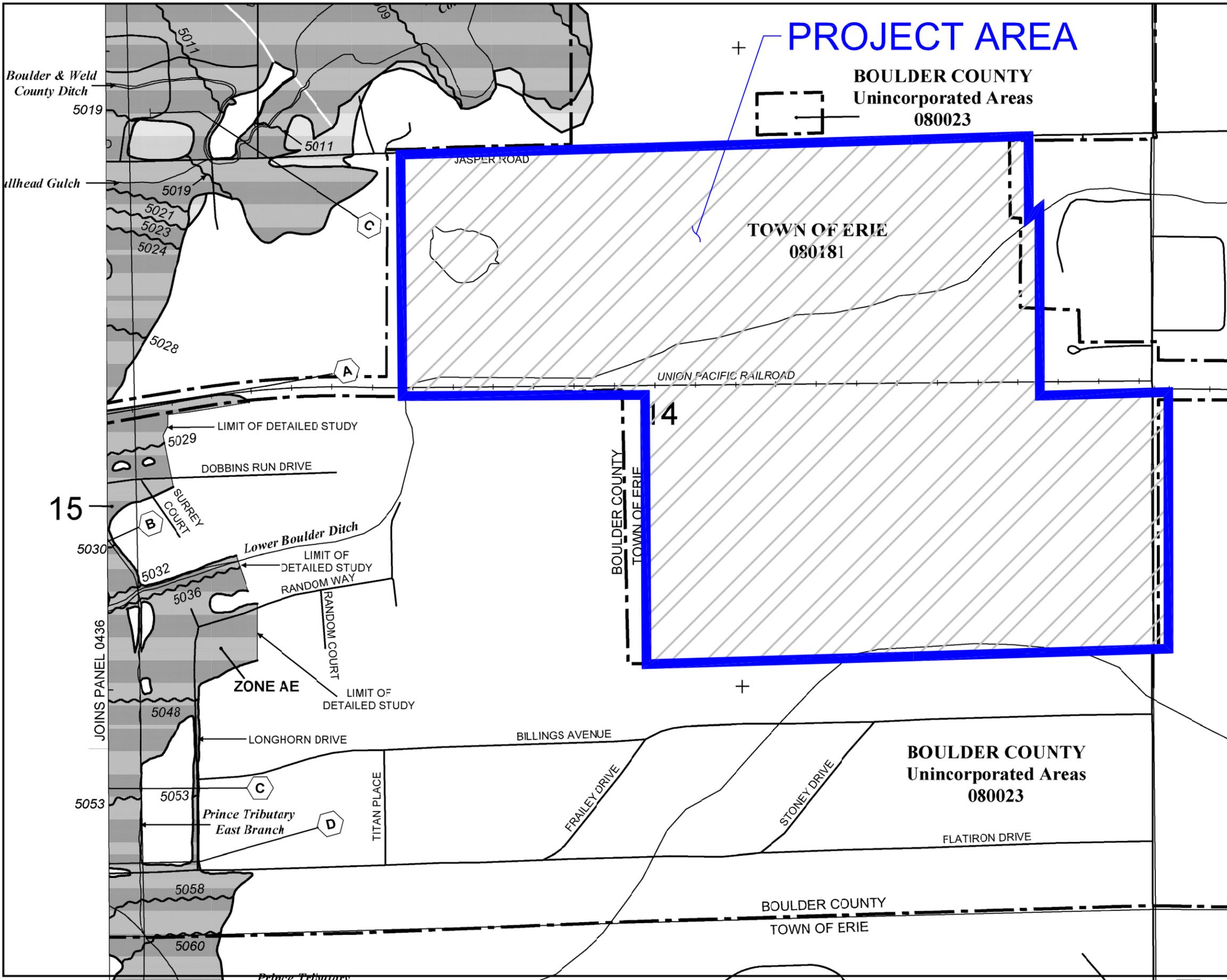
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0437J

FIRM
FLOOD INSURANCE RATE MAP
BOULDER COUNTY,
COLORADO
AND INCORPORATED AREAS

PANEL 437 OF 615
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOULDER COUNTY	080023	0437	J
ERIE, TOWN OF	080181	0437	J

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

**MAP NUMBER
08013C0437J**

**MAP REVISED
DECEMBER 18, 2012**

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Vicinity Map

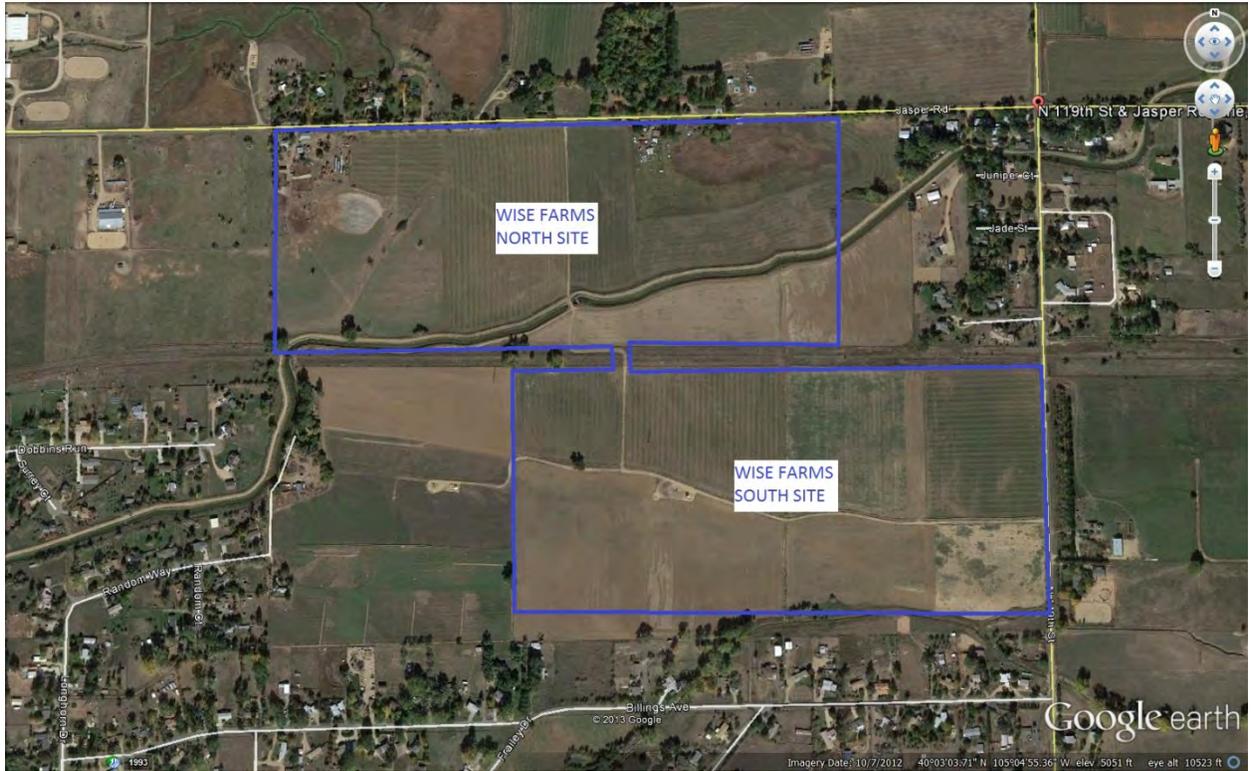
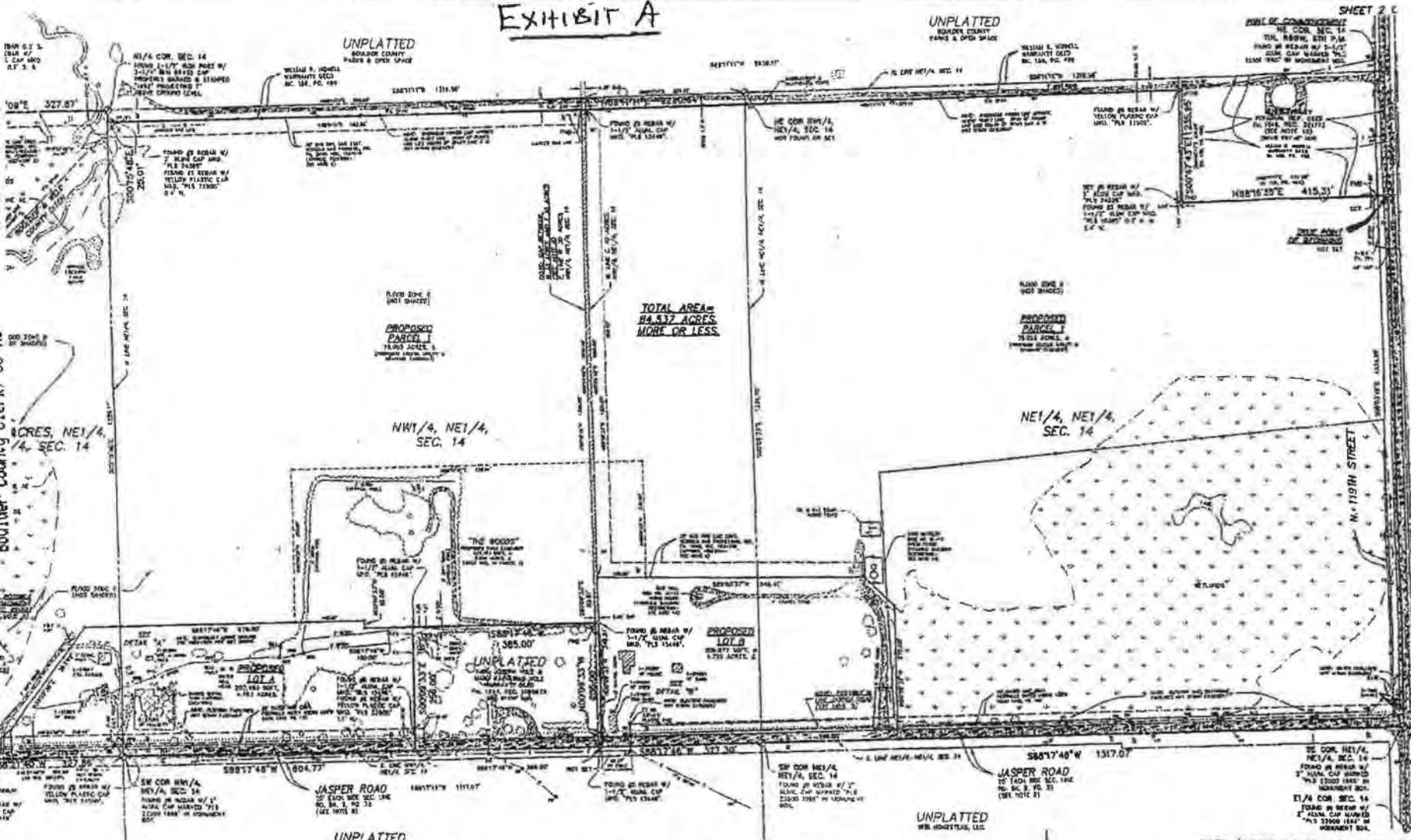


EXHIBIT A

2116552
Page: 11 of 11
02/06/2001 02:06P

R 0 88
Boulder County Clerk, CO AG



RECORDER'S NOTE: 2-6-01
PORTION OF RECORDED DOCUMENT
MAY NOT REPRODUCE LEGIBLY.

- MONUMENT KEY**
- PND FOUND AS BEAR W/ 1" ALUM CAP MARKED "143 2436"
 - BK1 SET AS BEAR W/ 1" ALUM CAP MARKED "143 2436"



ALTA/ACSM LAND TITLE SURVEY OF A TRACT OF LAND LOCATED THE N1/2 OF THE NE1/4 AND IN THE NE1/4 OF THE NW1/4 OF SECTION 14, T1N, R89W OF THE 6TH P.M., TOWN OF ERIE, COUNTY OF BOULDER, STATE OF COLORADO FOR: WISE HOMESTEAD, LLC

APP ALBERS, DREDEL & POHLY, B	
A Full Service Land Surveying Company	
1800 Industrial Circle, Suite 101, Loveland, Colorado 80537 (303) 412-1100	
DATE: OCTOBER 31, 2000	DRAWN BY: [Name]
SCALE: 1"=300'	SHEET NO: 11
REVISED - SEE: [List]	REVISIONS - SEE: [List]

ERIE OUTFALL SYSTEMS PLANNING

PRELIMINARY DESIGN

ERIE AND ADJACENT BOULDER AND WELD COUNTY AREAS



MAY 2001



TOWN OF ERIE

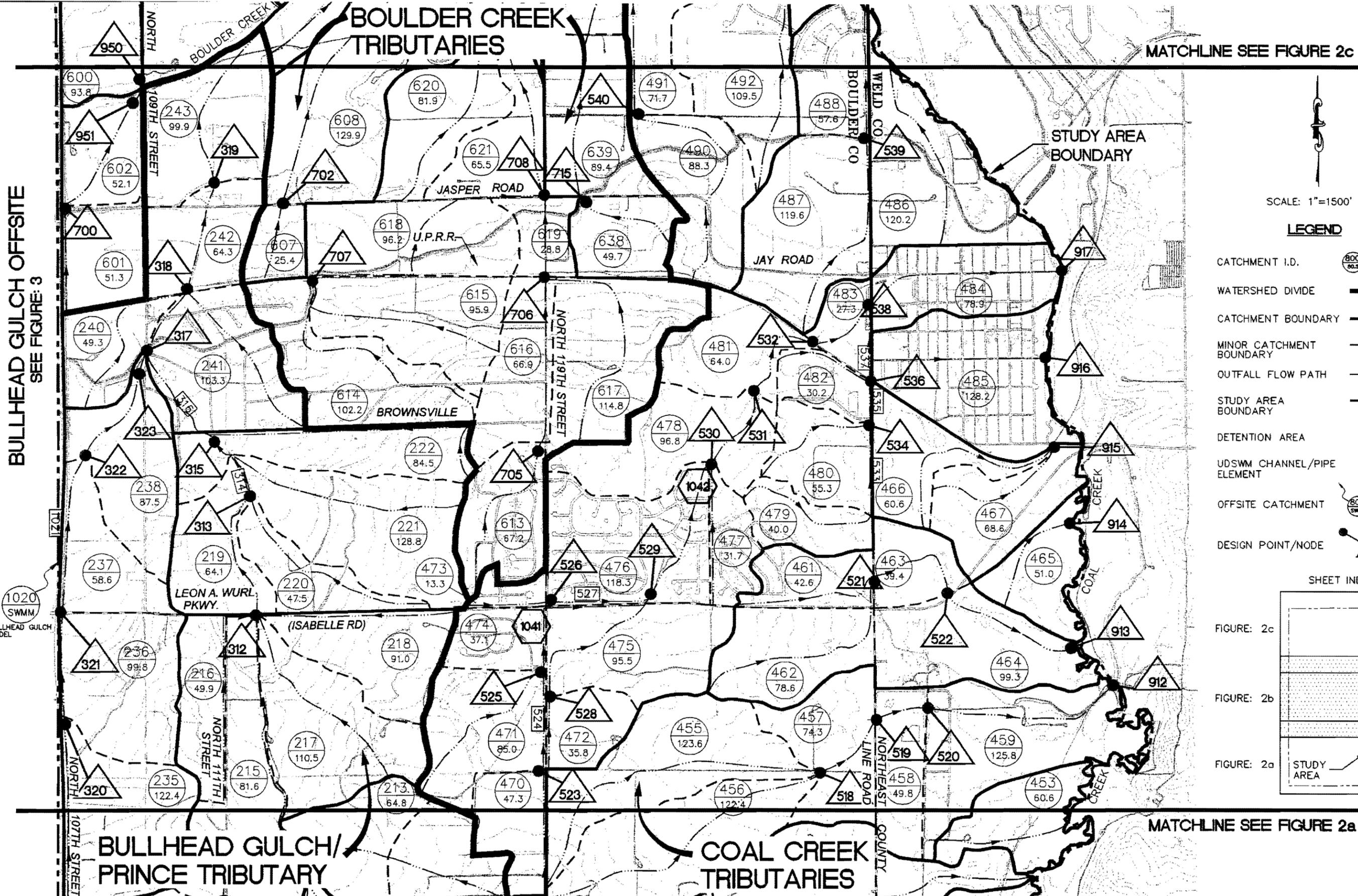
1874

Town of Erie
Urban Drainage and Flood Control District



Love & Associates, Inc.
water resource consultants

541 Front Street
Louisville, Colorado 80027-1849
Phone: 303-673-9795 Fax: 303-673-9796
E-mail: rllove@loveassociates.com



BULLHEAD GULCH OFFSITE
SEE FIGURE 3

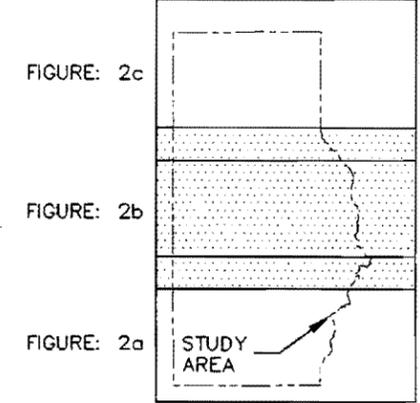
MATCHLINE SEE FIGURE 2c

SCALE: 1"=1500'

LEGEND

- CATCHMENT I.D. CATCHMENT ACRE
- WATERSHED DIVIDE
- CATCHMENT BOUNDARY
- MINOR CATCHMENT BOUNDARY
- OUTFALL FLOW PATH
- STUDY AREA BOUNDARY
- DETENTION AREA
- UDSWM CHANNEL/PIPE ELEMENT
- OFFSITE CATCHMENT CATCHMENT SOURCE
- DESIGN POINT/NODE

SHEET INDEX



MATCHLINE SEE FIGURE 2a

DATE: MAY 22, 2000
C:\PROJECTS\9922A\BASIN3.DWG

Zore Associates, Inc.
water resource consultants
241 Front Street
Louisville, Colorado 80027-1849
Phone: 303-673-9795
Fax: 303-673-9796

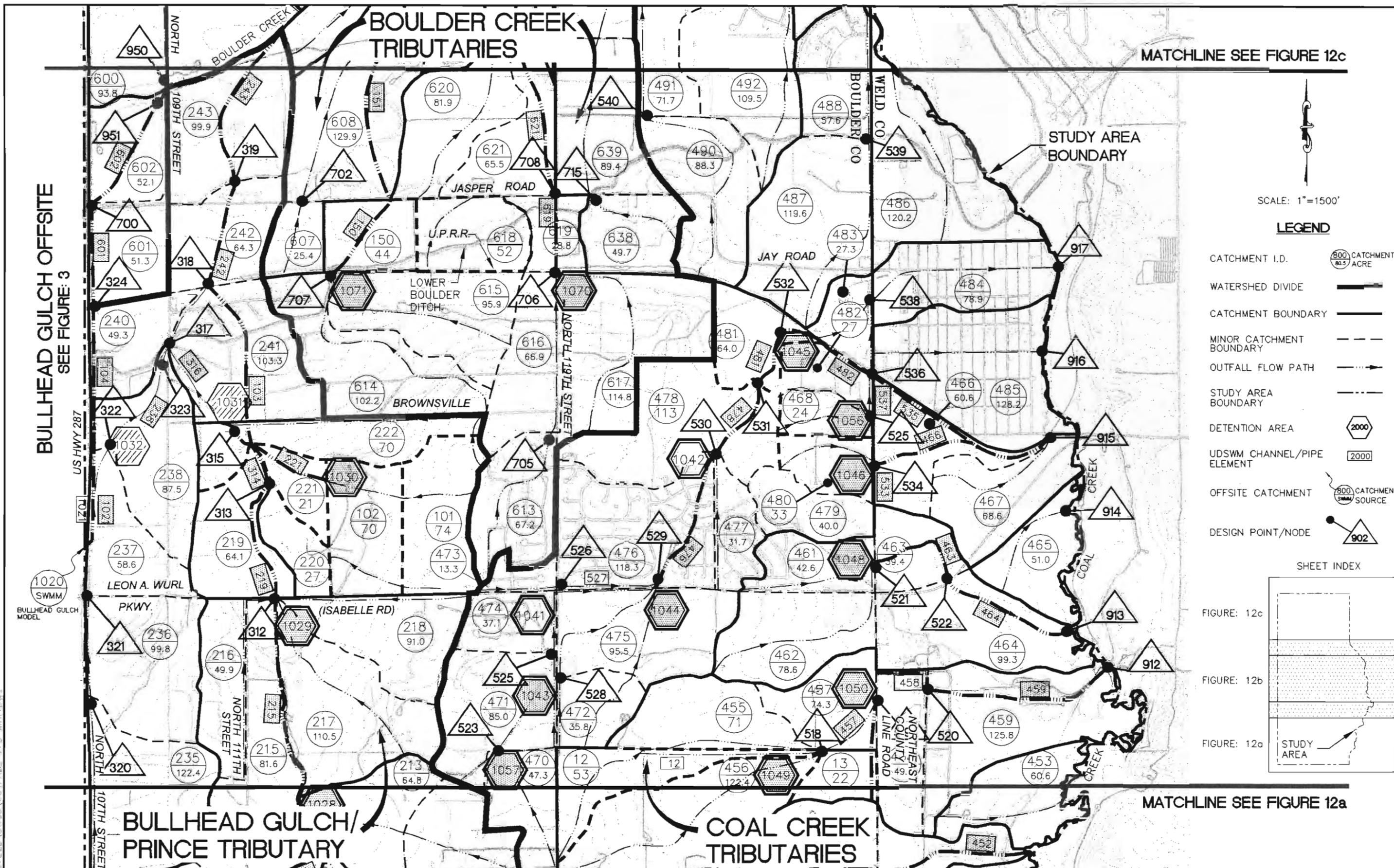
DESIGNED: RJP
DRAWN: DM
CHECKED: DJL
DATE: 5-00

TOWN OF ERIE
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

ERIE AND ADJACENT AREAS
OUTFALL SYSTEMS PLANNING

CATCHMENT DELINEATION AND
SWMM ELEMENTS IN THE
STUDY AREA

Figure 2b
Page II - 4



BULLHEAD GULCH OFFSITE
SEE FIGURE 3

MATCHLINE SEE FIGURE 12c

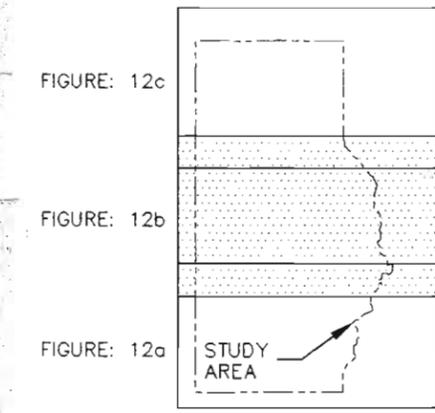
MATCHLINE SEE FIGURE 12a

SCALE: 1"=1500'

LEGEND

- CATCHMENT I.D. CATCHMENT ACRE
- WATERSHED DIVIDE
- CATCHMENT BOUNDARY
- MINOR CATCHMENT BOUNDARY
- OUTFALL FLOW PATH
- STUDY AREA BOUNDARY
- DETENTION AREA
- UDSWM CHANNEL/PIPE ELEMENT
- OFFSITE CATCHMENT CATCHMENT SOURCE
- DESIGN POINT/NODE

SHEET INDEX



DATE: FEBRUARY 2, 2001
 C:\PROJECTS\9922B\DWGS\OUTALL-SYS-MAP.DWG

Zone & Associates, Inc.
 water resource consultants
 841 Front Street
 Louisville, Colorado 80027-3449
 Phone: 303-673-9795
 Fax: 303-673-9796

DESIGNED: RJP
 DRAWN: DM
 CHECKED: DJL
 DATE: 02-01

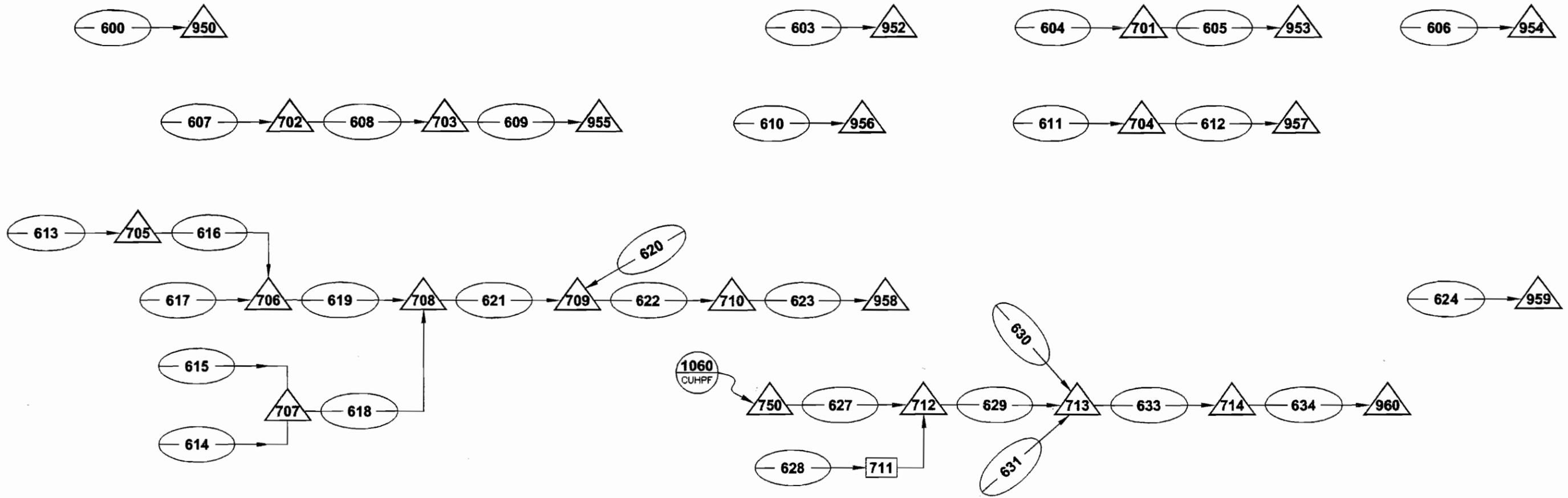
TOWN OF ERIE
 URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

ERIE AND ADJACENT AREAS
 OUTFALL SYSTEMS PLANNING

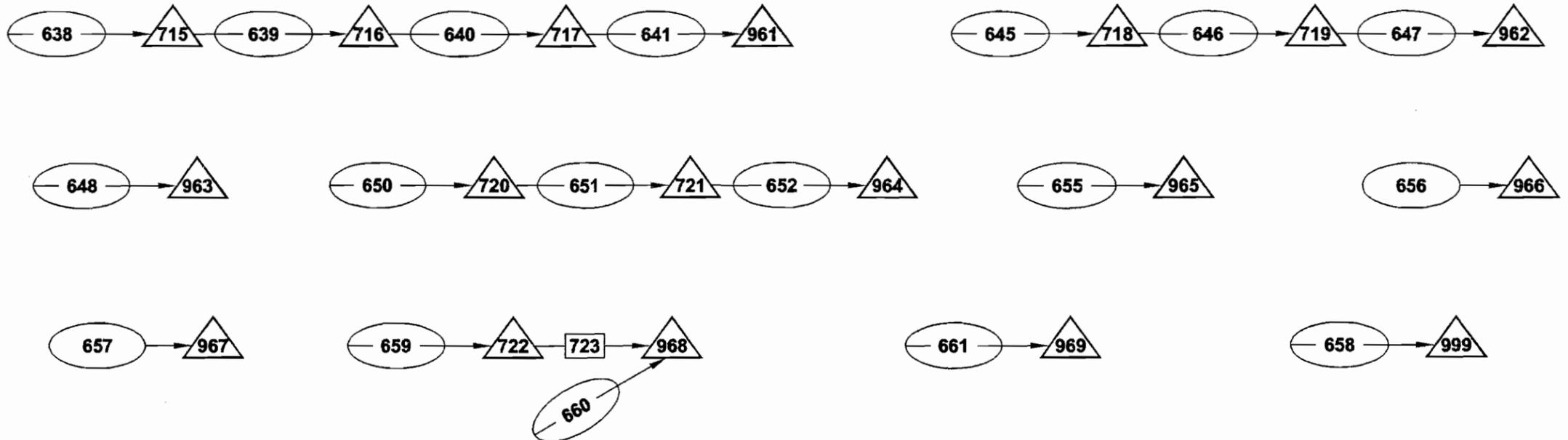
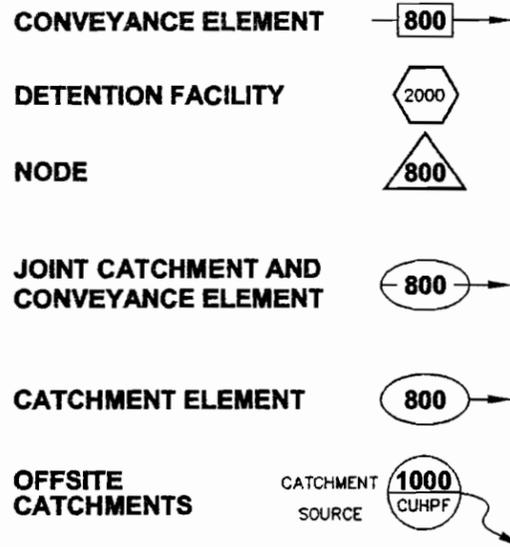
OUTFALL SYSTEMS MAP

Figure 12b
 Page V - 4

BOULDER CREEK TRIBUTARIES



LEGEND



DATE: MAY 30, 2000
E:\PROJECTS\9922A\DWGS\FLOWCHART.DWG

Zore & Associates, Inc.
water resource consultants

841 Front Street
Louisville, Colorado 80027-1849
Phone: 303-873-9795
Fax: 303-873-9796

DESIGNED: RJP
DRAWN: DM
CHECKED: DJL
DATE: 4-00

TOWN OF ERIE
BOULDER COUNTY
URBAN DRAINAGE AND FLOOD CONTROL DISTRICT

ERIE AND ADJACENT AREAS
OUTFALL SYSTEMS PLANNING

**SWMM FLOW CHARTS
EXISTING AND FUTURE CONDITIONS**

**Figure A4
Page A-16**

Table A9. UDSWM Basin and Conveyance Parameters, Outfall System

Bullhead Gulch/Prince Tributary

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP	WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES		MANNING N	OVERBANK/SURCHARGE		JK	
							HORIZ L	TO VERT R		DEPTH (FT)			
1025	305	5	2	PIPE	.0	0.	.0001	.0	.0	.001	.01	0	
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	.7	30.0	2.1	60.0						
1026	210	10	2	PIPE	.0	0.	.0001	.0	.0	.001	.01	0	
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	.5	18.0	2.2	26.0						
		11.0	300.0	13.1	494.0	13.5	777.0						
1027	304	5	2	PIPE	.0	0.	.0001	.0	.0	.001	.01	0	
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	5.2	100.0	14.4	200.0						
1028	311	7	2	PIPE	.0	0.	.0001	.0	.0	.001	.01	0	
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	3.4	40.0	7.8	80.0						
		16.0	400.0										
1029	312	7	2	PIPE	.0	0.	.0001	.0	.0	.001	.01	0	
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	6.8	40.0	15.6	80.0						
		32.0	400.0										
1030	221	7	2	PIPE	.0	0.	.0001	.0	.0	.001	.01	0	
		RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW											
		.0	.0	3.4	40.0	7.8	80.0						
		16.0	400.0										
1031	316	4	3	CHANNEL	.0	0.	.0001	.0	.0	.001	.01	103	
		DIVERSION TO GUTTER NUMBER 103 - TOTAL Q VS DIVERTED Q IN CFS											
		.0	.0	500.0	500.0	1000.0	500.0						
103	318	0	4	CHANNEL	10.0	2600.	.0130	3.0	3.0	.044	4.00	0	
		OVERFLOW											
		.0	.0	26.0	2600.	.0130	20.0	20.0	.056	10.00			
601	700	0	4	CHANNEL	8.0	1720.	.0060	3.0	3.0	.020	.50	0	
		OVERFLOW											
		.0	.0	11.0	1720.	.0060	20.0	20.0	.044	10.00			
602	951	0	4	CHANNEL	8.0	2280.	.0060	3.0	3.0	.044	3.00	0	
		OVERFLOW											
		.0	.0	26.0	2280.	.0060	20.0	20.0	.056	10.00			
700	602	0	3	CHANNEL	.0	0.	.0001	.0	.0	.001	.01	0	
		OVERFLOW											
		.0	.0	.0	0.	.0001	.0	.0	.001	.01			
951	1500	0	3	CHANNEL	.0	0.	.0001	.0	.0	.001	.01	0	
		OVERFLOW											
		.0	.0	.0	0.	.0001	.0	.0	.001	.01			
1032	325	4	3	CHANNEL	.0	0.	.0001	.0	.0	.001	.01	104	
		DIVERSION TO GUTTER NUMBER 104 - TOTAL Q VS DIVERTED Q IN CFS											
		.0	.0	1000.0	1000.0	2000.0	1000.0						
104	324	0	4	CHANNEL	20.0	2400.	.0090	4.0	4.0	.044	6.00	0	
		OVERFLOW											
		.0	.0	26.0	2400.	.0090	20.0	20.0	.056	10.00			
324	601	0	3	CHANNEL	.0	0.	.0001	.0	.0	.001	.01	0	
		OVERFLOW											
		.0	.0	.0	0.	.0001	.0	.0	.001	.01			
325	238	0	3	CHANNEL	.0	0.	.0001	.0	.0	.001	.01	0	
		OVERFLOW											
		.0	.0	.0	0.	.0001	.0	.0	.001	.01			
1020	1021	17	3	CHANNEL	.0	0.	.0001	.0	.0	.001	.01	-1	
		TIME IN HRS VS INFLOW IN CFS											
		.0	.0	.3	12.8	.4	62.4	.8	1355.5	1.2	3612.7	1.3	3753.8
		1.3	3746.0	1.4	3612.7	1.8	2523.5	2.0	1799.9	2.5	948.0	3.0	565.2
		3.5	365.8	4.0	277.2	5.0	161.6	6.0	71.6	8.0	.0		

Boulder Creek Tributaries

SUBAREA NUMBER	GUTTER OR MANHOLE	WIDTH (FT)	AREA (AC)	PERCENT IMPERV.	SLOPE (FT/FT)	RESISTANCE FACTOR		SURFACE STORAGE(IN)		INFILTRATION RATE(IN/HR)		GAGE NO
						IMPERV.	PERV.	IMPERV.	PERV.	MAXIMUM	MINIMUM	
-1	0	2.	.0	1.0	1.0000	1.000	1.000	1.000	1.000	1.000	1.000000	
600	600	6156.	93.8	2.0	.0240	.020	.200	.100	.300	3.84	.56	.00180 1
603	603	6968.	103.6	5.6	.0200	.020	.200	.100	.300	3.42	.53	.00180 1
604	604	2203.	25.6	2.0	.0220	.020	.200	.100	.300	4.16	.58	.00180 1
605	605	9475.	116.8	6.8	.0210	.020	.200	.100	.300	3.98	.57	.00180 1
606	606	10579.	45.7	2.0	.0030	.020	.200	.100	.300	3.00	.50	.00180 1
607	607	4428.	25.4	4.9	.0110	.020	.200	.100	.300	4.50	.60	.00180 1
608	608	12037.	129.9	5.5	.0080	.020	.200	.100	.300	3.41	.53	.00180 1
609	609	4309.	75.5	2.0	.0010	.020	.200	.100	.300	3.17	.51	.00180 1
610	610	14382.	95.1	13.2	.0280	.020	.200	.100	.300	4.02	.57	.00180 1
611	611	10352.	65.9	19.9	.0290	.020	.200	.100	.300	3.63	.54	.00180 1
612	612	3132.	29.1	10.1	.0140	.020	.200	.100	.300	3.15	.51	.00180 1
613	613	10944.	67.2	46.6	.0120	.020	.200	.100	.300	4.50	.60	.00180 1
614	614	9967.	102.2	42.3	.0260	.020	.200	.100	.300	4.50	.60	.00180 1
615	615	12069.	95.9	40.0	.0190	.020	.200	.100	.300	4.50	.60	.00180 1
616	616	5832.	66.9	40.5	.0300	.020	.200	.100	.300	4.50	.60	.00180 1
617	617	15768.	114.8	42.7	.0190	.020	.200	.100	.300	4.50	.60	.00180 1
618	618	5544.	52.1	28.8	.0100	.020	.200	.100	.300	4.50	.60	.00180 1
619	619	4626.	28.8	29.8	.0260	.020	.200	.100	.300	4.50	.60	.00180 1
620	620	11713.	81.9	14.0	.0060	.020	.200	.100	.300	4.50	.60	.00180 1
621	621	12859.	65.5	18.5	.0040	.020	.200	.100	.300	4.50	.60	.00180 1
622	622	7339.	76.0	6.8	.0050	.020	.200	.100	.300	3.14	.51	.00180 1
623	623	2747.	44.6	2.0	.0070	.020	.200	.100	.300	3.00	.50	.00180 1
624	624	13334.	51.9	9.0	.0060	.020	.200	.100	.300	3.26	.52	.00180 1
627	627	5472.	105.4	4.2	.0050	.020	.200	.100	.300	3.59	.54	.00180 1
628	628	6782.	30.7	2.0	.0060	.020	.200	.100	.300	3.53	.54	.00180 1
629	629	5621.	80.6	5.1	.0230	.020	.200	.100	.300	3.65	.54	.00180 1
630	630	15503.	129.9	2.0	.0110	.020	.200	.100	.300	3.08	.51	.00180 1
631	631	6599.	59.6	2.0	.0120	.020	.200	.100	.300	3.96	.56	.00180 1
633	633	6955.	76.8	16.8	.0110	.020	.200	.100	.300	4.10	.57	.00180 1
634	634	9424.	46.7	4.5	.0090	.020	.200	.100	.300	3.32	.52	.00180 1
638	638	4486.	49.7	37.0	.0180	.020	.200	.100	.300	4.50	.60	.00180 1

Table A9. UDSWM Basin and Conveyance Parameters, Outfall System

Boulder Creek Tributaries

SUBAREA NUMBER	GUTTER OR MANHOLE	WIDTH (FT)	AREA (AC)	PERCENT IMPERV.	SLOPE (FT/FT)	RESISTANCE FACTOR		SURFACE STORAGE(IN)		INFILTRATION RATE(IN/HR)		GAGE NO
						IMPERV.	PERV.	IMPERV.	PERV.	MAXIMUM	MINIMUM	
639	639	8554.	99.4	34.8	.0090	.020	.200	.100	.300	4.50	.60	.00180 1
640	640	9007.	79.4	17.6	.0090	.020	.200	.100	.300	3.78	.55	.00180 1
641	641	6786.	29.5	5.4	.0020	.020	.200	.100	.300	3.00	.50	.00180 1
645	645	11952.	103.5	13.8	.0280	.020	.200	.100	.300	3.65	.54	.00180 1
646	646	2682.	41.5	3.1	.0050	.020	.200	.100	.300	3.15	.51	.00180 1
647	647	9090.	105.1	2.0	.0060	.020	.200	.100	.300	3.00	.50	.00180 1
648	648	8203.	80.4	2.0	.0020	.020	.200	.100	.300	3.14	.51	.00180 1
650	650	14058.	80.0	3.7	.0190	.020	.200	.100	.300	3.11	.51	.00180 1
651	651	6626.	87.6	10.1	.0220	.020	.200	.100	.300	3.56	.54	.00180 1
652	652	7956.	51.9	2.0	.0030	.020	.200	.100	.300	3.00	.50	.00180 1
655	655	11275.	121.5	2.0	.0080	.020	.200	.100	.300	3.26	.52	.00180 1
658	658	7258.	72.9	2.0	.0060	.020	.200	.100	.300	3.02	.50	.00180 1
659	659	12280.	130.0	2.0	.0180	.020	.200	.100	.300	3.15	.51	.00180 1
660	660	10546.	45.9	2.0	.0040	.020	.200	.100	.300	3.00	.50	.00180 1
661	661	10584.	41.9	2.0	.0040	.020	.200	.100	.300	3.00	.50	.00180 1
656	966	1620.	58.4	2.0	.0020	.020	.200	.100	.300	3.00	.50	.00180 1
657	967	540.	15.9	2.0	.0070	.020	.200	.100	.300	3.00	.50	.00180 1
150	150	7200										

Table A9. UDSWM Basin and Conveyance Parameters, Outfall System

Boulder Creek Tributaries

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES		OVERBANK/SURCHARGE		JK						
								HORIZ	TO VERT	MANNING N	DEPTH (FT)							
639	716	0	4	CHANNEL	8.0	2640.	.0090	3.0	3.0	.020	.50	0						
				OVERFLOW	11.0	2640.	.0090	20.0	20.0	.044	10.00							
640	717	0	4	CHANNEL	10.0	2780.	.0090	3.0	3.0	.044	3.00	0						
				OVERFLOW	28.0	2780.	.0090	20.0	20.0	.056	10.00							
641	961	0	4	CHANNEL	10.0	1885.	.0020	3.0	3.0	.044	3.00	0						
				OVERFLOW	28.0	1885.	.0020	20.0	20.0	.056	10.00							
645	718	0	4	CHANNEL	5.0	3320.	.0280	3.0	3.0	.044	3.00	0						
				OVERFLOW	23.0	3320.	.0280	20.0	20.0	.056	10.00							
646	719	0	4	CHANNEL	8.0	745.	.0050	3.0	3.0	.044	3.00	0						
				OVERFLOW	26.0	745.	.0050	20.0	20.0	.056	10.00							
647	962	0	4	CHANNEL	10.0	2525.	.0060	3.0	3.0	.044	3.00	0						
				OVERFLOW	28.0	2525.	.0060	20.0	20.0	.056	10.00							
648	963	0	4	CHANNEL	5.0	3255.	.0020	3.0	3.0	.044	3.00	0						
				OVERFLOW	23.0	3255.	.0020	20.0	20.0	.056	10.00							
650	720	0	4	CHANNEL	5.0	3905.	.0190	3.0	3.0	.044	3.00	0						
				OVERFLOW	23.0	3905.	.0190	20.0	20.0	.056	10.00							
651	721	0	4	CHANNEL	8.0	2045.	.0220	3.0	3.0	.044	3.00	0						
				OVERFLOW	26.0	2045.	.0220	20.0	20.0	.056	10.00							
652	964	0	4	CHANNEL	10.0	2210.	.0030	3.0	3.0	.044	3.00	0						
				OVERFLOW	28.0	2210.	.0030	20.0	20.0	.056	10.00							
655	965	0	4	CHANNEL	5.0	3915.	.0080	3.0	3.0	.044	3.00	0						
				OVERFLOW	23.0	3915.	.0080	20.0	20.0	.056	10.00							
658	999	0	4	CHANNEL	8.0	3360.	.0060	3.0	3.0	.020	.50	0						
				OVERFLOW	11.0	3360.	.0060	20.0	20.0	.044	10.00							
659	722	0	4	CHANNEL	8.0	5685.	.0180	3.0	3.0	.020	.50	0						
				OVERFLOW	11.0	5685.	.0180	20.0	20.0	.044	10.00							
660	968	0	4	CHANNEL	5.0	3255.	.0040	3.0	3.0	.044	3.00	0						
				OVERFLOW	23.0	3255.	.0040	20.0	20.0	.056	10.00							
661	969	0	4	CHANNEL	8.0	4900.	.0040	3.0	3.0	.020	.50	0						
				OVERFLOW	11.0	4900.	.0040	20.0	20.0	.044	10.00							
150	151	0	4	CHANNEL	8.0	2000.	.0060	3.0	3.0	.020	.50	0						
				OVERFLOW	11.0	2000.	.0060	20.0	20.0	.044	10.00							
151	703	0	4	CHANNEL	5.0	3400.	.0060	3.0	3.0	.044	3.00	0						
				OVERFLOW	23.0	3400.	.0060	20.0	20.0	.056	10.00							
701	605	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
702	608	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
703	609	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
704	612	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
705	616	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
706	1070	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
707	1071	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
708	621	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
709	622	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
710	623	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
712	629	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
713	633	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
714	634	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
715	639	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
716	640	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
717	641	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
718	646	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
719	647	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
720	651	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
721	652	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
722	723	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
750	627	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
950	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
952	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
953	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
954	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
955	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
956	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
957	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
958	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
959	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
960	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
961	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
962	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
963	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
964	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
965	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
966	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
967	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
968	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
969	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
999	1500	0	3		.0	.0	.0001	.0	.0	.001	.01	0						
711	712	0	4	CHANNEL	5.0	1815.	.0120	3.0	3.0	.044	3.00	0						
				OVERFLOW	23.0	1815.	.0120	20.0	20.0	.056	10.00							
723	968	0	4	CHANNEL	8.0	1925.	.0050	3.0	3.0	.020	.50	0						
				OVERFLOW	11.0	1925.	.0050	20.0	20.0	.044	10.00							
1070	619	7	2	PIPE	.0	.0	.0001	.0	.0	.001	.01	0						
				RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW	.0	.0	2.0	60.0	13.0	120.0	32.0	180.0	44.0	215.0	46.0	240.0		
					55.0	470.0												

Table A9. UDSWM Basin and Conveyance Parameters, Outfall System

Boulder Creek Tributaries

GUTTER NUMBER	GUTTER CONNECTION	NDP	NP		WIDTH OR DIAM (FT)	LENGTH (FT)	INVERT SLOPE (FT/FT)	SIDE SLOPES		OVERBANK/SURCHARGE		JK						
								HORIZ	TO VERT	MANNING N	DEPTH (FT)							
1071	150	7	2	PIPE	.0	.0	.0001	.0	.0	.001	.01	0						
				RESERVOIR STORAGE IN ACRE-FEET VS SPILLWAY OUTFLOW	.0	.0	1.0	40.0	3.0	80.0	8.0	120.0	15.0	160.0	24.5	200.0		
1060	750	17	3	TIME IN HRS VS INFLOW IN CFS	.0	.0	.0001	.0	.0	.001	.01	-1						
					.0	.0	.4	1.2	.5	58.6	.8	646.5	1.0	1240.4	1.2	1421.0		
					1.3	1439.7	1.3	1414.2	1.8	1071.6	2.0	856.3	2.5	557.3	3.0	365.2		
					3.5	239.4	4.0	157.0	5.0	67.5	6.0	29.0	8.0	.0				

DESIGN STORM RETURN PERIODS

Land Use or Zoning	Design Storm Return Period	
	<u>Initial Storm</u>	<u>Major Storm</u>
Residential	2-year	100-year
Business	5-year	100-year
Public Building Areas	5-year	100-year
Parks, Greenbelts, etc.	2-year	100-year
Open Channels and Drainage ways	10 year	100-year
Detention Facilities	Water Quality and 10 year	100-year

813.03 Runoff Computations, Colorado Urban Hydrograph Procedure (CUHP)

The CUHP method is generally applicable to basins greater than 90 acres. However, the CUHP is required for watershed areas larger than 160-acres. The procedures for the CUHP, as explained in the Urban Storm Drainage Criteria Manual, shall be followed in the preparation of drainage reports and storm drainage facility designs in the Town. The CUHP program requires the input of a design storm, either as a detailed hyetograph or as a 1-hour rainfall depth. The program for the latter using the 2-hour storm distribution recommended in the Urban Storm Drainage Criteria Manual generates a detailed hyetograph distribution. The 1-hour rainfall depths for the Town of Erie are presented in Table 800-2.

**Table 800-2
TOWN OF ERIE
ONE-HOUR RAINFALL DEPTH**

Design Storm	Rainfall Depth (in.)
2-Year	1.01
5-Year	1.43
10-Year	1.73
50-Year	2.40
100-Year	2.70

The hydrograph from the CUHP program must be routed through any proposed conveyance facility using UDSWM or a similar method.

813.04 Runoff Computations, Rational Method

The Rational Method will be utilized for sizing storm sewers and for determining runoff magnitude from un-sewered areas. The limit of application of the Rational Method is approximately 160 acres. When the drainage basin exceeds 160 acres, the CUHP method shall be used.

The procedures for the Rational Method, as explained in the Urban Storm Drainage Criteria Manual, shall be followed in the preparation of drainage reports in the Town.

813.05 Runoff Coefficients

Rational method runoff coefficients: The runoff coefficient (C) to be used in conjunction with the Rational Method will be calculated using the percent imperviousness shown in Table 800-3 as explained in the Urban Storm Drainage Criteria Manual.

**TABLE 800-3
PERCENT IMPERVIOUS FOR RATIONAL METHOD**

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS
<u>Business</u>	
Commercial Areas	95
Neighborhood Areas	85
<u>Residential</u>	
Single-Family	*
Multi-Unit (detached)	60
Multi-Unit (attached)	75
1/2 Acre Lot or Larger	*
Apartments	80
<u>Industrial</u>	
Light Areas	80
Heavy Areas	90
<u>Parks, Cemeteries</u>	5
<u>Playgrounds</u>	10
<u>Schools</u>	50
<u>Railroad Yard Areas</u>	15
<u>Undeveloped Areas</u>	
Historic Flow Analysis	2
Greenbelts, Agricultural	2
Offsite Flow Analysis (when land use not defined)	45
<u>Streets</u>	
Paved	100
Gravel	40
<u>Drives and Walks</u>	90
<u>Roofs</u>	90
<u>Lawns, Sandy Soil</u>	0
<u>Lawns, Clay Soil</u>	0

Note: These Rational Formula coefficients may not be valid for large basins.
* Refer to Urban Storm Drainage Criteria Manual for percent impervious values.

813.06 Rainfall Intensities

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential:	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

**TABLE 800-4
ALLOWABLE RELEASE RATES FOR DETENTION PONDS - CFS/ACRE**

CONTROL FREQUENCY	SCS SOIL GROUP*		
	A	B	C & D
2-year	0.02	0.03	0.04
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
100-year	0.5	0.85	1.00

*SCS soil groups are classified according to their infiltration and transmission rates. The hydrologic soil groups are:
 A. - Soils having high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well to excessively drained sands or gravel. These soils have a high rate of water transmission.
 B. - Soils having moderate infiltration rates when thoroughly wetted. These consist chiefly of moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.
 C & D. - Soils having slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impeded downward movement of water or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.

814.09 Minimum Detention Volume

The minimum required detention volumes should be determined using the following equations (Refer to Urban Storm Drainage Criteria Manual Volume III for water quality release rates):

$V = KA$, (Equation 801)

For the 100-year,
 $K_{100} = (1.78I - 0.002I^2 - 3.56)/1000$ (Equation 802)

For the 10-year,
 $K_{10} = (0.95I - 1.90)/1000$ (Equation 803)

Where V = required volume for the 100 or 10-year storm (acre-feet),
 I = Developed basin impervious (%)
 A = Tributary area (Acres)

814.10 Compensating Detention Procedure

Detention facilities with drainage areas less than 90 acres are to be designed using the compensating detention procedure if any runoff is to flow undetained from the subject property. There may be more than one local detention facility on site. The compensating detention procedure requires that the release rates from the detained and undetained areas be equal to the allowable release rates from the total site. Therefore, the more undetained runoff, the less the allowable detention facility release rate. The limit on the undetained area is 5% or 5 acres, whichever is less.

Minimum Detention Volumes:



AGREEMENT
DRAINAGE, UTILITY AND ACCESS EASEMENTS
ROAD RIGHT-OF-WAY DEDICATION

THIS AGREEMENT is made and entered into this 25th day of JANUARY, 2001, by and between **WISE HOMESTEAD LLC**, a Colorado Limited Liability Company, hereinafter referred to as "Wise", the **COUNTY OF BOULDER**, a body corporate and politic, hereinafter referred to as "County", and the **TOWN OF ERIE, COLORADO**, a Colorado Municipal Corporation, hereinafter referred to as "Town".

RECITALS

A. Wise and the County have entered into a Purchase Agreement and Division of Land dated September 19, 2000, wherein Wise is selling a parcel of land located north of Jasper Road to the County for open space/agricultural use, identified as Proposed Parcel 1 on attached Exhibit A, hereinafter referred to as "Parcel 1".

B. The County and Town intend to jointly own Parcel 1, with the Town to manage the area of Parcel 1 identified as "The Woods".

C. Wise will retain ownership to two lots north of Jasper Road identified as Proposed Lot A and Proposed Lot B on attached Exhibit A, hereinafter referred to as "Lot A and Lot B". In addition, Wise retains ownership of land located south of Jasper Road, which Wise intends to develop consistent with the Land Use Regulations of the Town. Lots A and B and the land located south of Jasper Road owned by Wise are sometimes referred to as the "Wise Property".

D. Historically, there has been some drainage of the property located south of Jasper Road onto the property located north of Jasper Road including Parcel 1.

E. The Town is in the process of identifying the location of an interceptor sanitary sewer line to serve the Town, which, in part, will be located within Parcel 1, but the exact location and other details of which are not yet known and will be agreed upon in a separate document solely between the County and Town.

F. Wise has submitted to the Town an application to plat the Wise property north of Jasper Road ("Wise Homestead Park") to create Parcel 1 to be able to convey it to the County and the

Rob



Town. However, because of the uncertainty as to the location and manner of drainage discharge, the parties are not able to designate specific drainage or utility easements on Parcel 1 as part of the Final Plat, other than the existing two wetlands which are identified as drainage easements on the Plat subject to the terms of this Agreement.

G. The parties now intend to enter into this Agreement for the purpose of agreeing upon how the drainage discharge will be handled in the future, at the time the Wise Property is developed. The parties agree that the intent is to allow some form of drainage from the property south of Jasper to Parcel 1 in a manner that:

(1) Does not significantly impact the agricultural functioning of the affected portion of Parcel 1 or Parcel 1 as a whole, as cropland, or if it does, Wise shall be required to repurchase the affected portion as set forth in this Agreement, or

(2) Does not adversely affect the functioning of either wetland as a whole, located on Parcel 1.

AGREEMENT

NOW, THEREFORE, in consideration of the recitals, promises, covenants and undertakings hereinafter set forth, and other good and valuable consideration, which is hereby acknowledged and receipted for, the parties agree as follows:

DRAINAGE EASEMENTS

1. The County and Town shall accept drainage discharge from the property south of Jasper Road subject to the following:

A. The parties shall work together to find a mutually acceptable location for the acceptance of drainage onto Parcel 1, based upon the intent of the parties as set forth in Recital G above. The parties agree that such drainage shall be either into the east or west wetlands located on Parcel 1, as shown on Exhibit A, or a combination thereof, to the extent permitted by the Corps of Engineers. In no event shall the County and Town be required to accept drainage from the Wise property south of Jasper Road onto Parcel 1 in a manner which would



substantially interfere with the intended use of Parcel 1 as agricultural cropland and parkland (the parkland is identified on Exhibit A as "The Woods"). However, should the specific agreed upon drainage facilities render a portion of Parcel 1, that is presently being used for agricultural purposes, unable to be farmed (such as an open ditch), Wise shall be required to buy back from the County and Town that portion of Parcel 1 which is no longer able to be farmed (as an outlet with no development rights) at a price based upon \$27,000 per acre escalating at 5% per year from the date that the County and Town obtain title to Parcel 1. In such event Wise shall be responsible for constructing any facilities necessary (i.e. ditch crossing) for Parcel 1 to be farmed as one unit. Furthermore, the conveyance of said property to Wise shall contain a reservation of any easements necessary for the County over said property.

B. Any development on the Wise property south of Jasper Road will provide detention storage to discharge drainage at or less than the historic rate of flow from the developed area (1 cfs per acre).

C. The drainage flow will be discharged into the wetlands with adequate erosion control provisions and under proper permits from the Corps of Engineers so as to not adversely affect the functioning of either wetland as a whole.

D. Once a mutually acceptable location and manner of drainage has been agreed upon by the parties, as the owners of Parcel 1, the County and Town shall sign all necessary wetland permit applications and any other required permit applications to allow for the drainage discharge into the wetlands. Any required applications shall be prepared by Wise and Wise shall pay all costs associated with said permit applications.



E. All engineering and construction costs to discharge drainage generated from the Wise property south of Jasper Road to the wetlands on Parcel 1 will be borne by Wise.

F. Once a mutually acceptable location for the acceptance of drainage onto Parcel 1 has been approved by the parties based upon the intent of the parties as set forth in Recital G above, and a final drainage plan has been approved by the Town for the Wise property south of Jasper Road so that the exact location of the drainage discharge is known, and the specific agreed upon facilities do not interfere with the ability to farm the land, as owners of Parcel 1, the County and Town will grant Wise easements for said drainage and for the construction and maintenance of any required drainage facilities. With regard to the existing wetlands, any drainage into said wetlands shall be subject to the easement conditions and restrictions set forth in subparagraphs 1- 6 below. Wise shall not be required to pay for the easements over the existing wetlands, as shown on the Plat. However, should there be a net increase in acreage of the wetlands as determined by the Drainage Development Plan to be approved by the Town prior to development south of Jasper, Wise shall purchase an easement for the net increase in acreage as set forth below. Any approved drainage onto areas other than the wetlands, based upon the terms of this Agreement, shall also be subject to the terms and conditions of the easement restrictions set forth in subparagraphs 1- 6 below. Any and all easements required by Wise as set forth in this paragraph, except for the easements over the existing wetlands as shown on the Plat, shall be purchased at a price of \$13,500.00 per acre escalating at 5% per year from the date the County and Town obtain title to Parcel 1. The easement restrictions and conditions that shall attach to any easement conveyed to Wise (the property to be covered by any easement shall hereinafter be referred to as the "Easement Property", the



term Parcel 1 shall continue to refer to the entire Parcel 1 as identified in Recital A, including the Easement Property) are as follows:

The Grantee of said easement/s shall:

- 1) Bury all pipes and underground facilities to a sufficient depth so as to not interfere with normal, sound agricultural practices.
- 2) Restore the surface of the Easement Property to its condition prior to installation, construction, maintenance, alteration or replacement of the drainage facilities and appurtenances thereto.
- 3) Restore fences, drain tile, irrigation systems, landscaping, private roads and other improvements, to the conditions existing prior to Wise's activities on the Easement Property.
- 4) Pay to the County and Town the actual damages to growing crops, livestock and other items caused by Wise's activities on the Easement Property, and to pay for losses occasioned by any inability to farm the Easement Property or Parcel 1 due to the Wise's activities in creating, constructing, repairing or maintaining said easement.
- 5) Be responsible for all costs associated with the construction, maintenance and repair or replacement of the drainage facilities on the Easement Property. The use by the County of Parcel 1 for agricultural practices, shall be deemed to not interfere with the drainage easement for Parcel 1. The cost of any maintenance or repairs needed on the Easement Property arising in whole or in part from normal, sound agricultural practices on Parcel 1, shall be at the sole expense of Wise. Wise shall assume liability for and indemnify the County and Town from any liability for damages to persons on Parcel 1 and/or the Easement Property or to property on Parcel 1 and/or the Easement Property



which may result or arise in whole or in part from Wise's activities on Parcel 1 and/or the Easement Property.

6) Wise shall assume liability and indemnify the County and Town from any liability or costs due to the violation of environmental laws or regulations in effect at the time of Wise's construction of the drainage facilities which impact Parcel 1 and/or the Easement Property and which arise from Wise's activities and from Wise's drainage onto Parcel 1.

2. Additionally, the County and Town shall accept drainage onto Parcel 1 from Lots A and B, the location and manner of which shall be determined and agreed upon by all parties. In no event shall the County and Town be required to accept drainage onto Parcel 1 from Lots A and B in a manner which would substantially interfere with the intended use of Parcel 1 as agricultural cropland and parkland. Wise shall pay any costs associated with such drainage and for any easement required for the drainage based upon the same price as set forth in Paragraph 1 above. However, no easement shall be required unless there is new development on Lots A and B which would require specific drainage facilities. Should said drainage discharge be into either of the wetlands on Parcel 1, the provisions of Paragraphs F(1-6) shall apply and Wise shall be responsible for all engineering and construction costs required to discharge drainage into the wetlands. At the time of new development, once a final drainage plan has been developed for Lot A and/or Lot B so that the exact location of the drainage discharge is known, as owners of Parcel 1, the County and Town shall grant easements for said drainage and for the construction and maintenance of any required drainage facilities, including the conditions set forth in F(1-6).

UTILITY EASEMENTS

3. The Town and County shall work together to agree upon final location of the interceptor sewer line. Once the location is agreed upon, the County and Town shall provide the necessary easements over Parcel 1 for the location of the sewer line, and for access for construction and maintenance of the sewer line.

4. Upon the Town and County's determination of the final location of the interceptor sewer line, the County and Town shall provide the necessary easements for Lot A, Lot B and the parcel identified on Exhibit A as the unplatted parcel belonging to Karl Joseph Volz and Mary Katherine Volz, to obtain access to the



interceptor sewer line. The location of the easements shall be such as to minimize the disruption and use of Parcel 1 as agricultural open space and park land. The owners of the lots receiving any private sewer service shall be responsible for all costs of construction and maintenance for said private sewer service, unless said lines become public sewer mains.

ROAD RIGHT-OF-WAY DEDICATION

5. The existing right-of-way for Jasper Road and N. 119th Street is 40 feet wide, 20 feet on each side of the section lines. The Town requires, as a part of the platting process, that the rights-of-way be increased to 80 feet in width, 40 feet on each side of the section lines. The parties agree Wise shall dedicate the existing 20 foot rights-of-way located on Parcel 1, Lot A and Lot B, plus the additional required 20 foot expansion of the right-of-way on Lot A and Lot B for no cash consideration. However, the additional required 20 foot expansion of the rights-of-way located on Parcel 1 shall be included in the total acreage that the County and Town are purchasing from Wise at the rate of \$27,000.00 per acre.

6. The required expansion of the Jasper Road right-of-way to 80 feet in width will result in old Wise homestead structures being partially or totally located within the expanded right-of-way. The Town agrees to grant a license allowing the structures to remain within the expanded right-of-way, which license cannot be terminated by the Town prior to six (6) months after receipt by Wise of written notice of termination.

MISCELLANEOUS

7. All of the terms, conditions, covenants and agreements herein set forth and contained shall survive the closing of the sale-purchase of Parcel 1 from Wise to the County and Town, shall continue after said closing to be binding upon and inure to the benefit of the parties hereto, their successors and assigns, and shall be covenants and conditions running with the land.

8. The validity and effect of this Agreement shall be determined in accordance with the laws of the State of Colorado.

9. Wise agrees that all future development or use of Lot A and Lot B shall be in conformance with the requirements of all Town Ordinances, resolutions, codes and review procedures then in effect at the time of the proposed development or use of the property, and shall be restricted by the Conservation Easements to be granted to the County pursuant to the Purchase Agreement.

10. This Agreement is intended to benefit the parties to this Agreement with regard to their plans for their respective parcels of property as set forth in this Agreement. The



STATE OF COLORADO)
) ss.
COUNTY OF BOULDER)

The foregoing Agreement was acknowledged before me this 15th day of JANUARY, 2001, by Sarah Allene Wise, as Manager of Wise Homestead, LLC.

WITNESS my hand and official seal.
My commission expires: OCTOBER 24, 2003



[Signature]
Notary Public

COUNTY OF BOULDER, a body corporate and politic

By: [Signature]
Ronald K. Stewart, ~~Chair~~

By: [Signature]
Jana L. Mendez, ~~Vice Chair~~ CHAIR

By: [Signature]
Paul D. Danish, Commissioner

STATE OF COLORADO)
) ss.
COUNTY OF BOULDER)

The foregoing Agreement was acknowledged before me this 23rd day of January, 2001, by Ronald K. Stewart, Chair, Jana L. Mendez, Vice-Chair, Paul D. Danish, Commissioner, of the Board County Commissioners of Boulder County.

WITNESS my hand and official seal.
My commission expires: 8/15/2003



[Signature]
Notary Public

BB. SUB-BASIN HYDROLOGY

BASIN LAND USE - SWMM BASIN
LAND USE - INLET DESIGN
POND SIZING DESIGN
SF2 & SF3
INLET DESIGN

COMPOSITE BASIN COEFFICIENTS

Subdivision: WISE FARMS

Soil Type: B

Project Name: WISE FARMS

Project No. 230801

Calculated By: AYK

Checked By: MRS

Date: 12/21/2016

SWMM ANALYSIS

Wise Farms

Total Area	125.28 acres					Composite Calculations				
	Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
	0.25-0.75 acre Lot	30%	0.27	0.28	0.60	51.69	12.4	0.11	0.12	0.25
	Paved	100%	0.89	0.93	0.94	16.47	13.1	0.12	0.12	0.12
	Parks/Open Space	5%	0.04	0.05	0.48	51.80	2.1	0.02	0.02	0.20
	Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	5.32	0.1	0.00	0.00	0.02
	TOTAL					125.28	27.7	0.25	0.26	0.59

Basin 110

Total Area	7.10 acres					Composite Calculations				
	Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
	0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.87	7.9	0.07	0.07	0.16
	Paved	100%	0.89	0.93	0.94	0.27	3.8	0.03	0.04	0.04
	Parks/Open Space	5%	0.04	0.05	0.48	2.79	2.0	0.02	0.02	0.19
	Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	2.18	0.6	0.01	0.01	0.14
	TOTAL					7.10	14.3	0.13	0.13	0.52

Basin 115

Total Area	16.99 acres					Composite Calculations				
	Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
	0.25-0.75 acre Lot	30%	0.27	0.28	0.60	8.73	15.4	0.14	0.14	0.31
	Paved	100%	0.89	0.93	0.94	3.36	19.8	0.18	0.18	0.19
	Parks/Open Space	5%	0.04	0.05	0.48	4.80	1.4	0.01	0.01	0.14
	Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.10	0.0	0.00	0.00	0.00
	TOTAL					16.99	36.6	0.33	0.34	0.63

Basin 120

Total Area	34.82 acres					Composite Calculations				
	Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
	0.25-0.75 acre Lot	30%	0.27	0.28	0.60	19.10	16.5	0.15	0.15	0.33
	Paved	100%	0.89	0.93	0.94	5.59	16.0	0.14	0.15	0.15
	Parks/Open Space	5%	0.04	0.05	0.48	7.09	1.0	0.01	0.01	0.10
	Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	3.04	0.2	0.00	0.00	0.04
	TOTAL					34.82	33.7	0.30	0.31	0.62

COMPOSITE BASIN COEFFICIENTS

Subdivision: WISE FARMS

Soil Type: B

Project Name: WISE FARMS

Project No. 230801

Calculated By: AYK

Checked By: MRS

Date: 12/21/2016

Basin 130

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
15.88 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.00	0.0	0.00	0.00	0.00	
Paved	100%	0.89	0.93	0.94	1.07	6.8	0.06	0.06	0.06	
Parks/Open Space	5%	0.04	0.05	0.48	14.80	4.7	0.04	0.04	0.45	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					15.88	11.4	0.10	0.11	0.51	

Basin 140

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
8.91 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.00	0.0	0.00	0.00	0.00	
Paved	100%	0.89	0.93	0.94	0.00	0.0	0.00	0.00	0.00	
Parks/Open Space	5%	0.04	0.05	0.48	8.91	5.0	0.04	0.05	0.48	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					8.91	5.0	0.04	0.05	0.48	

Basin 145

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
8.95 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	5.30	17.8	0.16	0.17	0.36	
Paved	100%	0.89	0.93	0.94	0.99	11.1	0.10	0.10	0.10	
Parks/Open Space	5%	0.04	0.05	0.48	2.65	1.5	0.01	0.01	0.14	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					8.95	30.3	0.27	0.28	0.60	

Basin 150

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
28.88 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	16.70	17.3	0.15	0.16	0.35	
Paved	100%	0.89	0.93	0.94	5.19	18.0	0.16	0.17	0.17	
Parks/Open Space	5%	0.04	0.05	0.48	6.99	1.2	0.01	0.01	0.12	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					28.88	36.5	0.33	0.34	0.63	

Basin 160

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
3.74 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.00	0.0	0.00	0.00	0.00	
Paved	100%	0.89	0.93	0.94	0.00	0.0	0.00	0.00	0.00	
Parks/Open Space	5%	0.04	0.05	0.48	3.74	5.0	0.04	0.05	0.48	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					3.74	5.0	0.04	0.05	0.48	

COMPOSITE BASIN COEFFICIENTS

Subdivision: Wise Farms

Soil Type: B

Project Name: Wise Farms

Project No. 107307

Calculated By: AYK

Checked By: MS

Date: 12/21/2016

INLET DESIGN

Basin 110

Total Area		Composite Calculations							
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
7.10 acres									
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.90	8.0	0.07	0.07	0.16
Paved	100%	0.89	0.93	0.94	0.27	3.8	0.03	0.04	0.04
Parks/Open Space	5%	0.04	0.05	0.48	2.75	1.9	0.02	0.02	0.19
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	2.18	0.6	0.01	0.01	0.14
TOTAL					7.10	14.4	0.13	0.13	0.52

Basin 115A

Total Area		Composite Calculations							
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
6.75 acres									
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	3.29	14.6	0.13	0.14	0.29
Paved	100%	0.89	0.93	0.94	1.28	18.9	0.17	0.18	0.18
Parks/Open Space	5%	0.04	0.05	0.48	2.18	1.6	0.01	0.02	0.15
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00
TOTAL					6.75	35.2	0.31	0.33	0.63

Basin 115B

Total Area		Composite Calculations							
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
4.80 acres									
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	2.49	15.6	0.14	0.14	0.31
Paved	100%	0.89	0.93	0.94	0.65	13.6	0.12	0.13	0.13
Parks/Open Space	5%	0.04	0.05	0.48	1.66	1.7	0.02	0.02	0.17
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00
TOTAL					4.80	30.9	0.28	0.29	0.61

Basin 115C

Total Area		Composite Calculations							
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀
2.10 acres									
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.24	17.7	0.16	0.16	0.35
Paved	100%	0.89	0.93	0.94	0.76	36.3	0.32	0.34	0.34
Parks/Open Space	5%	0.04	0.05	0.48	-0.01	0.0	0.00	0.00	0.00
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.10	0.1	0.00	0.00	0.02
TOTAL					2.10	54.1	0.48	0.50	0.72

COMPOSITE BASIN COEFFICIENTS

Subdivision: Wise Farms

Soil Type: B

Project Name: Wise Farms

Project No. 107307

Calculated By: AYK

Checked By: MS

Date: 12/21/2016

Basin 115D

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
3.40 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	2.11	18.6	0.17	0.17	0.37	
Paved	100%	0.89	0.93	0.94	0.67	19.6	0.17	0.18	0.18	
Parks/Open Space	5%	0.04	0.05	0.48	0.62	0.9	0.01	0.01	0.09	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					3.40	39.1	0.35	0.36	0.65	

Basin 120A

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
1.81 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.07	17.7	0.16	0.17	0.36	
Paved	100%	0.89	0.93	0.94	0.74	40.8	0.36	0.38	0.39	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					1.81	58.6	0.52	0.54	0.74	

Basin 120B

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
5.81 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	3.89	20.1	0.18	0.19	0.40	
Paved	100%	0.89	0.93	0.94	0.52	8.9	0.08	0.08	0.08	
Parks/Open Space	5%	0.04	0.05	0.48	1.41	1.2	0.01	0.01	0.12	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					5.81	30.1	0.27	0.28	0.60	

Basin 120C

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
4.21 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	3.21	22.9	0.20	0.21	0.46	
Paved	100%	0.89	0.93	0.94	1.00	23.7	0.21	0.22	0.22	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					4.21	46.6	0.41	0.43	0.68	

COMPOSITE BASIN COEFFICIENTS

Subdivision: Wise Farms

Soil Type: B

Project Name: Wise Farms

Project No. 107307

Calculated By: AYK

Checked By: MS

Date: 12/21/2016

Basin 120D

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
7.08 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	3.05	12.9	0.12	0.12	0.26	
Paved	100%	0.89	0.93	0.94	0.86	12.1	0.11	0.11	0.11	
Parks/Open Space	5%	0.04	0.05	0.48	3.17	2.2	0.02	0.02	0.21	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					7.08	27.3	0.24	0.25	0.59	

Basin 120E

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
6.43 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	2.67	12.4	0.11	0.12	0.25	
Paved	100%	0.89	0.93	0.94	0.88	13.6	0.12	0.13	0.13	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	2.89	0.9	0.01	0.01	0.21	
TOTAL					6.43	26.9	0.24	0.25	0.59	

Basin 120F

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
4.40 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	2.29	15.6	0.14	0.15	0.31	
Paved	100%	0.89	0.93	0.94	0.89	20.1	0.18	0.19	0.19	
Parks/Open Space	5%	0.04	0.05	0.48	1.23	1.4	0.01	0.01	0.13	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					4.40	37.1	0.33	0.35	0.64	

Basin 120G

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
1.77 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.00	0.0	0.00	0.00	0.00	
Paved	100%	0.89	0.93	0.94	0.29	16.1	0.14	0.15	0.15	
Parks/Open Space	5%	0.04	0.05	0.48	1.49	4.2	0.04	0.04	0.40	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					1.77	20.3	0.18	0.19	0.55	

COMPOSITE BASIN COEFFICIENTS

Subdivision: Wise Farms

Soil Type: B

Project Name: Wise Farms

Project No. 107307

Calculated By: AYK

Checked By: MS

Date: 12/21/2016

Basin 120H

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
3.29 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	2.89	26.3	0.23	0.24	0.53	
Paved	100%	0.89	0.93	0.94	0.41	12.4	0.11	0.12	0.12	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					3.29	38.7	0.34	0.36	0.64	

Basin 130

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
15.88 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.00	0.0	0.00	0.00	0.00	
Paved	100%	0.89	0.93	0.94	1.07	6.8	0.06	0.06	0.06	
Parks/Open Space	5%	0.04	0.05	0.48	14.80	4.7	0.04	0.04	0.45	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					15.88	11.4	0.10	0.11	0.51	

Basin 140

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
8.91 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.00	0.0	0.00	0.00	0.00	
Paved	100%	0.89	0.93	0.94	0.00	0.0	0.00	0.00	0.00	
Parks/Open Space	5%	0.04	0.05	0.48	8.91	5.0	0.04	0.05	0.48	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					8.91	5.0	0.04	0.05	0.48	

Basin 145A

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
4.39 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	2.17	14.9	0.13	0.14	0.30	
Paved	100%	0.89	0.93	0.94	0.99	22.6	0.20	0.21	0.21	
Parks/Open Space	5%	0.04	0.05	0.48	1.22	1.4	0.01	0.01	0.13	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					4.39	38.9	0.35	0.36	0.64	

COMPOSITE BASIN COEFFICIENTS

Subdivision: Wise Farms

Soil Type: B

Project Name: Wise Farms

Project No. 107307

Calculated By: AYK

Checked By: MS

Date: 12/21/2016

Basin 145B

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
4.58 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	3.11	20.4	0.18	0.19	0.41	
Paved	100%	0.89	0.93	0.94	0.00	0.0	0.00	0.00	0.00	
Parks/Open Space	5%	0.04	0.05	0.48	1.47	1.6	0.01	0.01	0.15	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					4.58	22.0	0.20	0.20	0.56	

Basin 150A

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
1.99 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.25	18.8	0.17	0.17	0.38	
Paved	100%	0.89	0.93	0.94	0.35	17.8	0.16	0.17	0.17	
Parks/Open Space	5%	0.04	0.05	0.48	0.39	1.0	0.01	0.01	0.09	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					1.99	37.6	0.33	0.35	0.64	

Basin 150B

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
4.72 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	3.21	20.4	0.18	0.19	0.41	
Paved	100%	0.89	0.93	0.94	1.51	32.0	0.28	0.30	0.30	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					4.72	52.4	0.47	0.49	0.71	

Basin 150C

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
5.13 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	3.90	22.8	0.20	0.21	0.46	
Paved	100%	0.89	0.93	0.94	1.24	24.1	0.21	0.22	0.23	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					5.13	46.9	0.42	0.44	0.68	

COMPOSITE BASIN COEFFICIENTS

Subdivision: Wise Farms

Soil Type: B

Project Name: Wise Farms

Project No. 107307

Calculated By: AYK

Checked By: MS

Date: 12/21/2016

Basin 150D

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
2.96 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	2.44	24.7	0.22	0.23	0.49	
Paved	100%	0.89	0.93	0.94	0.52	17.7	0.16	0.16	0.17	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					2.96	42.4	0.38	0.39	0.66	

Basin 150E

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
0.86 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.55	19.1	0.17	0.18	0.38	
Paved	100%	0.89	0.93	0.94	0.31	35.8	0.32	0.33	0.34	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					0.86	55.0	0.49	0.51	0.72	

Basin 150F

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
1.66 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.15	20.9	0.19	0.19	0.42	
Paved	100%	0.89	0.93	0.94	0.50	30.4	0.27	0.28	0.29	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					1.66	51.2	0.46	0.48	0.71	

Basin 150G

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
4.30 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.85	12.9	0.11	0.12	0.26	
Paved	100%	0.89	0.93	0.94	0.00	0.0	0.00	0.00	0.00	
Parks/Open Space	5%	0.04	0.05	0.48	2.45	2.8	0.03	0.03	0.27	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					4.30	15.8	0.14	0.15	0.53	

COMPOSITE BASIN COEFFICIENTS

Subdivision: Wise Farms

Soil Type: B

Project Name: Wise Farms

Project No. 107307

Calculated By: AYK

Checked By: MS

Date: 12/21/2016

Basin 150H

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
1.82 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.15	19.1	0.17	0.18	0.38	
Paved	100%	0.89	0.93	0.94	0.66	36.5	0.32	0.34	0.34	
Parks/Open Space	5%	0.04	0.05	0.48	0.00	0.0	0.00	0.00	0.00	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					1.82	55.5	0.49	0.52	0.73	

Basin 150I

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
3.71 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.00	0.0	0.00	0.00	0.00	
Paved	100%	0.89	0.93	0.94	0.00	0.0	0.00	0.00	0.00	
Parks/Open Space	5%	0.04	0.05	0.48	3.71	5.0	0.04	0.05	0.48	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					3.71	5.0	0.04	0.05	0.48	

Basin 150J

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
1.73 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	1.33	23.0	0.20	0.21	0.46	
Paved	100%	0.89	0.93	0.94	0.00	0.0	0.00	0.00	0.00	
Parks/Open Space	5%	0.04	0.05	0.48	1.73	5.0	0.04	0.05	0.48	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					3.06	28.0	0.25	0.26	0.94	

Basin 160

Total Area		Composite Calculations								
Land Use	Imp.	C ₂	C ₅	C ₁₀₀	Area	Imp%	% C ₂	% C ₅	% C ₁₀₀	
3.74 acres										
0.25-0.75 acre Lot	30%	0.27	0.28	0.60	0.00	0.0	0.00	0.00	0.00	
Paved	100%	0.89	0.93	0.94	0.00	0.0	0.00	0.00	0.00	
Parks/Open Space	5%	0.04	0.05	0.48	3.74	5.0	0.04	0.05	0.48	
Historic Flow (Oil & gas Sites)	2%	0.02	0.02	0.46	0.00	0.0	0.00	0.00	0.00	
TOTAL					3.74	5.0	0.04	0.05	0.48	

STANDARD FORM SF-2
TIME OF CONCENTRATION- 5 yr

Subdivision: WISE FARMS

Project Name: WISE FARMS

Project No. 230801

Calculated By: AYK

Checked By: MRS

Date: 12/21/2016

SUB-BASIN DATA			INITIAL/OVERLAND (T _i)			TRAVEL TIME (T _t)				T _c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C _s	L (FT)	S (%)	T _i (MIN)	L (FT)	S (%)	VEL. (FPS)	T _t (MIN)	COMP. T _c (MIN)	TOTAL LENGTH(FT)	MIN. T _c (MIN)	T _c (MIN)
Basin 110	7.1	0.13	200	1.0	24.6	1050	1.5	2.4	7.1	31.7	1250.0	16.9	16.9
Basin 115A	6.8	0.33	50	2.0	7.8	763	2.6	3.2	3.9	11.8	813.0	14.5	11.8
Basin 115B	4.8	0.29	100	1.0	14.6	1577	2.4	3.1	8.5	23.1	1677.0	19.3	19.3
Basin 115C	2.1	0.50	50	2.0	6.0	1050	1.5	2.4	7.4	13.4	1100.0	16.1	13.4
Basin 115D	3.4	0.36	50	2.0	7.4	850	1.8	2.7	5.3	12.7	900.0	15.0	12.7
Basin 120A	1.8	0.54	50	2.0	5.6	700	1.0	2.0	5.8	11.4	750.0	14.2	11.4
Basin 120B	5.8	0.28	50	2.0	8.3	1050	2.1	2.9	6.0	14.3	1100.0	16.1	14.3
Basin 120C	4.2	0.43	50	2.0	6.7	1005	1.4	2.4	7.1	13.8	1055.0	15.9	13.8
Basin 120D	7.1	0.25	50	2.0	8.5	1550	2.1	2.9	8.9	17.5	1600.0	18.9	17.5
Basin 120E	6.4	0.25	50	2.0	8.6	700	2.7	3.2	3.6	12.2	750.0	14.2	12.2
Basin 120F	4.4	0.35	50	2.0	7.6	350	3.5	3.7	1.6	9.2	400.0	12.2	9.2
Basin 120G	1.8	0.19	50	2.0	9.2	1400	0.8	1.8	13.0	22.3	1450.0	18.1	18.1
Basin 120H	3.3	0.36	51	2.0	7.6	510	0.8	1.8	4.8	12.4	561.0	13.1	12.4
Basin 130	15.9	0.11	200	0.5	31.9	1000	3.0	3.5	4.8	36.7	1200.0	16.7	16.7
Basin 140	8.9	0.05	200	0.5	33.8	800	0.9	1.8	7.5	41.2	1000.0	15.6	15.6
Basin 145A	4.4	0.36	50	2.0	7.5	900	0.5	1.4	10.6	18.1	950.0	15.3	15.3
Basin 145B	4.6	0.20	50	2.0	9.0	350	4.0	4.0	1.5	10.5	400.0	12.2	10.5
Basin 150A	2.0	0.35	200	0.5	24.1	1050	0.7	1.5	11.3	35.4	1250.0	16.9	16.9
Basin 150B	4.7	0.49	50	2.0	6.2	600	1.0	2.0	5.0	11.2	650.0	13.6	11.2
Basin 150C	5.1	0.44	50	2.0	6.7	700	1.3	2.2	5.3	12.0	750.0	14.2	12.0
Basin 150D	3.0	0.39	50	2.0	7.1	500	0.6	1.5	5.4	12.5	550.0	13.1	12.5
Basin 150E	0.9	0.51	50	2.0	5.9	450	0.9	1.8	4.2	10.1	500.0	12.8	10.1
Basin 150F	1.7	0.48	50	2.0	6.3	500	0.6	1.5	5.4	11.7	550.0	13.1	11.7
Basin 150G	4.3	0.15	50	2.0	9.6	530	0.5	1.4	6.2	15.9	580.0	13.2	13.2
Basin 150H	1.8	0.52	50	2.0	5.9	450	0.7	1.5	4.8	10.7	500.0	12.8	10.7
Basin 150I	3.7	0.05	50	2.0	10.6	600	1.7	2.5	4.0	14.6	650.0	13.6	13.6
Basin 150J	3.1	0.26	50	2.0	8.5	600	1.7	2.5	4.0	12.4	650.0	13.6	12.4
Basin 160	3.7	0.05	200	0.5	33.8	600	1.5	2.4	4.1	37.9	800.0	14.4	14.4

NOTES:

$T_i = (1.8 * (1.1 - C_s) * (L)^{0.5}) / (S^{0.33})$

$T_t = L / 60V$ (Velocity From Fig. 3-2)

$T_c \text{ Check} = 10 + L / 180$

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision WISE FARMS

Project Name: WISE FARMS
Project No. 230801
Calculated By: AYK
Checked By: MRS
Date: 12/21/2016

Design Storm 2 yr.
2-Year P1 = 1.0 in.

COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C% (Ac)	I (in/hr)	Q (cfs)	TOTAL RUNOFF					STREET		PIPE			TRAVEL TIME			REMARKS			
									Inlet Type	Q (Intercept)	Q (Curb-On)	Tc (min)	C% (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)		Velocity (fps)	Tt (min)	
DRAINAGE TO POND 340																									
Basin 120 H	C7	Basin 120H	3.29	0.34	12.4	1.13	2.5	2.8	1 @10' Sump Inlet	2.8	0.0	12.4	1.13	2.5	2.8			2.8	0.50	24.00	771.0	3.76	3.4	Piped to DP A-1	
Basin 110	A1	Basin 110	7.10	0.13	16.9	0.91	2.2	2.0				16.9	2.04	2.2	4.4	2.4	4.4				550.0	3.10	3.0	Swale to Pond 340	
Basin 115A	B1	Basin 115A	6.75	0.31	11.8	2.11	2.6	5.4				11.8	2.11	2.6	5.4	1.0	5.4				740.0	2.00	6.2	Overland to DP B2	
Basin 115A, 115B	B2	Basin 115B	4.80	0.28	19.3	1.32	2.0	2.7				19.3	3.43	2.0	6.9	1.0	6.9				670.0	2.00	5.6	Overland to DP C6	
Basin 115C	B3	Basin 115C	2.10	0.48	13.4	1.01	2.4	2.4				13.4	1.01	2.4	2.4	1.0	2.4				890.0	2.00	7.4	Overland to DP B4	
Basin 115C, 115D	B4	Basin 115D	3.40	0.35	12.7	1.18	2.5	2.9	1 @10' Sump Inlet	10.0	0.0	20.8	2.19	1.9	4.3			10.0	0.50	30.00	50.0	4.00	0.2	Piped to DP 1	
Basin 120A	C1	Basin 120A	1.81	0.52	11.4	0.94	2.6	2.4				11.4	0.94	2.6	2.4	1.0	2.4				815.0	2.00	6.8	Overland to DP C3	
Basin 120A, 120C	C3	Basin 120C	4.21	0.41	13.8	1.75	2.4	4.2				18.2	2.69	2.1	5.6	1.0	5.6				450.0	2.00	3.8	Overland to DP C5	
Basin 120A, 120C, 120E	C5	Basin 120E	6.43	0.24	12.2	1.54	2.5	3.9	2 @15' On-Grade Inlet	8.0	0.0	22.0	4.23	1.9	8.0			8.0	1.00	36.00	150.0	6.50	0.4	Piped to DP 2	
Basin 120B	C2	Basin 120B	5.81	0.27	14.3	1.56	2.3	3.7				14.3	1.56	2.3	3.7	1.0	3.7				1340.0	2.00	11.2	Overland to DP C4	
Basin 120B, 120D	C4	Basin 120D	7.08	0.24	17.5	1.72	2.1	3.7				25.5	3.28	1.7	5.7	1.0	5.7				150.0	2.00	1.3	Overland to DP B4	
Basin 120F	C6	Basin 120F	4.40	0.33	9.2	1.45	2.8	4.1	2 @15' Sump Inlet	11.1	0.0	9.2	1.45	2.8	4.1			11.1	0.50	30.00	50.0	4.10	0.2	Piped to DP 2	
Basin 115A, 115B	DP 2											26.7	12.40	1.7	21.0										
Basin 120A,B,C,D,E,F																		21.0	1.00	48.00	50.0	8.40	0.1	Piped to DP 1	
Basin 115A,B,C,D																									
Basin 120A,B,C,D,E,F	DP 1											26.8	14.60	1.7	24.7										
Basin 120G		Basin 120G	1.77	0.18	18.1	0.32	2.1	0.7				18.1	0.32	2.1	0.7	1.0	0.7				1340.0	2.00	11.2	Overlands to Pond 340	
Basin 130	130	Basin 130	15.88	0.10	16.7	1.61	2.2	3.5				16.7	1.61	2.2	3.5										

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision WISE FARMS

Project Name: WISE FARMS
Project No. 230801
Calculated By: AYK
Checked By: MRS
Date: 12/21/2016

Design Storm 2 yr.
2-Year P1 = 1.0 in.

COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS				
									Inlet Type	Q (Intercept)	Q (Curb-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)		Length (ft)	Velocity (fps)	Tt (min)	
													1.0	3.5				10.0	2.00	0.1	Overlands Offsite				
DRAIANGE TO POND 340																									
Basin 140	140	Basin 140	8.91	0.04	15.6	0.40	2.3	0.9				15.6	0.40	2.3	0.9	1.0	0.9			550.0	2.00	4.6	Overland to Boulder Ditch		
Basin 160	160	Basin 160	3.74	0.04	14.4	0.17	2.3	0.4				14.4	0.17	2.3	0.4	1.0	0.4			890.0	2.00	7.4	Overlands Offsite		
Basin 145B	D2	Basin 145B	4.58	0.20	10.5	0.90	2.7	2.4				10.5	0.90	2.7	2.4	1.0	2.4			890.0	2.00	7.4	Overland to Wetlands		
Basin 145A	D1	Basin 145A	4.39	0.35	15.3	1.52	2.3	3.4				15.3	1.52	2.3	3.4	1.0	3.4			50.0	2.00	0.4	Overland to DP 3		
Basin 150A	E1	Basin 150A	1.99	0.33	16.9	0.66	2.2	1.4				16.9	0.66	2.2	1.4	1.0	1.4			50.0	2.00	0.4	Overland to DP 3		
Basin 150A, 145A	DP 3								2 @5' Sump Inlet	3.3	0.0	17.4	2.18	2.1	4.7			4.7	0.50	30.00	660.0	3.90	2.8	Piped to DP 4	
Basin 150B	E2	Basin 150B	4.72	0.47	11.2	2.20	2.6	5.8	Sump Inlet	5.8	0.0	11.2	2.20	2.6	5.8			5.8	0.50	30.00	660.0	4.60	2.4	Piped to DP 4	
Basin 145A, 150A, B	DP 4											20.2	4.38	2.0	8.7			8.7	1.00	30.00	660.0	6.30	1.7	Piped to Pond 370	
Basin 150G	E7	Basin 150G	4.30	0.14	13.2	0.60	2.4	1.5	1 @10' Sump Inlet	1.5	0.0	13.2	0.60	2.4	1.5			1.5	0.50	24.00	300.0	3.10	1.6	Piped to DP E6	
Basin 150G, 150F	E6	Basin 150F	1.66	0.46	11.7	0.76	2.6	1.9	1 @5' Sump Inlet	1.9	0.0	14.8	1.36	2.3	3.1			3.1	0.50	30.00	50.0	5.00	0.2	Piped to DP E8	
Basin 150F, G, H	E8	Basin 150H	1.82	0.49	10.7	0.90	2.7	2.4	1 @5' Sump Inlet	2.4	0.0	15.0	2.26	2.3	5.2			5.2	1.00	30.00	620.0	5.70	1.8	Piped to DP E3	
Basin 150C	E3	Basin 150C	5.13	0.42	12.0	2.14	2.5	5.4	1 @10' Sump Inlet	5.4	0.0	12.0	2.14	2.5	5.4			5.4	1.00	30.00	50.0	8.00	0.1	Piped to DP E4	
Basin 150E	E5	Basin 150E	0.86	0.49	10.1	0.42	2.7	1.1				10.1	0.42	2.7	1.1										
Basin 150C, D, E	E4	Basin 150D	2.96	0.38	12.5	1.12	2.5	2.8	1 @ 10' Sump Inlet	3.8	0.0	12.6	1.54	2.5	3.8	1.0	1.1			300.0	2.00	2.5	Overland to E4		
Basin 150C,D,E,F,G,H	DP 5											16.8	5.94	2.2	12.9			3.8	0.50	24.00	50.0	4.11	0.2	Piped to DP 4	
Basin 150J	E10	Basin 150J	3.06	0.25	12.4	0.76	2.5	1.9	1 @ 10' Sump Inlet	1.9	0.0	12.4	0.76	2.5	1.9			12.9	1.00	36.00	200.0	5.60	0.6	Piped to Pond 370	
Basin 150I	E9	Basin 150I	3.71	0.04	13.6	0.16	2.4	0.4				13.6	0.16	2.4	0.4			1.9	0.50	30.00	50.0	3.30	0.3	Piped to Pond 370	
																1.0	0.4			50.0	2.00	0.4	Overlands to Pond 370		

**STANDARD FORM SF-3 SKY RANCH
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)**

Subdivision WISE FARMS

Project Name: WISE FARMS
Project No. 230801
Calculated By: AYK
Checked By: MRS
Date: 12/21/2016

Design Storm 100 yr.
100-Year P1 = 2.7 in.

COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	TOTAL RUNOFF						STREET		PIPE			TRAVEL TIME			REMARKS	
									Inlet Type	Q (Intercept)	Q (Curb-On)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)		Tt (min)
DRAINAGE TO POND 340																								
Basin 120H	C7	Basin 120H	3.29	0.64	12.4	2.12	6.7	14.1	1 @ 10' Sump Inlet	14.1	0.0	12.4	2.12	6.7	14.1			14.1	0.50	24.00	771.0	5.73	2.2	Piped to DP A-1
Basin 110	A1	Basin 110	7.10	0.52	16.9	3.72	5.8	21.4				16.9	5.84	5.8	33.6	2.4	33.6				550.0	3.10	3.0	Swale to Pond 340
Basin 115A	B1	Basin 115A	6.75	0.63	11.8	4.23	6.8	28.8				11.8	4.23	6.8	28.8	1.0	28.8				740.0	2.00	6.2	Overland to DP B2
Basin 115A, 115B	B2	Basin 115B	4.80	0.61	19.3	2.91	5.4	15.7				19.3	7.14	5.4	38.5	1.0	38.5				670.0	2.00	5.6	Overland to DP C6
Basin 115C	B3	Basin 115C	2.10	0.72	13.4	1.51	6.4	9.7				13.4	1.51	6.4	9.7	1.0	9.7				890.0	2.00	7.4	Overland to DP B4
Basin 115C, 115D	B4	Basin 115D	3.40	0.65	12.7	2.20	6.6	14.5	2 @ 15' Sump Inlet	54.7	0.0	20.8	3.71	5.2	19.2			54.7	1.00	36.00	50.0	11.00	0.1	Piped to DP 1
Basin 120A	C1	Basin 120A	1.81	0.74	11.4	1.34	6.9	9.2				11.4	1.34	6.9	9.2	1.0	9.2				815.0	2.00	6.8	Overland to DP C3
Basin 120A, 120C	C3	Basin 120C	4.21	0.68	13.8	2.88	6.3	18.2				18.2	4.22	5.6	23.4	1.0	23.4				450.0	2.00	3.8	Overland to DP C5
Basin 120A, 120C, 120E	C5	Basin 120E	6.43	0.59	12.2	3.77	6.7	25.3	2 @ 15' On-Grade Inlet	33.0	7.2	22.0	7.99	5.0	40.2	1	7.2	33.0	1.00	36.00	150.0	2.00	1.3	Overland to DP C6
Basin 120B	C2	Basin 120B	5.81	0.60	14.3	3.50	6.2	21.8				14.3	3.50	6.2	21.8	1.0	21.8				150.0	10.27	0.2	Piped to DP 2
Basin 120B, 120D	C4	Basin 120D	7.08	0.59	17.5	4.16	5.7	23.6				25.5	7.66	4.6	35.5	1.0	21.8				1340.0	2.00	11.2	Overland to DP C4
Basin 120F	C6	Basin 120F	4.40	0.64	9.2	2.80	7.5	21.0	2 @ 15' Sump Inlet	66.7	0.0	9.2	2.80	7.5	21.0						150.0	2.00	1.3	Overland to DP B4
Basin 115A, 115B																		66.7	0.50	30.00	50.0	6.40	0.1	Piped to DP 2
Basin 120A,B,C,D,E,F	DP 2											26.7	25.58	4.5	115.4			115.4	1.00	48.00	50.0	12.90	0.1	Piped to DP 1
Basin 115A,B,C,D																								
Basin 120A,B,C,D,E,F	DP 1											26.8	29.29	4.5	132.0			132.0	1.00	48.00	50.0	13.00	0.1	Piped to Pond 340
Basin 120G		Basin 120G	1.77	0.55	18.1	0.98	5.6	5.5				18.1	0.98	5.6	5.5									
Basin 130	130	Basin 130	15.88	0.51	16.7	8.10	5.8	47.0				16.7	8.10	5.8	47.0	1.0	5.5				1340.0	2.00	11.2	Overlands to Pond 340
																					10.0	2.00	0.1	Overlands Offsite

WATER QUALITY POND SIZING (ULTIMATE)

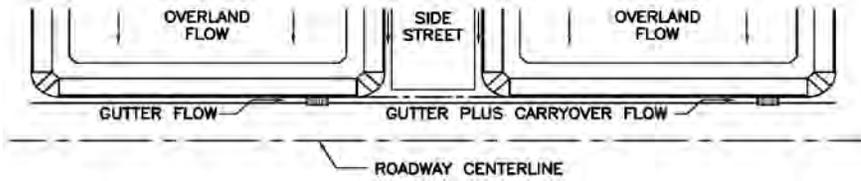
Subdivision: WISE FARMS

Project Name: WISE FARMS
 Project No. 230801
 Calculated By: AYK
 Checked By: MRS
 Date: 12/21/2016

Pond ID	Basin ID	Tributary Area (AC)	Impervious (%)	WQCV (AC-FT)	EURV (AC-FT)	V100 (AC-FT)	Allowable Release (CFS)	Design Release (CFS)
	Basin 110	7.1	14.3	0.05	0.09		7.1	
	Basin 115	17.0	36.6	0.24	0.57		17.0	
	Basin 120	34.8	33.7	0.47	1.08		34.8	
Pond 340		58.9	32.2	0.8	1.7	3.4	58.9	74.7
	Basin 140	8.9	5.0	0.0	0.0		8.9	
	Basin 145	8.9	30.3	0.1	0.2		8.9	
	Basin 150	28.9	36.5	0.4	1.0		28.9	
Pond 370		46.7	29.3	0.6	1.3	3.9	105.7	103.4

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: DP B4



Show Details

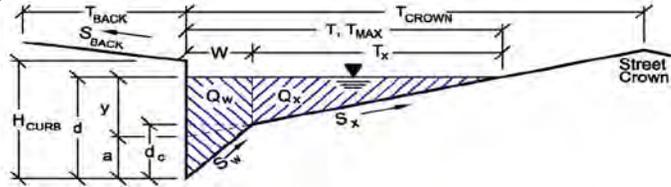
<p>Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):</p>		<p>Minor Storm Major Storm</p> <p>$Q_{Known} =$ <input type="text" value="10.0"/> <input type="text" value="54.7"/> cfs</p>	<--- FILL IN THIS SECTION OR... FILL IN THE SECTIONS BELOW. <---									
<p>* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.</p>												
<p>Geographic Information: (Enter data in the blue cells):</p>												
<p>Site Type:</p> <p><input type="radio"/> Site is Urban</p> <p><input type="radio"/> Site is Non-Urban</p>	<p>Flows Developed For:</p> <p><input type="radio"/> Street Inlets</p> <p><input type="radio"/> Area Inlets in a Median</p>	<p>Subcatchment Area = <input type="text"/> Acres</p> <p>Percent Imperviousness = <input type="text"/> %</p> <p>NRCS Soil Type = <input type="text"/> A, B, C, or D</p>										
		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Slope (ft/ft)</th> <th>Length (ft)</th> </tr> </thead> <tbody> <tr> <td>Overland Flow =</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> <tr> <td>Channel Flow =</td> <td><input type="text"/></td> <td><input type="text"/></td> </tr> </tbody> </table>		Slope (ft/ft)	Length (ft)	Overland Flow =	<input type="text"/>	<input type="text"/>	Channel Flow =	<input type="text"/>	<input type="text"/>	
	Slope (ft/ft)	Length (ft)										
Overland Flow =	<input type="text"/>	<input type="text"/>										
Channel Flow =	<input type="text"/>	<input type="text"/>										
<p>Rainfall Information: Intensity i (in/hr) = $C_1 \cdot P_1 / (C_2 + 1.2)^{C_3}$</p>												
	<p>Design Storm Return Period, $T_r =$ <input type="text"/> years</p> <p>Return Period One-Hour Precipitation, $P_1 =$ <input type="text"/> inches</p> <p>$C_1 =$ <input type="text"/></p> <p>$C_2 =$ <input type="text"/></p> <p>$C_3 =$ <input type="text"/></p> <p>User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), $C_s =$ <input type="text"/></p> <p>User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), $C_5 =$ <input type="text"/></p>	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> </tr> </thead> <tbody> <tr> <td>Bypass (Carry-Over) Flow from upstream Subcatchments, $Q_b =$</td> <td style="text-align: center;">0.0</td> <td style="text-align: center;">0.0</td> </tr> <tr> <td>Total Design Peak Flow, $Q =$</td> <td style="text-align: center; border: 2px solid green;">10.0</td> <td style="text-align: center; border: 2px solid green;">54.7</td> </tr> </tbody> </table>		Minor Storm	Major Storm	Bypass (Carry-Over) Flow from upstream Subcatchments, $Q_b =$	0.0	0.0	Total Design Peak Flow, $Q =$	10.0	54.7	
	Minor Storm	Major Storm										
Bypass (Carry-Over) Flow from upstream Subcatchments, $Q_b =$	0.0	0.0										
Total Design Peak Flow, $Q =$	10.0	54.7										

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Wise Farms

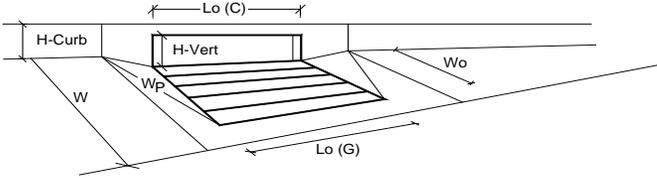
Inlet ID: DP B4



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 12.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.8$ ft												
Gutter Width	$W = 2.83$ ft												
Street Transverse Slope	$S_x = 0.020$ ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td>17.8</td> <td>17.8</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>6.0</td> <td>12.0</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	17.8	17.8	ft	$d_{MAX} =$	6.0	12.0	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	17.8	17.8	ft										
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Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td>check = yes</td> </tr> </tbody> </table>		Minor Storm	Major Storm			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes				
	Minor Storm	Major Storm											
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes										
MINOR STORM Allowable Capacity is based on Depth Criterion													
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Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'													
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$Q_{allow} =$	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td></td> <td>SUMP</td> <td>SUMP</td> <td>cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm			SUMP	SUMP	cfs				
	Minor Storm	Major Storm											
	SUMP	SUMP	cfs										

INLET IN A SUMP OR SAG LOCATION

Project = Wise Farms
 Inlet ID = DP B4

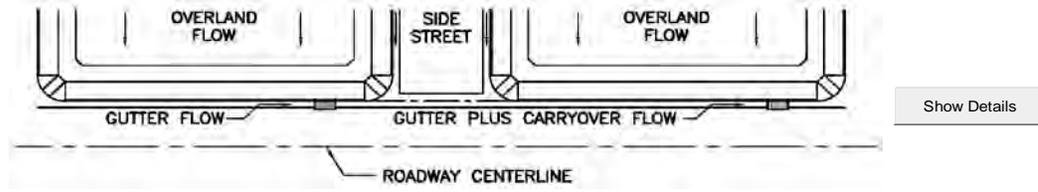


Design Information (Input)		MINOR		MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches	
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches	<input type="checkbox"/> Override Depths
Grate Information		MINOR		MAJOR	
Length of a Unit Grate	$L_o (G)$ =	N/A	N/A	feet	
Width of a Unit Grate	W_o =	N/A	N/A	feet	
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_l (G)$ =	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w (G)$ =	N/A	N/A		
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o (G)$ =	N/A	N/A		
Curb Opening Information		MINOR		MAJOR	
Length of a Unit Curb Opening	$L_o (C)$ =	15.00	15.00	feet	
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches	
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches	
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees	
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.83	2.83	feet	
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_l (C)$ =	0.10	0.10		
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w (C)$ =	3.60	3.60		
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_o (C)$ =	0.67	0.67		
Total Inlet Interception Capacity (assumes clogged condition)		MINOR		MAJOR	
	Q_a =	15.2	79.9	cfs	
	$Q_{PEAK REQUIRED}$ =	10.0	54.7	cfs	

Inlet Capacity IS GOOD for Minor and Major Storms (-Q PEAK)

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: DP C5



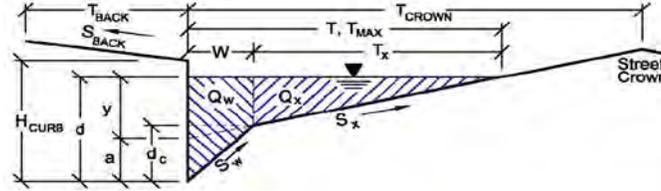
Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		*Q _{Known} =	Minor Storm	Major Storm	
			8.0	40.2	cfs
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.					
Geographic Information: (Enter data in the blue cells):					
Site Type: <input type="radio"/> Site is Urban <input type="radio"/> Site is Non-Urban		Flows Developed For: <input type="radio"/> Street Inlets <input type="radio"/> Area Inlets in a Median		Subcatchment Area = <input type="text"/> Acres Percent Imperviousness = <input type="text"/> % NRCS Soil Type = <input type="text"/> A, B, C, or D	
		Overland Flow = <input type="text"/> Slope (ft/ft) <input type="text"/> Length (ft)		Channel Flow = <input type="text"/> <input type="text"/>	
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$			Minor Storm	Major Storm	
Design Storm Return Period, T _r =			<input type="text"/>	<input type="text"/>	years
Return Period One-Hour Precipitation, P ₁ =			<input type="text"/>	<input type="text"/>	inches
C ₁ =			<input type="text"/>	<input type="text"/>	
C ₂ =			<input type="text"/>	<input type="text"/>	
C ₃ =			<input type="text"/>	<input type="text"/>	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			<input type="text"/>	<input type="text"/>	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ =			<input type="text"/>	<input type="text"/>	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q _b =			0.0	0.0	cfs
Total Design Peak Flow, Q =			8.0	40.2	cfs

←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
 ←←←

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

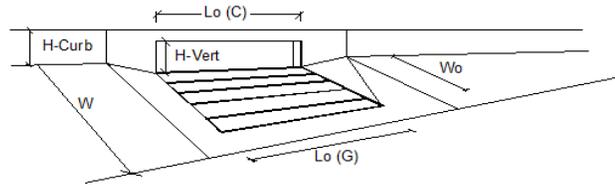
Project: Wise Farms
 Inlet ID: DP C5



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="12.0"/> ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>												
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.8"/> ft												
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.83"/> ft												
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.010"/> ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>												
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> <th style="padding: 2px;"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$T_{MAX} =$ <input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: center;">ft</td> </tr> <tr> <td style="text-align: center;">$d_{MAX} =$ <input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="12.0"/></td> <td style="text-align: center;">inches</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;">check = yes</td> </tr> </tbody> </table>	Minor Storm	Major Storm		$T_{MAX} = $ <input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft	$d_{MAX} = $ <input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches	<input type="checkbox"/>	<input type="checkbox"/>	check = yes
Minor Storm	Major Storm												
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<input type="checkbox"/>	<input type="checkbox"/>	check = yes											
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
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MINOR STORM Allowable Capacity is based on Depth Criterion													
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Minor Storm	Major Storm												
<input style="width: 50px;" type="text" value="10.5"/>	<input style="width: 50px;" type="text" value="102.7"/>	cfs											

INLET ON A CONTINUOUS GRADE

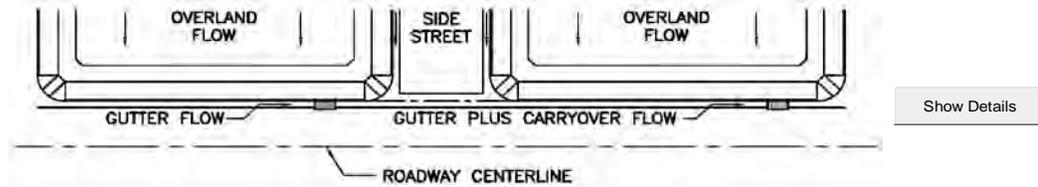
Project: Wise Farms
 Inlet ID: DP C5



Design Information (Input)	MINOR		MAJOR	
	Type of Inlet	Type = CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{LOCAL} = 3.0	3.0	inches	
Total Number of Units in the Inlet (Grate or Curb Opening)	No = 2	2		
Length of a Single Unit Inlet (Grate or Curb Opening)	L _o = 15.00	15.00	ft	
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W _o = N/A	N/A	ft	
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C _{r-G} = N/A	N/A		
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C _{r-C} = 0.10	0.10		
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'				
Total Inlet Interception Capacity	Q = 8.00	33.00	cfs	
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b = 0.0	7.2	cfs	
Capture Percentage = Q_i/Q_o =	C% = 100	82	%	

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: DP 3

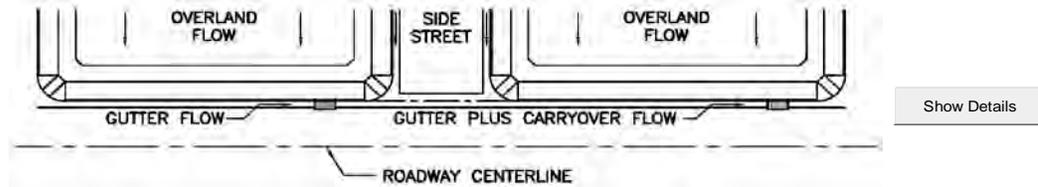


Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		* Q_{Known} =	Minor Storm	Major Storm	
			3.3	21.8	cfs
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.					
Geographic Information: (Enter data in the blue cells):					
Site Type: <input type="radio"/> Site is Urban <input type="radio"/> Site is Non-Urban		Flows Developed For: <input type="radio"/> Street Inlets <input type="radio"/> Area Inlets in a Median		Subcatchment Area = <input type="text"/> Acres Percent Imperviousness = <input type="text"/> % NRCS Soil Type = <input type="text"/> A, B, C, or D	
		Overland Flow = <input type="text"/>		Channel Flow = <input type="text"/>	
		Slope (ft/ft) = <input type="text"/>		Length (ft) = <input type="text"/>	
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$					
		Design Storm Return Period, T_r = <input type="text"/> years		Return Period One-Hour Precipitation, P_1 = <input type="text"/> inches	
		C_1 = <input type="text"/>		C_2 = <input type="text"/>	
		C_3 = <input type="text"/>		User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C = <input type="text"/>	
		User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 = <input type="text"/>		Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b = <input type="text"/> 0.0 <input type="text"/> 0.0 cfs	
		Total Design Peak Flow, Q = <input type="text"/> 3.3 <input type="text"/> 21.8 cfs			

←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
 ←←←

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: DP C6



Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =

Minor Storm	Major Storm
4.1	21.0

 cfs
 * If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Subcatchment Area = Acres
 Percent Imperviousness = %
 NRCS Soil Type = A, B, C, or D

Site Type: Site is Urban Site is Non-Urban
 Flows Developed For: Street Inlets Area Inlets in a Median

Overland Flow =

Slope (ft/ft)	Length (ft)
<input type="text"/>	<input type="text"/>

 Channel Flow =

<input type="text"/>	<input type="text"/>
----------------------	----------------------

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) * C_3$

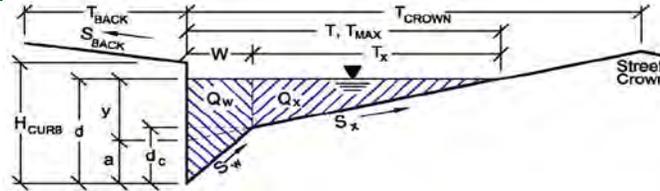
	Minor Storm	Major Storm
Design Storm Return Period, T _r =	<input type="text"/>	<input type="text"/>
Return Period One-Hour Precipitation, P ₁ =	<input type="text"/>	<input type="text"/>
C ₁ =	<input type="text"/>	<input type="text"/>
C ₂ =	<input type="text"/>	<input type="text"/>
C ₃ =	<input type="text"/>	<input type="text"/>
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	<input type="text"/>	<input type="text"/>
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ =	<input type="text"/>	<input type="text"/>
Bypass (Carry-Over) Flow from upstream Subcatchments, Q _b =	6.9	45.7
Total Design Peak Flow, Q =	11.0	66.7

←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
 ←←←

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

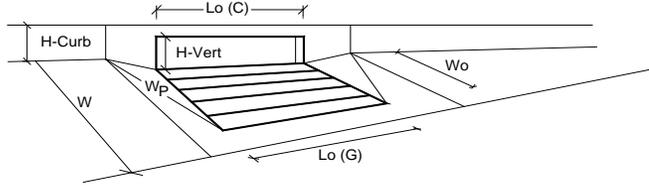
Project: Wise Farms
 Inlet ID: DP C6



Gutter Geometry (Enter data in the blue cells)									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="12.0"/> ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>								
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.8"/> ft								
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.83"/> ft								
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>								
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; border: none;">$T_{MAX} =$</td> <td style="text-align: center; border: none;">Minor Storm</td> <td style="text-align: center; border: none;">Major Storm</td> <td style="border: none;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50px;">17.8</td> <td style="border: 1px solid black; width: 50px;">17.8</td> <td style="border: 1px solid black; width: 50px;">17.8</td> <td style="border: none;">ft</td> </tr> </table>	$T_{MAX} = $	Minor Storm	Major Storm		17.8	17.8	17.8	ft
$T_{MAX} = $	Minor Storm	Major Storm							
17.8	17.8	17.8	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; border: none;">$d_{MAX} =$</td> <td style="text-align: center; border: none;">Minor Storm</td> <td style="text-align: center; border: none;">Major Storm</td> <td style="border: none;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50px;">6.0</td> <td style="border: 1px solid black; width: 50px;">6.0</td> <td style="border: 1px solid black; width: 50px;">12.0</td> <td style="border: none;">inches</td> </tr> </table>	$d_{MAX} = $	Minor Storm	Major Storm		6.0	6.0	12.0	inches
$d_{MAX} = $	Minor Storm	Major Storm							
6.0	6.0	12.0	inches						
Allow Flow Depth at Street Crown (leave blank for no)	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; border: none;"><input checked="" type="checkbox"/></td> <td style="text-align: center; border: none;"><input checked="" type="checkbox"/></td> <td style="border: none;">check = yes</td> </tr> </table>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes							
MINOR STORM Allowable Capacity is based on Depth Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
$Q_{allow} = $	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; border: none;">Minor Storm</td> <td style="text-align: center; border: none;">Major Storm</td> <td style="border: none;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50px;">SUMP</td> <td style="border: 1px solid black; width: 50px;">SUMP</td> <td style="border: none;">cfs</td> </tr> </table>	Minor Storm	Major Storm		SUMP	SUMP	cfs		
Minor Storm	Major Storm								
SUMP	SUMP	cfs							

INLET IN A SUMP OR SAG LOCATION

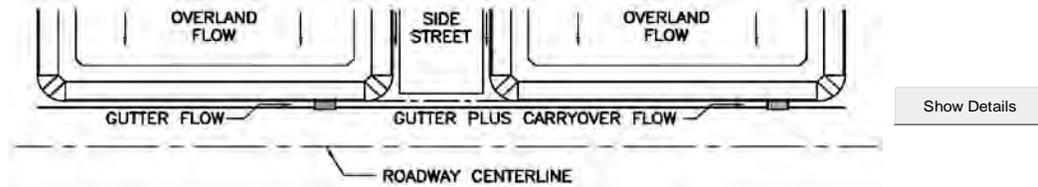
Project = Wise Farms
 Inlet ID = DP C6



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow)	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	2	2	
Water Depth at Flowline (outside of local depression)	6.0	12.0	inches
	MINOR MAJOR		Override Depths
Grate Information			
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information			
Length of a Unit Curb Opening	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.83	2.83	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)			
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	15.2	79.9	cfs
	11.0	66.7	cfs

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: DP C7



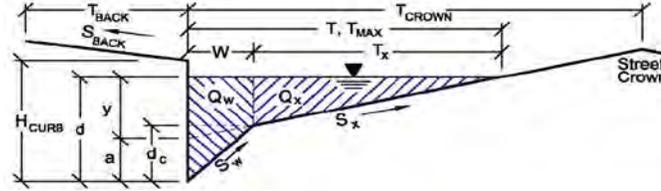
Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		*Q _{Known} =	Minor Storm	Major Storm	
			2.8	14.1	cfs
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.					
Geographic Information: (Enter data in the blue cells):					
Site Type: <input type="radio"/> Site is Urban <input type="radio"/> Site is Non-Urban		Flows Developed For: <input type="radio"/> Street Inlets <input type="radio"/> Area Inlets in a Median		Subcatchment Area = <input type="text"/> Acres Percent Imperviousness = <input type="text"/> % NRCS Soil Type = <input type="text"/> A, B, C, or D	
		Overland Flow = <input type="text"/>		Channel Flow = <input type="text"/>	
		Slope (ft/ft) = <input type="text"/>		Length (ft) = <input type="text"/>	
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$					
		Design Storm Return Period, T _r = <input type="text"/> years		Return Period One-Hour Precipitation, P ₁ = <input type="text"/> inches	
		C ₁ = <input type="text"/>		C ₂ = <input type="text"/>	
		C ₃ = <input type="text"/>		C ₅ = <input type="text"/>	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C = <input type="text"/>		User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ = <input type="text"/>		Bypass (Carry-Over) Flow from upstream Subcatchments, Q _b = <input type="text"/> cfs	
		Total Design Peak Flow, Q = <input type="text"/>		Total Design Peak Flow, Q = <input type="text"/> cfs	
		2.8		14.1	

←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
 ←←←

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

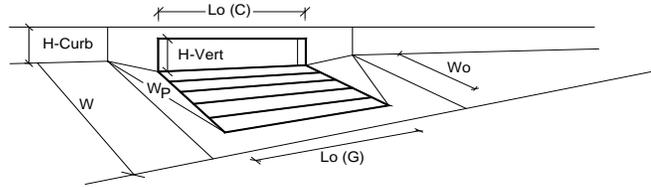
Project: Wise Farms
 Inlet ID: DP C7



Gutter Geometry (Enter data in the blue cells)									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="12.0"/> ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>								
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.8"/> ft								
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.83"/> ft								
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>								
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; border: none;">$T_{MAX} =$</td> <td style="text-align: center; border: none;">Minor Storm</td> <td style="text-align: center; border: none;">Major Storm</td> <td style="border: none;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50px;">17.8</td> <td style="border: 1px solid black; width: 50px;">17.8</td> <td style="border: 1px solid black; width: 50px;">17.8</td> <td style="border: none;">ft</td> </tr> </table>	$T_{MAX} = $	Minor Storm	Major Storm		17.8	17.8	17.8	ft
$T_{MAX} = $	Minor Storm	Major Storm							
17.8	17.8	17.8	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; border: none;">$d_{MAX} =$</td> <td style="text-align: center; border: none;">Minor Storm</td> <td style="text-align: center; border: none;">Major Storm</td> <td style="border: none;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50px;">6.0</td> <td style="border: 1px solid black; width: 50px;">6.0</td> <td style="border: 1px solid black; width: 50px;">12.0</td> <td style="border: none;">inches</td> </tr> </table>	$d_{MAX} = $	Minor Storm	Major Storm		6.0	6.0	12.0	inches
$d_{MAX} = $	Minor Storm	Major Storm							
6.0	6.0	12.0	inches						
Allow Flow Depth at Street Crown (leave blank for no)	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; border: none;"><input checked="" type="checkbox"/></td> <td style="text-align: center; border: none;"><input checked="" type="checkbox"/></td> <td style="border: none;">check = yes</td> </tr> </table>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes							
MINOR STORM Allowable Capacity is based on Depth Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
$Q_{allow} = $	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center; border: none;">Minor Storm</td> <td style="text-align: center; border: none;">Major Storm</td> <td style="border: none;"></td> </tr> <tr> <td style="border: 1px solid black; width: 50px;">SUMP</td> <td style="border: 1px solid black; width: 50px;">SUMP</td> <td style="border: none;">cfs</td> </tr> </table>	Minor Storm	Major Storm		SUMP	SUMP	cfs		
Minor Storm	Major Storm								
SUMP	SUMP	cfs							

INLET IN A SUMP OR SAG LOCATION

Project = Wise Farms
 Inlet ID = DP C7

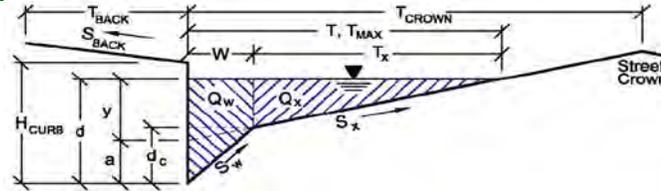


Design Information (Input)	MINOR		MAJOR		
Type of Inlet	CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{local} =$	3.00	3.00	inches	
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches	<input type="checkbox"/> Override Depths
Grate Information	MINOR		MAJOR		
Length of a Unit Grate	$L_g (G) =$	N/A	N/A	feet	
Width of a Unit Grate	$W_o =$	N/A	N/A	feet	
Area Opening Ratio for a Grate (typical values 0.15-0.90)	$A_{ratio} =$	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_l (G) =$	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w (G) =$	N/A	N/A		
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o (G) =$	N/A	N/A		
Curb Opening Information	MINOR		MAJOR		
Length of a Unit Curb Opening	$L_c (C) =$	10.00	10.00	feet	
Height of Vertical Curb Opening in Inches	$H_{vert} =$	6.00	6.00	inches	
Height of Curb Orifice Throat in Inches	$H_{throat} =$	6.00	6.00	inches	
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees	
Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.83	2.83	feet	
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_l (C) =$	0.10	0.10		
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w (C) =$	3.60	3.60		
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_o (C) =$	0.67	0.67		
Total Inlet Interception Capacity (assumes clogged condition)	MINOR		MAJOR		
	$Q_a =$	6.5	25.5	cfs	
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK REQUIRED} =$	2.8	14.1	cfs	

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

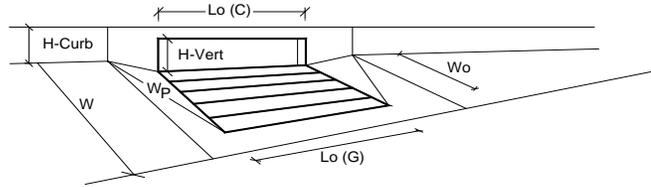
Project: Wise Farms
 Inlet ID: DP 3



Gutter Geometry (Enter data in the blue cells)																	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="12.0"/> ft																
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft																
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>																
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches																
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.8"/> ft																
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.83"/> ft																
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft																
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft																
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft																
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>																
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: right;">ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="12.0"/></td> <td style="text-align: right;">inches</td> </tr> <tr> <td>Allow Flow Depth at Street Crown (leave blank for no)</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: right;">check = yes</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} = $	<input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft	$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches	Allow Flow Depth at Street Crown (leave blank for no)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes
	Minor Storm	Major Storm															
$T_{MAX} = $	<input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft														
$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches														
Allow Flow Depth at Street Crown (leave blank for no)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes														
MINOR STORM Allowable Capacity is based on Depth Criterion	$Q_{allow} = $ <input style="width: 50px;" type="text" value="SUMP"/> <input style="width: 50px;" type="text" value="SUMP"/> cfs																
MAJOR STORM Allowable Capacity is based on Depth Criterion																	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak' Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'																	

INLET IN A SUMP OR SAG LOCATION

Project = Wise Farms
 Inlet ID = DP 3

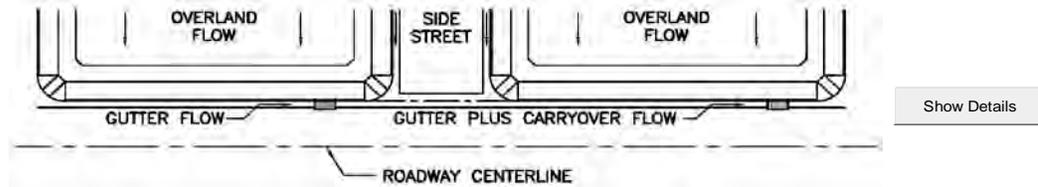


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a _{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches
Grate Information		MINOR	MAJOR	<input type="checkbox"/> Override Depths
Length of a Unit Grate	L _g (G) =	N/A	N/A	feet
Width of a Unit Grate	W _g =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A _{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C _f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C _w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C _o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L _c (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H _{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H _{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W _p =	2.83	2.83	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C _f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C _w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C _o (C) =	0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)		MINOR	MAJOR	
	Q _a =	8.7	25.5	cfs
	Q _{PEAK REQUIRED} =	3.3	21.8	cfs

Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: E2



Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm
*Q _{Known} =	5.8	23.3
cfs		

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Site Type: <input type="radio"/> Site is Urban <input type="radio"/> Site is Non-Urban	Flows Developed For: <input type="radio"/> Street Inlets <input type="radio"/> Area Inlets in a Median	Subcatchment Area = <input type="text"/> Acres Percent Imperviousness = <input type="text"/> % NRCS Soil Type = <input type="text"/> A, B, C, or D
		Slope (ft/ft) Length (ft)
		Overland Flow = <input type="text"/> <input type="text"/> Channel Flow = <input type="text"/> <input type="text"/>

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T_r =	<input type="text"/>	<input type="text"/>
Return Period One-Hour Precipitation, P_1 =	<input type="text"/>	<input type="text"/>
C_1 =	<input type="text"/>	<input type="text"/>
C_2 =	<input type="text"/>	<input type="text"/>
C_3 =	<input type="text"/>	<input type="text"/>
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	<input type="text"/>	<input type="text"/>
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	<input type="text"/>	<input type="text"/>
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0
	cfs	
Total Design Peak Flow, Q =	5.8	23.3
	cfs	

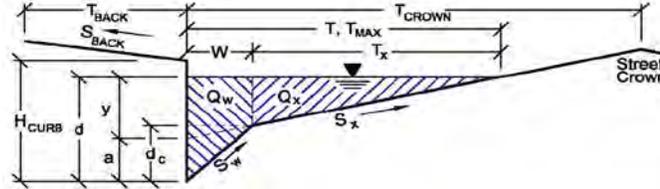
←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:
Inlet ID:

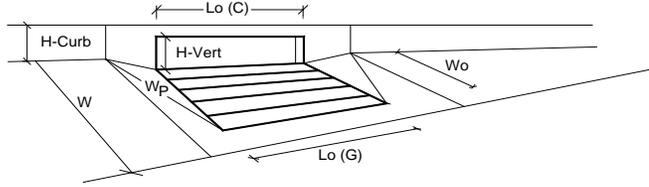
Wise Farms
E2



Gutter Geometry (Enter data in the blue cells)																	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="12.0"/> ft																
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft																
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>																
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches																
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.8"/> ft																
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.83"/> ft																
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft																
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft																
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft																
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>																
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: right;">ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="12.0"/></td> <td style="text-align: right;">inches</td> </tr> <tr> <td></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: right;">check = yes</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} = $	<input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft	$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes
	Minor Storm	Major Storm															
$T_{MAX} = $	<input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft														
$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches														
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes														
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm																	
Allow Flow Depth at Street Crown (leave blank for no)																	
MINOR STORM Allowable Capacity is based on Depth Criterion																	
MAJOR STORM Allowable Capacity is based on Depth Criterion																	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'																	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'																	
$Q_{allow} = $	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: right;">cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm			<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs								
	Minor Storm	Major Storm															
	<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs														

INLET IN A SUMP OR SAG LOCATION

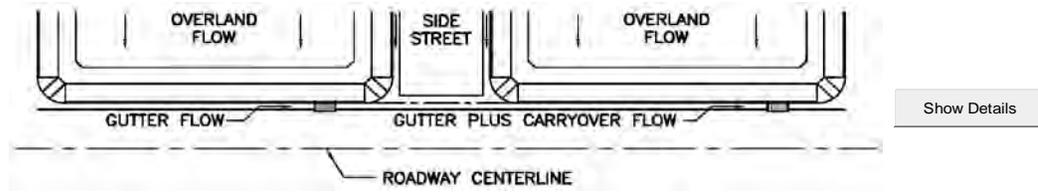
Project = Wise Farms
 Inlet ID = E2



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	2	2	
Water Depth at Flowline (outside of local depression)	6.0	12.0	inches
	MINOR MAJOR		Override Depths
Grate Information			
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information			
Length of a Unit Curb Opening	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.83	2.83	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
	MINOR MAJOR		
Total Inlet Interception Capacity (assumes clogged condition)	8.7	25.5	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	5.8	23.3	cfs

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: E3



Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =

Minor Storm	Major Storm
5.4	23.7

 cfs
 * If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Subcatchment Area = Acres
 Percent Imperviousness = %
 NRCS Soil Type = A, B, C, or D

Site Type: Site is Urban
 Site is Non-Urban

Flows Developed For: Street Inlets
 Area Inlets in a Median

Overland Flow =

Slope (ft/ft)	Length (ft)
<input type="text"/>	<input type="text"/>

 Channel Flow =

<input type="text"/>	<input type="text"/>
----------------------	----------------------

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T _r =	<input type="text"/>	<input type="text"/>
Return Period One-Hour Precipitation, P ₁ =	<input type="text"/>	<input type="text"/>
C ₁ =	<input type="text"/>	<input type="text"/>
C ₂ =	<input type="text"/>	<input type="text"/>
C ₃ =	<input type="text"/>	<input type="text"/>
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	<input type="text"/>	<input type="text"/>
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ =	<input type="text"/>	<input type="text"/>
Bypass (Carry-Over) Flow from upstream Subcatchments, Q _b =	0.0	0.0
Total Design Peak Flow, Q =	5.4	23.7

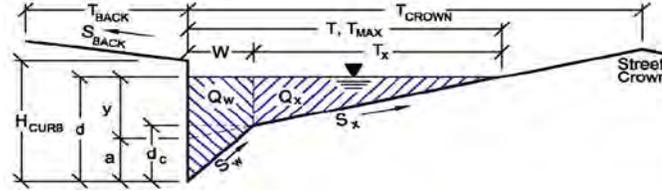
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 FILL IN THE SECTIONS BELOW.
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Wise Farms

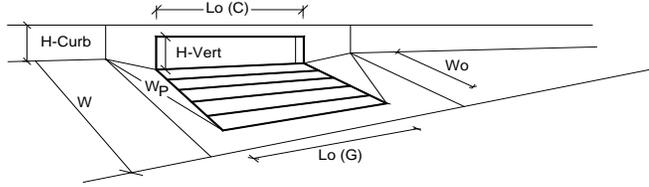
Inlet ID: E3



Gutter Geometry (Enter data in the blue cells)									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="12.0"/> ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>								
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.8"/> ft								
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.83"/> ft								
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft								
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft								
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>								
Max. Allowable Spread for Minor & Major Storm	<table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td>$T_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: right;">ft</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} = $	<input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft
	Minor Storm	Major Storm							
$T_{MAX} = $	<input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td>$d_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="12.0"/></td> <td style="text-align: right;">inches</td> </tr> </table>		Minor Storm	Major Storm		$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches
	Minor Storm	Major Storm							
$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches						
Allow Flow Depth at Street Crown (leave blank for no)	<table style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: right;">check = yes</td> </tr> </table>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes					
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes							
MINOR STORM Allowable Capacity is based on Depth Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'									
$Q_{allow} = $	<table style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: right;">cfs</td> </tr> </table>		Minor Storm	Major Storm			<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs
	Minor Storm	Major Storm							
	<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs						

INLET IN A SUMP OR SAG LOCATION

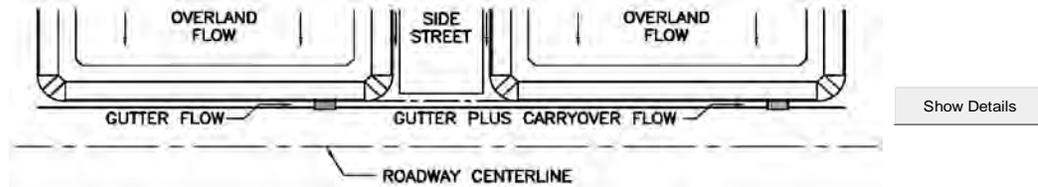
Project = Wise Farms
 Inlet ID = E3



Design Information (Input)	MINOR		MAJOR		
Type of Inlet	CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{local} =$	3.00	3.00		inches
Number of Unit Inlets (Grate or Curb Opening)	$N_o =$	1	1		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0		inches
Grate Information					<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate	$L_o (G) =$	N/A	N/A		feet
Width of a Unit Grate	$W_o =$	N/A	N/A		feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	$A_{ratio} =$	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_l (G) =$	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w (G) =$	N/A	N/A		
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o (G) =$	N/A	N/A		
Curb Opening Information					
Length of a Unit Curb Opening	$L_o (C) =$	10.00	10.00		feet
Height of Vertical Curb Opening in Inches	$H_{vert} =$	6.00	6.00		inches
Height of Curb Orifice Throat in Inches	$H_{throat} =$	6.00	6.00		inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40		degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.83	2.83		feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_l (C) =$	0.10	0.10		
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w (C) =$	3.60	3.60		
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_o (C) =$	0.67	0.67		
Total Inlet Interception Capacity (assumes clogged condition)	$Q_a =$	6.5	25.5		cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK REQUIRED} =$	5.4	23.7		cfs

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: E4



Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =

Minor Storm	Major Storm
3.8	17.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Subcatchment Area = Acres
 Percent Imperviousness = %
 NRCS Soil Type = A, B, C, or D

Site Type: Site is Urban
 Site is Non-Urban

Flows Developed For: Street Inlets
 Area Inlets in a Median

Overland Flow =

Slope (ft/ft)	Length (ft)
<input type="text"/>	<input type="text"/>

 Channel Flow =

<input type="text"/>	<input type="text"/>
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Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T _r =	<input type="text"/>	<input type="text"/>	years
Return Period One-Hour Precipitation, P ₁ =	<input type="text"/>	<input type="text"/>	inches
C ₁ =	<input type="text"/>	<input type="text"/>	
C ₂ =	<input type="text"/>	<input type="text"/>	
C ₃ =	<input type="text"/>	<input type="text"/>	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	<input type="text"/>	<input type="text"/>	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ =	<input type="text"/>	<input type="text"/>	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q _b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	3.8	17.0	cfs

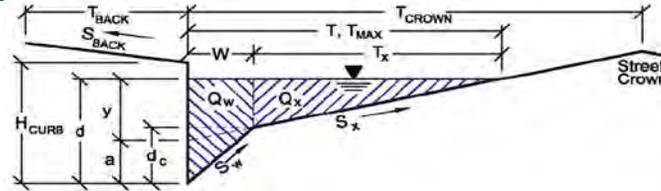
←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: Wise Farms

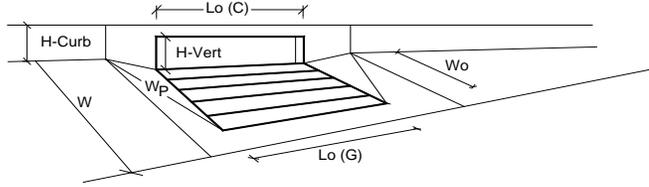
Inlet ID: E4



Gutter Geometry (Enter data in the blue cells)																	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = $ <input style="width: 50px;" type="text" value="12.0"/> ft																
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft																
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = $ <input style="width: 50px;" type="text" value="0.020"/>																
Height of Curb at Gutter Flow Line	$H_{CURB} = $ <input style="width: 50px;" type="text" value="6.00"/> inches																
Distance from Curb Face to Street Crown	$T_{CROWN} = $ <input style="width: 50px;" type="text" value="17.8"/> ft																
Gutter Width	$W = $ <input style="width: 50px;" type="text" value="2.83"/> ft																
Street Transverse Slope	$S_x = $ <input style="width: 50px;" type="text" value="0.020"/> ft/ft																
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = $ <input style="width: 50px;" type="text" value="0.083"/> ft/ft																
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = $ <input style="width: 50px;" type="text" value="0.000"/> ft/ft																
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = $ <input style="width: 50px;" type="text" value="0.016"/>																
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="17.8"/></td> <td style="text-align: right;">ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="6.0"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="12.0"/></td> <td style="text-align: right;">inches</td> </tr> <tr> <td></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td style="text-align: right;">check = yes</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} = $	<input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft	$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes
	Minor Storm	Major Storm															
$T_{MAX} = $	<input style="width: 50px;" type="text" value="17.8"/>	<input style="width: 50px;" type="text" value="17.8"/>	ft														
$d_{MAX} = $	<input style="width: 50px;" type="text" value="6.0"/>	<input style="width: 50px;" type="text" value="12.0"/>	inches														
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	check = yes														
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm																	
Allow Flow Depth at Street Crown (leave blank for no)																	
MINOR STORM Allowable Capacity is based on Depth Criterion																	
MAJOR STORM Allowable Capacity is based on Depth Criterion																	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'																	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'																	
$Q_{allow} = $	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;"></th> <th style="width: 25%; text-align: center;">Minor Storm</th> <th style="width: 25%; text-align: center;">Major Storm</th> <th style="width: 10%;"></th> </tr> </thead> <tbody> <tr> <td></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: center;"><input style="width: 50px;" type="text" value="SUMP"/></td> <td style="text-align: right;">cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm			<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs								
	Minor Storm	Major Storm															
	<input style="width: 50px;" type="text" value="SUMP"/>	<input style="width: 50px;" type="text" value="SUMP"/>	cfs														

INLET IN A SUMP OR SAG LOCATION

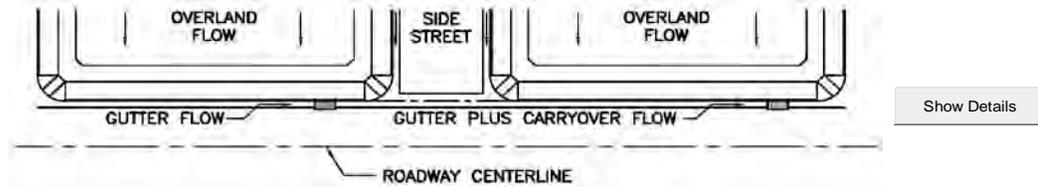
Project = Wise Farms
 Inlet ID = E4



Design Information (Input)	MINOR		MAJOR		
Type of Inlet	CDOT Type R Curb Opening				
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	$a_{local} =$	3.00	3.00		inches
Number of Unit Inlets (Grate or Curb Opening)	$N_o =$	1	1		
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0		inches
Grate Information					<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate	$L_o (G) =$	N/A	N/A		feet
Width of a Unit Grate	$W_o =$	N/A	N/A		feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	$A_{ratio} =$	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	$C_l (G) =$	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	$C_w (G) =$	N/A	N/A		
Grate Orifice Coefficient (typical value 0.60 - 0.80)	$C_o (G) =$	N/A	N/A		
Curb Opening Information					
Length of a Unit Curb Opening	$L_o (C) =$	10.00	10.00		feet
Height of Vertical Curb Opening in Inches	$H_{vert} =$	6.00	6.00		inches
Height of Curb Orifice Throat in Inches	$H_{throat} =$	6.00	6.00		inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40		degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	$W_p =$	2.83	2.83		feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	$C_l (C) =$	0.10	0.10		
Curb Opening Weir Coefficient (typical value 2.3-3.7)	$C_w (C) =$	3.60	3.60		
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	$C_o (C) =$	0.67	0.67		
Total Inlet Interception Capacity (assumes clogged condition)	$Q_a =$	6.5	25.5		cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	$Q_{PEAK REQUIRED} =$	3.8	17.0		cfs

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: E6



Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel): *Q_{Known} =

Minor Storm	Major Storm
1.9	8.0

 cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

Subcatchment Area = Acres
 Percent Imperviousness = %
 NRCS Soil Type = A, B, C, or D

Site Type: Site is Urban Site is Non-Urban

Flows Developed For: Street Inlets Area Inlets in a Median

Overland Flow =

Slope (ft/ft)	Length (ft)
<input type="text"/>	<input type="text"/>

Channel Flow =

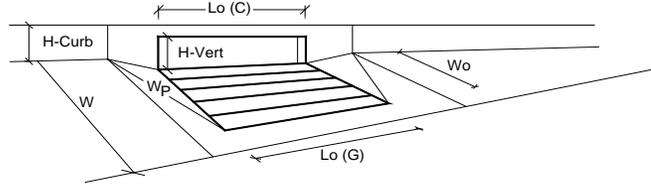
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$

	Minor Storm	Major Storm
Design Storm Return Period, T _r =	<input type="text"/>	<input type="text"/>
Return Period One-Hour Precipitation, P ₁ =	<input type="text"/>	<input type="text"/>
C ₁ =	<input type="text"/>	<input type="text"/>
C ₂ =	<input type="text"/>	<input type="text"/>
C ₃ =	<input type="text"/>	<input type="text"/>
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	<input type="text"/>	<input type="text"/>
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ =	<input type="text"/>	<input type="text"/>
Bypass (Carry-Over) Flow from upstream Subcatchments, Q _b =	0.0	0.0
Total Design Peak Flow, Q =	1.9	8.0

←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
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INLET IN A SUMP OR SAG LOCATION

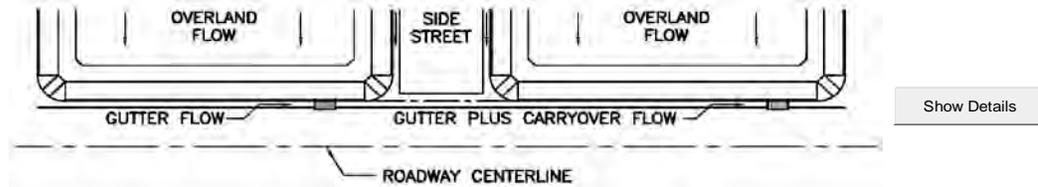
Project = Wise Farms
 Inlet ID = E6



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	6.0	12.0	inches
	MINOR MAJOR		Override Depths
Grate Information			
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information			
Length of a Unit Curb Opening	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.83	2.83	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
	MINOR MAJOR		
Total Inlet Interception Capacity (assumes clogged condition)	4.5	12.3	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	1.9	8.0	cfs

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: E7



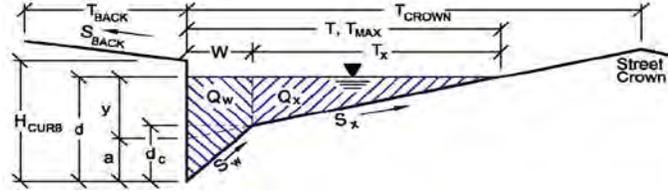
Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		*Q _{Known} =	Minor Storm	Major Storm	
			1.5	14.8	cfs
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.					
Geographic Information: (Enter data in the blue cells):					
Site Type: <input type="radio"/> Site is Urban <input type="radio"/> Site is Non-Urban		Flows Developed For: <input type="radio"/> Street Inlets <input type="radio"/> Area Inlets in a Median		Subcatchment Area = <input type="text"/> Acres Percent Imperviousness = <input type="text"/> % NRCS Soil Type = <input type="text"/> A, B, C, or D	
		Overland Flow = <input type="text"/> Slope (ft/ft) <input type="text"/> Length (ft)			
		Channel Flow = <input type="text"/>			
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$					
		Design Storm Return Period, T _r = <input type="text"/> years		Minor Storm Major Storm	
		Return Period One-Hour Precipitation, P ₁ = <input type="text"/> inches			
		C ₁ = <input type="text"/>			
		C ₂ = <input type="text"/>			
		C ₃ = <input type="text"/>			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C = <input type="text"/>					
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ = <input type="text"/>					
		Bypass (Carry-Over) Flow from upstream Subcatchments, Q _b = <input type="text"/> 0.0		<input type="text"/> 0.0 cfs	
		Total Design Peak Flow, Q = <input type="text"/> 1.5		<input type="text"/> 14.8 cfs	

←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
 ←←←

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

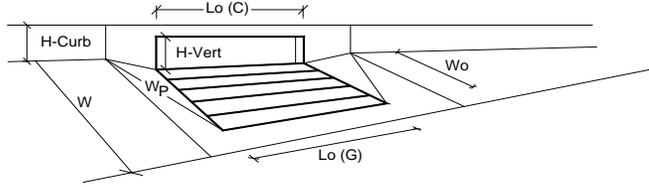
Project: Wise Farms
 Inlet ID: E7



Gutter Geometry (Enter data in the blue cells)	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 12.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.8$ ft
Gutter Width	$W = 2.83$ ft
Street Transverse Slope	$S_x = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = 17.8$ ft (Minor Storm) / 17.8 ft (Major Storm)
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = 6.0$ inches (Minor Storm) / 12.0 inches (Major Storm)
Allow Flow Depth at Street Crown (leave blank for no)	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> check = yes
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'	
$Q_{allow} =$	Minor Storm: SUMP cfs / Major Storm: SUMP cfs

INLET IN A SUMP OR SAG LOCATION

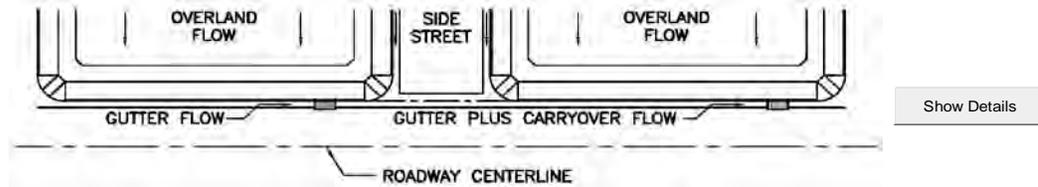
Project = Wise Farms
 Inlet ID = E7



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	6.0	12.0	inches
	MINOR MAJOR		Override Depths
Grate Information			
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information			
Length of a Unit Curb Opening	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.83	2.83	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
	MINOR MAJOR		
Total Inlet Interception Capacity (assumes clogged condition)	6.5	25.5	cfs
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	1.5	14.8	cfs

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: E8



Design Flow: ONLY if already determined through other methods:
 (local peak flow for 1/2 of street OR grass-lined channel): * Q_{Known} =

Minor Storm	Major Storm
2.4	9.3

 cfs
 * If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

Geographic Information: (Enter data in the blue cells):

Subcatchment Area = Acres
 Percent Imperviousness = %
 NRCS Soil Type = A, B, C, or D

Site Type: Site is Urban
 Site is Non-Urban

Flows Developed For: Street Inlets
 Area Inlets in a Median

Overland Flow =

Slope (ft/ft)	Length (ft)
<input type="text"/>	<input type="text"/>

 Channel Flow =

<input type="text"/>	<input type="text"/>
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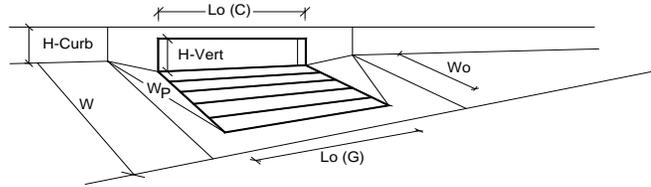
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =	<input type="text"/>	<input type="text"/>	years
Return Period One-Hour Precipitation, P_1 =	<input type="text"/>	<input type="text"/>	inches
C_1 =	<input type="text"/>	<input type="text"/>	
C_2 =	<input type="text"/>	<input type="text"/>	
C_3 =	<input type="text"/>	<input type="text"/>	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =	<input type="text"/>	<input type="text"/>	
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =	<input type="text"/>	<input type="text"/>	
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	2.4	9.3	cfs

←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
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INLET IN A SUMP OR SAG LOCATION

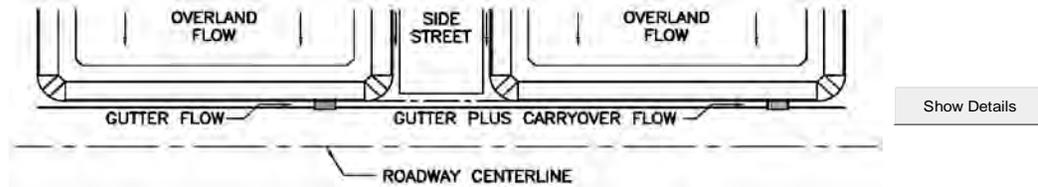
Project = Wise Farms
 Inlet ID = E8



Design Information (Input)	MINOR	MAJOR		
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow)	3.00	3.00	inches	
Number of Unit Inlets (Grate or Curb Opening)	1	1		
Water Depth at Flowline (outside of local depression)	6.0	12.0	inches	
	MINOR MAJOR		Override Depths	
Grate Information				
Length of a Unit Grate	N/A	N/A	feet	
Width of a Unit Grate	N/A	N/A	feet	
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A		
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A		
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A		
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A		
Curb Opening Information				
Length of a Unit Curb Opening	5.00	5.00	feet	
Height of Vertical Curb Opening in Inches	6.00	6.00	inches	
Height of Curb Orifice Throat in Inches	6.00	6.00	inches	
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees	
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.83	2.83	feet	
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10		
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60		
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67		
Total Inlet Interception Capacity (assumes clogged condition)				
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)	4.5	12.3	cfs	
	Q _{PEAK} REQUIRED =	2.4	9.3	cfs

**DESIGN PEAK FLOW FOR ONE-HALF OF STREET
OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD**

Project: Wise Farms
 Inlet ID: E10



Design Flow: ONLY if already determined through other methods: (local peak flow for 1/2 of street OR grass-lined channel):		*Q _{Known} =	Minor Storm	Major Storm	
			1.9	19.1	cfs
* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.					
Geographic Information: (Enter data in the blue cells):					
Site Type: <input type="radio"/> Site is Urban <input type="radio"/> Site is Non-Urban		Flows Developed For: <input type="radio"/> Street Inlets <input type="radio"/> Area Inlets in a Median		Subcatchment Area = <input type="text"/> Acres Percent Imperviousness = <input type="text"/> % NRCS Soil Type = <input type="text"/> A, B, C, or D	
		Overland Flow =	Slope (ft/ft)	Length (ft)	
		Channel Flow =	<input type="text"/>	<input type="text"/>	
Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^{C_3}$		Minor Storm	Major Storm		
Design Storm Return Period, T _r =		<input type="text"/>	<input type="text"/>	years	
Return Period One-Hour Precipitation, P ₁ =		<input type="text"/>	<input type="text"/>	inches	
C ₁ =		<input type="text"/>	<input type="text"/>		
C ₂ =		<input type="text"/>	<input type="text"/>		
C ₃ =		<input type="text"/>	<input type="text"/>		
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =		<input type="text"/>	<input type="text"/>		
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C ₅ =		<input type="text"/>	<input type="text"/>		
Bypass (Carry-Over) Flow from upstream Subcatchments, Q _b =		0.0	0.0	cfs	
Total Design Peak Flow, Q =		1.9	19.1	cfs	

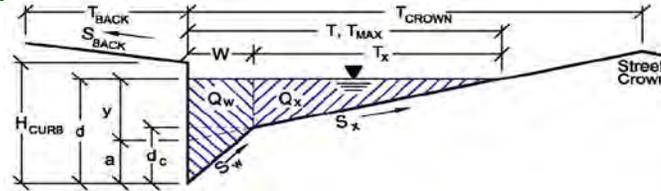
←←← FILL IN THIS SECTION OR...
 FILL IN THE SECTIONS BELOW.
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ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:
Inlet ID:

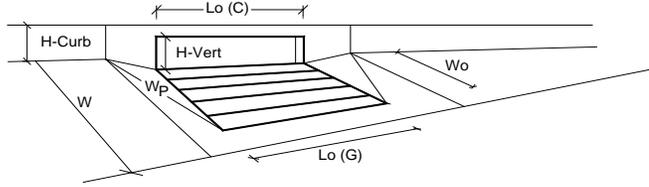
Wise Farms
E10



Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 12.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.8$ ft						
Gutter Width	$W = 2.83$ ft						
Street Transverse Slope	$S_x = 0.020$ ft/ft						
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft						
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.000$ ft/ft						
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$						
Max. Allowable Spread for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td>$T_{MAX} = 17.8$</td> <td>17.8</td> <td>ft</td> </tr> </table>	Minor Storm	Major Storm		$T_{MAX} = 17.8$	17.8	ft
Minor Storm	Major Storm						
$T_{MAX} = 17.8$	17.8	ft					
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td>$d_{MAX} = 6.0$</td> <td>12.0</td> <td>inches</td> </tr> </table>	Minor Storm	Major Storm		$d_{MAX} = 6.0$	12.0	inches
Minor Storm	Major Storm						
$d_{MAX} = 6.0$	12.0	inches					
Allow Flow Depth at Street Crown (leave blank for no)	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> check = yes						
MINOR STORM Allowable Capacity is based on Depth Criterion							
MAJOR STORM Allowable Capacity is based on Depth Criterion							
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'							
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'							
$Q_{allow} =$	<table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td style="border: 1px solid black; padding: 2px;">SUMP</td> <td style="border: 1px solid black; padding: 2px;">SUMP</td> <td>cfs</td> </tr> </table>	Minor Storm	Major Storm		SUMP	SUMP	cfs
Minor Storm	Major Storm						
SUMP	SUMP	cfs					

INLET IN A SUMP OR SAG LOCATION

Project = Wise Farms
 Inlet ID = E10



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	1	1	
Water Depth at Flowline (outside of local depression)	6.0	12.0	inches
Grate Information	MINOR	MAJOR	Override Depths
Length of a Unit Grate	N/A	N/A	feet
Width of a Unit Grate	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	N/A	N/A	
Curb Opening Information	MINOR	MAJOR	
Length of a Unit Curb Opening	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	2.83	2.83	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	0.67	0.67	
Total Inlet Interception Capacity (assumes clogged condition)	MINOR	MAJOR	
Q_a	6.5	25.5	cfs
Q_{PEAK REQUIRED}	1.9	19.1	cfs

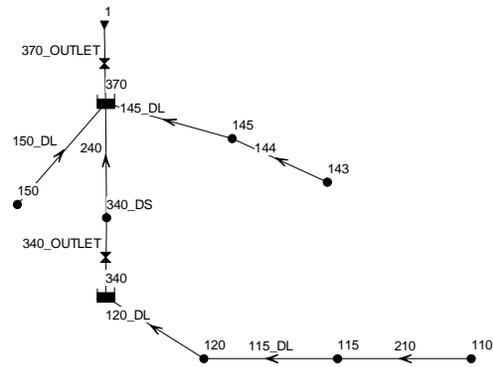
Inlet Capacity IS GOOD for Minor and Major Storms (>Q PEAK)

C. HYDRAULIC COMPUTATION

UHP/SWMM SCHEMATIC
100-YEAR CUHP INPUT / OUTPUT
100-YEAR SWMM INPUT/OUTPUT

Wise Farms

01/01/2005 00:01:00



WISE FARMS~100 YEAR

Summary of CUHP Input Parameters (Version 1.4.2)

Catchment Name/ID	SWMM Node/ID	Raingage Name/ID	Area (sq.mi.)	Dist. to Centroid (miles)	Length (miles)	Slope (ft./ft.)	Percent Imperv.	Depression Storage		Parameters			DCIA Level and Fractions			Percent Eff. Imperv.
								Pervious (inches)	Imperv. (inches)	Initial Rate (in./hr.)	Final Rate (in.hr.)	Decay Coeff. (1/sec.)	DCIA Level	Dir. Con'ct Imperv. Fraction	Receiv. Perv. Fraction	
110	110	100-YR	0.012	0.189	0.308	0.017	13.8	0.40	0.10	4.50	0.50	0.0018	0.00	0.28	0.11	12.66
115	115	100-YR	0.026	0.186	0.341	0.024	37.3	0.40	0.10	4.50	0.50	0.0018	0.00	0.75	0.19	36.10
120	120	100-YR	0.054	0.313	0.492	0.028	33.7	0.40	0.10	4.50	0.50	0.0018	0.00	0.67	0.18	32.38
130	130	100-YR	0.025	0.137	0.284	0.035	11.4	0.40	0.10	4.50	0.50	0.0018	0.00	0.23	0.10	10.36
140	140	100-YR	0.014	0.116	0.189	0.013	5.0	0.40	0.10	4.50	0.50	0.0018	0.00	0.10	0.05	4.47
145	145	100-YR	0.014	0.169	0.314	0.007	30.3	0.40	0.10	4.50	0.50	0.0018	0.00	0.61	0.17	28.91
150	150	100-YR	0.045	0.140	0.313	0.011	36.5	0.40	0.10	4.50	0.50	0.0018	0.00	0.73	0.19	35.27
160	160	100-YR	0.006	0.078	0.098	0.031	5.0	0.40	0.10	4.50	0.50	0.0018	0.00	0.10	0.05	4.47

WISE FARMS ~ 100 YEAR

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 1.4.2)

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		Ct	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
110		0.314	0.149	67.3	9.22	35.0	6.51	15.4	5	27,007	1.74	47,049	60.0	7	47,034	0.99
115		0.192	0.271	21.6	5.99	11.2	4.24	10.0	36	60,440	2.04	123,592	40.0	42	123,574	2.53
120		0.156	0.274	25.8	6.92	13.4	4.89	11.5	63	126,397	2.00	252,550	40.0	76	251,888	2.18
130	119th & RTD	0.256	0.165	34.1	5.83	17.7	4.12	9.7	22	57,644	1.71	98,651	45.0	26	98,613	1.62
140		0.358	0.166	45.8	7.34	23.8	5.19	12.2	9	32,343	1.63	52,807	50.0	11	52,787	1.27
145		0.245	0.204	44.7	8.53	23.3	6.02	14.2	9	32,489	1.95	63,481	50.0	13	63,418	1.47
150		0.162	0.287	17.5	5.35	9.1	3.78	8.9	78	104,834	2.03	213,282	40.0	81	212,079	2.82
160	NE Entrance	0.469	0.146	33.5	5.26	17.4	3.72	8.8	5	13,576	1.63	22,166	45.0	6	22,137	1.58

Wise Farms - 100-Year Full Buildout SWMM5
By CVL Consultants, Inc. - June 2016
WARNING 08: elevation drop exceeds length for Conduit 145_DL
WARNING 08: elevation drop exceeds length for Conduit 150_DL
WARNING 08: elevation drop exceeds length for Conduit 120_DL
WARNING 04: minimum elevation drop used for Conduit 115_DL
WARNING 02: maximum depth increased for Node 340_DS

NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.

Analysis Options

Flow Units CFS
Process Models:
 Rainfall/Runoff NO
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
Flow Routing Method KINWAVE
Starting Date JAN-01-2005 00:00:00
Ending Date JAN-01-2005 02:00:00
Antecedent Dry Days 0.0
Report Time Step 00:01:00
Routing Time Step 60.00 sec

```

*****
Flow Routing Continuity          Volume      Volume
                                acre-feet   10^6 gal
*****                          -----
Dry Weather Inflow .....        0.000      0.000
Wet Weather Inflow .....        0.000      0.000
Groundwater Inflow .....        0.000      0.000
RDII Inflow .....               0.000      0.000
External Inflow .....           14.990     4.885
External Outflow .....           9.809     3.196
Flooding Loss .....             0.000     0.000
Evaporation Loss .....          0.000     0.000
Exfiltration Loss .....         0.000     0.000
Initial Stored Volume ....       0.000     0.000
Final Stored Volume .....        5.173     1.686
Continuity Error (%) .....       0.057

```

```

*****
Highest Flow Instability Indexes
*****
Link 210 (4)
Link 150_DL (1)
Link 240 (1)
Link 120_DL (1)
Link 115_DL (1)

```

```

*****
Routing Time Step Summary
*****
Minimum Time Step      :    60.00 sec
Average Time Step      :    60.00 sec
Maximum Time Step      :    60.00 sec
Percent in Steady State :    0.00
Average Iterations per Step :    1.58
Percent Not Converging :    0.00

```

Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
110	JUNCTION	0.50	0.74	5048.74	0 01:01	0.74
145	JUNCTION	0.00	0.00	5017.00	0 00:00	0.00
150	JUNCTION	0.10	0.10	5014.10	0 00:01	0.10
340_DS	JUNCTION	1.36	2.10	5026.60	0 01:15	2.10
120	JUNCTION	0.00	0.00	5044.00	0 00:00	0.00
115	JUNCTION	0.49	0.74	5044.74	0 01:02	0.74
143	JUNCTION	0.00	0.00	5019.00	0 00:00	0.00
1	OUTFALL	0.00	0.00	5011.73	0 00:00	0.00
370	STORAGE	2.27	3.94	5016.44	0 01:24	3.94
340	STORAGE	1.93	3.39	5034.39	0 01:15	3.39

Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
110	JUNCTION	7.38	7.38	0 01:01	0.236	0.235	0.000
145	JUNCTION	13.13	13.13	0 00:51	0.389	0.388	0.000
150	JUNCTION	81.31	81.31	0 00:41	1.56	1.56	0.000
340_DS	JUNCTION	0.00	74.74	0 01:15	0	2.29	0.000
120	JUNCTION	76.07	123.34	0 00:41	1.81	2.94	0.000
115	JUNCTION	42.15	47.27	0 00:41	0.899	1.13	0.000
143	JUNCTION	0.00	0.00	0 00:00	0	0	0.000
gal							
1	OUTFALL	0.00	103.43	0 01:24	0	3.2	0.000
370	STORAGE	0.00	132.47	0 00:53	0	4.18	-0.015
340	STORAGE	0.00	123.34	0 00:41	0	2.94	-0.004

Node Surcharge Summary

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Feet	Min. Depth Below Rim Feet
110	JUNCTION	2.00	0.736	4.264
145	JUNCTION	2.00	0.000	6.000
150	JUNCTION	2.00	0.100	0.900
340_DS	JUNCTION	2.00	2.098	1.902
120	JUNCTION	2.00	0.000	20.000
115	JUNCTION	2.00	0.736	19.264
143	JUNCTION	2.00	0.000	5.000
370	STORAGE	2.00	3.940	16.060
340	STORAGE	2.00	3.388	16.612

Node Flooding Summary

No nodes were flooded.

Storage Volume Summary

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
370	99.066	11	0	0	171.714	20	0 01:24	103.43
340	84.239	10	0	0	147.657	17	0 01:14	74.74

Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
1	93.33	63.94	103.43	3.196
System	93.33	63.94	103.43	3.196

 Link Flow Summary

Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Veloc ft/sec	Max/ Full Flow	Max/ Full Depth
145_DL	DUMMY	13.13	0 00:51			
150_DL	DUMMY	81.31	0 00:41			
240	CONDUIT	74.71	0 01:17	11.21	0.54	0.52
120_DL	DUMMY	123.34	0 00:41			
115_DL	DUMMY	47.27	0 00:41			
144	CONDUIT	0.00	0 00:00	0.00	0.00	0.00
210	CONDUIT	7.38	0 01:02	5.49	0.13	0.25
370_OUTLET	DUMMY	103.43	0 01:24			
340_OUTLET	DUMMY	74.74	0 01:15			

 Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Thu Jun 02 09:23:28 2016
 Analysis ended on: Thu Jun 02 09:23:28 2016
 Total elapsed time: < 1 sec

WISE FARMS
ERIE, Colorado



D.SWALE DESIGN

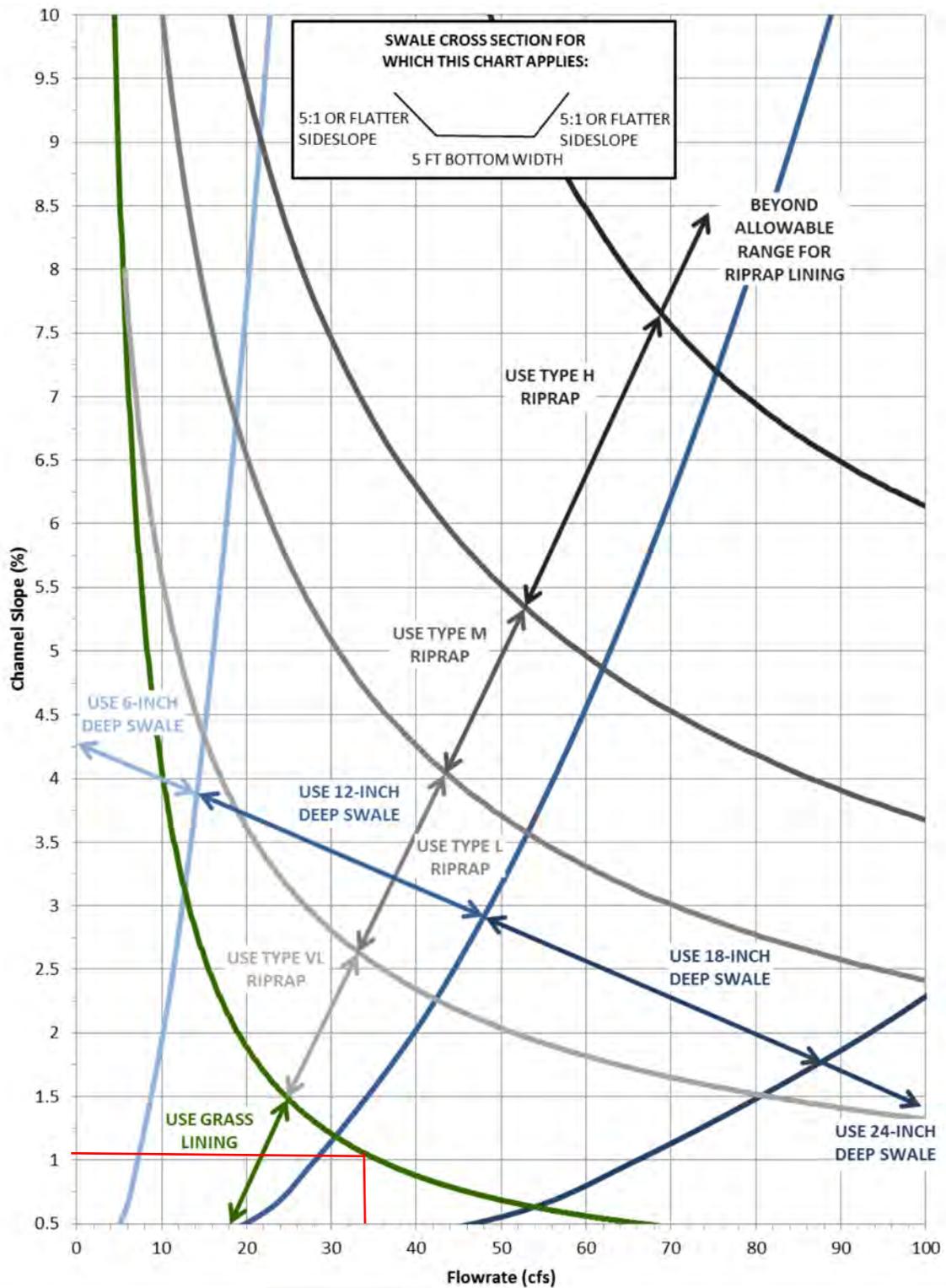


Figure 8-24. Swale stability chart: greater than 4-foot bottom width and side slopes between 5:1 and 10:1

(Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)

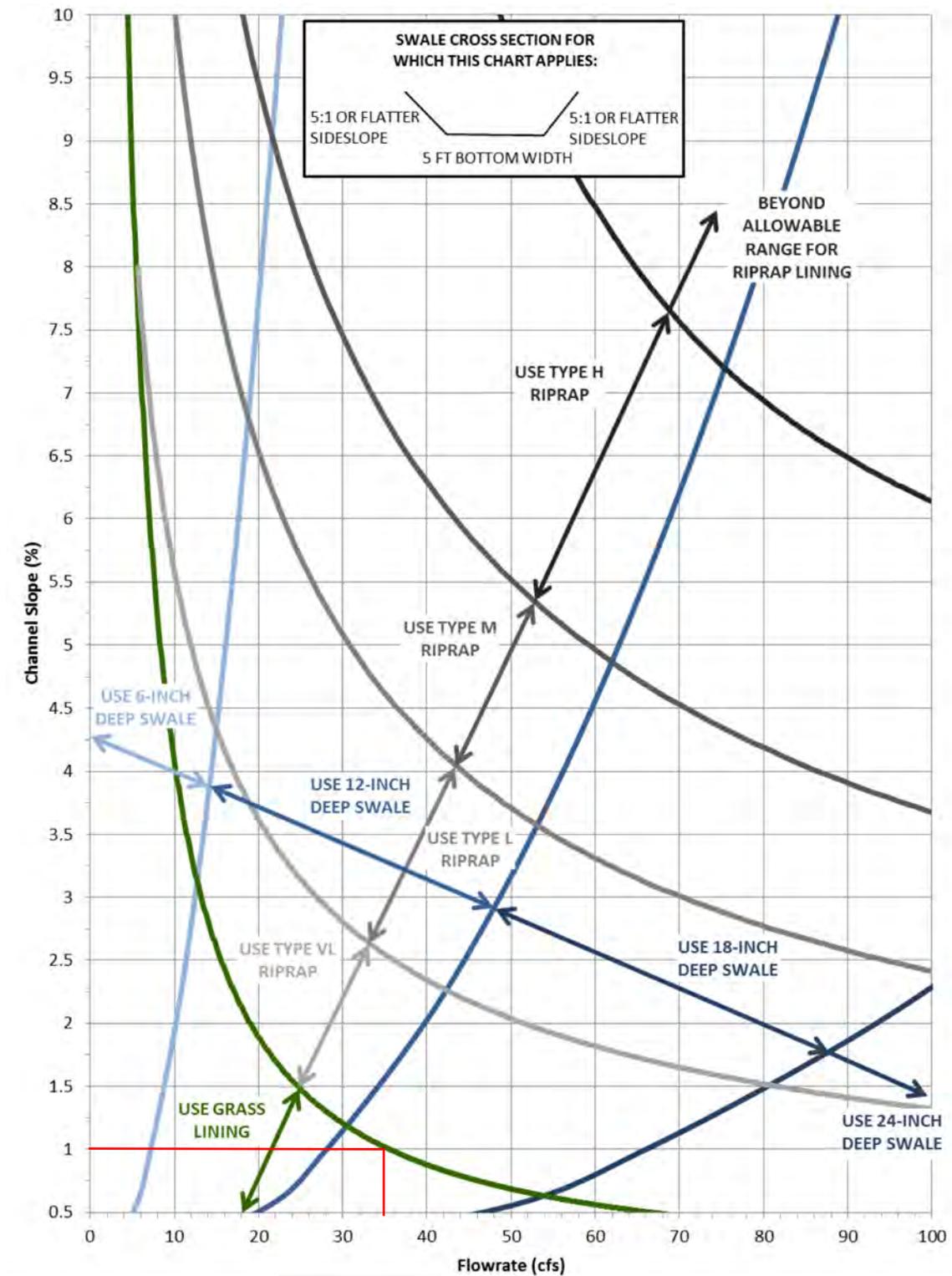


Figure 8-24. Swale stability chart: greater than 4-foot bottom width and side slopes between 5:1 and 10:1

(Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)

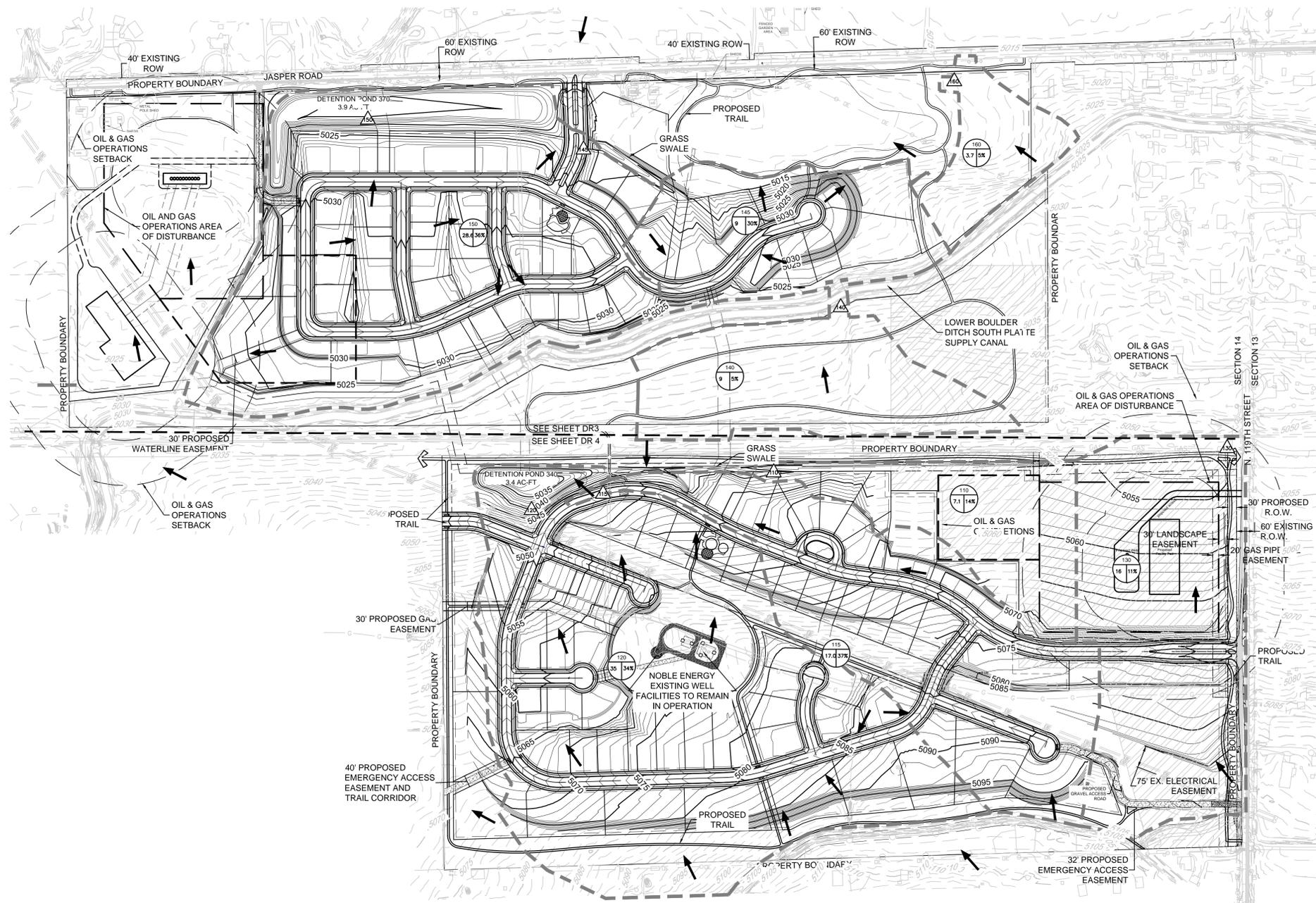
Grass Swale for DP A-1

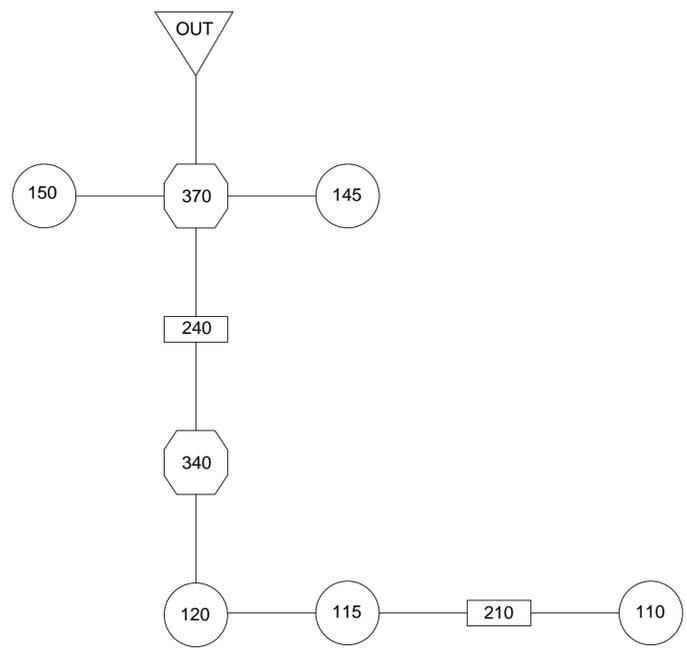
Discharge = 34.2 CFS
Bottom Width = 5 ft
Depth = 18 inch
Side Slope = 5:1
Longitudinal Slope= 1.1%
Top Width = 20 ft
Lining = Grass

Grass Swale for DP 3

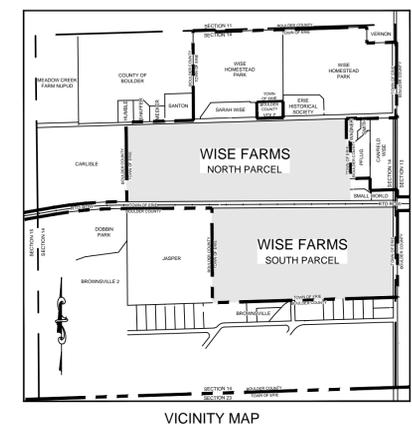
Discharge = 21.8 CFS
Bottom Width = 5 ft
Depth = 18 inch
Side Slope = 5:1
Longitudinal Slope= 1.0%
Top Width = 20 ft
Lining = Grass

E. DRAINAGE MAPS





SWMM SCHEMATIC

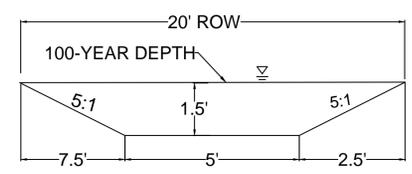


VICINITY MAP

LEGEND

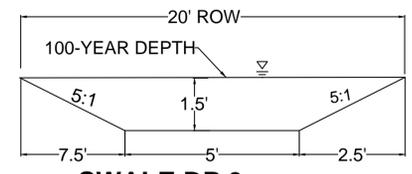
- B BASIN
- J JUNCTION
- C CHANNEL/CONDUIT
- P POND

Q100 = 34.2 CFS
SLOPE = 1.1%



SWALE DP A-1
NO TO SCALE

Q100 = 21.8 CFS
SLOPE = 1.7%

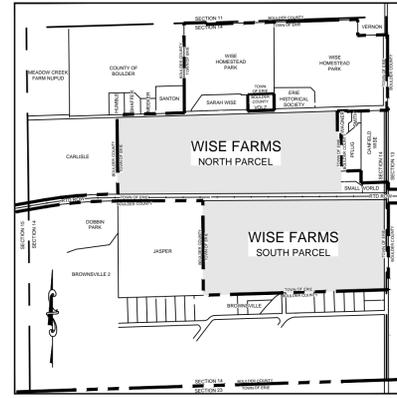
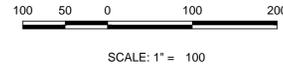


SWALE DP 3
NO TO SCALE

SHEET NUMBER	DRAWN BY:	SCALE:	DATE:	No.	Revisions	Date	Init.	Appr.	Date
D2	ATK	AS SHOWN	JUNE 2016	-	-	-	-	-	-
SWMM SCHEMATIC									
WISE FARMS SUBDIVISION									
DRAINAGE MAP									
JASPER INVESTMENTS, LLC									
C/O JIM DULLEA									
SOUTH KENWOOD COURT									
HIGHLANDS RANCH, CO 80123									
CVL CONSULTANTS									
10333 East Dry Creek Road									
Suite 240									
Englewood, CO 80112									
Tel: (720) 882-9546									
Fax: (720) 882-9546									

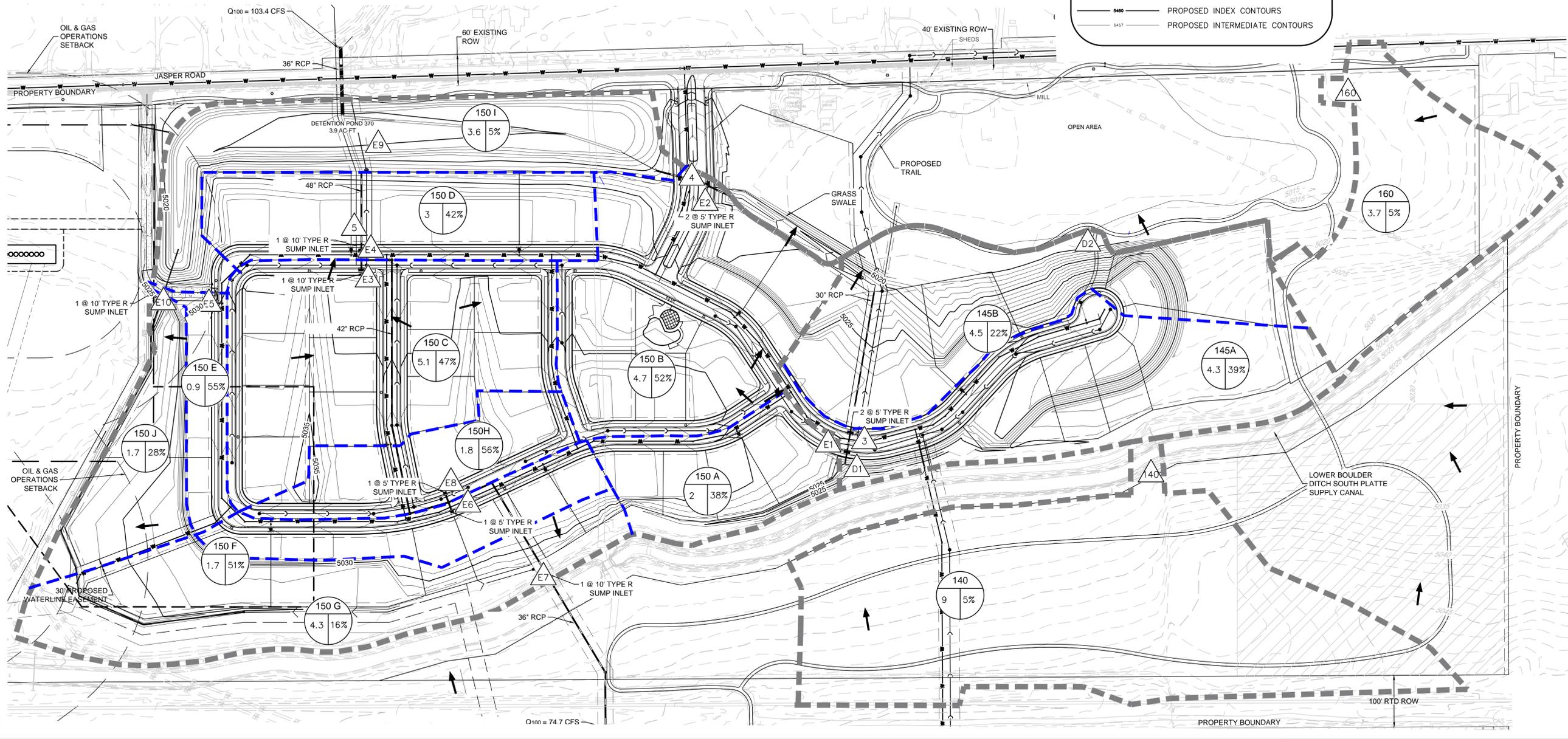
BASIN SUMMARY			
Basin ID	Area (AC)	Q2 (CFS)	Q100 (CFS)
Basin 140	8.91	0.89	25.60
Basin 145A	4.39	3.45	17.11
Basin 145B	4.58	2.40	18.35
Basin 150A	1.99	1.44	7.30
Basin 150B	4.72	5.75	23.35
Basin 150C	5.13	5.42	23.66
Basin 150D	2.96	2.78	13.01
Basin 150E	0.86	1.14	4.48
Basin 150F	1.66	1.94	7.98
Basin 150G	4.30	1.47	14.80
Basin 150H	1.82	2.39	9.34
Basin 150I	3.71	0.40	11.33
Basin 150J	3.06	1.91	19.13
Basin 160	3.74	0.39	11.13

DESIGN POINT SUMMARY			
Design Point	Area (AC)	Q2 (CFS)	Q100 (CFS)
140	8.91	0.89	25.60
160	3.74	0.39	11.13
D2	4.58	2.40	18.35
D1	4.39	3.45	17.11
E1	1.99	1.44	7.30
DP 3	-	4.66	23.29
E2	4.72	5.75	23.35
DP 4	-	8.67	40.44
E7	4.30	1.47	14.80
E6	1.66	3.13	21.72
E8	1.82	5.18	29.90
E3	5.13	5.42	23.66
E5	0.86	1.14	4.48
E4	2.96	3.81	17.03
DP 5	-	12.88	65.63
E10	3.06	1.91	19.13
E9	3.71	0.40	11.33



LEGEND

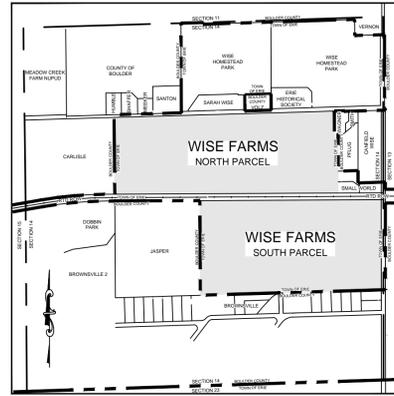
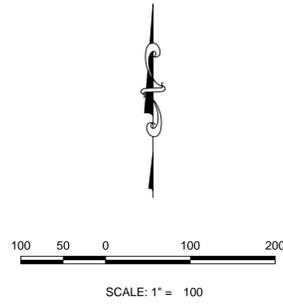
- PROPOSED BASIN
A = BASIN DESIGNATION
B = AREA IN ACRES
C = % IMPERVIOUS
- DESIGN POINT
- FLOW ARROW
- PROPOSED MINOR BOUNDARY LINE
- PROPOSED MAJOR BOUNDARY LINE
- PROPOSED MANHOLE
- PROPOSED STORM DRAINAGE PIPE
- PROPOSED TYPE R INLET
- EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS



SHEET NUMBER	D3		
	DRAWN BY: ATK	CHECKED BY: MRS	DATE: JUNE 2016
SCALE: AS SHOWN	FILE NO: 818.0200001	DRAWING MAP NORTH WISE FARMS SUBDIVISION DRAINAGE MAP	
JASPER INVESTMENTS, LLC C/O JIM DULLEA SOUTH KENWOOD COURT HIGHLANDS RANCH, CO 80123		10333 East Dry Creek Road Suite 240 Englewood, CO 80112 Fax: (720) 882-9546	
CVL CONSULTANTS		No.	Revisions
		Date	Appr. Date

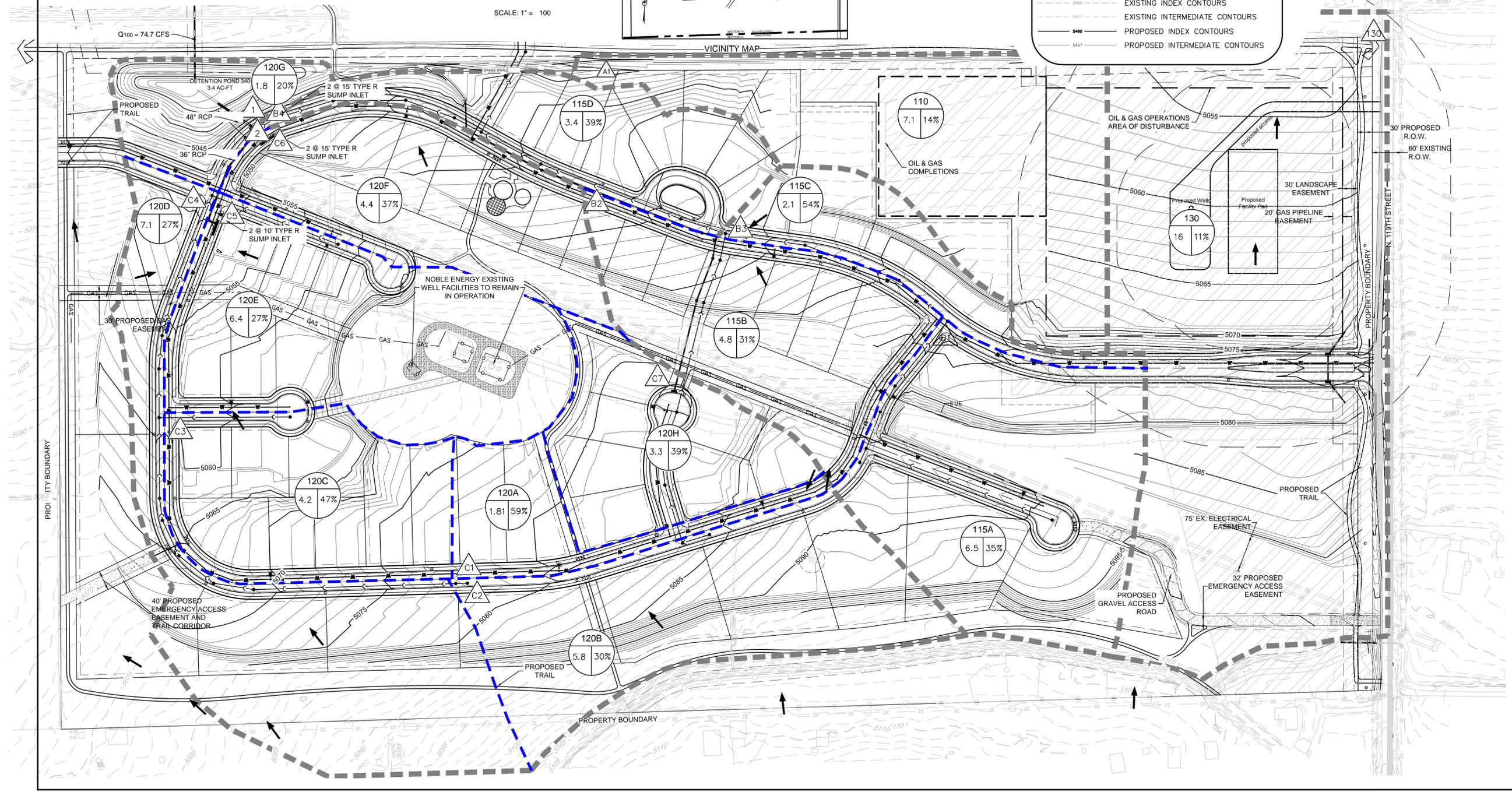
BASIN SUMMARY			
Basin ID	Area (AC)	Q2 (CFS)	Q100 (CFS)
Basin 110	7.10	1.96	21.44
Basin 115A	6.75	5.40	28.80
Basin 115B	4.80	2.67	15.67
Basin 115C	2.10	2.44	9.71
Basin 115D	3.40	2.92	14.45
Basin 120A	1.81	2.44	9.23
Basin 120B	5.81	3.65	21.83
Basin 120C	4.21	4.16	18.25
Basin 120D	7.08	3.67	23.61
Basin 120E	6.43	3.88	25.28
Basin 120F	4.40	4.11	21.05
Basin 120G	1.77	0.67	5.48
Basin 120H	3.29	2.84	14.14
Basin 130	15.88	3.52	47.00

DESIGN POINT SUMMARY			
Design Point	Area (AC)	Q2 (CFS)	Q100 (CFS)
A1	7.10	4.42	33.64
B1	6.75	5.40	28.80
B2	4.80	6.95	38.45
B3	2.10	2.44	9.71
B4	3.40	4.27	19.18
C1	1.81	2.44	9.23
C3	4.21	5.61	23.40
C5	6.43	8.00	40.18
C2	5.81	3.65	21.83
C4	7.08	5.71	35.52
C6	4.40	4.11	21.05
DP 2	0.00	21.01	115.44
DP 1	0.00	24.68	131.98
130	15.88	3.52	47.00



LEGEND

- PROPOSED BASIN
A = BASIN DESIGNATION
B = AREA IN ACRES
C = % IMPERVIOUS
- DESIGN POINT
- FLOW ARROW
- PROPOSED MINOR BOUNDARY LINE
- PROPOSED MAJOR BOUNDARY LINE
- PROPOSED MANHOLE
- PROPOSED STORM DRAINAGE PIPE
- PROPOSED TYPE R INLET
- EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS



DRAINAGE MAP SOUTH

D4	DRAWN BY: ATK	SCALE: AS SHOWN	SHEET NUMBER
	CHECKED BY: MRS	FILE NO: 813.0230001	
DATE: JUNE 2016	JASPER INVESTMENTS, LLC C/O JIM DILLEA SOUTH KENWOOD COURT HIGHLANDS RANCH, CO 80123		No. Revisions
10333 East Dry Creek Road Suite 240 Englewood, CO 80112 Tel: (720) 882-9526 Fax: (720) 882-9546			Date Init. Appr. Date
CVL CONSULTANTS			

Wise Farms

PRELIMINARY UTILITY REPORT

Town of Erie, Colorado

Prepared for:

Jasper Land Investments, LLC.

Contact: Jim Dullea
9162 S. Kenwood Court
Highlands Ranch, Colorado 80126
Phone: (303) 902-5400

Prepared by:

CVL Consultants of Colorado, Inc.

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10333 E. Dry Creek Rd., Suite 240
Englewood, Colorado 80112
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December 21, 2016

Town Acceptance

This report has been reviewed and found to be in general compliance with the Town of Erie Standards and Specifications for Design and Construction and other Town requirements. THE ACCURACY AND VALIDITY OF THE ENGINEERING DESIGN, DETAILS, DIMENSIONS, QUANTITIES, AND CONCEPTS IN THIS REPORT REMAINS THE SOLE RESPONSIBILITY OF THE PROFESSIONAL ENGINEER WHOSE STAMP AND SIGNATURE APPEAR HEREON.

Accepted by: _____ Date _____
Deputy Public Works Director

If during the construction process or at any time within one year following the acceptance by the TOWN of the completed improvements, any deficiencies or errors are discovered in the construction plans, specifications, drainage reports, or the actual constructed improvements, the TOWN shall have the right to require the developer to make any and all corrections which may be deemed necessary by the TOWN.

Table of Contents

- I) SITE LOCATION & DESCRIPTION**
- II) WATER DISTRIBUTION SYSTEM**
- III) SANITARY COLLECTION SYSTEM**
- IV) CONCLUSIONS**
- V) REFERENCES**
- VI) APPENDICES**

I. SITE DESCRIPTION

The “Wise Farms” project is a planned single family residential subdivision, with a mixture of parks and open space. The project will be built in two phases, a north phase and a south phase.

The north phase is an 86 acre residential subdivision located in the Town of Erie, and bounded by Jasper Road to the north, N. 119th Street to the east and a RTD right-of-way spur to the south. The north phase is bisected by the Lower Boulder Ditch South Supply Channel. An electrical transmission line easement crosses the project site in the southwest corner, running from northwest to southeast. An existing sanitary sewer main and easement runs north to south near the west edge of the north phase.

The South phase is an 82 acre residential subdivision located in the Town of Erie and bounded by RTD right of way on the north, N 119th Street to the east, and Brownsville subdivision to the South. An existing 75 foot electrical easement and overhead transmission line crosses the project site running from the northwest corner to the southeast corner of the site. There is an existing 30’ regional trail easement, as well as a 15’ existing communication easement along the north edge of the site. A 30 foot Encana pipeline easement, 20 foot pipeline construction easement, and a 30 foot waterline easement are proposed in the northeast corner of the south phase

The project consists of the development of 45 home sites in the north phase and 57 home sites in the south, and the roadways and utility infrastructure to support them; which includes water, sanitary sewer, and storm sewer.

II. WATER DISTIBUTION SYSTEM

The water distribution system for this development will be tied into two existing water mains, one to the north and one to the south. This will provide a looped system for redundancy and consistent supply and quality.

The north connection is located at the south end of Lombardi Street in the Kenosha Farms subdivision. The existing main is zone 2 and is at an initial pressure of 90 psi. A water line will be installed from this connection point south through private property to Jasper Road. The Waterline will be installed along Jasper road to the site.

The south connection is located in N 119th Street at Tynan Drive just south of the site. The existing main is a zone 3 connection and is at an initial pressure of 90 psi. A water line will be installed from this connection point to the north along N 119th Street to the site.

A pressure reducing valve (PRV) will be installed on the water line from the south connection and is modeled at 61.1 PSI taking this water line from a zone 3 down to a zone 2. A connection will be made from the north phase to the south phase.

The water system is modeled using specifications from the town of Erie Standards and Specifications. This places the average demand at 140 gallons per capita per day. This demand was multiplied by an estimated 2.79 people per unit to an average demand per unit of 0.271 gallons per minute. The max demand was modeled as 2.6 times the average demand. The max hour demand was modeled as 3.9 times the average demand. The site demands as well as two existing dwelling units were included in the water model. In the south parcel of the site, accessory dwelling units are being proposed. The demands of these units are accounted for by assuming a demand 1.5 times the standard demand, which brings the demand for the south to 210 gallons per capita per day.

Seven scenarios were modeled, average day, max day, max hour day, fire flow analysis, fire flow demand with no flow from the north, fire flow demand with no flow from the south, and fire flow demand with fire flow at J15. Fire flow demands were modeled with max day flows and at 1000 gallons per minute at each fire flow node modeled.

WATER MODEL SUMMARY – NO FIRE FLOW				
SCENARIO	MIN PRESSURE	MIN PRESSURE AT NODE	MAX ONSITE PRESSURE	MAX PRESSURE AT NODE
AVERAGE DAY	55.3	J16	83.9	J25
MAX DAY	55.1	J16	83.8	J25
MAX HOUR	55.1	J16	83.8	J25

MINIMUM SYSTEM PRESSURES WITH FIRE FLOW				
SCENARIO	FIRE FLOW AT NODE	RESIDUAL AT FIRE FLOW NODE	NODE WITH MIN SYSTEM PRESSURE	MIN SYSTEM PRESSURE
FIRE FLOW	J15	51.4	J16	49.0
FIRE FLOW – NO NORTH CONNECTION	J15	46.2	J16	43.8
FIRE FLOW – NO SOUTH CONNECTION	J15	25.4	J16	23.0
FIRE FLOW AT J14	J14	45.0	J16	49.4

MIN RESIDUAL AT FIRE FLOW NODE		
SCENARIO	FIRE FLOW NODE	RESIDUAL AT NODE
FIRE FLOW	J16	43.9
FIRE FLOW – NO NORTH CONNECTION	J16	38.7
FIRE FLOW – NO SOUTH CONNECTION	J16	20.0

III. SANITARY COLLECTION SYSTEM

The sanitary collection system for this development will be tied into two existing sanitary mains, both on the north end of the north phase of the site. These connections will serve both phases of the project. The western connection serves the western portion of the north phase, while the eastern connection serves the eastern portion of the north phase as well as the entire south phase.

The sanitary system is designed using specifications from the town of Erie Standards and Specifications. This places the average residential flow at 90 gallons per capita per day. This flow was multiplied by an estimated 2.79 people per unit to an average flow per unit of 251.1 gallons per day. In the south parcel, accessory dwelling units are being proposed. The flows of these units are accounted for by assuming 1.5 times the standard flow, which brings the average residential flow for the south to 135 gallons per capita per day or per unit, 376.7 gallons per day. The peaking factor was calculated using the equation (taken from the Erie Standards and Specifications):

$$PF=3.8 / (ADF)^{0.17} \text{ (where ADF = Annual average daily flow in MGD) and } 2.5 < PF > 5$$

SANITARY FLOWS						
PIPE	NUMBER OF UNITS	AVERAGE FLOW (MGD)	CALCULATED PEAKING FACTOR	PEAKING FACTOR	PEAK FLOW (MGD)	PIPE CAPACITY (MGD)
WESTERN CONNECTION 8" PVC	24	0.0060	9.06	5	0.0300	0.57
SOUTH CONNECTION 8" PVC	57	0.0215	7.30	5	0.1075	0.57
EAST + SOUTH CONNECTION 8" PVC	63	0.0230	7.22	5	0.1150	0.57
EASTERN CONNECTION 12" PVC	77	0.0265	7.04	5	0.1325	2.12

IV. CONCLUSIONS

The water system will be sufficient to supply greater than 40 psi during max hour conditions and greater than 43 psi static. The system will also be able to provide greater than 20 psi residual during max day and fire flow conditions at any node even if there is a water main break on either of the feed lines.

The proposed sanitary system will be sufficient for the collection of all sanitary flows even during peak flows.

Based on the findings of this report, the proposed infrastructure will support the requirements of the proposed development per the town of Erie Standards and Specifications.

V. REFERENCES

Standards and Specifications, Town of Erie, Colorado, www.erieco.gov

VI. APPENDIX

A. APPENDIX A – WATER SYSTEM CALCULATIONS

B. APPENDIX B – SANITARY SYSTEM CALCULATIONS

WATER SYSTEM DEMANDS

WATER DEMANDS

NODE	UNITS	EFFECTIVE UNITS*	AVERAGE DAY (GPM)	MAX DAY	MAX HOUR
J1	7	11	2.848	7.405	11.108
J2	8	12	3.255	8.463	12.695
J4	7	11	2.848	7.405	11.108
J5	2	3	0.814	2.116	3.174
J6	2	3	0.814	2.116	3.174
J7	0	0	0.000	0.000	0.000
J8	4	6	1.628	4.232	6.347
J9	4	6	1.628	4.232	6.347
J10	5	8	2.034	5.289	7.934
J11	6	9	2.441	6.347	9.521
J13	4	6	1.628	4.232	6.347
J14	4	6	1.628	4.232	6.347
J15	2	3	0.814	2.116	3.174
J16	2	3	0.814	2.116	3.174
J17	3		0.814	2.116	3.174
J18	4		1.085	2.821	4.232
J19	5		1.356	3.526	5.289
J20	2		0.543	1.411	2.116
J21	3		0.814	2.116	3.174
J22	5		1.356	3.526	5.289
J23	3		0.814	2.116	3.174
J24	5		1.356	3.526	5.289
J25	0		0.000	0.000	0.000
J26	7		1.899	4.937	7.405
J27	8		2.170	5.642	8.463
J28	0		0.000	0.000	0.000
J29	0		0.000	0.000	0.000
J30	0		0.000	0.000	0.000
J31	0		0.000	0.000	0.000
J32	1		0.271	0.705	1.058
J33	0		0.000	0.000	0.000
J34	1		0.271	0.705	1.058
J35	0		0.000	0.000	0.000
J36	0		0.000	0.000	0.000
J37	0		0.000	0.000	0.000

*EFFECTIVE UNITS INCLUDES ACCESSORY DWELLING UNITS

ASSUMPTIONS FOR MODEL:

140 GPCD

2.79 PEOPLE PER UNIT

MD/AD = 2.6

MH/AD = 3.9

HAZEN WILLIAMS FOR 8" AND 10" PIPE C = 100

HAZEN WILLIAMS FOR 16" PIPE C = 110

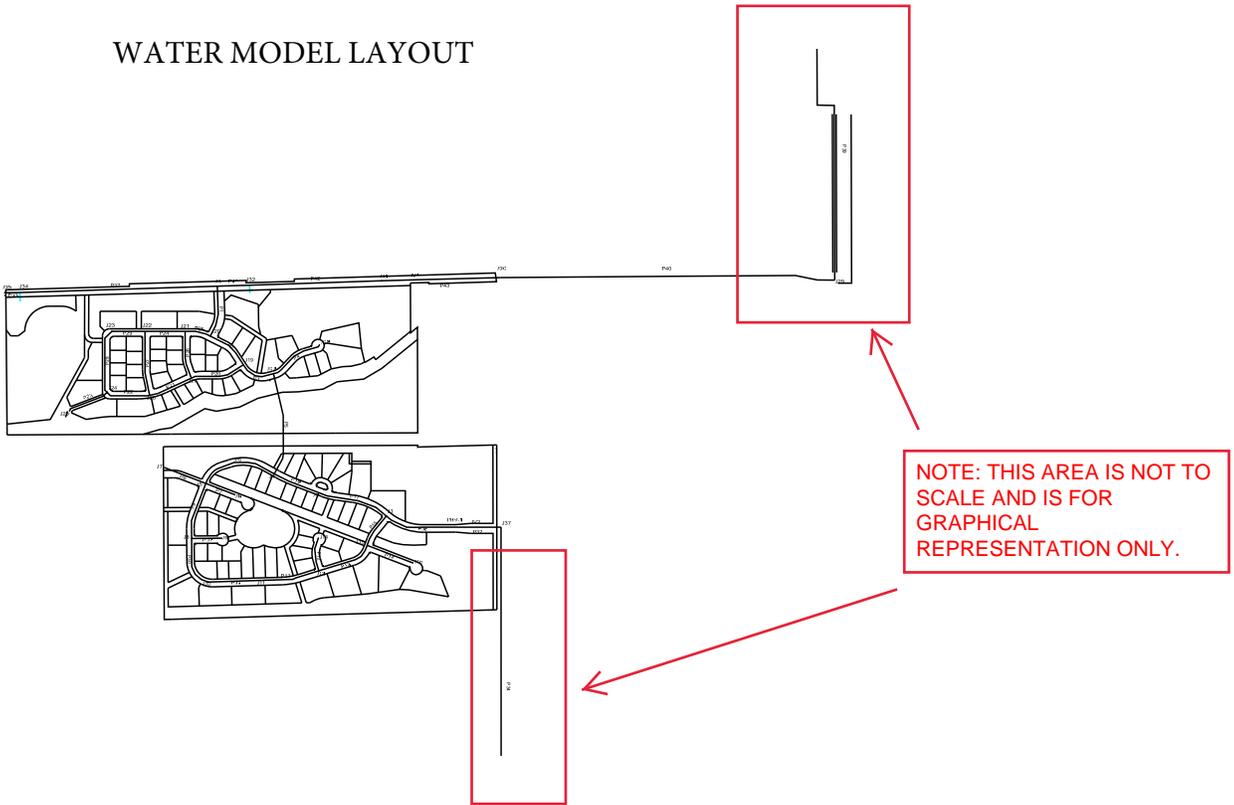
MANNINGS n = 0.011

DARCY-WEISENBACH E = 0.0009

WATER SYSTEM SCHEMATIC

Active Scenario: Base

WATER MODEL LAYOUT



AVERAGE DAY

Active Scenario: AVERAGE DAY

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diam eter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)
P38	19.71	J28	R1	16.0	PVC	110.0	-35.94	0.06	5,218.00	5,218.00
P34	2,550.03	J37	J36	12.0	PVC	100.0	0.00	0.00	5,305.67	5,305.67
P35	42.89	J36	R2	12.0	PVC	100.0	0.00	0.00	5,305.67	5,305.67
P32	364.51	PRV-1	J37	12.0	PVC	100.0	0.00	0.00	5,305.67	5,305.67
P36	574.84	J1	PRV-1	8.0	PVC	100.0	0.00	0.00	5,217.93	5,217.93
P43	949.52	J30	J31	12.0	PVC	100.0	35.94	0.10	5,217.99	5,217.98
P39	2,120.51	J28	J29	16.0	PVC	110.0	35.94	0.06	5,218.00	5,218.00
P40	2,668.75	J29	J30	16.0	PVC	110.0	35.94	0.06	5,218.00	5,217.99
P37	1,577.67	J33	J34	12.0	PVC	100.0	0.27	0.00	5,217.97	5,217.97
P33	120.64	J34	J35	12.0	PVC	100.0	0.00	0.00	5,217.97	5,217.97
P42	1,058.17	J31	J32	12.0	PVC	100.0	35.94	0.10	5,217.98	5,217.97
P41	256.66	J32	J33	12.0	PVC	100.0	35.67	0.10	5,217.97	5,217.97
P1	411.41	J33	J20	12.0	PVC	100.0	35.40	0.10	5,217.97	5,217.97
P2	359.78	J20	J19	8.0	PVC	100.0	15.74	0.10	5,217.97	5,217.96
P3	280.92	J19	J17	8.0	PVC	100.0	25.09	0.16	5,217.96	5,217.95
P4	450.22	J17	J18	8.0	PVC	100.0	1.08	0.01	5,217.95	5,217.95
P5	827.85	J17	J4	8.0	PVC	100.0	23.19	0.15	5,217.95	5,217.93
P6	637.69	J4	J5	8.0	PVC	100.0	9.30	0.06	5,217.93	5,217.93
P7	254.09	J5	J6	8.0	PVC	100.0	0.81	0.01	5,217.93	5,217.93
P8	357.65	J5	J7	8.0	PVC	100.0	0.00	0.00	5,217.93	5,217.93
P9	460.40	J5	J8	8.0	PVC	100.0	7.68	0.05	5,217.93	5,217.93
P10	245.51	J8	J9	8.0	PVC	100.0	1.63	0.01	5,217.93	5,217.93
P11	466.09	J11	J13	8.0	PVC	100.0	-0.05	0.00	5,217.93	5,217.93
P12	275.13	J13	J14	8.0	PVC	100.0	1.63	0.01	5,217.93	5,217.93
P13	459.46	J13	J15	8.0	PVC	100.0	-3.31	0.02	5,217.93	5,217.93
P14	396.64	J15	J16	8.0	PVC	100.0	0.81	0.01	5,217.93	5,217.93
P15	282.28	J15	J1	8.0	PVC	100.0	-4.94	0.03	5,217.93	5,217.93
P17	589.92	J1	J2	8.0	PVC	100.0	-7.79	0.05	5,217.93	5,217.93
P19	378.58	J2	J4	8.0	PVC	100.0	-11.04	0.07	5,217.93	5,217.93
P20	442.87	J19	J27	8.0	PVC	100.0	-10.71	0.07	5,217.96	5,217.97
P21	361.38	J27	J26	8.0	PVC	100.0	-5.18	0.03	5,217.97	5,217.97
P22	352.35	J26	J24	8.0	PVC	100.0	-3.43	0.02	5,217.97	5,217.97
P23	340.94	J24	J25	12.0	PVC	100.0	0.00	0.00	5,217.97	5,217.97
P24	320.42	J22	J21	12.0	PVC	100.0	-10.60	0.03	5,217.97	5,217.97
P25	207.11	J21	J20	12.0	PVC	100.0	-19.12	0.05	5,217.97	5,217.97
P26	382.28	J21	J27	8.0	PVC	100.0	7.70	0.05	5,217.97	5,217.97
P27	515.13	J22	J26	8.0	PVC	100.0	3.64	0.02	5,217.97	5,217.97
P28	517.72	J24	J23	12.0	PVC	100.0	-4.79	0.01	5,217.97	5,217.97
P29	264.88	J23	J22	12.0	PVC	100.0	-5.60	0.02	5,217.97	5,217.97
P30	412.54	J8	J10	8.0	PVC	100.0	4.42	0.03	5,217.93	5,217.93
P31	431.13	J10	J11	8.0	PVC	100.0	2.39	0.02	5,217.93	5,217.93

Active Scenario: AVERAGE DAY

ID	Label	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
44	J1	2.85	5,217.93	62.7
205	J37	0.00	5,305.67	99.6
214	J28	0.00	5,218.00	90.4
219	J36	0.00	5,305.67	99.8
384	J31	0.00	5,217.98	87.5
386	J33	0.00	5,217.97	86.1
388	J35	0.00	5,217.97	84.9
438	J30	0.00	5,217.99	86.5
441	J29	0.00	5,218.00	75.7
448	J34	0.27	5,217.97	84.3
451	J32	0.27	5,217.97	85.8
470	J20	0.54	5,217.97	83.1
472	J19	1.36	5,217.96	81.9
476	J17	0.81	5,217.95	82.3
478	J18	1.08	5,217.95	80.5
480	J4	2.85	5,217.93	70.9
482	J5	0.81	5,217.93	73.3
484	J6	0.81	5,217.93	69.1
486	J7	0.00	5,217.93	75.3
488	J8	1.63	5,217.93	68.9
490	J9	1.63	5,217.93	67.7
494	J11	2.44	5,217.93	60.8
496	J13	1.63	5,217.93	58.4
498	J14	1.63	5,217.93	59.7
500	J15	0.81	5,217.93	57.6
502	J16	0.81	5,217.93	55.3
507	J2	3.25	5,217.93	68.1
512	J27	2.17	5,217.97	80.0
514	J26	1.90	5,217.97	80.9
516	J24	1.36	5,217.97	79.6
518	J25	0.00	5,217.97	83.9
520	J22	1.36	5,217.97	82.2
522	J21	0.81	5,217.97	82.1
527	J23	0.81	5,217.97	81.8
530	J10	2.03	5,217.93	64.8

MAX DAY

Active Scenario: MAX DAY

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diam eter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)
P38	19.71	J28	R1	16.0	PVC	110.0	-89.20	0.14	5,218.00	5,218.00
P34	2,550.03	J37	J36	12.0	PVC	100.0	-4.26	0.01	5,305.67	5,305.67
P35	42.89	J36	R2	12.0	PVC	100.0	-4.26	0.01	5,305.67	5,305.67
P32	364.51	PRV-1	J37	12.0	PVC	100.0	-4.26	0.01	5,305.67	5,305.67
P36	574.84	J1	PRV-1	8.0	PVC	100.0	-4.27	0.03	5,217.62	5,217.62
P43	949.52	J30	J31	12.0	PVC	100.0	89.20	0.25	5,217.95	5,217.91
P39	2,120.51	J28	J29	16.0	PVC	110.0	89.20	0.14	5,218.00	5,217.98
P40	2,668.75	J29	J30	16.0	PVC	110.0	89.20	0.14	5,217.98	5,217.95
P37	1,577.67	J33	J34	12.0	PVC	100.0	0.71	0.00	5,217.85	5,217.85
P33	120.64	J34	J35	12.0	PVC	100.0	0.00	0.00	5,217.85	5,217.85
P42	1,058.17	J31	J32	12.0	PVC	100.0	89.20	0.25	5,217.91	5,217.86
P41	256.66	J32	J33	12.0	PVC	100.0	88.49	0.25	5,217.86	5,217.85
P1	411.41	J33	J20	12.0	PVC	100.0	87.79	0.25	5,217.85	5,217.83
P2	359.78	J20	J19	8.0	PVC	100.0	38.53	0.25	5,217.83	5,217.80
P3	280.92	J19	J17	8.0	PVC	100.0	60.98	0.39	5,217.80	5,217.76
P4	450.22	J17	J18	8.0	PVC	100.0	2.82	0.02	5,217.76	5,217.76
P5	827.85	J17	J4	8.0	PVC	100.0	56.04	0.36	5,217.76	5,217.64
P6	637.69	J4	J5	8.0	PVC	100.0	22.74	0.15	5,217.64	5,217.62
P7	254.09	J5	J6	8.0	PVC	100.0	2.12	0.01	5,217.62	5,217.62
P8	357.65	J5	J7	8.0	PVC	100.0	0.00	0.00	5,217.62	5,217.62
P9	460.40	J5	J8	8.0	PVC	100.0	18.50	0.12	5,217.62	5,217.61
P10	245.51	J8	J9	8.0	PVC	100.0	4.23	0.03	5,217.61	5,217.61
P11	466.09	J11	J13	8.0	PVC	100.0	-1.60	0.01	5,217.61	5,217.61
P12	275.13	J13	J14	8.0	PVC	100.0	4.23	0.03	5,217.61	5,217.61
P13	459.46	J13	J15	8.0	PVC	100.0	-10.06	0.06	5,217.61	5,217.61
P14	396.64	J15	J16	8.0	PVC	100.0	2.12	0.01	5,217.61	5,217.61
P15	282.28	J15	J1	8.0	PVC	100.0	-14.29	0.09	5,217.61	5,217.62
P17	589.92	J1	J2	8.0	PVC	100.0	-17.43	0.11	5,217.62	5,217.63
P19	378.58	J2	J4	8.0	PVC	100.0	-25.90	0.17	5,217.63	5,217.64
P20	442.87	J19	J27	8.0	PVC	100.0	-25.98	0.17	5,217.80	5,217.82
P21	361.38	J27	J26	8.0	PVC	100.0	-12.60	0.08	5,217.82	5,217.82
P22	352.35	J26	J24	8.0	PVC	100.0	-8.47	0.05	5,217.82	5,217.82
P23	340.94	J24	J25	12.0	PVC	100.0	0.00	0.00	5,217.82	5,217.82
P24	320.42	J22	J21	12.0	PVC	100.0	-26.71	0.08	5,217.82	5,217.83
P25	207.11	J21	J20	12.0	PVC	100.0	-47.84	0.14	5,217.83	5,217.83
P26	382.28	J21	J27	8.0	PVC	100.0	19.02	0.12	5,217.83	5,217.82
P27	515.13	J22	J26	8.0	PVC	100.0	9.06	0.06	5,217.82	5,217.82
P28	517.72	J24	J23	12.0	PVC	100.0	-12.00	0.03	5,217.82	5,217.82
P29	264.88	J23	J22	12.0	PVC	100.0	-14.12	0.04	5,217.82	5,217.82
P30	412.54	J8	J10	8.0	PVC	100.0	10.04	0.06	5,217.61	5,217.61
P31	431.13	J10	J11	8.0	PVC	100.0	4.75	0.03	5,217.61	5,217.61

Active Scenario: MAX DAY

ID	Label	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
44	J1	7.40	5,217.62	62.6
205	J37	0.00	5,305.67	99.6
214	J28	0.00	5,218.00	90.4
219	J36	0.00	5,305.67	99.8
384	J31	0.00	5,217.91	87.5
386	J33	0.00	5,217.85	86.0
388	J35	0.00	5,217.85	84.9
438	J30	0.00	5,217.95	86.5
441	J29	0.00	5,217.98	75.7
448	J34	0.70	5,217.85	84.2
451	J32	0.70	5,217.86	85.8
470	J20	1.41	5,217.83	83.0
472	J19	3.53	5,217.80	81.9
476	J17	2.12	5,217.76	82.2
478	J18	2.82	5,217.76	80.4
480	J4	7.40	5,217.64	70.8
482	J5	2.12	5,217.62	73.2
484	J6	2.12	5,217.62	69.0
486	J7	0.00	5,217.62	75.2
488	J8	4.23	5,217.61	68.8
490	J9	4.23	5,217.61	67.6
494	J11	6.35	5,217.61	60.6
496	J13	4.23	5,217.61	58.2
498	J14	4.23	5,217.61	59.6
500	J15	2.12	5,217.61	57.5
502	J16	2.12	5,217.61	55.1
507	J2	8.46	5,217.63	67.9
512	J27	5.64	5,217.82	80.0
514	J26	4.94	5,217.82	80.8
516	J24	3.53	5,217.82	79.5
518	J25	0.00	5,217.82	83.8
520	J22	3.53	5,217.82	82.1
522	J21	2.12	5,217.83	82.0
527	J23	2.12	5,217.82	81.7
530	J10	5.29	5,217.61	64.7

MAX HOUR

Active Scenario: MAX HOUR

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diam eter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)
P38	19.71	J28	R1	16.0	PVC	110.0	-103.88	0.17	5,218.00	5,218.00
P34	2,550.03	J37	J36	12.0	PVC	100.0	-36.29	0.10	5,305.65	5,305.67
P35	42.89	J36	R2	12.0	PVC	100.0	-36.29	0.10	5,305.67	5,305.67
P32	364.51	PRV-1	J37	12.0	PVC	100.0	-36.29	0.10	5,305.64	5,305.65
P36	574.84	J1	PRV-1	8.0	PVC	100.0	-36.30	0.23	5,217.58	5,217.62
P43	949.52	J30	J31	12.0	PVC	100.0	103.88	0.29	5,217.94	5,217.88
P39	2,120.51	J28	J29	16.0	PVC	110.0	103.88	0.17	5,218.00	5,217.97
P40	2,668.75	J29	J30	16.0	PVC	110.0	103.88	0.17	5,217.97	5,217.94
P37	1,577.67	J33	J34	12.0	PVC	100.0	1.06	0.00	5,217.80	5,217.80
P33	120.64	J34	J35	12.0	PVC	100.0	0.00	0.00	5,217.80	5,217.80
P42	1,058.17	J31	J32	12.0	PVC	100.0	103.88	0.29	5,217.88	5,217.81
P41	256.66	J32	J33	12.0	PVC	100.0	102.82	0.29	5,217.81	5,217.80
P1	411.41	J33	J20	12.0	PVC	100.0	101.77	0.29	5,217.80	5,217.77
P2	359.78	J20	J19	8.0	PVC	100.0	41.01	0.26	5,217.77	5,217.74
P3	280.92	J19	J17	8.0	PVC	100.0	61.57	0.39	5,217.74	5,217.70
P4	450.22	J17	J18	8.0	PVC	100.0	4.23	0.03	5,217.70	5,217.70
P5	827.85	J17	J4	8.0	PVC	100.0	54.16	0.35	5,217.70	5,217.59
P6	637.69	J4	J5	8.0	PVC	100.0	26.37	0.17	5,217.59	5,217.56
P7	254.09	J5	J6	8.0	PVC	100.0	3.17	0.02	5,217.56	5,217.56
P8	357.65	J5	J7	8.0	PVC	100.0	0.00	0.00	5,217.56	5,217.56
P9	460.40	J5	J8	8.0	PVC	100.0	20.02	0.13	5,217.56	5,217.55
P10	245.51	J8	J9	8.0	PVC	100.0	6.35	0.04	5,217.55	5,217.55
P11	466.09	J11	J13	8.0	PVC	100.0	-10.13	0.06	5,217.55	5,217.55
P12	275.13	J13	J14	8.0	PVC	100.0	6.35	0.04	5,217.55	5,217.55
P13	459.46	J13	J15	8.0	PVC	100.0	-22.83	0.15	5,217.55	5,217.57
P14	396.64	J15	J16	8.0	PVC	100.0	3.17	0.02	5,217.57	5,217.57
P15	282.28	J15	J1	8.0	PVC	100.0	-29.18	0.19	5,217.57	5,217.58
P17	589.92	J1	J2	8.0	PVC	100.0	-3.99	0.03	5,217.58	5,217.58
P19	378.58	J2	J4	8.0	PVC	100.0	-16.69	0.11	5,217.58	5,217.59
P20	442.87	J19	J27	8.0	PVC	100.0	-25.85	0.16	5,217.74	5,217.76
P21	361.38	J27	J26	8.0	PVC	100.0	-12.80	0.08	5,217.76	5,217.76
P22	352.35	J26	J24	8.0	PVC	100.0	-9.54	0.06	5,217.76	5,217.76
P23	340.94	J24	J25	12.0	PVC	100.0	0.00	0.00	5,217.76	5,217.76
P24	320.42	J22	J21	12.0	PVC	100.0	-33.96	0.10	5,217.77	5,217.77
P25	207.11	J21	J20	12.0	PVC	100.0	-58.64	0.17	5,217.77	5,217.77
P26	382.28	J21	J27	8.0	PVC	100.0	21.51	0.14	5,217.77	5,217.76
P27	515.13	J22	J26	8.0	PVC	100.0	10.67	0.07	5,217.77	5,217.76
P28	517.72	J24	J23	12.0	PVC	100.0	-14.82	0.04	5,217.76	5,217.77
P29	264.88	J23	J22	12.0	PVC	100.0	-18.00	0.05	5,217.77	5,217.77
P30	412.54	J8	J10	8.0	PVC	100.0	7.32	0.05	5,217.55	5,217.55
P31	431.13	J10	J11	8.0	PVC	100.0	-0.61	0.00	5,217.55	5,217.55

Active Scenario: MAX HOUR

ID	Label	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
44	J1	11.11	5,217.58	62.5
205	J37	0.00	5,305.65	99.6
214	J28	0.00	5,218.00	90.4
219	J36	0.00	5,305.67	99.8
384	J31	0.00	5,217.88	87.5
386	J33	0.00	5,217.80	86.0
388	J35	0.00	5,217.80	84.9
438	J30	0.00	5,217.94	86.5
441	J29	0.00	5,217.97	75.7
448	J34	1.06	5,217.80	84.2
451	J32	1.06	5,217.81	85.8
470	J20	2.12	5,217.77	83.0
472	J19	5.29	5,217.74	81.8
476	J17	3.17	5,217.70	82.2
478	J18	4.23	5,217.70	80.4
480	J4	11.11	5,217.59	70.8
482	J5	3.17	5,217.56	73.2
484	J6	3.17	5,217.56	68.9
486	J7	0.00	5,217.56	75.1
488	J8	6.35	5,217.55	68.8
490	J9	6.35	5,217.55	67.5
494	J11	9.52	5,217.55	60.6
496	J13	6.35	5,217.55	58.2
498	J14	6.35	5,217.55	59.6
500	J15	3.17	5,217.57	57.5
502	J16	3.17	5,217.57	55.1
507	J2	12.69	5,217.58	67.9
512	J27	8.46	5,217.76	79.9
514	J26	7.41	5,217.76	80.8
516	J24	5.29	5,217.76	79.5
518	J25	0.00	5,217.76	83.8
520	J22	5.29	5,217.77	82.1
522	J21	3.17	5,217.77	82.0
527	J23	3.17	5,217.77	81.7
530	J10	7.93	5,217.55	64.7

MAX DAY WITH
FIRE FLOW

Active Scenario: MAX DAY WITH FIRE FLOW

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
J1	ZONE - 2	2	True	1,000.00	1,007.40	1,008.40	58.6	51.2	J16	True
J37	ZONE - 3	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J28	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J36	ZONE - 3	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J31	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J33	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J35	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J30	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J29	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J34	ZONE - 2	2	True	1,000.00	1,000.70	1,001.70	78.0	54.0	J16	True
J32	ZONE - 2	2	True	1,000.00	1,000.70	1,001.70	82.6	54.1	J16	True
J20	ZONE - 2	2	True	1,000.00	1,001.41	1,002.41	79.4	53.9	J16	True
J19	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	77.8	53.7	J16	True
J17	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	77.4	53.3	J16	True
J18	ZONE - 2	2	True	1,000.00	1,002.82	1,003.82	69.7	53.3	J16	True
J4	ZONE - 2	2	True	1,000.00	1,007.40	1,008.40	65.7	51.9	J16	True
J5	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	65.0	51.2	J16	True
J6	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	57.5	51.2	J16	True
J7	ZONE - 2	2	True	1,000.00	1,000.00	1,001.00	62.4	51.2	J16	True
J8	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	59.5	50.8	J16	True
J9	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	55.1	50.8	J16	True
J11	ZONE - 2	2	True	1,000.00	1,006.35	1,007.35	51.3	50.1	J16	True
J13	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	50.0	49.7	J16	True
J14	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	47.8	49.7	J16	True
J15	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	51.4	49.0	J16	True
J16	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	43.9	51.4	J15	True
J2	ZONE - 2	2	True	1,000.00	1,008.46	1,009.46	62.4	51.6	J16	True
J27	ZONE - 2	2	True	1,000.00	1,005.64	1,006.64	75.5	53.9	J16	True
J26	ZONE - 2	2	True	1,000.00	1,004.94	1,005.94	76.1	53.9	J16	True
J24	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	74.7	53.9	J16	True
J25	ZONE - 2	2	True	1,000.00	1,000.00	1,001.00	78.4	53.9	J16	True

Active Scenario: MAX DAY WITH FIRE FLOW

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
J22	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	77.9	53.9	J16	True
J21	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	78.2	53.9	J16	True
J23	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	77.2	53.9	J16	True
J10	ZONE - 2	2	True	1,000.00	1,005.29	1,006.29	55.1	50.5	J16	True

FIRE FLOW WITH
NO FLOW FROM THE NORTH

Active Scenario: MAX DAY WITH FIRE FLOW - NO FLOW FROM NORTH CONNECTION

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
J1	ZONE - 2	2	True	1,000.00	1,007.40	1,008.40	53.8	46.4	J16	True
J37	ZONE - 3	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J28	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J36	ZONE - 3	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J31	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J33	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J35	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J30	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J29	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J34	ZONE - 2	2	True	1,000.00	1,000.70	1,001.70	48.7	45.8	J16	True
J32	ZONE - 2	2	True	1,000.00	1,000.70	1,001.70	52.6	45.8	J16	True
J20	ZONE - 2	2	True	1,000.00	1,001.41	1,002.41	51.1	45.8	J16	True
J19	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	51.6	45.8	J16	True
J17	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	55.8	45.8	J16	True
J18	ZONE - 2	2	True	1,000.00	1,002.82	1,003.82	48.1	45.8	J16	True
J4	ZONE - 2	2	True	1,000.00	1,007.40	1,008.40	55.7	45.8	J16	True
J5	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	56.7	45.5	J16	True
J6	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	49.2	45.5	J16	True
J7	ZONE - 2	2	True	1,000.00	1,000.00	1,001.00	54.1	45.5	J16	True
J8	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	52.1	45.2	J16	True
J9	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	47.7	45.2	J16	True
J11	ZONE - 2	2	True	1,000.00	1,006.35	1,007.35	45.1	44.8	J16	True
J13	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	44.3	44.4	J16	True
J14	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	42.1	44.3	J13	True
J15	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	46.2	43.8	J16	True
J16	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	38.7	46.2	J15	True
J2	ZONE - 2	2	True	1,000.00	1,008.46	1,009.46	54.6	46.0	J16	True
J27	ZONE - 2	2	True	1,000.00	1,005.64	1,006.64	47.9	45.8	J16	True
J26	ZONE - 2	2	True	1,000.00	1,004.94	1,005.94	48.1	45.8	J16	True
J24	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	46.7	45.8	J16	True
J25	ZONE - 2	2	True	1,000.00	1,000.00	1,001.00	50.4	45.8	J16	True

Active Scenario: MAX DAY WITH FIRE FLOW - NO FLOW FROM NORTH CONNECTION

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
J22	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	49.8	45.8	J16	True
J21	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	50.0	45.8	J16	True
J23	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	49.1	45.8	J16	True
J10	ZONE - 2	2	True	1,000.00	1,005.29	1,006.29	48.3	45.0	J16	True

FIRE FLOW WITH
NO FLOW FROM THE SOUTH

Active Scenario: MAX DAY WITH FIRE FLOW - NO FLOW FROM SOUTH CONNECTION

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
J1	ZONE - 2	2	True	1,000.00	1,007.40	1,008.40	31.2	24.2	J16	True
J37	ZONE - 3	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J28	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J36	ZONE - 3	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J31	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J33	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J35	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J30	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J29	ZONE - 2	(N/A)	(N/A)	1,000.00	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)	(N/A)
J34	ZONE - 2	2	True	1,000.00	1,000.70	1,001.70	74.6	48.3	J16	True
J32	ZONE - 2	2	True	1,000.00	1,000.70	1,001.70	79.5	48.8	J16	True
J20	ZONE - 2	2	True	1,000.00	1,001.41	1,002.41	75.4	47.5	J16	True
J19	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	72.4	45.6	J16	True
J17	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	68.7	41.6	J16	True
J18	ZONE - 2	2	True	1,000.00	1,002.82	1,003.82	61.1	41.6	J16	True
J4	ZONE - 2	2	True	1,000.00	1,007.40	1,008.40	45.4	29.8	J16	True
J5	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	43.2	27.9	J16	True
J6	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	35.7	27.9	J16	True
J7	ZONE - 2	2	True	1,000.00	1,000.00	1,001.00	40.6	27.9	J16	True
J8	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	37.0	26.9	J16	True
J9	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	32.6	26.9	J16	True
J11	ZONE - 2	2	True	1,000.00	1,006.35	1,007.35	27.5	25.2	J16	True
J13	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	25.3	24.2	J16	True
J14	ZONE - 2	2	True	1,000.00	1,004.23	1,005.23	23.1	24.2	J16	True
J15	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	25.3	23.0	J16	True
J16	ZONE - 2	3	False	1,000.00	1,002.12	969.60	20.0	27.2	J15	True
J2	ZONE - 2	2	True	1,000.00	1,008.46	1,009.46	39.4	27.2	J16	True
J27	ZONE - 2	2	True	1,000.00	1,005.64	1,006.64	71.2	46.8	J16	True
J26	ZONE - 2	2	True	1,000.00	1,004.94	1,005.94	71.9	47.1	J16	True
J24	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	70.6	47.2	J16	True
J25	ZONE - 2	2	True	1,000.00	1,000.00	1,001.00	74.3	47.2	J16	True

Active Scenario: MAX DAY WITH FIRE FLOW - NO FLOW FROM SOUTH CONNECTION

Label	Zone	Fire Flow Iterations	Satisfies Fire Flow Constraints?	Fire Flow (Needed) (gpm)	Flow (Total Needed) (gpm)	Flow (Total Available) (gpm)	Pressure (Calculated Residual) (psi)	Pressure (Calculated System Lower Limit) (psi)	Junction w/ Minimum Pressure (System)	Is Fire Flow Run Balanced?
J22	ZONE - 2	2	True	1,000.00	1,003.53	1,004.53	73.8	47.2	J16	True
J21	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	74.1	47.3	J16	True
J23	ZONE - 2	2	True	1,000.00	1,002.12	1,003.12	73.1	47.2	J16	True
J10	ZONE - 2	2	True	1,000.00	1,005.29	1,006.29	32.0	26.1	J16	True

MAX DAY WITH
FIRE FLOW AT J14

Active Scenario: MAX DAY FIRE FLOW AT J14

Label	Length (Scaled) (ft)	Start Node	Stop Node	Diam eter (in)	Material	Hazen- Williams C	Flow (gpm)	Velocity (ft/s)	Hydraulic Grade (Start) (ft)	Hydraulic Grade (Stop) (ft)
P38	19.71	J28	R1	16.0	PVC	110.0	-407.53	0.65	5,218.00	5,218.00
P34	2,550.03	J37	J36	12.0	PVC	100.0	-685.92	1.95	5,300.32	5,305.57
P35	42.89	J36	R2	12.0	PVC	100.0	-685.92	1.95	5,305.57	5,305.67
P32	364.51	PRV-1	J37	12.0	PVC	100.0	-685.92	1.95	5,299.57	5,300.32
P36	574.84	J1	PRV-1	8.0	PVC	100.0	-685.92	4.38	5,209.12	5,217.62
P43	949.52	J30	J31	12.0	PVC	100.0	407.53	1.16	5,217.22	5,216.48
P39	2,120.51	J28	J29	16.0	PVC	110.0	407.53	0.65	5,218.00	5,217.65
P40	2,668.75	J29	J30	16.0	PVC	110.0	407.53	0.65	5,217.65	5,217.22
P37	1,577.67	J33	J34	12.0	PVC	100.0	0.70	0.00	5,215.45	5,215.45
P33	120.64	J34	J35	12.0	PVC	100.0	0.00	0.00	5,215.45	5,215.45
P42	1,058.17	J31	J32	12.0	PVC	100.0	407.53	1.16	5,216.48	5,215.65
P41	256.66	J32	J33	12.0	PVC	100.0	406.82	1.15	5,215.65	5,215.45
P1	411.41	J33	J20	12.0	PVC	100.0	406.12	1.15	5,215.45	5,215.13
P2	359.78	J20	J19	8.0	PVC	100.0	219.03	1.40	5,215.13	5,214.49
P3	280.92	J19	J17	8.0	PVC	100.0	379.32	2.42	5,214.49	5,213.11
P4	450.22	J17	J18	8.0	PVC	100.0	2.82	0.02	5,213.11	5,213.11
P5	827.85	J17	J4	8.0	PVC	100.0	374.38	2.39	5,213.11	5,209.12
P6	637.69	J4	J5	8.0	PVC	100.0	365.16	2.33	5,209.12	5,206.19
P7	254.09	J5	J6	8.0	PVC	100.0	2.12	0.01	5,206.19	5,206.19
P8	357.65	J5	J7	8.0	PVC	100.0	0.00	0.00	5,206.19	5,206.19
P9	460.40	J5	J8	8.0	PVC	100.0	360.93	2.30	5,206.19	5,204.12
P10	245.51	J8	J9	8.0	PVC	100.0	4.23	0.03	5,204.12	5,204.12
P11	466.09	J11	J13	8.0	PVC	100.0	340.83	2.18	5,200.54	5,198.66
P12	275.13	J13	J14	8.0	PVC	100.0	1,004.2 3	6.41	5,198.66	5,190.42
P13	459.46	J13	J15	8.0	PVC	100.0	-667.64	4.26	5,198.66	5,205.11
P14	396.64	J15	J16	8.0	PVC	100.0	2.12	0.01	5,205.11	5,205.11
P15	282.28	J15	J1	8.0	PVC	100.0	-671.87	4.29	5,205.11	5,209.12
P17	589.92	J1	J2	8.0	PVC	100.0	6.65	0.04	5,209.12	5,209.12
P19	378.58	J2	J4	8.0	PVC	100.0	-1.81	0.01	5,209.12	5,209.12
P20	442.87	J19	J27	8.0	PVC	100.0	-163.81	1.05	5,214.49	5,214.95
P21	361.38	J27	J26	8.0	PVC	100.0	-75.32	0.48	5,214.95	5,215.04
P22	352.35	J26	J24	8.0	PVC	100.0	-40.83	0.26	5,215.04	5,215.07
P23	340.94	J24	J25	12.0	PVC	100.0	0.00	0.00	5,215.07	5,215.07
P24	320.42	J22	J21	12.0	PVC	100.0	-89.42	0.25	5,215.08	5,215.10
P25	207.11	J21	J20	12.0	PVC	100.0	-185.68	0.53	5,215.10	5,215.13
P26	382.28	J21	J27	8.0	PVC	100.0	94.14	0.60	5,215.10	5,214.95
P27	515.13	J22	J26	8.0	PVC	100.0	39.42	0.25	5,215.08	5,215.04
P28	517.72	J24	J23	12.0	PVC	100.0	-44.35	0.13	5,215.07	5,215.08
P29	264.88	J23	J22	12.0	PVC	100.0	-46.47	0.13	5,215.08	5,215.08
P30	412.54	J8	J10	8.0	PVC	100.0	352.46	2.25	5,204.12	5,202.35
P31	431.13	J10	J11	8.0	PVC	100.0	347.18	2.22	5,202.35	5,200.54

Active Scenario: MAX DAY FIRE FLOW AT J14

ID	Label	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
44	J1	7.40	5,209.12	58.9
205	J37	0.00	5,300.32	97.3
214	J28	0.00	5,218.00	90.4
219	J36	0.00	5,305.57	99.8
384	J31	0.00	5,216.48	86.8
386	J33	0.00	5,215.45	85.0
388	J35	0.00	5,215.45	83.8
438	J30	0.00	5,217.22	86.2
441	J29	0.00	5,217.65	75.6
448	J34	0.70	5,215.45	83.2
451	J32	0.70	5,215.65	84.8
470	J20	1.41	5,215.13	81.9
472	J19	3.53	5,214.49	80.4
476	J17	2.12	5,213.11	80.2
478	J18	2.82	5,213.11	78.4
480	J4	7.40	5,209.12	67.1
482	J5	2.12	5,206.19	68.2
484	J6	2.12	5,206.19	64.0
486	J7	0.00	5,206.19	70.2
488	J8	4.23	5,204.12	62.9
490	J9	4.23	5,204.12	61.7
494	J11	6.35	5,200.54	53.2
496	J13	4.23	5,198.66	50.0
498	J14	1,004.23	5,190.42	47.8
500	J15	2.12	5,205.11	52.1
502	J16	2.12	5,205.11	49.7
507	J2	8.46	5,209.12	64.3
512	J27	5.64	5,214.95	78.7
514	J26	4.94	5,215.04	79.6
516	J24	3.53	5,215.07	78.3
518	J25	0.00	5,215.07	82.7
520	J22	3.53	5,215.08	80.9
522	J21	2.12	5,215.10	80.9
527	J23	2.12	5,215.08	80.5
530	J10	5.29	5,202.35	58.1

**SANITARY SEWER
CALCULATIONS**

8 INCH PIPE - FLOW AT 80% FULL

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.011
Channel Slope	0.400 %
Normal Depth	6.40 in
Diameter	8.00 in

Results

Discharge	0.57	mgd
Flow Area	0.30	ft ²
Wetted Perimeter	1.48	ft
Hydraulic Radius	2.43	in
Top Width	0.53	ft
Critical Depth	0.45	ft
Percent Full	80.0	%
Critical Slope	0.00618	ft/ft
Velocity	2.95	ft/s
Velocity Head	0.14	ft
Specific Energy	0.67	ft
Froude Number	0.69	
Maximum Discharge	0.97	ft ³ /s
Discharge Full	0.90	ft ³ /s
Slope Full	0.00382	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	80.00	%
Downstream Velocity	Infinity	ft/s

8 INCH PIPE - FLOW AT 80% FULL

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	6.40	in
Critical Depth	0.45	ft
Channel Slope	0.400	%
Critical Slope	0.00618	ft/ft

12 INCH PIPE - MAX FLOW

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.011
Channel Slope	0.220 %
Normal Depth	12.00 in
Diameter	12.00 in
Discharge	1.28 mgd

Results

Discharge	1.28 mgd
Normal Depth	12.00 in
Flow Area	0.79 ft ²
Wetted Perimeter	3.14 ft
Hydraulic Radius	3.00 in
Top Width	0.00 ft
Critical Depth	0.60 ft
Percent Full	100.0 %
Critical Slope	0.00489 ft/ft
Velocity	2.51 ft/s
Velocity Head	0.10 ft
Specific Energy	1.10 ft
Froude Number	0.00
Maximum Discharge	2.12 ft ³ /s
Discharge Full	1.97 ft ³ /s
Slope Full	0.00220 ft/ft
Flow Type	SubCritical

GVF Input Data

Downstream Depth	0.00 in
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.00 in
Profile Description	
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.00 %

12 INCH PIPE - MAX FLOW

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	12.00	in
Critical Depth	0.60	ft
Channel Slope	0.220	%
Critical Slope	0.00489	ft/ft

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**NATURAL AND
CULTURAL RESOURCES ASSESSMENT**

WISE FARM

TOWN OF ERIE, BOULDER COUNTY, COLORADO

Prepared for—

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Prepared by—

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April 17, 2014

ERO Project #5653



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CONTENTS

Summary.....	i
Introduction.....	1
Site Description.....	1
Wetlands and Waters of the U.S.	2
Background.....	2
Site Conditions and Regulations.....	2
Threatened, Endangered, and Candidate Species	3
Preble’s Meadow Jumping Mouse.....	6
Colorado Butterfly Plant.....	6
Ute Ladies’-Tresses Orchid	7
Other Species of Concern	8
Raptors and Migratory Birds	8
Other Wildlife.....	9
Cultural Resources	10
References.....	11

TABLES

Table 1. Federally threatened, endangered, and candidate species potentially found in Boulder County or potentially affected by projects in Boulder County.	4
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Summary

PCS Group, Inc. retained ERO Resources Corporation (ERO) to provide a natural and cultural resources assessment for the Wise Farm property (property) in the Town of Erie, Boulder County, Colorado. ERO assessed the property for potential wetlands and waters of the U.S., threatened and endangered species, and wildlife. ERO also assessed the property for the presence of properties listed on the National and Colorado registers of historic places. Below is a summary of the resources found at the property and recommendations or future actions necessary based on the current site conditions and federal, state, and local regulations.

Wetlands and Other Waters of the U.S. – The U.S. Army Corps of Engineers determined that the two depressional wetlands on the property are isolated, non-jurisdictional wetlands and not regulated under the Clean Water Act. The Lower Boulder Ditch and Leyner Cottonwood Number 1 Ditch were determined to be jurisdictional. The jurisdictional determination is valid for five years from December 14, 2012 and expires on December 13, 2017. If activities such as bridges or realignment are proposed for the ditch, authorization from the U.S. Army Corps of Engineers will be required.

Threatened and Endangered Species – Suitable habitat for federally listed threatened or endangered species is not present in the property. No action is necessary to comply with the Endangered Species Act.

Migratory Birds and Other Wildlife – ERO found no migratory bird nests in the property, but there are a number of large trees on the property that provide suitable nesting habitat. Tree removal should be done during the non-nesting season, which is generally from August 15 to April 1. If trees must be removed during nesting season, a survey for active nests should be done prior to removal. If an active nest is present, removal cannot occur until the nest is abandoned for the season. The cultivated fields on the property provide low quality wildlife habitat and no sensitive or uncommon wildlife species are present.

Cultural Resources – Although Wise Farm has been part of the Town of Erie’s history since 1869 and the Erie Historical Society’s Wise Farm Museum is across Jasper Road from the property, the property and structures on the property are not listed on the National or State registers of historic places. Although not listed on the registers, the Colorado State Historic Preservation Office considers linear features such as canals and railroads as potentially eligible, so the Lower Boulder Ditch, Leyner Cottonwood Ditch Number 1, and Union Pacific Railroad may be eligible for listing. These resources typically only need to be evaluated if there is a federal nexus, such as obtaining authorization from the U.S. Army Corps of Engineers for work on the Lower Boulder Ditch or Leyner Cottonwood Ditch Number 1.

NATURAL AND CULTURAL RESOURCES ASSESSMENT

WISE FARM TOWN OF ERIE, BOULDER COUNTY, COLORADO

APRIL 17, 2014

Introduction

PCS Group, Inc. retained ERO Resources Corporation (ERO) to provide a natural resources assessment for the Wise Farm property, a proposed residential development in Boulder County, Colorado (Figure 1). On September 26, 2013, Mary L. Powell, a natural resource specialist with ERO, visited the property to review natural resources (2013 site visit). During this assessment, activities included reviewing potential wetlands, identifying potential federally threatened and endangered species habitat, and identifying other natural resources that might affect development of the property. Jurisdictional wetland delineations were not conducted during this assessment. This report provides information on existing site conditions and resources, as well as current regulatory guidelines related to those resources. ERO assumes that the landowner or developer is responsible for obtaining proper federal, state, or local permits for development of the property.

Site Description

The property is located within Section 14, Township 1 North, Range 69 West of the 6th Principal Meridian, in Boulder County, Colorado (Figure 1). The UTM coordinates of the approximate center of the property are Zone 13N; 493083mE, 4433466mN. The Wise Farm property is an approximately 180-acre property located southwest of the intersection of Jasper Road and North 119th Street in Erie, Colorado (Figure 2). The majority of the property is cultivated agricultural fields dominated by alfalfa (*Medicago* spp.) An inactive Union Pacific Railroad track runs east/west through the middle of the property. A few residences and sheds are located along the northern border of the property (Figure 2). The Lower Boulder Ditch crosses the north half of the property and the Leyner Cottonwood Number 1 Ditch runs just north of part of the southern property

boundary. The property is surrounded a by a mix of low-density residential land and agricultural land.

Wetlands and Waters of the U.S.

Background

The Clean Water Act (CWA) was passed by the U.S. Congress in 1972 to protect the physical, biological, and chemical quality of waters of the U.S. The U.S. Army Corps of Engineers (Corps) Regulatory Program administers and enforces Section 404 of the CWA. Under Section 404, a Corps permit is required for the discharge of dredged or fill material into wetlands and waters of the U.S. The Corps defines waters of the U.S. as all navigable waters and their tributaries, all interstate waters and their tributaries, all wetlands adjacent to these waters, and all impoundments of these waters. Because of court challenges to the Corps' jurisdiction over wetlands and waters of the U.S., the Corps' regulatory guidance is in a state of flux. Currently, the Corps' regulatory jurisdiction over isolated, nonnavigable, intrastate waters has been eliminated if the sole nexus to interstate commerce was use of the waters by migratory birds. The Corps now considers traditionally navigable waters (TNWs), wetlands adjacent to a TNW, and tributaries to TNWs that are relatively permanent waters (RPWs) and their abutting wetlands to be jurisdictional waters. Other wetlands and waters require a determination that the wetland or tributary would have an effect that is more than speculative or insubstantial on the chemical, physical, or biological integrity of a TNW to be jurisdictional. The U.S. Environmental Protection Agency and the Corps recently submitted a proposed rule to the Office of Management and Budget that is widely expected to extend CWA jurisdiction to many currently nonjurisdictional, isolated wetlands.

Site Conditions and Regulations

The property was previously assessed for potential isolated wetlands, jurisdictional wetlands, and other waters of the U.S. by Western Ecological Resource, Inc. The assessment identified two depressional wetlands in the north half of the property that have no apparent surface connection to other wetlands or waters. The assessment also identified the Lower Boulder Ditch and the Leyner Cottonwood Number 1 Ditch as

waters with adjacent fringe wetlands. Based on the assessment, the Corps determined that the depressional wetlands are isolated and not jurisdictional waters of the U.S., but also determined that the Lower Boulder Ditch and the Leyner Cottonwood Number 1 Ditch have a surface connection to jurisdictional waters of the U.S. and so are themselves jurisdictional waters of the U.S. The jurisdictional determination is valid from December 14, 2012 to December 13, 2017.

If any work is planned within the ditches that would require the placement of dredged or fill material within the ditches or their adjacent wetlands, authorization under Section 404 of the Clean Water Act would be required. Although the Corps has determined that the isolated depressional wetlands are nonjurisdictional, ERO recommends filling them as soon as practical to avoid the possibility that the EPA/Corps final rule changes their status and invalidates the jurisdictional determination.

If work such as stormwater outfalls or utilities extend off the property, affected areas should be assessed for the presence of waters of the U.S.

Threatened, Endangered, and Candidate Species

The property was assessed for potential habitat for threatened, endangered, and candidate species under the Endangered Species Act (ESA). Federally threatened and endangered species are protected under the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). Significant adverse effects to a federally listed species or its habitat require consultation with the U.S. Fish and Wildlife Service (Service) under Section 7 or 10 of the ESA. The Service lists several threatened and endangered species with potential habitat in Boulder County, or potentially affected by projects in Boulder County (Table 1).

Natural and Cultural
Resources Assessment
Wise Farm
Town of Erie, Boulder County, Colorado

Table 1. Federally threatened, endangered, and candidate species potentially found in Boulder County or potentially affected by projects in Boulder County.

Common Name	Scientific Name	Status *	Habitat	Suitable Habitat Present or Potential to be Affected by Project?
Mammals				
Black footed ferret	<i>Mustela nigripes</i>	EXP	Prairie and grassland ranging from mid-west to western US	No
Canada lynx	<i>Lynx canadensis</i>	T	Coniferous or mixed forest in boreal/montane regions; sometimes enters open forest, rocky regions, or tundra	No
Preble's meadow jumping mouse	<i>Zapus hudsonius preblei</i>	T	Shrub riparian/wet meadows	No
Birds				
Interior least tern **	<i>Sterna antillarum athalassos</i>	E	Sandy/pebble beaches on lakes, reservoirs, and rivers	No
Mexican spotted owl	<i>Strix occidentalis</i>	T	Closed canopy forests in steep canyons	No
Piping plover **	<i>Charadrius melodus</i>	T	Sandy lakeshore beaches, river sandbars	No
Whooping crane **	<i>Grus americana</i>	E	Mudflats around reservoirs and in agricultural areas	No
Fish				
Greenback cutthroat trout	<i>Oncorhynchus clarki stomias</i>	T	Clear, swift-flowing mountain streams with cover such as overhanging banks and vegetation	No
Pallid sturgeon **	<i>Scaphirhynchus albus</i>	E	Large, turbid, free-flowing rivers with a strong current and gravel or sandy substrate	No
Plants				

Natural and Cultural
Resources Assessment
Wise Farm
Town of Erie, Boulder County, Colorado

Common Name	Scientific Name	Status *	Habitat	Suitable Habitat Present or Potential to be Affected by Project?
Colorado butterfly plant	<i>Gaura neomexicana</i> ssp. <i>coloradensis</i>	T	Subirrigated, alluvial soils on level floodplains and drainage bottoms between 5,000 to 6,000 feet	No
Ute ladies'-tresses orchid	<i>Spiranthes diluvialis</i>	T	Moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes below 6,500 feet	No
Western prairie fringed orchid**	<i>Platanthera praeclara</i>	T	Moist to wet tallgrass prairies and sedge meadows, mostly in relatively undisturbed grasslands	No

*T = Federally Threatened Species, E = Federally Endangered Species, C= Federally Candidate Species.

**Water depletions in the South Platte River may affect the species and/or critical habitat in downstream reaches in other counties or states.

Source: Service 2010.

The proposed project would not directly affect the black-footed ferret, Canada lynx, Mexican spotted owl, or greenback cutthroat trout because of the lack of potentially suitable habitat in the property. The interior least tern, piping plover, whooping crane, and pallid sturgeon are species that are affected by water depletions from the South Platte River. If the project includes activities that deplete water in the South Platte River, such as diverting water from a stream, these species could be affected by the project and a consultation with the Service may be required.

Potential habitat for the Preble's meadow jumping mouse, Colorado butterfly plant, and Ute ladies'-tresses orchid is more prevalent within development sites across the Front Range, particularly in Boulder County. Because these species are more likely to be addressed by counties and regulatory agencies such as the Corps, a more detailed discussion is provided below.

Preble's Meadow Jumping Mouse

Species Background

Preble's meadow jumping mouse (Preble's) was listed as a threatened species on May 13, 1998 under the ESA (see Federal Register Vol. 63, No 232:66777-66784 12/3/98). Under existing regulations, either a habitat assessment or a full presence/absence survey for Preble's is required for any habitat-disturbing activity within areas determined to be potential Preble's habitat (generally stream and riparian habitats along the Colorado Front Range and southeastern Wyoming). Typically, Preble's occurs below 7,600 feet in elevation, generally in lowlands with medium to high moisture along permanent or intermittent streams and canals (Meaney et al. 1997). Preble's occurs in low undergrowth consisting of grasses and forbs, in open wet meadows, riparian corridors near forests, or where tall shrubs and low trees provide adequate cover (Service 1999; Meaney et al. 1997). Preble's typically inhabits areas characterized by well-developed plains riparian vegetation with relatively undisturbed grassland and a water source nearby.

Potential Habitat and Possible Effects

The property was assessed for potential Preble's habitat. The isolated wetlands and the ditches do not include vegetation communities typical of those associated with Preble's. The ditches are regularly maintained, so there are no shrubs or tall vegetation along them. The isolated wetlands are surrounded by weedy herbaceous vegetation. Additionally, there is no well-developed riparian habitat on or near the property. For these reasons, development of the property would have no effect on Preble's.

Recommendations

Because no potential habitat is present on the property, no action is necessary regarding Preble's.

Colorado Butterfly Plant

Species Background

The Colorado butterfly plant (CBP) is a short-lived perennial herb found in moist areas of floodplains. It occurs on subirrigated, alluvial soils on level or slightly sloping floodplains and drainage bottoms at elevations 5,000 to 6,400 feet. Colonies are often

found in low depressions or along bends in wide, active, meandering stream channels that are periodically disturbed. Historically, the main cause of disturbance was probably flooding (Service 2004). The CBP flowers from June to September and produces fruit from July to October (Spackman et al. 1997). This species is federally listed as threatened under the ESA and is found within a small area in southeastern Wyoming, western Nebraska, and north-central Colorado (NatureServe 2012).

Potential Habitat and Possible Effects

The Service has not established official survey guidelines for the CBP; however, no suitable habitat is present within the property because a natural drainage characterized by wetlands and an active floodplain is not present within the property.

Recommendations

Because the property does not contain suitable habitat, development of the property would have no effect on CBP and no action is necessary.

Ute Ladies'-Tresses Orchid

Species Background

The Ute ladies'-tresses orchid (ULTO) is federally listed as threatened. ULTO occurs at elevations below 6,500 feet in moist to wet alluvial meadows, floodplains of perennial streams, and around springs and lakes where the soil is seasonally saturated within 18 inches of the surface. Generally, the species occurs where the vegetative cover is relatively open and not overly dense or overgrazed. Once thought to be fairly common in low elevation riparian areas in the interior western United States, ULTO is now rare (Service 1992a).

In Colorado, the Service requires surveys in areas of suitable habitat on the 100-year floodplain of the South Platte River, Fountain Creek, and Yampa River and their perennial tributaries, or in any area with suitable habitat in Boulder and Jefferson counties. ULTO does not bloom until late July to early September (depending on the year) and timing of surveys must be synchronized with blooming (Service 1992a).

Potential Habitat and Possible Effects

ULTO is known to occur in Boulder County in the Boulder Creek floodplain north of the property. The known populations of ULTO are associated with ungrazed and undisturbed wetlands dominated by sedges and rushes. The depressional wetlands on the property do not include similar habitat. One wetland is heavily grazed by cattle and the other wetland is surrounded by species such as foxtail barley (*Hordeum jubatum*) and saltgrass (*Distichlis spicata*), neither of these conditions are suitable for ULTO.

Additionally, the soils on the property are sandy loams and clay loam, not the alluvium with which ULTO is typically associated. Because the wetland vegetation and soils are not suitable for ULTO, development of the property would have no effect on ULTO.

Recommendations

Because the property does not contain suitable habitat, no action is necessary regarding ULTO.

Other Species of Concern

Raptors and Migratory Birds

Migratory birds, as well as their eggs and nests, are protected under the Migratory Bird Treaty Act (MBTA). Bald and golden eagles are additionally protected by the Bald and Golden Eagle Protection Act. The MBTA does not contain any prohibition that applies to the destruction of a bird nest alone (without birds or eggs), provided that no possession occurs during the destruction. While destruction of a nest by itself is not prohibited under the MBTA, nest destruction that results in the unpermitted take of migratory birds or their eggs is illegal and fully prosecutable under the MBTA (Migratory Bird Permit Memorandum, U.S. Fish and Wildlife April 15, 2003). The regulatory definition of a take means to pursue, hunt, shoot, wound, kill, trap, capture, or collect; or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect.

The best way to avoid a violation of the MBTA is to remove vegetation outside of the active breeding season, which typically falls between March and August, depending on the species. Public awareness of the MBTA has grown in recent years, and most MBTA

enforcement actions are the result of a concerned member of the community reporting a violation.

Potential Habitat and Possible Effects

Although nests were not observed during the 2013 site visit, a variety of birds likely nest in the large trees along Jasper Road and in the scattered isolated trees on the property. Because of grazing and cultivation, ground nesting birds are not likely to be present. Any tree removal has the potential to destroy nests and will reduce nesting habitat on the parcel.

Recommendations

No nests were observed within the property during the 2013 site visit, but nests are certain to be present. To avoid destroying an active nest, ERO recommends that all vegetation be removed from the site between September and March, outside of the breeding season. If tree removal is not possible during the non-nesting season, a survey for active nests should be done. If an active nest is present, activities that would directly impact the nest, or that would encroach close enough to cause adult birds to abandon the nest during the breeding season, should be restricted.

Other Wildlife

The cultivated fields provide low quality habitat for wildlife. Species likely to be present include occasional songbirds foraging on insects and seeds and small mammals such as deer mouse. Larger birds such as magpie and raptors may also use the property. There is no habitat for sensitive or uncommon species on the property.

As with any human development, including residential development, wildlife species sensitive to human disturbance are likely to decline in abundance or abandon the area, while other wildlife species adapted to urban development are likely to increase in abundance. Because wildlife habitat on the property is low quality, Species likely to decline would include some raptors and possibly coyotes. Species likely to increase would include red fox, raccoon, and great horned owl. Overall, surrounding and continuing development contributes to a decline in the number and diversity of wildlife

species nearby and to a change in species composition to favor species that adapt better to human disturbance.

Cultural Resources

The National Historic Preservation Act (NHPA), as amended, protects buildings, sites, districts, structures, and objects that have significant scientific, historic, or cultural value. The act established affirmative responsibilities of federal agencies to preserve historic and prehistoric resources. Effects on properties that are listed on, or that are eligible for listing on, the National Register of Historic Places (National Register) must be taken into account in federal planning and operations. Any property that may qualify for listing on the National Register must not be inadvertently transferred, sold, demolished, substantially altered, or allowed to deteriorate.

Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation (ACHP) is then afforded a reasonable opportunity to comment. The historic preservation review process mandated by Section 106 is outlined in regulations issued by the ACHP. Revised regulations, known as “Protection of Historic Properties” (36 CFR Part 800), were updated on August 5, 2004.

The State of Colorado also maintains a list of historic properties significant to the state. These properties do not receive federal protection, but the state considers the potential effects to them that may result from state-funded projects. State listing also makes properties eligible for state grants for restoration and preservation.

Although Wise Farm has been part of the Town of Erie’s history since 1869 and the Erie Historical Society’s Wise Farm Museum is across Jasper Road from the property, the property and structures on the property are not listed on the National or State registers of historic places.

The Colorado State Historic Preservation Office (SHPO) considers all linear resources to be eligible to the NHRP, unless proven not eligible through research and documentation of the *entire* linear resource. So, although not listed on the registers, the Lower Boulder Ditch, and the Leyner Cottonwood Number 1 Ditch, and Union Pacific Railroad may be eligible for listing. Some structures on the property, including the two buildings

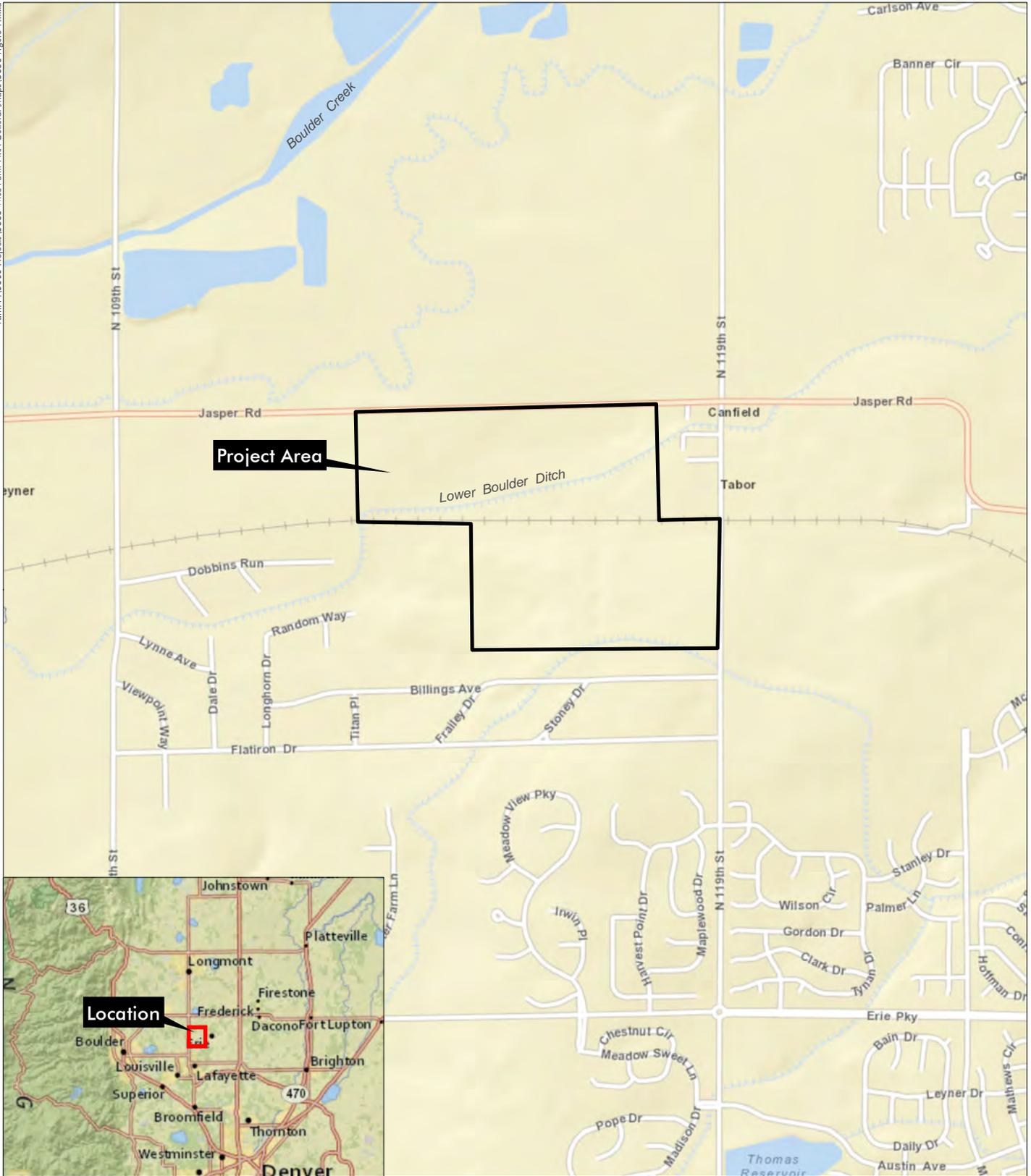
associated with the old wood mill, may be old enough to be potentially eligible for listing as well. These potentially federally-eligible resources typically only need to be evaluated if there is a federal nexus, such as obtaining authorization from the U.S. Army Corps of Engineers for work on the Lower Boulder Ditch or and the Leyner Cottonwood Number 1 Ditch. There are no state regulations regarding unlisted state-eligible properties.

Development of the property would not affect any state or federally-listed historic resources. The potentially eligible resources would require evaluation only in the event a federal action such as CWA Section 404 Permit authorization is required.

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- U.S. Fish and Wildlife Service. 2007a. Endangered and Threatened Wildlife and Plants; Revised Proposed Rule to Amend the Listing for the Preble's Meadow Jumping Mouse (*Zapus hudsonius preblei*) to Specify over what Portion of its Range the Subspecies is Threatened; Proposed Rule. Federal Register Part III Rules and Regulations, 50 CFR Part 17, 72:215. November 7.
- U.S. Fish and Wildlife Service (Service). 2010. Endangered, Threatened, Proposed and Candidate Species, Colorado Counties. Available at: <http://www.fws.gov/mountain-prairie/endspp/CountyLists/Colorado.pdf>. Last updated: July 2010.



Wise Farm Natural and Cultural Resources Assessment

Section 14, T1N, R69W; 6th PM
 UTM NAD 83: Zone 13N; 493084mE, 4433465mN
 Latitude, Longitude: 40.0513965°N, 105.081087°W
 USGS Erie, CO Quadrangle
 Boulder County, Colorado

Figure 1 Vicinity Map



Prepared for: PCS Group, Inc.
 File: 5653 Figure 1.mxd (GS)
 February 5, 2014





Wise Farm Natural and Cultural Resources Assessment

 Project Area Boundary

Image Source: Microsoft®, March 2012

Figure 2

0 125 250
Feet



Prepared for: PCS Group, Inc.
File: 5653 Figure 2.mxd (6S)
February 5, 2014





DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

December 14, 2012

Mr. David Johnson
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302

**RE: Approved JD for the Wise Homestead Site
Corps File No. 200580180**

Dear Mr. Johnson:

Reference is made to the above-mentioned project located in Section 14, T1N, R69W, Boulder County, Colorado. Wetland 2 and 5 were determined to be non-jurisdictional and are not regulated under Section 404 of the Clean Water Act. The Lower Boulder Ditch and the Leyner Cottonwood No.1 Ditch are jurisdictional.

This site has been reviewed in accordance with Section 404 of the Clean Water Act under which the U.S. Army Corps of Engineers regulates the discharge of dredged and fill material and certain excavation activities in waters of the United States. Waters of the U.S. may include ephemeral, intermittent and perennial streams, their surface connected wetlands and adjacent wetlands and certain lakes, ponds, drainage ditches and irrigation ditches that have a nexus to interstate commerce.

An approved jurisdictional determination (JD) has been completed for this project. The JD is attached to this letter. If you are not in agreement with the JD decision, you may request an administrative appeal under regulation 33 CFR 331, by using the attached Appeal Form and Administrative Appeal Process form. The request for appeal must be received within 60 days from the date of this letter. If you would like more information on the jurisdictional appeal process, contact this office. It is not necessary to submit a Request for Appeal if you do not object to the JD.

Those aquatic resources that were determined to be jurisdictional are known as "Waters of the United States" and are regulated under Section 404 of the Clean Water Act. Any placement of fill material into these aquatic resources would require a Department of the Army permit prior to impacts.

If any work associated with this project requires the placement of dredged or fill material, and any excavation associated with a dredged or fill project, either temporary or permanent, in the Lower Boulder Ditch or the Leyner Cottonwood No.1 Ditch, this office should be notified by a proponent of the project for Department of the Army permits or changes in permit requirements pursuant to Section 404 of the Clean Water Act.

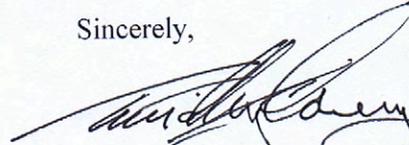
Any work in the Lower Boulder Ditch or the Leyner Cottonwood No.1 Ditch should be shown on a map identifying the Quarter Section, Township, Range and County of the work and the dimensions of work in each area. Any loss of wetlands may require mitigation. Mitigation requirements will be determined during the Department of the Army permitting review.

This JD is valid for a period of five years from the date of this letter, unless new information warrants revisions of the JDs before the expiration date, or unless the Corps has identified, after a possible public notice and comment, that specific geographic areas with rapidly changing environmental conditions merit re-verification on a more frequent basis.

The Omaha District, Regulatory Branch is committed to providing quality and timely service to our customers. In an effort to improve customer service, please take a moment to complete our Customer Service Survey found on our website at <http://per2.nwp.usace.army.mil/survey.html>. If you do not have Internet access, you may call and request a paper copy of the survey that you can complete and return to us by mail or fax. (Completing the survey is a voluntary action)

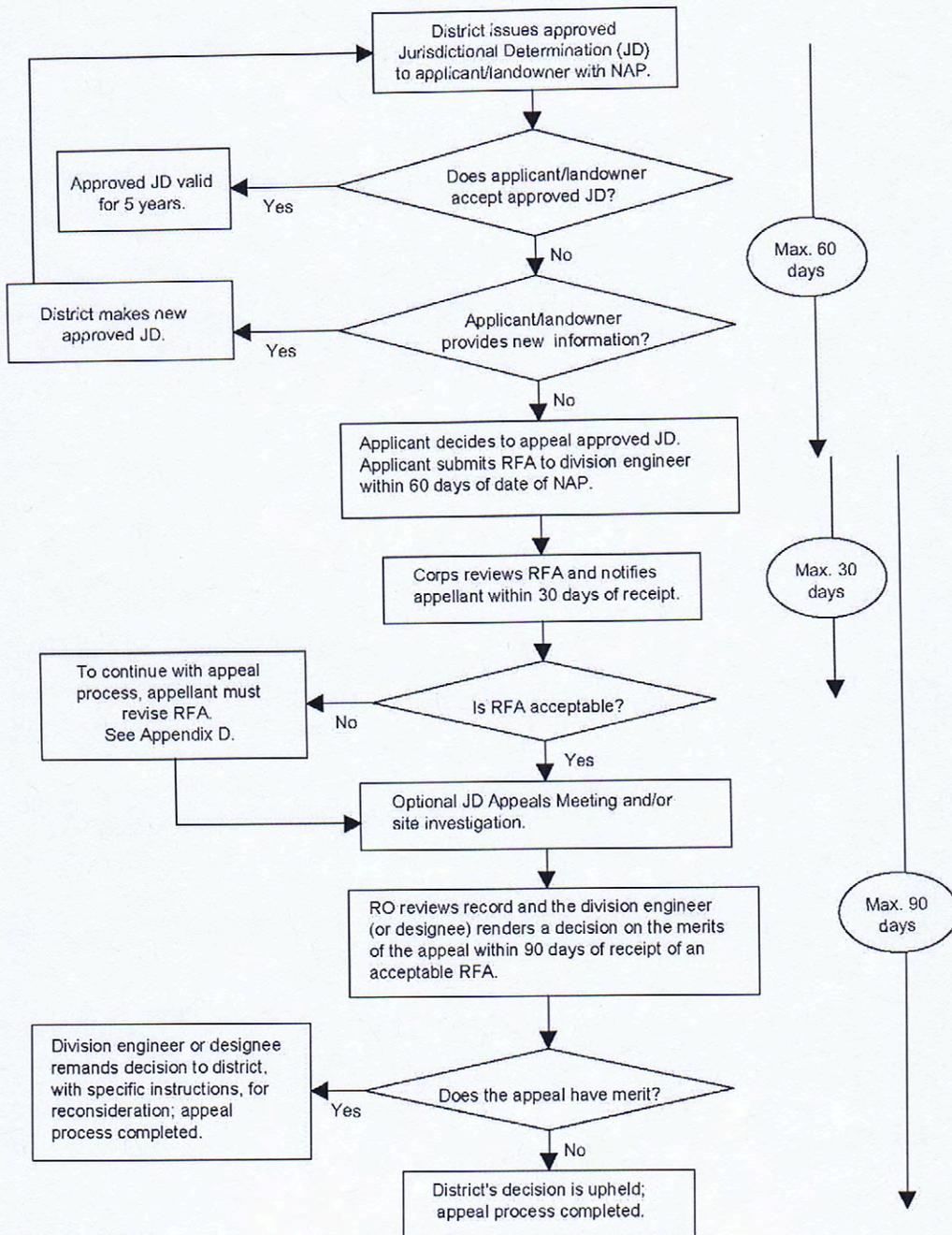
If there are any questions call **Mr. Terry McKee** of my office at **303-979-4120** and reference **Corps File No. 200580180**.

Sincerely,



Timothy T. Carey
Chief, Denver Regulatory Office

Administrative Appeal Process for Approved Jurisdictional Determinations



Appendix C

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant:	File Number: 200580180	Date:
Attached is:	See Section below	
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
	PERMIT DENIAL	C
X	APPROVED JURISDICTIONAL DETERMINATION	D
	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at <http://usace.army.mil/inet/functions/cw/cecwo/reg> or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **OBJECT:** If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **APPEAL:** If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- **ACCEPT:** You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- **APPEAL:** If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:

If you only have questions regarding the appeal process you may also contact:

US Army Corps of Engineers, Northwestern Division
Attn: Mary Hoffman, Northwestern Division Administrative Appeals Officer
1125 NW Couch Street
Portland, OR 97208-2870 Telephone (503) 808-3888
Mary.J.Hoffman@usace.army.mil

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Signature of appellant or agent.

Date:

Telephone number:

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): December 14, 2012

B. DISTRICT OFFICE, FILE NAME, AND NUMBER: Denver Regulatory Office, Wise Homestead, NWO-2005-80180-DEN

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State: **Co** County/parish/borough: **Boulder** City: **west of Erie**

Center coordinates of site (lat/long in degree decimal format): Lat. **40:0478 N**; Long. **-105:0781 W**

Universal Transverse Mercator:

Name of nearest waterbody: **Leyner Cottonwood No. 1 Ditch**

Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: **South Platte River.**

Name of watershed or Hydrologic Unit Code (HUC): **10190005**

Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.

Check if other sites (e.g., offsite mitigation sites, disposal sites, etc...) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

Office (Desk) Determination. Date: **October 24, 2012**

Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "navigable waters of the U.S." within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [Required]

Waters subject to the ebb and flow of the tide.

Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.

Explain:

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **Are** "waters of the U.S." within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [Required]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply):¹

TNWs, including territorial seas

Wetlands adjacent to TNWs

Relatively permanent waters² (RPWs) that flow directly or indirectly into TNWs

Non-RPWs that flow directly or indirectly into TNWs

Wetlands directly abutting RPWs that flow directly or indirectly into TNWs

Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs

Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs

Impoundments of jurisdictional waters

Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:

Non-wetland waters: **Leyner Cottonwood No.1 ditch – 1,242** linear feet: **4** width (ft) and/or _____ acres.

Wetlands: _____ acres.

c. Limits (boundaries) of jurisdiction based on: **Established by OHWM.**

Elevation of established OHWM (if known):

2. Non-regulated waters/wetlands (check if applicable):³

Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.

Explain:

¹ Boxes checked below shall be supported by completing the appropriate sections in Section III below.

² For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).

³ Supporting documentation is presented in Section III.F.

SECTION III: CWA ANALYSIS

A. TNWs AND WETLANDS ADJACENT TO TNWs

The agencies will assert jurisdiction over TNWs and wetlands adjacent to TNWs. If the aquatic resource is a TNW, complete Section III.A.1 and Section III.D.1. only; if the aquatic resource is a wetland adjacent to a TNW, complete Sections III.A.1 and 2 and Section III.D.1.; otherwise, see Section III.B below.

1. TNW

Identify TNW:

Summarize rationale supporting determination:

2. Wetland adjacent to TNW

Summarize rationale supporting conclusion that wetland is "adjacent":

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are "relatively permanent waters" (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody⁴ is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite. The determination whether a significant nexus exists is determined in Section III.C below.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:

Watershed size: 300 square miles

Drainage area: this canal flows for approx. 20 miles. The irrigation canal likely receives little or no overland sheet flow, and so is possibly physical isolated from the surrounding drainage in the immediate area. The canal is generally located at the same elevation of the surrounding land and receives little or no stormwater or precipitation runoff.

Average annual rainfall: 14 inches

Average annual snowfall: 40 inches

(ii) Physical Characteristics:

(a) Relationship with TNW:

Tributary flows directly into TNW.

Tributary flows through 2 tributaries before entering TNW.

Project waters are 20-25 river miles from TNW.

Project waters are 1 (or less) river miles from RPW.

Project waters are 10-15 aerial (straight) miles from TNW.

Project waters are 1 (or less) aerial (straight) miles from RPW.

Project waters cross or serve as state boundaries. Explain:

⁴ Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

Identify flow route to TNW⁵: **Flows to Lower Boulder Ditch that flows to the South Platte River.**

Tributary stream order, if known:

(b) General Tributary Characteristics (check all that apply):

Tributary is: Natural
 Artificial (man-made). Explain: **This is an irrigation ditch, which flows during an agricultural irrigation season.**
 Manipulated (man-altered). Explain:

Tributary properties with respect to top of bank (estimate):

Average width: **4** feet
Average depth: **2** feet
Average side slopes: **2:1**.

Primary tributary substrate composition (check all that apply):

Silts Sands Concrete
 Cobbles Gravel Muck
 Bedrock Vegetation. Type/% cover:
 Other. Explain:

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: **This is a stable irrigation ditch which is confined is by bermed banks.**

Presence of run/riffle/pool complexes. Explain:

Tributary geometry: **Relatively straight**

Tributary gradient (approximate average slope): **2 %**

(c) Flow:

Tributary provides for: **Seasonal flow**

Estimate average number of flow events in review area/year: **1**

Describe flow regime: **This irrigation ditch flows during the irrigation season.**

Other information on duration and volume:

Surface flow is: **Discrete and confined**. Characteristics: **This is a man-made irrigation ditch.**

Subsurface flow: **Pick List**. Explain findings:

Dye (or other) test performed:

Tributary has (check all that apply):

Bed and banks
 OHWM⁶ (check all indicators that apply):
 clear, natural line impressed on the bank the presence of litter and debris
 changes in the character of soil destruction of terrestrial vegetation
 shelving the presence of wrack line
 vegetation matted down, bent, or absent sediment sorting
 leaf litter disturbed or washed away scour
 sediment deposition multiple observed or predicted flow events
 water staining abrupt change in plant community
 other (list):
 Discontinuous OHWM.⁷ Explain:

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

High Tide Line indicated by: Mean High Water Mark indicated by:
 oil or scum line along shore objects survey to available datum;
 fine shell or debris deposits (foreshore) physical markings;
 physical markings/characteristics vegetation lines/changes in vegetation types.
 tidal gauges
 other (list):

(iii) **Chemical Characteristics:**

⁵ Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

⁶ A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.

⁷ Ibid.

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.).

Explain: **Water flow is general milky/brown in color during irrigaton flow season.**

Identify specific pollutants, if known:

(iv) **Biological Characteristics. Channel supports (check all that apply):**

Riparian corridor. Characteristics (type, average width): **Adjacent land is composed of general agricultural land. It is vegetated with native and non-native grasses, weeds shrubs and trees.**

Wetland fringe. Characteristics:

Habitat for:

Federally Listed species. Explain findings:

Fish/spawn areas. Explain findings:

Other environmentally-sensitive species. Explain findings:

Aquatic/wildlife diversity. Explain findings: **The surrounding area of this site consists of upland vegetation composed of native and non-native grasses, weeds, trees and shrubs with adjacent agricultural land. This area promotes habitat for small mammals, birds, snakes, and other wildlife adapted to agricultural habitat.**

2. **Characteristics of wetlands adjacent to non-TNW that flow directly or indirectly into TNW**

(i) **Physical Characteristics:**

(a) General Wetland Characteristics:

Properties:

Wetland size: acres

Wetland type. Explain:

Wetland quality. Explain:

Project wetlands cross or serve as state boundaries. Explain:

(b) General Flow Relationship with Non-TNW:

Flow is: **Pick List**. Explain:

Surface flow is: **Pick List**

Characteristics:

Subsurface flow: **Pick List**. Explain findings:

Dye (or other) test performed:

(c) Wetland Adjacency Determination with Non-TNW:

Directly abutting

Not directly abutting

Discrete wetland hydrologic connection. Explain:

Ecological connection. Explain:

Separated by berm/barrier. Explain:

(d) Proximity (Relationship) to TNW

Project wetlands are **Pick List** river miles from TNW.

Project waters are **Pick List** aerial (straight) miles from TNW.

Flow is from: **Pick List**.

Estimate approximate location of wetland as within the **Pick List** floodplain.

(ii) **Chemical Characteristics:**

Characterize wetland system (e.g., water color is clear, brown, oil film on surface; water quality; general watershed characteristics; etc.). Explain:

Identify specific pollutants, if known:

(iii) **Biological Characteristics. Wetland supports (check all that apply):**

Riparian buffer. Characteristics (type, average width):

Vegetation type/percent cover. Explain:

Habitat for:

Federally Listed species. Explain findings:

Fish/spawn areas. Explain findings:

Other environmentally-sensitive species. Explain findings:

Aquatic/wildlife diversity. Explain findings:

3. **Characteristics of all wetlands adjacent to the tributary (if any)**

All wetland(s) being considered in the cumulative analysis: **Pick List**

Approximately () acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

Directly abuts? (Y/N)

Size (in acres)

Directly abuts? (Y/N)

Size (in acres)

Summarize overall biological, chemical and physical functions being performed:

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D:
2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:
3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. **TNWs and Adjacent Wetlands.** Check all that apply and provide size estimates in review area:
 TNWs: linear feet width (ft), Or, acres.
 Wetlands adjacent to TNWs: acres.
2. **RPWs that flow directly or indirectly into TNWs.**
 Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial:
 Tributaries of TNW where tributaries have continuous flow "seasonally" (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: **Flows 6-7 months per year, duration and volume vary depending on the water year and water rights. Flows to Lower Boulder Ditch to Coal Ridge Ditch that flow to Sand Hill Reservoir that outlets to South Platte River**

Provide estimates for jurisdictional waters in the review area (check all that apply):

Tributary waters: linear feet width (ft).

Other non-wetland waters: acres.

Identify type(s) of waters: .

3. Non-RPWs⁸ that flow directly or indirectly into TNWs.

- Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):

Tributary waters: linear feet width (ft).

Other non-wetland waters: acres.

Identify type(s) of waters: .

4. Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.

- Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
- Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .
- Wetlands directly abutting an RPW where tributaries typically flow "seasonally." Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW: .

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

5. Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.

- Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

6. Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.

- Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: acres.

7. Impoundments of jurisdictional waters.⁹

As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.

- Demonstrate that impoundment was created from "waters of the U.S.," or
- Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
- Demonstrate that water is isolated with a nexus to commerce (see E below).

E. ISOLATED [INTERSTATE OR INTRA-STATE] WATERS, INCLUDING ISOLATED WETLANDS, THE USE, DEGRADATION OR DESTRUCTION OF WHICH COULD AFFECT INTERSTATE COMMERCE, INCLUDING ANY SUCH WATERS (CHECK ALL THAT APPLY):¹⁰

- which are or could be used by interstate or foreign travelers for recreational or other purposes.
- from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.
- which are or could be used for industrial purposes by industries in interstate commerce.
- Interstate isolated waters. Explain: .
- Other factors. Explain: .

Identify water body and summarize rationale supporting determination: .

⁸See Footnote # 3.

⁹To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.

¹⁰ Prior to asserting or declining CWA jurisdiction based solely on this category, Corps Districts will elevate the action to Corps and EPA HQ for review consistent with the process described in the Corps/EPA Memorandum Regarding CWA Act Jurisdiction Following Rapanos.

Provide estimates for jurisdictional waters in the review area (check all that apply):

- Tributary waters: linear feet width (ft).
- Other non-wetland waters: acres.
- Identify type(s) of waters: .
- Wetlands: acres.

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
 - Prior to the Jan 2001 Supreme Court decision in "SWANCC," the review area would have been regulated based solely on the "Migratory Bird Rule" (MBR).
- Waters do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction. Explain: .
- Other: (explain, if not covered above): .

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- Non-wetland waters (i.e., rivers, streams): linear feet width (ft).
- Lakes/ponds: acres.
- Other non-wetland waters: acres. List type of aquatic resource: .
- Wetlands: acres.

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the "Significant Nexus" standard, where such a finding is required for jurisdiction (check all that apply):

- Non-wetland waters (i.e., rivers, streams): linear feet, width (ft).
- Lakes/ponds: acres.
- Other non-wetland waters: acres. List type of aquatic resource: .
- Wetlands: acres.

SECTION IV: DATA SOURCES.

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: **Western Ecological Resource, Inc.**
- Data sheets prepared/submitted by or on behalf of the applicant/consultant.
 - Office concurs with data sheets/delineation report.
 - Office does not concur with data sheets/delineation report.
- Data sheets prepared by the Corps:
- Corps navigable waters' study:
- U.S. Geological Survey Hydrologic Atlas:
 - USGS NHD data.
 - USGS 8 and 12 digit HUC maps.
- U.S. Geological Survey map(s). Cite scale & quad name: **1:24,000 Erie .**
- USDA Natural Resources Conservation Service Soil Survey. Citation: .
- National wetlands inventory map(s). Cite name: .
- State/Local wetland inventory map(s): .
- FEMA/FIRM maps:
- 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- Photographs: Aerial (Name & Date): **google aerial .**
 - or Other (Name & Date):
- Previous determination(s). File no. and date of response letter: .
- Applicable/supporting case law: **Rapanos and Carabell cases.**
- Applicable/supporting scientific literature: .
- Other information (please specify): .

B. ADDITIONAL COMMENTS TO SUPPORT JD:

APPROVED JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR APPROVED JURISDICTIONAL DETERMINATION (JD): December 14, 2012

B. DISTRICT OFFICE, FILE NAME, AND NUMBER:

Denver Regulatory Office, Wise Homestead, NWO-2005-80180-DEN

C. PROJECT LOCATION AND BACKGROUND INFORMATION:

State: CO County/parish/borough: Boulder City: west of Erie
Center coordinates of site (lat/long in degree decimal format):

Wetland 2 - Lat. 40.054072 N, Long. -105.08007 W

Wetland 5 - Lat 40.053456 N, Long -105.087017 W

Name of nearest waterbody: Lower Boulder Ditch

Name of nearest Traditional Navigable Water (TNW) into which the aquatic resource flows: South Platte River

Name of watershed or Hydrologic Unit Code (HUC): 10190005

Check if map/diagram of review area and/or potential jurisdictional areas is/are available upon request.

Check if other sites (e.g., offsite mitigation sites, disposal sites, etc...) are associated with this action and are recorded on a different JD form.

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

Office (Desk) Determination. Date: October 24, 2012

Field Determination. Date(s):

SECTION II: SUMMARY OF FINDINGS

A. RHA SECTION 10 DETERMINATION OF JURISDICTION.

There **Are no** "navigable waters of the U.S." within Rivers and Harbors Act (RHA) jurisdiction (as defined by 33 CFR part 329) in the review area. [Required]

Waters subject to the ebb and flow of the tide.

Waters are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.

Explain: .

B. CWA SECTION 404 DETERMINATION OF JURISDICTION.

There **are and are not** "waters of the U.S." within Clean Water Act (CWA) jurisdiction (as defined by 33 CFR part 328) in the review area. [Required]

1. Waters of the U.S.

a. Indicate presence of waters of U.S. in review area (check all that apply):¹

TNWs, including territorial seas

Wetlands adjacent to TNWs

Relatively permanent waters² (RPWs) that flow directly or indirectly into TNWs

Non-RPWs that flow directly or indirectly into TNWs

Wetlands directly abutting RPWs that flow directly or indirectly into TNWs

Wetlands adjacent to but not directly abutting RPWs that flow directly or indirectly into TNWs

Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs

Impoundments of jurisdictional waters

Isolated (interstate or intrastate) waters, including isolated wetlands

b. Identify (estimate) size of waters of the U.S. in the review area:

Non-wetland waters: Lower Boulder Ditch - 3,450 linear feet: 25 width (ft)

Wetlands: acres.

c. Limits (boundaries) of jurisdiction based on: Pick List

Elevation of established OHWM (if known): .

2. Non-regulated waters/wetlands (check if applicable):³

¹ Boxes checked below shall be supported by completing the appropriate sections in Section III below.

² For purposes of this form, an RPW is defined as a tributary that is not a TNW and that typically flows year-round or has continuous flow at least "seasonally" (e.g., typically 3 months).

- Potentially jurisdictional waters and/or wetlands were assessed within the review area and determined to be not jurisdictional.
Explain: **Wetlands 2 and 5 were assessed and determined to have no significant nexus to a downstream TNW. See Section C below.**

B. CHARACTERISTICS OF TRIBUTARY (THAT IS NOT A TNW) AND ITS ADJACENT WETLANDS (IF ANY):

This section summarizes information regarding characteristics of the tributary and its adjacent wetlands, if any, and it helps determine whether or not the standards for jurisdiction established under *Rapanos* have been met.

The agencies will assert jurisdiction over non-navigable tributaries of TNWs where the tributaries are “relatively permanent waters” (RPWs), i.e. tributaries that typically flow year-round or have continuous flow at least seasonally (e.g., typically 3 months). A wetland that directly abuts an RPW is also jurisdictional. If the aquatic resource is not a TNW, but has year-round (perennial) flow, skip to Section III.D.2. If the aquatic resource is a wetland directly abutting a tributary with perennial flow, skip to Section III.D.4.

A wetland that is adjacent to but that does not directly abut an RPW requires a significant nexus evaluation. Corps districts and EPA regions will include in the record any available information that documents the existence of a significant nexus between a relatively permanent tributary that is not perennial (and its adjacent wetlands if any) and a traditional navigable water, even though a significant nexus finding is not required as a matter of law.

If the waterbody⁴ is not an RPW, or a wetland directly abutting an RPW, a JD will require additional data to determine if the waterbody has a significant nexus with a TNW. If the tributary has adjacent wetlands, the significant nexus evaluation must consider the tributary in combination with all of its adjacent wetlands. This significant nexus evaluation that combines, for analytical purposes, the tributary and all of its adjacent wetlands is used whether the review area identified in the JD request is the tributary, or its adjacent wetlands, or both. If the JD covers a tributary with adjacent wetlands, complete Section III.B.1 for the tributary, Section III.B.2 for any onsite wetlands, and Section III.B.3 for all wetlands adjacent to that tributary, both onsite and offsite.

1. Characteristics of non-TNWs that flow directly or indirectly into TNW

(i) General Area Conditions:

Watershed size: **400 square miles**

Drainage area: **this canal flows for approx. 31 miles. The irrigation canal likely receives little or no overland sheet flow, and so is possibly physically isolated from the surrounding drainage in the immediate area. The canal is perched approximately 12 feet above the surrounding land and receives little or no stormwater or precipitation runoff.**

Average annual rainfall: **15.4 inches**

Average annual snowfall: **60.2 inches**

(ii) Physical Characteristics:

(a) Relationship with TNW:

Tributary flows directly into TNW.

Tributary flows through **2** tributaries before entering TNW.

Project waters are **20-25** river miles from TNW.

Project waters are **1 (or less)** river miles from RPW.

Project waters are **10-15** aerial (straight) miles from TNW.

Project waters are **1 (or less)** aerial (straight) miles from RPW.

Project waters cross or serve as state boundaries. Explain:

Identify flow route to TNW⁵: **Wetlands 2 and 5 are physically adjacent to the Lower Boulder Ditch, which spills water seasonally to an unnamed tributary that flows to the St. Vrain Creek. Further downstream, the canal flows to Coal Ridge Ditch that flows to Sand Hill Reservoir that outlets to South Platte River.**

Tributary stream order, if known:

(b) General Tributary Characteristics (check all that apply):

Tributary is: Natural

Artificial (man-made). Explain:

Manipulated (man-altered). Explain:

Tributary properties with respect to top of bank (estimate):

Average width: **25** feet

Average depth: **5** feet

Average side slopes: **2:1**.

Primary tributary substrate composition (check all that apply):

Silts

Sands

Concrete

³ Supporting documentation is presented in Section III.F.

⁴ Note that the Instructional Guidebook contains additional information regarding swales, ditches, washes, and erosional features generally and in the arid West.

⁵ Flow route can be described by identifying, e.g., tributary a, which flows through the review area, to flow into tributary b, which then flows into TNW.

- Cobbles Gravel Muck
 Bedrock Vegetation. Type/% cover:
 Other. Explain: **This canal is made up of packed dirt and clay.**

Tributary condition/stability [e.g., highly eroding, sloughing banks]. Explain: **Stabil and maintained. Banks are populated with smooth brome.**

Presence of run/riffle/pool complexes. Explain:.

Tributary geometry: **Relatively straight**

Tributary gradient (approximate average slope): **1 %**

(c) **Flow:**

Tributary provides for: **Seasonal flow**

Estimate average number of flow events in review area/year: **1**

Describe flow regime: **Water is diverted into the canal for irrigation purposes from April to October during the agricultural season.**

Other information on duration and volume

Surface flow is: **Discrete and confined.** Characteristics: **This canal is a maintained and delivers irrigation water during the agricultural growing season.**

Subsurface flow: Explain findings:

Dye (or other) test performed:

Tributary has (check all that apply):

- | | |
|--|---|
| <input checked="" type="checkbox"/> Bed and banks | <input type="checkbox"/> the presence of litter and debris |
| <input checked="" type="checkbox"/> OHWM ⁶ (check all indicators that apply): | <input checked="" type="checkbox"/> destruction of terrestrial vegetation |
| <input checked="" type="checkbox"/> clear, natural line impressed on the bank | <input type="checkbox"/> the presence of wrack line |
| <input type="checkbox"/> changes in the character of soil | <input type="checkbox"/> sediment sorting |
| <input type="checkbox"/> shelving | <input type="checkbox"/> scour |
| <input type="checkbox"/> vegetation matted down, bent, or absent | <input type="checkbox"/> multiple observed or predicted flow events |
| <input type="checkbox"/> leaf litter disturbed or washed away | <input type="checkbox"/> abrupt change in plant community |
| <input type="checkbox"/> sediment deposition | |
| <input type="checkbox"/> water staining | |
| <input type="checkbox"/> other (list): | |
| <input type="checkbox"/> Discontinuous OHWM. ⁷ Explain: | |

If factors other than the OHWM were used to determine lateral extent of CWA jurisdiction (check all that apply):

- | | |
|--|--|
| <input checked="" type="checkbox"/> High Tide Line indicated by: | <input checked="" type="checkbox"/> Mean High Water Mark indicated by: |
| <input type="checkbox"/> oil or scum line along shore objects | <input type="checkbox"/> survey to available datum; |
| <input type="checkbox"/> fine shell or debris deposits (foreshore) | <input type="checkbox"/> physical markings; |
| <input type="checkbox"/> physical markings/characteristics | <input type="checkbox"/> vegetation lines/changes in vegetation types. |
| <input type="checkbox"/> tidal gauges | |
| <input type="checkbox"/> other (list): | |

(iii) **Chemical Characteristics:**

Characterize tributary (e.g., water color is clear, discolored, oily film; water quality; general watershed characteristics, etc.). Explain:

Water is generally clear. Flows are shunted off Boulder Creek during the irrigation season.

Identify specific pollutants, if known:

(iv) **Biological Characteristics. Channel supports (check all that apply):**

- Riparian corridor. Characteristics (type, average width):
 Wetland fringe. Characteristics:
 Habitat for:
 Federally Listed species. Explain findings:
 Fish/spawn areas. Explain findings:
 Other environmentally-sensitive species. Explain findings:
 Aquatic/wildlife diversity. Explain findings:

3. **Characteristics of all wetlands adjacent to the tributary (if any)**

All wetland(s) being considered in the cumulative analysis: **2**

Approximately (**5**) acres in total are being considered in the cumulative analysis.

For each wetland, specify the following:

⁶A natural or man-made discontinuity in the OHWM does not necessarily sever jurisdiction (e.g., where the stream temporarily flows underground, or where the OHWM has been removed by development or agricultural practices). Where there is a break in the OHWM that is unrelated to the waterbody's flow regime (e.g., flow over a rock outcrop or through a culvert), the agencies will look for indicators of flow above and below the break.

⁷Ibid.

Directly abuts? (Y/N)

N

Size (in acres)

5

Directly abuts? (Y/N)

Size (in acres)

Summarize overall biological, chemical and physical functions being performed: **The biological function may provide habitat for micro and macro invertebrates. Chemical function is most likely insignificant given that flows from these wetlands would rarely, if ever, reach a downstream TNW.**

C. SIGNIFICANT NEXUS DETERMINATION

A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by any wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical, and biological integrity of a TNW. For each of the following situations, a significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of a TNW. Considerations when evaluating significant nexus include, but are not limited to the volume, duration, and frequency of the flow of water in the tributary and its proximity to a TNW, and the functions performed by the tributary and all its adjacent wetlands. It is not appropriate to determine significant nexus based solely on any specific threshold of distance (e.g. between a tributary and its adjacent wetland or between a tributary and the TNW). Similarly, the fact an adjacent wetland lies within or outside of a floodplain is not solely determinative of significant nexus.

Draw connections between the features documented and the effects on the TNW, as identified in the *Rapanos* Guidance and discussed in the Instructional Guidebook. Factors to consider include, for example:

- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to carry pollutants or flood waters to TNWs, or to reduce the amount of pollutants or flood waters reaching a TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), provide habitat and lifecycle support functions for fish and other species, such as feeding, nesting, spawning, or rearing young for species that are present in the TNW?
- Does the tributary, in combination with its adjacent wetlands (if any), have the capacity to transfer nutrients and organic carbon that support downstream foodwebs?
- Does the tributary, in combination with its adjacent wetlands (if any), have other relationships to the physical, chemical, or biological integrity of the TNW?

Note: the above list of considerations is not inclusive and other functions observed or known to occur should be documented below:

1. **Significant nexus findings for non-RPW that has no adjacent wetlands and flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary itself, then go to Section III.D:
2. **Significant nexus findings for non-RPW and its adjacent wetlands, where the non-RPW flows directly or indirectly into TNWs.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:
3. **Significant nexus findings for wetlands adjacent to an RPW but that do not directly abut the RPW.** Explain findings of presence or absence of significant nexus below, based on the tributary in combination with all of its adjacent wetlands, then go to Section III.D:

Please note, current *Rapanos* Guidance states:

The agencies will apply the significant nexus standard as follows:

" A significant nexus analysis will assess the flow characteristics and functions of the tributary itself and the functions performed by all wetlands adjacent to the tributary to determine if they significantly affect the chemical, physical and biological integrity of downstream traditional navigable waters."

The determination below deviates from this guidance due to the proximal characteristics of the relationship between the adjacent wetlands and the canal, acting as a tributary to a downstream TNW. An exception is made in this case due to the perched nature of the canal at this location. As the extent and proximity of wetlands adjacent to the canal over its 31 miles are unknown, and the canal does not function as a typical natural tributary within a drainage, it is not appropriate to use the above referenced guidance in this case. Rather than evaluate all wetlands adjacent to the canal, this determination is only evaluating the wetlands on-site and their possible nexus with the canal and downstream TNW. Other wetlands adjacent to this canal will be evaluated as needed.

Findings of no significant nexus.

Lower Boulder Ditch receives no overland sheet flow from the surrounding area or from the adjacent wetlands, and so is physically isolated from the drainage. The canal is perched approximately 12 feet above the surrounding land and receives no stormwater or precipitation runoff. Flows are regulated within the canal, so flows would rarely, if ever, overtop and reach the wetlands down-gradient.

These wetlands are located approximately 20.5 river miles from the St. Vrain, a TNW. From this subject site, the Lower Boulder Ditch flows approximately 13 miles to a flume over an unnamed tributary. This unnamed tributary flows approximately 7.65 miles to the St. Vrain Creek. At the location of the flume, the Lower Boulder Ditch has an outlet where water can be spilled into the unnamed tributary. Discharges at this outlet are unknown. Beyond this confluence, the canal flows to Coal Ridge Ditch that flows to Sand Hill Reservoir that outlets to South Platte River.

Wetland 2 - This wetland is located in a depressional basin and receives stormwater runoff from the surrounding landscape, and likely has a high groundwater table in the spring. The surrounding hayfield is not flood irrigated and there is no outlet to the basin. This wetland is located 340 feet north of the Lower Boulder Ditch and approximately 12 feet lower in elevation than the ditch. When visited on October 18, 2012, the cattail area had no water and the soils were dry, while the ditch was full and flowing. Thus, it appears there is likely no seepage from the ditch to the wetland. This wetland is topographically lower than the ditch and thus appears to be hydrologically isolated from waters of the U.S. features. This wetland is characterized by reed canarygrass (*Phalaris arundinacea*) and dense stands of annual weeds with broadleaf cattails (*Typha latifolia*) in the center. The wetland appears to be shrinking in size, as evidenced by the concentric ring of kochia (*Kochia scoparia*) around the cattails.

Wetland 5 – This wetland is associated with an ephemeral pond. This wetland/pond is located 560 feet north of the Lower Boulder Ditch in a depression on the southwestern area of the property. When visited on October 18, 2012, it was characterized by the dry soils of a seasonal aquatic pond. The dry pond bed is surrounded by saltgrass (*Distichlis spicata*). Water for the wetland is provided by stormwater runoff and perhaps a seasonal high groundwater table. The surrounding pasture is not flood irrigated and there is no outlet from the pond. Also, there does not appear to be any seepage from the Lower Boulder Ditch to the dry pond bed, even though the pond bed is topographically lower. Thus, this wetland/pond appears to be hydrologically isolated from waters of the U.S. features. Wetland 5 is a seasonal pond surrounded by saltgrass; however, the elevation of the area of salt grass is above the seasonal high water level of the pond and may not have a wetland hydrology. At this time it has not been determined that the salt grass pond fringe area is 3-parameter wetland.

The hydrologic nexus from these two wetlands to St. Vrain Creek is so minimal as to be insubstantial, possibly even nonexistent. There is also no evidence of a significant biological or ecological nexus, such as ESA habitat or aquatic life movement. The proximity and topography of the relationship between the wetlands and the ditch are such that only during an extreme high precipitation event would it be conceivable that flows from this wetland would reach even Lower Boulder Ditch, let alone St. Vrain Creek or the South Platte River

There is no evidence of the presence of more than a speculative or insubstantial effect on the chemical, physical and/or biological integrity of the downstream TNW.

D. DETERMINATIONS OF JURISDICTIONAL FINDINGS. THE SUBJECT WATERS/WETLANDS ARE (CHECK ALL THAT APPLY):

1. TNWs and Adjacent Wetlands. Check all that apply and provide size estimates in review area:

- TNWs: linear feet width (ft), Or, acres.
 Wetlands adjacent to TNWs: acres.

2. RPWs that flow directly or indirectly into TNWs.

- Tributaries of TNWs where tributaries typically flow year-round are jurisdictional. Provide data and rationale indicating that tributary is perennial:
 Tributaries of TNW where tributaries have continuous flow “seasonally” (e.g., typically three months each year) are jurisdictional. Data supporting this conclusion is provided at Section III.B. Provide rationale indicating that tributary flows seasonally: **Flows 6-7 months per year, duration and volume vary depending on the water year and water rights. Flows to Coal Ridge Ditch that flows to Sand Hill Reservoir that outlets to South Platte River.**

Provide estimates for jurisdictional waters in the review area (check all that apply):

- Tributary waters: : **3,450** linear feet: **25** width (ft) **31 miles in total length**
 Other non-wetland waters: acres.
Identify type(s) of waters: .

3. Non-RPWs⁸ that flow directly or indirectly into TNWs.

- Waterbody that is not a TNW or an RPW, but flows directly or indirectly into a TNW, and it has a significant nexus with a TNW is jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional waters within the review area (check all that apply):

- Tributary waters: linear feet width (ft).
 Other non-wetland waters: acres.
Identify type(s) of waters: .

4. Wetlands directly abutting an RPW that flow directly or indirectly into TNWs.

- Wetlands directly abut RPW and thus are jurisdictional as adjacent wetlands.
 Wetlands directly abutting an RPW where tributaries typically flow year-round. Provide data and rationale indicating that tributary is perennial in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW:
 Wetlands directly abutting an RPW where tributaries typically flow “seasonally.” Provide data indicating that tributary is seasonal in Section III.B and rationale in Section III.D.2, above. Provide rationale indicating that wetland is directly abutting an RPW:

Provide acreage estimates for jurisdictional wetlands in the review area: acres.

⁸See Footnote # 3.

5. **Wetlands adjacent to but not directly abutting an RPW that flow directly or indirectly into TNWs.**

- Wetlands that do not directly abut an RPW, but when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide acreage estimates for jurisdictional wetlands in the review area: _____ acres.

6. **Wetlands adjacent to non-RPWs that flow directly or indirectly into TNWs.**

- Wetlands adjacent to such waters, and have when considered in combination with the tributary to which they are adjacent and with similarly situated adjacent wetlands, have a significant nexus with a TNW are jurisdictional. Data supporting this conclusion is provided at Section III.C.

Provide estimates for jurisdictional wetlands in the review area: _____ acres.

7. **Impoundments of jurisdictional waters.⁹**

As a general rule, the impoundment of a jurisdictional tributary remains jurisdictional.

- Demonstrate that impoundment was created from “waters of the U.S.,” or
 Demonstrate that water meets the criteria for one of the categories presented above (1-6), or
 Demonstrate that water is isolated with a nexus to commerce (see E below).

SECTION III: CWA ANALYSIS

F. NON-JURISDICTIONAL WATERS, INCLUDING WETLANDS (CHECK ALL THAT APPLY):

- If potential wetlands were assessed within the review area, these areas did not meet the criteria in the 1987 Corps of Engineers Wetland Delineation Manual and/or appropriate Regional Supplements.
- Review area included isolated waters with no substantial nexus to interstate (or foreign) commerce.
 Prior to the Jan 2001 Supreme Court decision in “SWANCC,” the review area would have been regulated based solely on the “Migratory Bird Rule” (MBR).
- Waters do not meet the “Significant Nexus” standard, where such a finding is required for jurisdiction. Explain:
- Other: (explain, if not covered above):

Provide acreage estimates for non-jurisdictional waters in the review area, where the sole potential basis of jurisdiction is the MBR factors (i.e., presence of migratory birds, presence of endangered species, use of water for irrigated agriculture), using best professional judgment (check all that apply):

- Non-wetland waters (i.e., rivers, streams): _____ linear feet _____ width (ft).
 Lakes/ponds: **Wetland 5 – wetland/ephemeral pond 1 acre**
 Other non-wetland waters: _____ acres. List type of aquatic resource: _____
 Wetlands: **Wetland 2 – 4 acres,**

Provide acreage estimates for non-jurisdictional waters in the review area that do not meet the “Significant Nexus” standard, where such a finding is required for jurisdiction (check all that apply):

- Non-wetland waters (i.e., rivers, streams): _____
 Lakes/ponds: _____ acres. **Wetland 5 – wetland/ephemeral pond 1 acre**
 Other non-wetland waters: _____ acres. List type of aquatic resource: _____
 Wetlands: **Wetland 2 – 4 acres,**

SECTION IV: DATA SOURCES.

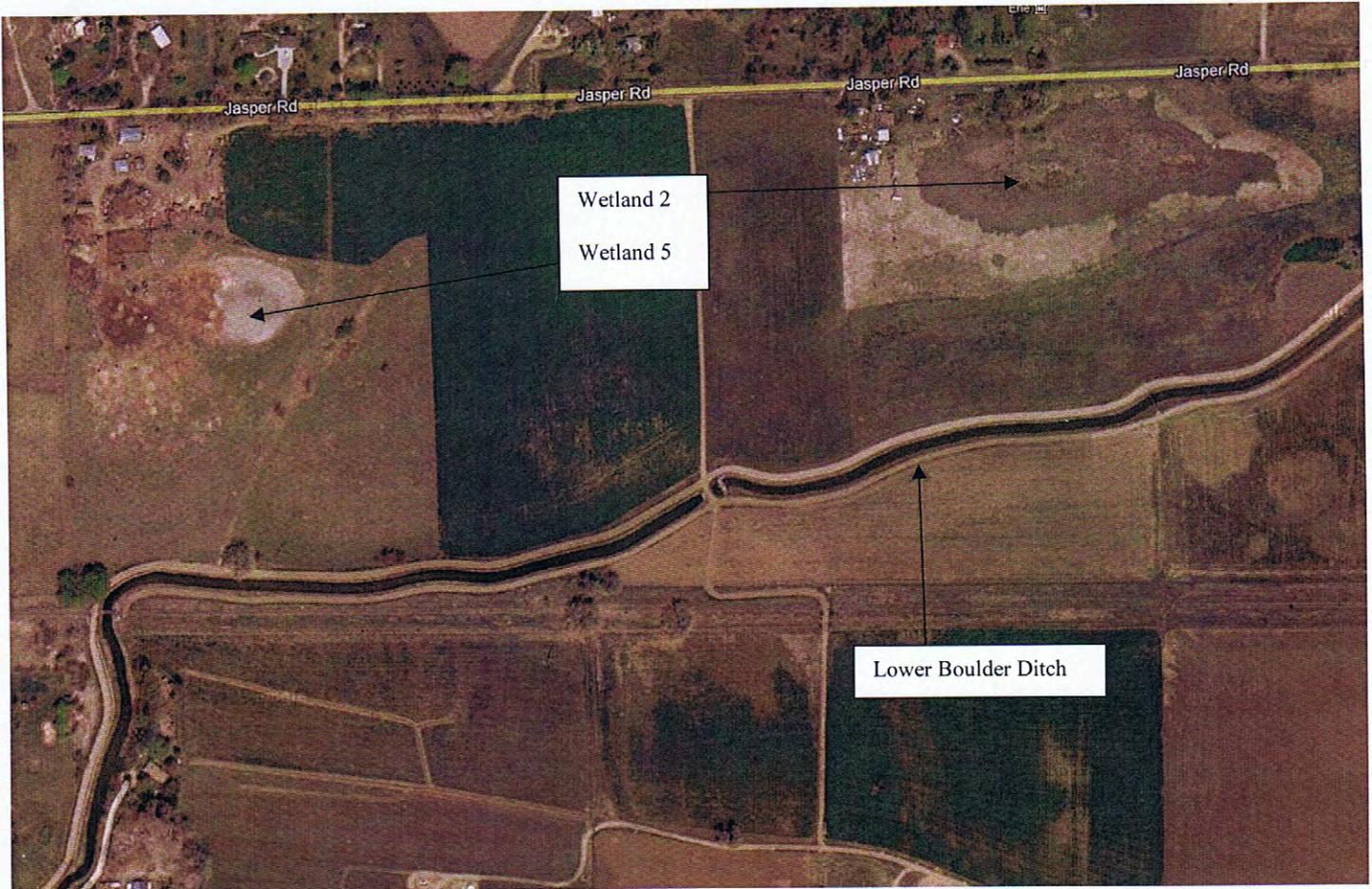
A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked and requested, appropriately reference sources below):

- Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: **Western Ecological Resource, Inc.**
- Data sheets prepared/submitted by or on behalf of the applicant/consultant.
 Office concurs with data sheets/delineation report.
 Office does not concur with data sheets/delineation report.
- Data sheets prepared by the Corps: _____
 Corps navigable waters’ study: _____
- U.S. Geological Survey Hydrologic Atlas: _____
 USGS NHD data.
 USGS 8 and 12 digit HUC maps.
- U.S. Geological Survey map(s). Cite scale & quad name **1:24000 ERIE**
- USDA Natural Resources Conservation Service Soil Survey. Citation: _____
- National wetlands inventory map(s). Cite name: _____

⁹ To complete the analysis refer to the key in Section III.D.6 of the Instructional Guidebook.

- State/Local wetland inventory map(s): . . .
- FEMA/FIRM maps: . . .
- 100-year Floodplain Elevation is: (National Geodectic Vertical Datum of 1929)
- Photographs: Aerial (Name & Date): **project site, wetland 2 and wetland 5**
or Other (Name & Date): **project site, wetland 2 and wetland 5, October 18, 2012**
- Previous determination(s). File no. and date of response letter: . . .
- Applicable/supporting case law: **Rapanos and Carabell cases.**
- Applicable/supporting scientific literature: . . .
- Other information (please specify): . . .

B. ADDITIONAL COMMENTS TO SUPPORT JD: Site Map





**WESTERN
ECOLOGICAL
RESOURCE, INC.**

711 Walnut Street
Boulder, Colorado 80302
(303) 449-9009
Fax (303) 449-9038
mail@westerneco.com

March 15, 2005

Mr. Terry McKee
U.S. Army Corps of Engineers
Denver Regulatory Office
9307 South Wadsworth Blvd
Littleton, CO 80128-6901

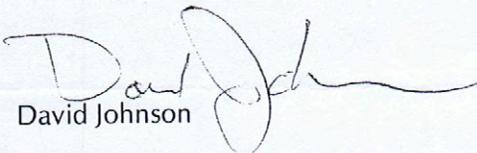
RE: Wise Property, Erie, Colorado

Via Fax and Mail

Dear Terry:

In June of 1999 we submitted a Wetland Delineation Report for the Wise Homestead located just west of Erie in Boulder County, Colorado. Specifically, the project is located in Township 1 North, Range 69 West, Section 14 (Figure 1). The wetland delineation has now expired and we believe the wetlands may be isolated and hence non-jurisdictional. An approved jurisdictional determination is requested. We would like to meet you on the project site at your earliest convenience.

Sincerely,


David Johnson

DJ/ro

Enclosure

Cc: James Dullea



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
DENVER REGULATORY OFFICE, 9307 SOUTH WADSWORTH BOULEVARD
LITTLETON, COLORADO 80128-6901

March 30, 2005

Mr. David Johnson
Western Ecological Resource, Inc.
711 Walnut Street
Boulder, CO 80302

**RE: Approved Jurisdictional Determination, Wise Property, Erie, Colorado
Corps File No. 200580180**

Dear Mr. Johnson:

Reference is made to the March 28, 2005 site meeting by Mr. Terry McKee of this office with Ms. Rea Orthner of your office. This project was reviewed on behalf of the Wise Homestead. This project is located in Section 14, T1N, R69W, Boulder County, Colorado. This review was in accordance with Section 404 of the Clean Water Act under which the U.S. Army Corps of Engineers regulates the discharge of dredged and fill material, and any excavation activities associated with a dredged and fill project, into waters of the United States. Waters of the United States include ephemeral, intermittent and perennial streams, their surface connected wetlands and adjacent wetlands and certain lakes, ponds, irrigation and drainage ditches that have a nexus to interstate commerce.

Approved jurisdictional determination: Based upon the ruling by the Supreme Court in the matter of Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers, No. 99-1178 (January 9, 2001), the Department of the Army's (DA) regulatory authority over isolated, non-navigable, intrastate waters has been eliminated if the sole nexus to interstate commerce was use of the waters by migratory birds. It is apparent under the ruling above that the DA does not have the authority to regulate work in wetlands 1, 2, 3, 4, 5, the Boulder and Weld County Ditch, the Lower Boulder Ditch and the Leyner Cottonwood Ditch. These areas are not waters of the U.S. and therefore non-jurisdictional. No permit or other authorization by the DA is required for work in these areas.

This approved jurisdictional determination and delineation is valid for a period of five years from the date of this letter unless new information warrants revision of the determination.

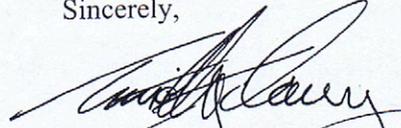
The attached **Jurisdictional Determination** form provides the basis of jurisdiction for wetlands 1, 2, 3, 4, 5, the Boulder and Weld County Ditch, the Lower Boulder Ditch and the Leyner Cottonwood Ditch. If the applicant wishes to appeal this approved jurisdictional determination, the attached **Notification of Administrative Appeal Options** form should be completed and sent to Mr. Mores Bergman at the address noted on the form.

Although a DA permit will not be required for work in wetlands 1, 2, 3, 4, 5, the Boulder and Weld County Ditch, the Lower Boulder Ditch and the Leyner Cottonwood Ditch, this does not eliminate the requirement that you obtain any other applicable Federal, state, tribal or local permits as required.

There are no other aquatic sites or jurisdictional waters of the U.S. on this property.

If you have any questions call **Mr. Terry McKee** at **(303) 979-4120** and reference **Corps File No. 200580180**.

Sincerely,

A handwritten signature in black ink, appearing to read "Timothy T. Carey". The signature is fluid and cursive, with a large loop at the end.

Timothy T. Carey
Chief, Denver Regulatory Office

tm

DISTRICT OFFICE: Omaha District Denver Regulatory Office

FILE NUMBER: 200580180

PROJECT LOCATION INFORMATION:

State: Colorado

County: Boulder

Center coordinates of site (latitude/longitude): 40 03 09 105 04 53

Approximate size of area (parcel) reviewed, including uplands: 300 acres.

Name of nearest waterway: Boulder Creek

Name of watershed: St. Vrain

JURISDICTIONAL DETERMINATION

Completed: Desktop determination

Date:

Site visit(s)

Date(s): March 28, 2005

Jurisdictional Determination (JD):

Preliminary JD - Based on available information, there appear to be (or) there appear to be no "waters of the United States" and/or "navigable waters of the United States" on the project site. A preliminary JD is not appealable (Reference 33 CFR part 331).

Approved JD - An approved JD is an appealable action (Reference 33 CFR part 331).

Check all that apply:

There are "navigable waters of the United States" (as defined by 33 CFR part 329 and associated guidance) within the reviewed area. Approximate size of jurisdictional area: _____.

There are "waters of the United States" (as defined by 33 CFR part 328 and associated guidance) within the reviewed area. Approximate size of jurisdictional area: _____.

There are "isolated, non-navigable, intra-state waters or wetlands" within the reviewed area.

Decision supported by SWANCC/Migratory Bird Rule Information Sheet for Determination of No Jurisdiction.

BASIS OF JURISDICTIONAL DETERMINATION:

A. Waters defined under 33 CFR part 329 as "navigable waters of the United States":

The presence of waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce.

B. Waters defined under 33 CFR part 328.3(a) as "waters of the United States":

(1) The presence of waters, which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.

(2) The presence of interstate waters including interstate wetlands¹.

(3) The presence of other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate commerce including any such waters (check all that apply):

(i) which are or could be used by interstate or foreign travelers for recreational or other purposes.

(ii) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce.

(iii) which are or could be used for industrial purposes by industries in interstate commerce.

(4) Impoundments of waters otherwise defined as waters of the US.

(5) The presence of a tributary to a water identified in (1) - (4) above.

(6) The presence of territorial seas.

(7) The presence of wetlands adjacent² to other waters of the US, except for those wetlands adjacent to other wetlands.

Rationale for the Basis of Jurisdictional Determination (applies to any boxes checked above). *If the jurisdictional water or wetland is not itself a navigable water of the United States, describe connection(s) to the downstream navigable waters. If B(1) or B(3) is used as the Basis of Jurisdiction, document navigability and/or interstate commerce connection (i.e., discuss site conditions, including why the waterbody is navigable and/or how the destruction of the waterbody could affect interstate or foreign commerce). If B(2, 4, 5 or 6) is used as the Basis of Jurisdiction, document the rationale used to make the determination. If B(7) is used as the Basis of Jurisdiction, document the rationale used to make adjacency determination:*

Lateral Extent of Jurisdiction: (Reference: 33 CFR parts 328 and 329)

Ordinary High Water Mark indicated by:

clear, natural line impressed on the bank

the presence of litter and debris

changes in the character of soil

destruction of terrestrial vegetation

shelving

other:

High Tide Line indicated by:

oil or scum line along shore objects

fine shell or debris deposits (foreshore)

physical markings/characteristics

tidal gages

other:

Mean High Water Mark indicated by:

survey to available datum; physical markings; vegetation lines/changes in vegetation types.

Wetland boundaries, as shown on the attached wetland delineation map and/or in a delineation report prepared by:

Basis For Not Asserting Jurisdiction:

- The reviewed area consists entirely of uplands.
- Unable to confirm the presence of waters in 33 CFR part 328(a)(1, 2, or 4-7).
- Headquarters declined to approve jurisdiction on the basis of 33 CFR part 328.3(a)(3).
- The Corps has made a case-specific determination that the following waters present on the site are not Waters of the United States:
- Waste treatment systems, including treatment ponds or lagoons, pursuant to 33 CFR part 328.3.
- Artificially irrigated areas, which would revert to upland if the irrigation ceased.
- Artificial lakes and ponds created by excavating and/or diking dry land to collect and retain water and which are used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing.
- Artificial reflecting or swimming pools or other small ornamental bodies of water created by excavating and/or diking dry land to retain water for primarily aesthetic reasons.
- Water-filled depressions created in dry land incidental to construction activity and pits excavated in dry land for the purpose of obtaining fill, sand, or gravel unless and until the construction or excavation operation is abandoned and the resulting body of water meets the definition of waters of the United States found at 33 CFR 328.3(a).
- Isolated, intrastate wetland with no nexus to interstate commerce.
- Prior converted cropland, as determined by the Natural Resources Conservation Service. Explain rationale:
- Non-tidal drainage or irrigation ditches excavated on dry land. Explain rationale: Boulder and Weld County Ditch terminates in upland 200380105 Feb 24, 03 field verification, Lower Boulder Ditch terminates in upland 200180398 Jun 5, 01 field verification and Leyner Cottonwood Ditch terminates in upland 200480567 Oct 20, 04 field verification
- Other (explain): Wetlands 1, 2, and 5 are neither adjacent to nor surface connected to waters of the U.S. They are surrounded by uplands with upland vegetation. Wetlands 3 and 4 are surface connected only to the non-jurisdictional Boulder and Weld County Ditch

DATA REVIEWED FOR JURISDICTIONAL DETERMINATION (mark all that apply):

- Maps, plans, plots or plat submitted by or on behalf of the applicant.
- Data sheets prepared/submitted by or on behalf of the applicant.
- This office concurs with the delineation report, dated _____, prepared by (company):
- This office does not concur with the delineation report, dated _____, prepared by (company):
- Data sheets prepared by the Corps.
- Corps' navigable waters' studies:
- U.S. Geological Survey Hydrologic Atlas:
- U.S. Geological Survey 7.5 Minute Topographic maps: eric
- U.S. Geological Survey 7.5 Minute Historic quadrangles:
- U.S. Geological Survey 15 Minute Historic quadrangles:
- USDA Natural Resources Conservation Service Soil Survey:
- National wetlands inventory maps:
- State/Local wetland inventory maps:
- FEMA/FIRM maps (Map Name & Date):
- 100-year Floodplain Elevation is: _____ (NGVD)
- Aerial Photographs (Name & Date):
- Other photographs (Date):
- Advanced Identification Wetland maps:
- Site visit/determination conducted on: March 28, 05
- Applicable/supporting case law:
- Other information (please specify):

¹Wetlands are identified and delineated using the methods and criteria established in the Corps Wetland Delineation Manual (87 Manual) (i.e., occurrence of hydrophytic vegetation, hydric soils and wetland hydrology).

²The term "adjacent" means bordering, contiguous, or neighboring. Wetlands separated from other waters of the U.S. by man-made dikes or barriers, natural river berms, beach dunes, and the like are also adjacent.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Wise Homestead	File Number: 200580180	Date: Mar 30, 2005
Attached is:		See Section below
<input type="checkbox"/>	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
<input type="checkbox"/>	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
<input type="checkbox"/>	PERMIT DENIAL	C
X	APPROVED JURISDICTIONAL DETERMINATION	D
<input type="checkbox"/>	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at <http://usace.army.mil/inet/functions/cw/cecwo/reg> or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **OBJECT:** If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **APPEAL:** If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- **ACCEPT:** You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- **APPEAL:** If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:

Timothy T. Carey
Chief, Denver Regulatory Office
9307 South Wadsworth Boulevard
Littleton, CO 80128
(303) 979-4120

If you only have questions regarding the appeal process you may also contact:

US Army Corps of Engineers
Northwestern Division
Attn: Mores Bergman, Appeal Officer
12565 West Center Road
Omaha, Nebraska 68144-3869
Telephone (402) 697-2533

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

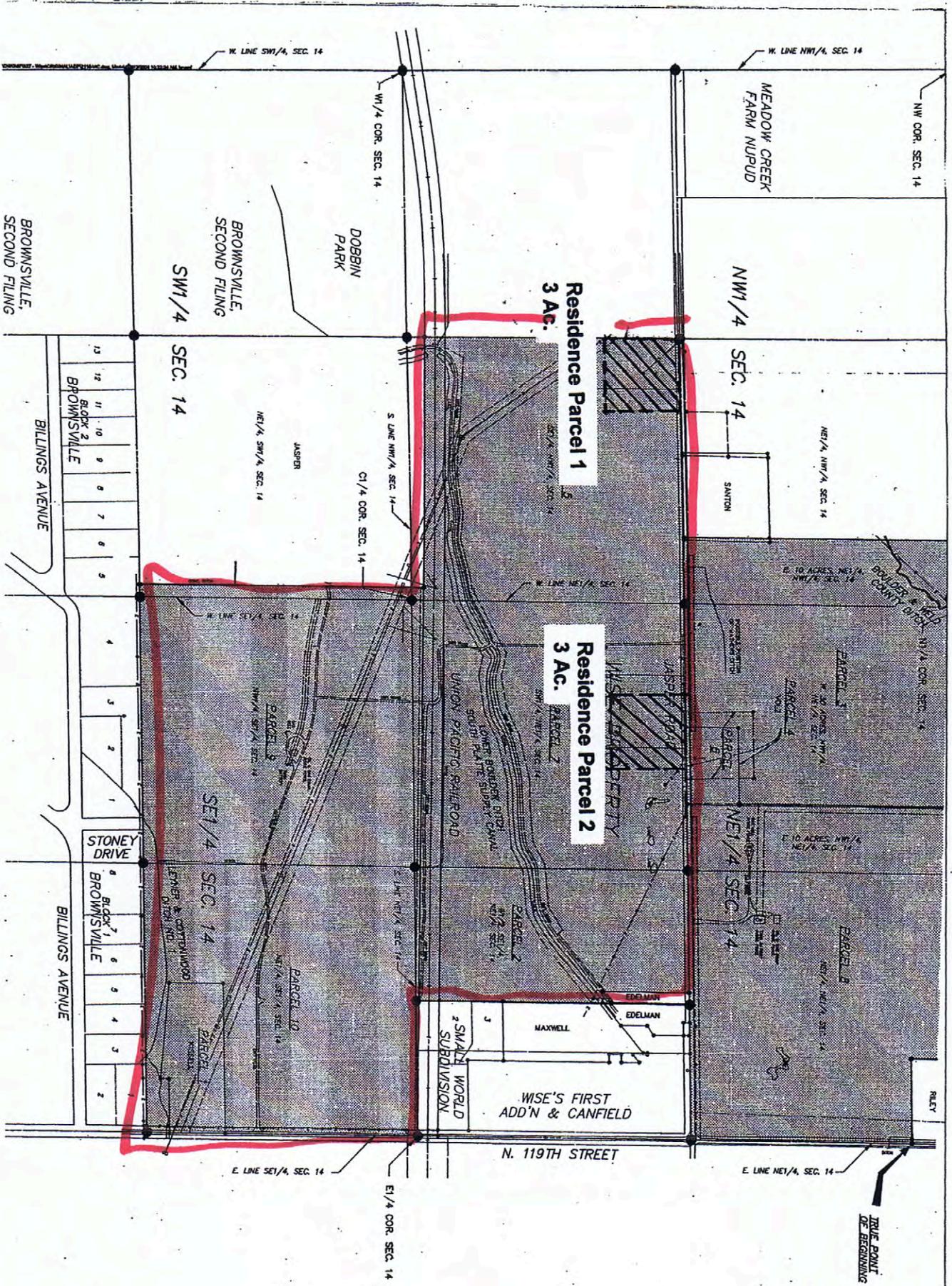


Exhibit B

Basis For Not Asserting Jurisdiction:

- The reviewed area consists entirely of uplands.
- Unable to confirm the presence of waters in 33 CFR part 328(a)(1, 2, or 4-7).
- Headquarters declined to approve jurisdiction on the basis of 33 CFR part 328.3(a)(3).
- The Corps has made a case-specific determination that the following waters present on the site are not Waters of the United States:
- Waste treatment systems, including treatment ponds or lagoons, pursuant to 33 CFR part 328.3.
 - Artificially irrigated areas, which would revert to upland if the irrigation ceased.
 - Artificial lakes and ponds created by excavating and/or diking dry land to collect and retain water and which are used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing.
 - Artificial reflecting or swimming pools or other small ornamental bodies of water created by excavating and/or diking dry land to retain water for primarily aesthetic reasons.
 - Water-filled depressions created in dry land incidental to construction activity and pits excavated in dry land for the purpose of obtaining fill, sand, or gravel unless and until the construction or excavation operation is abandoned and the resulting body of water meets the definition of waters of the United States found at 33 CFR 328.3(a).
 - Isolated, intrastate wetland with no nexus to interstate commerce.
 - Prior converted cropland, as determined by the Natural Resources Conservation Service. Explain rationale:
 - Non-tidal drainage or irrigation ditches excavated on dry land. Explain rationale: Boulder and Weld County Ditch terminates in upland 200380105 Feb 24, 03 field verification, Lower Boulder Ditch terminates in upland 200180398 Jun 5, 01 field verification and Leyner Cottonwood Ditch terminates in upland 200480567 Oct 20, 04 field verification
 - Other (explain): Wetlands 1, 2, and 5 are neither adjacent to nor surface connected to waters of the U.S. They are surrounded by uplands with upland vegetation. Wetlands 3 and 4 are surface connected only to the non-jurisdictional Boulder and Weld County Ditch

DATA REVIEWED FOR JURISDICTIONAL DETERMINATION (mark all that apply):

- Maps, plans, plots or plat submitted by or on behalf of the applicant.
- Data sheets prepared/submitted by or on behalf of the applicant.
- This office concurs with the delineation report, dated _____, prepared by (company):
 - This office does not concur with the delineation report, dated _____, prepared by (company):
- Data sheets prepared by the Corps.
- Corps' navigable waters' studies:
- U.S. Geological Survey Hydrologic Atlas:
- U.S. Geological Survey 7.5 Minute Topographic maps: eric
- U.S. Geological Survey 7.5 Minute Historic quadrangles:
- U.S. Geological Survey 15 Minute Historic quadrangles:
- USDA Natural Resources Conservation Service Soil Survey:
- National wetlands inventory maps:
- State/Local wetland inventory maps:
- FEMA/FIRM maps (Map Name & Date):
- 100-year Floodplain Elevation is: (NGVD)
- Aerial Photographs (Name & Date):
- Other photographs (Date):
- Advanced Identification Wetland maps:
- Site visit/determination conducted on: March 28, 05
- Applicable/supporting case law:
- Other information (please specify):

¹Wetlands are identified and delineated using the methods and criteria established in the Corps Wetland Delineation Manual (87 Manual) (i.e., occurrence of hydrophytic vegetation, hydric soils and wetland hydrology).

²The term "adjacent" means bordering, contiguous, or neighboring. Wetlands separated from other waters of the U.S. by man-made dikes or barriers, natural river berms, beach dunes, and the like are also adjacent.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: Wise Homestead	File Number: 200580180	Date: Mar 30, 2005
Attached is:		See Section below
<input type="checkbox"/>	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
<input type="checkbox"/>	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
<input type="checkbox"/>	PERMIT DENIAL	C
<input checked="" type="checkbox"/>	APPROVED JURISDICTIONAL DETERMINATION	D
<input type="checkbox"/>	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at <http://usace.army.mil/inet/functions/cw/cecwo/reg> or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **OBJECT:** If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- **APPEAL:** If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- **ACCEPT:** You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- **APPEAL:** If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:

Timothy T. Carey
Chief, Denver Regulatory Office
9307 South Wadsworth Boulevard
Littleton, CO 80128
(303) 979-4120

If you only have questions regarding the appeal process you may also contact:

US Army Corps of Engineers
Northwestern Division
Attn: Mores Bergman, Appeal Officer
12565 West Center Road
Omaha, Nebraska 68144-3869
Telephone (402) 697-2533

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

Mine Subsidence Investigation

Wise Property
Section 14,
Township 1 North, Range 69 West,
Boulder County, Colorado



Prepared For:
Jasper Investments, LLC.
9162 South Kenwood Court
Highlands Ranch, Colorado 80126

WESTERN ENVIRONMENT AND ECOLOGY, INC.

2217 West Powers Avenue
Littleton, Colorado 80120
303-730-3452 - phone
303-730-3461 - fax
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www.westernenvironment.com

Mine Subsidence Investigation

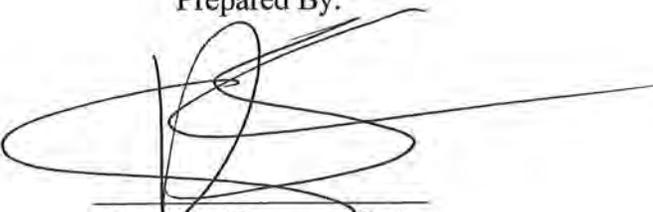
**Wise Property
Section 14,
Township 1 North, Range 69 West,
Boulder County, Colorado**

Prepared For:
Jasper Investments, LLC.
9162 South Kenwood Court
Highlands Ranch, Colorado 80126

May 31, 2005

Western Environment and Ecology, Inc.
Project Number 394-001-01

Prepared By:



Greg D. Sherman, P.G.
President

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TABLE OF CONTENTS

1.0	CONCLUSIONS AND RECOMMENDATIONS	1
2.0	INTRODUCTION	2
3.0	SITE CHARACTERISTICS	4
4.0	COAL MINE DESCRIPTION	6
5.0	DRILLING PROCEDURES	7
6.0	REGIONAL GEOLOGY OF THE ERIE AREA	8
6.1	Outcropping Units	8
6.2	Structure	11
7.0	SITE GEOLOGY	12
8.0	DESCRIPTION OF HOLES	14
9.0	POTENTIAL MECHANISMS OF COAL MINE ROOF FAILURE	17
10.0	STRAIN ANALYSIS	19
11.0	CLOSURE	21
12.0	SELECTED REFERENCES	22

FIGURE

Figure 1	Project Location Map	3
Figure 2	Hole Location Map	5
Figure 3	Generalized Composite Stratigraphic Section	9
Figure 4	Generalized Stratigraphic Models of the Laramie Formation	10
Figure 5	Geologic Cross Section Map	13

APPENDICES

Appendix A	Lithologic Logs
Appendix B	Geophysical Logs

1.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of the mine subsidence investigation completed on the Wise Property in Section 14, Township 1 North, Range 69 West, Western Environment and Ecology, Inc. (Western Environment) presents the following:

- The average depth to the top of the “main” seam is approximately 100.7 feet below the surface.
- Significant inaccuracies exist on the original mine maps.

Using these conclusions the following general recommendations for development are presented.

- No mine subsidence related development restrictions are required on those portions of the property indicated on Figure 2 as not effected by mining.
- If development of the “restricted” portions of the Wise Property is anticipated, additional studies, included drilling, will be required.
- Infrastructure, including roads and utilities, should utilize areas unaffected by mining. This includes a corridor within the “restricted” area that drilling indicated no mining has occurred.

*See
Pg 20.*

2.0 INTRODUCTION

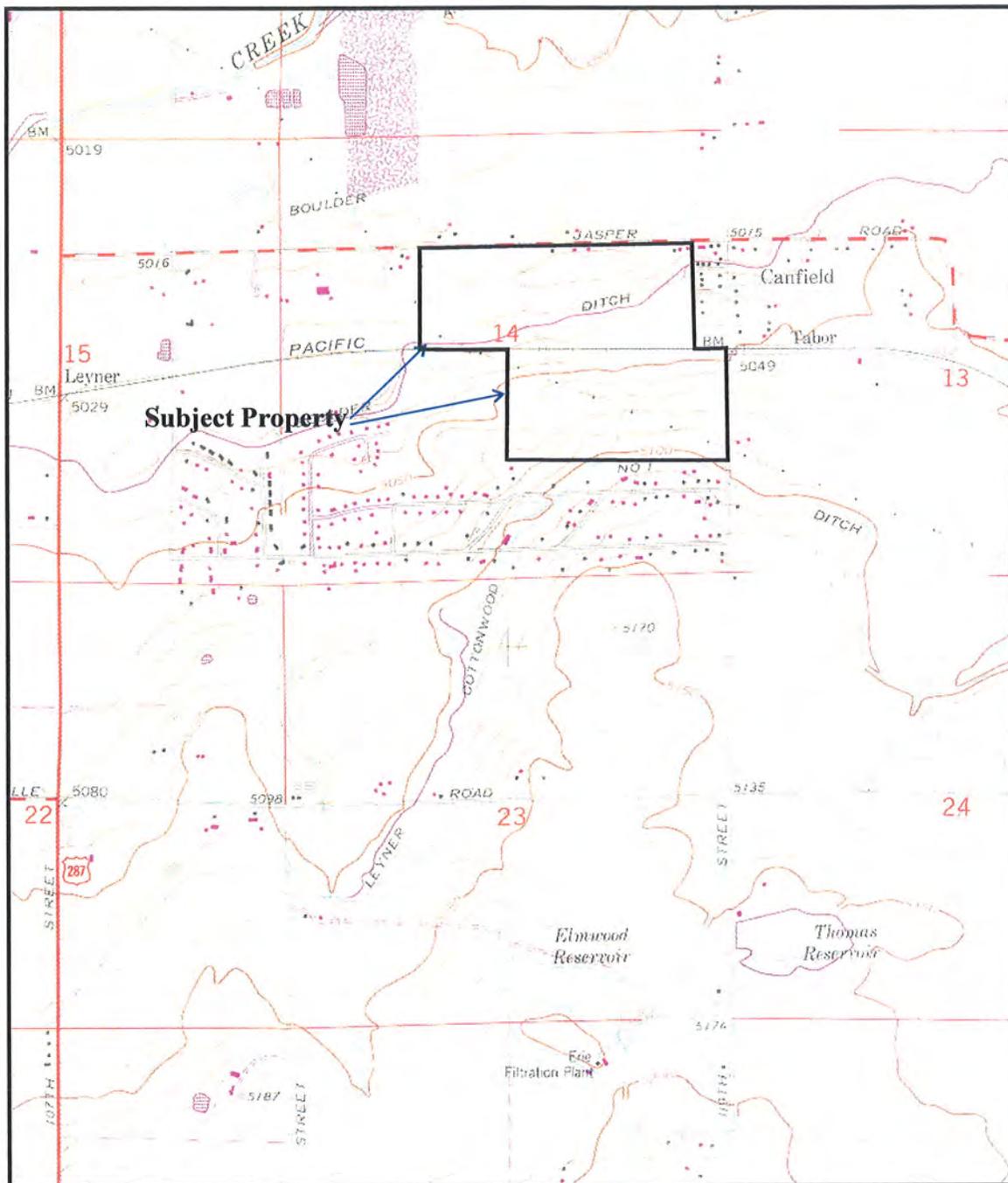
Western Environment was retained by Mr. Jim Dullea of Jasper Investments, LLC. to perform a mine subsidence investigation on undeveloped agricultural land located in Section 14, Township 1 North, Range 69 West in Boulder County, Colorado (Figure 1). The site, which is currently in active cultivation, totals approximately 160 acres. Mr. Dullea indicated he is interested in purchasing the land for a proposed single family residential development. Additionally, Western Environment has completed a previous investigation on the subject property. This report is entitled *Mine Subsidence Investigation, Wise Property*, dated April 7, 1999, Project Number 98-001-01.

The purpose of this investigation is to determine the extent and condition of the mine workings occurring on the property. Additionally, recommendations for the location of structures in unmined areas is presented.

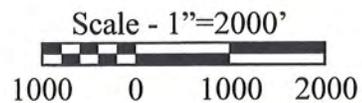
The results and recommendations contained in this report are intended for use as an aid in planning and design. The information herein should be made available to the project geotechnical and structural engineers. This report should be submitted to the Town of Erie and the Colorado Geological Survey for review. This will aid in assuring a more predictable and thus economic development process.



Northeast portion of property, near railroad



USGS Erie Quadrangle, 1979



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AND ECOLOGY, INC**
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Littleton, Colorado 80120

Figure 1 - Project Location Map
Wise Property,
160 Acres in Section 14,
Township 1 North, Range 69 West,
Boulder County, Colorado

3.0 SITE CHARACTERISTICS

This mine subsidence investigation was conducted for approximately 160 acres in Section 14, Township 2 North, Range 69 West, in Boulder County, Colorado. The site is located southwest of Canfield near the intersection of Jasper Road and 119th Street in Boulder County, Colorado (Figure 2). The site is bordered by residential development to the south and east. Small agricultural properties are present to the north and west.

At the time of the investigation, the property consisted of alternately fallow and active agricultural farm land. Additionally, one oil/gas production facility was observed.

The abandoned coal mines which underlie the project are referenced in the files of the Colorado Geological Survey as the Banner, Standard, Star, and Jackson Mines. A detailed description of the mines is presented in Section 4.0.



Wise Property, looking west

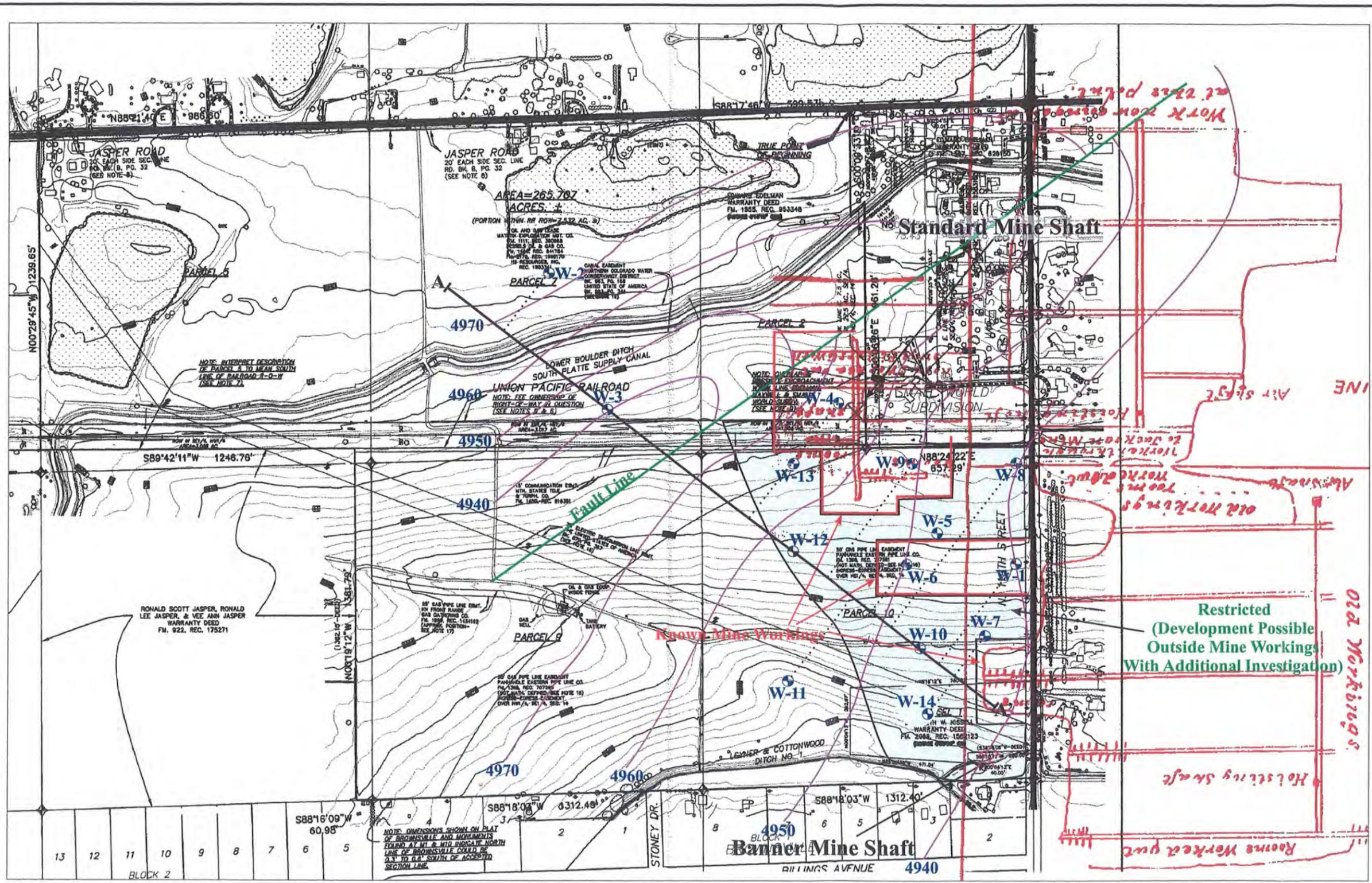
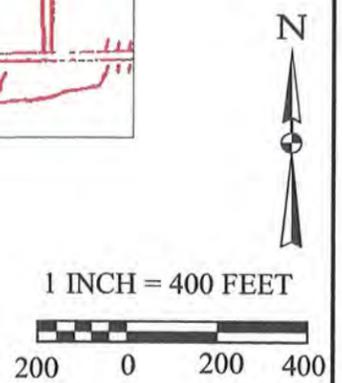


Figure 2
 Wise Property
 Section 14,
 Township 1 North, Range 69 West,
 Boulder County, Colorado

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 Littleton, Colorado 80120

Legend

- W-3 Borehole Location
- 4970 Elevation of Laramie / Fox Hills Formation Contact
- Known Mine Workings
- Approximate Fault Location
- Development Possible with additional investigation



4.0 COAL MINE DESCRIPTION

The mines which operated below the Wise Project are referred to as the Banner, Standard, Star, and Jackson Mines. Records on file with the Colorado Division of Mines (CDM) indicate a map date of 1888 for the mines. No map occurs for the Banner Shaft. No records were found for ownership or production of the Standard and Star Mines. However, production records do exist for the Banner Shaft which indicate it was an exploration shaft with no coal economically produced.

The Jackson Mine operated from 1884 through 1890. Total mine production of 98,831 tons were recorded with the Colorado Division of Mines with a maximum yearly production of 19,020 tons in 1888. Entry was gained through a 74 foot shaft (Figure 2). The average seam thickness was 4 feet 8 inches. The last owner of record was the Arrow Coal Company.

The mines were classified as a modified room and pillar (room and board) mine. Haulage ways were ten feet wide and were separated by 50-100 foot wide "chain pillars." Rooms had approximate widths of thirty feet and lengths of 150 feet. Based upon previous investigations calculated extraction rates of approximately 50% could be anticipated.



Props-and-caps type roof support
(photo from Denver Public Library, Western History Department)

5.0 DRILLING PROCEDURES

In addition to the seven holes previously advanced on the property, Western Environment completed an additional seven holes for the current investigation. Bideau Drilling of Casper, Wyoming was the drilling contractor. A truck mounted Mayhew rotary drill was selected for the study. All holes were both lithologically and geophysically logged. Lithologic strip logs (Appendix B) were taken of cutting samples at five foot intervals. Geophysical logs consisting of a three arm caliper were run on each hole intercepting the mine. Additionally, natural gamma radiation, spontaneous potential and resistivity logs were run on the holes. Copies of the geophysical logs and lithologic logs from this, and the previous study, can be found in Appendix C.

The geophysical instrument, a Mount Sopris Model MCX Digital Logger, was calibrated prior to use to graphically show the diameter of the hole. The full extension of the caliper arms would indicate a cavity of at least greater than 21 inches. The drill will normally make a 5 1/8 inch hole. Therefore, a significantly larger hole could indicate mining activity.

After drilling and logging, each hole required plugging in a manner which would not allow water to enter the workings or contaminate potential aquifers. On all holes, a simple cement plug was set from 2 to 15 feet with the remaining footage of the hole being filled with Colorado State Mined Land Reclamation Board approved abandonment fluid which is designed to inhibit fluid penetration. Native soil was then replaced from 2 feet to the surface.

Hole locations were determined using a Garmin GPS unit and can be assumed accurate to within 15 feet. Latitude and longitude are shown on the lithologic logs (Appendix A)



Digital Logger

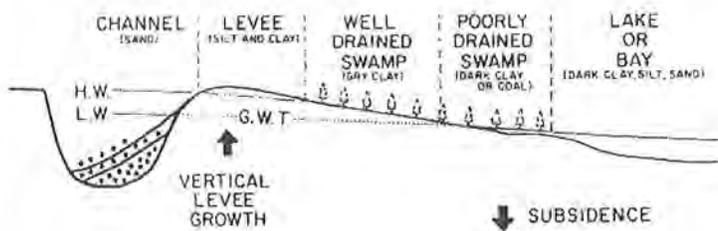
6.0 REGIONAL GEOLOGY OF THE ERIE, COLORADO AREA

6.1 Outcropping Units

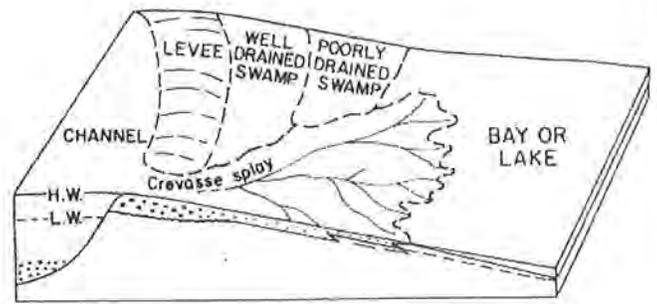
The Wise Property lies in Section 14, Township 1 North, Range 69 West, in Boulder County, Colorado. Outcropping units within and surrounding the study area are the Pierre Shale, the Fox Hills Sandstone, the Laramie Formation and Quaternary gravels and soils (Figure 4). The Pierre Shale is a lead gray to brown and black shale of marine origin. Total thickness in the area is greater than 7,000 feet (Blair 1951) with the majority of the formation made of shale. Near the top the shale becomes increasingly sandy and contains beds of fine sandstones and siltstone as it grades into the Fox Hills Formation.

The Fox Hills Formation is a massive cross bedded sandstone. It was deposited in a beach or delta front environment and conformably overlies the Pierre Shale. The lower two thirds of the formation is a fine to coarse-grained bluff colored sandstone which weathers to a light tan to tan color. Numerous iron-colored calcareous concretions are present, ranging in size from fractions of an inch to several feet in thickness. The upper one-third of the Fox Hills Formation is about 140 feet as measured in the NW1/4 of Section 28, Township 1 South, Range 70 West. Thicknesses vary from 60 feet near Ralston Creek (as described by Van Horn, 1957) to 250 feet near the Baseline Reservoir.

The Laramie Formation is predominantly fresh water in origin, consisting of sequences of sand, silts and coals, (Figure 5). The lower portion is approximately 100 feet thick and is composed of sandstones, sandy shales, claystones and coal beds. These coal beds have been economically mined in the past. The upper unit has a thickness of approximately 600 feet and is made of mostly clay, shales, very fine sandy shales and lenticular beds of sandstones. The shales are largely carbonaceous, and in places, becomes lignitic. The Laramie Formation lies conformably on the Fox Hills Sandstone.

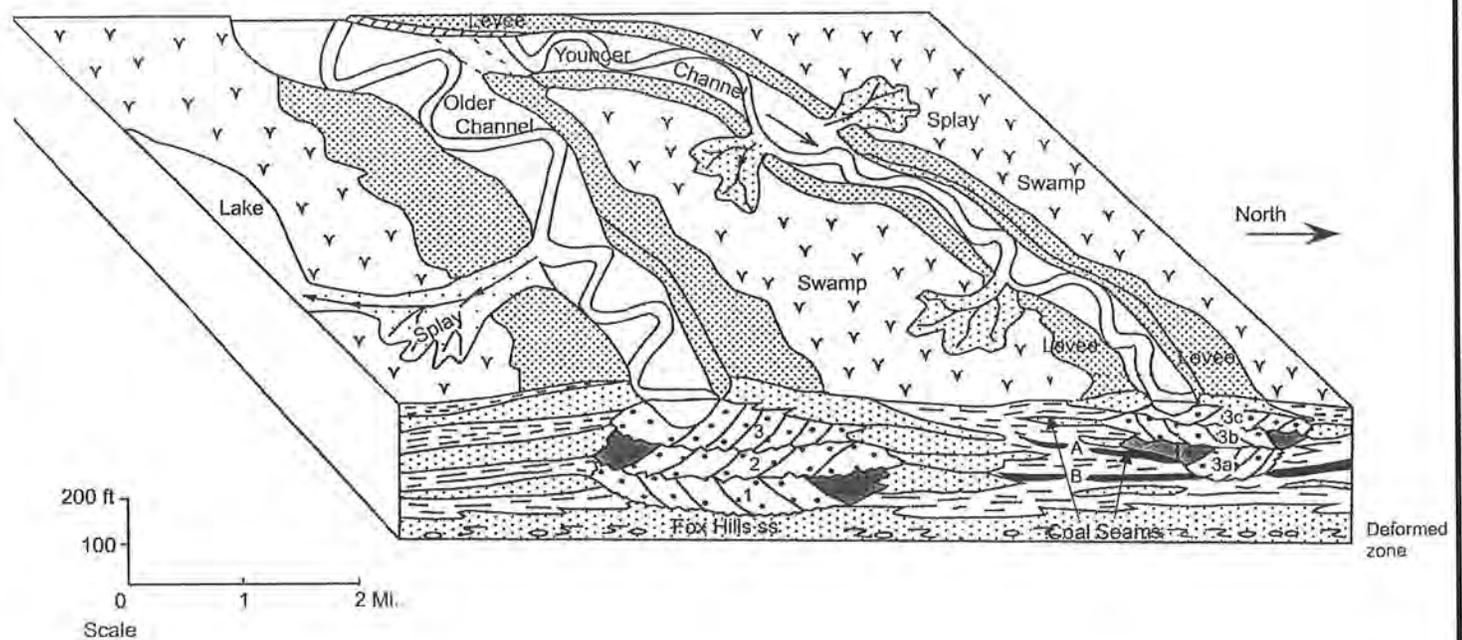


Channel and channel margin environments for lithologies in Laramie Formation.



LARAMIE ENVIRONMENTS OF DEPOSITION

Relationship of channel margin environments to crevasse splay deltas.



Figures from: A Guide to the uppermost Cretaceous stratigraphy, central Front Range Colorado, deltaic sedimentation, growth faulting and early Lamide vertical Movement
Weimer, R.J. 1973

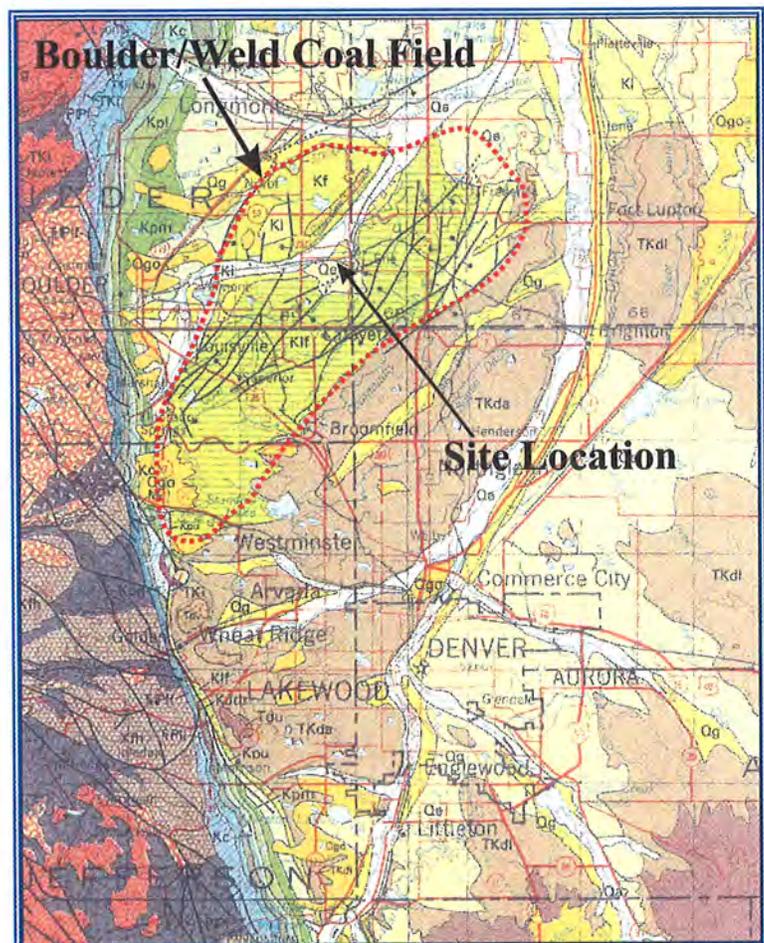
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LITTLETON, COLORADO 80120

Figure 4 - Generalized Stratigraphic
Models of the Laramie Formation
Wise Property,
160 Acres in Section 14,
Township 1 North, Range 69 West,
Boulder County, Colorado

6.2 Structure

The Wise Property lies on the western edge of the Denver-Julesburg Basin against the Front Range uplift. This basin contains up to 13,000 feet of sediments derived from the ancestral Rocky Mountains which laid to the west. A basement controlled late Cretaceous Laramide faulting is most prevalent and is the result of deformation associated with uplift. The second has been described by Davis and Weimer (1976) as growth faulting as a result of overpressuring of the deltaic sequence at the time of deposition.

Growth faulting is the major structural feature seen in the Erie area. A zone is present with dominant faults trending in a northeast direction. This system is ten miles wide and thirty miles long. These faults are high angle normal structures near the surface, but seismic work has shown that they tend to flatten and die out at depth. Work by Davis and Weimer (1976) shows that these listric normal faults do not continue below the Hygiene member of the Pierre Shale. Antithetic faults resulting from tension then formed horsts and grabens. This effect has resulted in increased thickness of sediments in the graben areas. The Fox Hills Formation has been reported to have a total thickness near a growth fault of 484 feet (Spencer 1961). The Laramie Formation also has increased thicknesses in these zones and this is believed to be the reason for increased thicknesses in the coal seams in the Boulder-Weld coal field.



Colorado Front Range Geology, from Tweto, 1979

7.0 SITE GEOLOGY

Four distinct geologic units were encountered during drilling on the Wise Property. The uppermost unit is a sandy soil, possibly of aeolian origin, approximately 5 to 25 feet thick. The engineering characteristics of this material is extremely variable across the site and will require additional geotechnical investigations to quantify.

The next lower unit consists of light brown, medium-grained gravels. These gravels, when present, occur between 25 and 35 feet in depth and average approximately 10 feet thick. Their composition, like the sandy soils, are highly variable across the site.

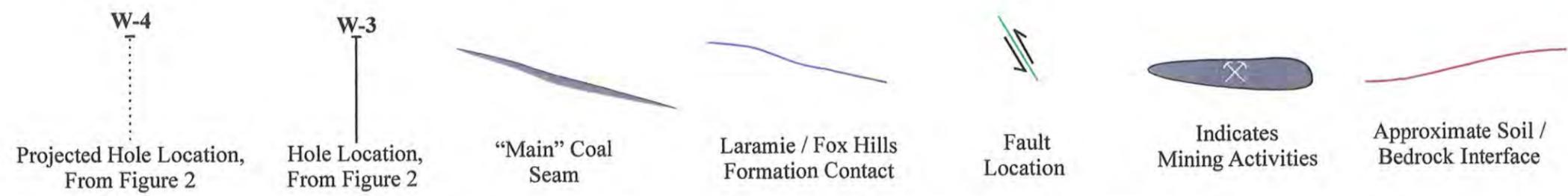
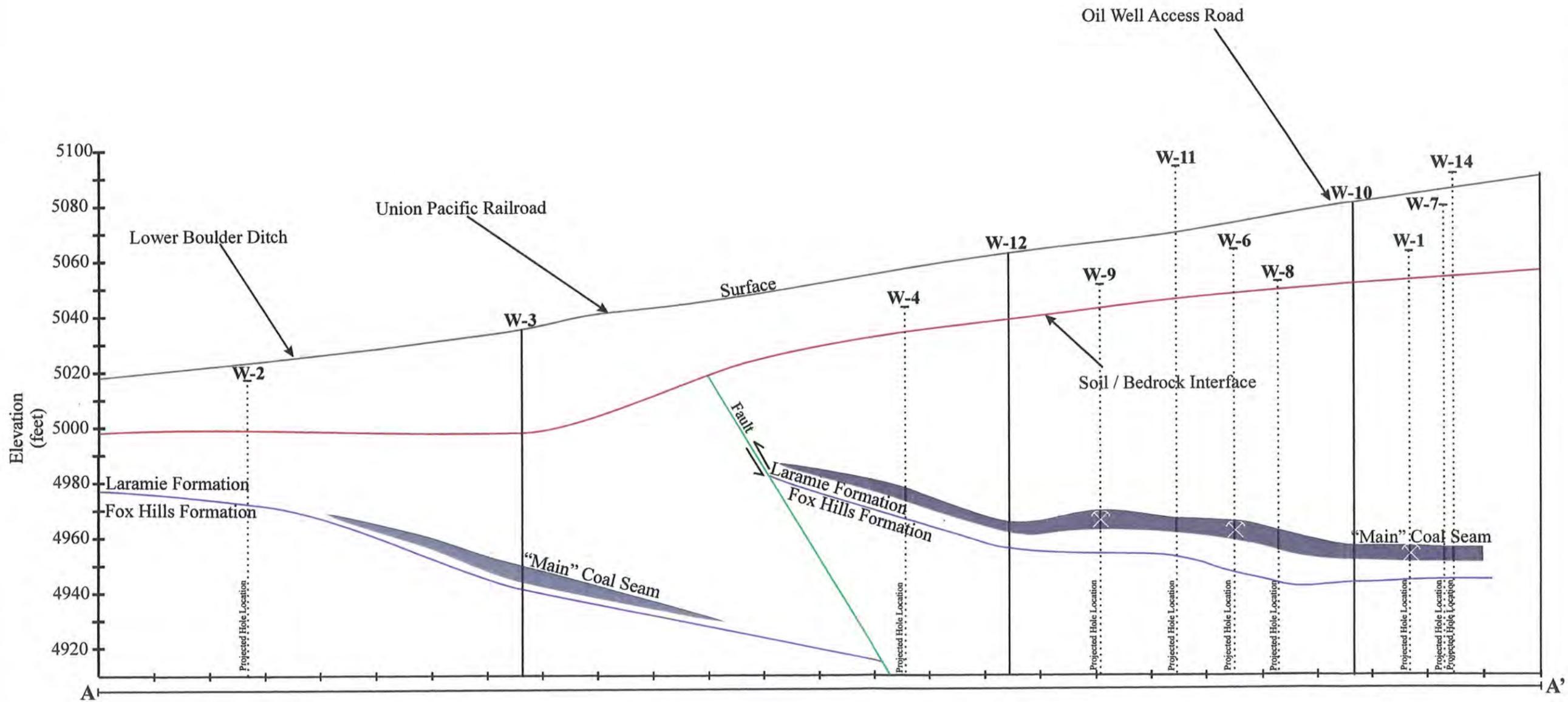
The next lower unit encountered is the clays, silts, fine-grained sands and coals of the Cretaceous-age Laramie Formation. The contact between the Laramie and the recent deposits occurs between 25 and 35 feet in depth. The Standard, Jackson, and Star main seam occurs between 75 and 137 feet. The seam thickness, where mined, was approximately 7 feet.

The lowest stratigraphically significant interval was the Laramie/ Fox Hills Contact. It's depth, in those holes which intersected the contact, ranged between 45 to 147 feet. The upper Fox Hills Formation is characterized by light gray fine to very fine-grained quartzose sands.

Structurally, the site straddles a major northeast-southwest trending fault (Figure 2 & 5). This fault, which creates approximately 50 feet of displacement of the "main" seam, also acts to isolate mining activities to the south and east of the structure.



Location of "Banner Mine" shaft



Data used to construct geologic cross section of Wise Property obtained from geophysical and lithologic logs of wells advanced on property.

Figure 5 - Geologic Cross Section Map
 Wise Property
 Section 14
 Township 1 North, Range 69 West,
 Boulder County, Colorado

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 Littleton, Colorado 80120

8.0 DESCRIPTION OF HOLES

The description of rotary holes drilled on the Wise project are from the drill cuttings taken every five feet for each boring. Holes W-1 to W-7 are from the 1999 report. Holes W-8 to W-14 were completed during the current investigation.

Hole W-1 Light brown, sandy soil occurred from 0 to 20 feet. Light gray claystone was encountered from 20 feet to 104 feet. The “main” seam interval was penetrated from 104 to 110 feet. An **open void** producing the maximum caliper deflection of 35 inches occurred at 109 feet. Total depth of the hole was 140 feet. Circulation was lost at 105 feet.

Hole W-2 Light brown, sandy soil occurred from 0 to 24 feet. Gravel was encountered from 24 to 40 feet. Interbedded gray claystones and coal occurred from 40 to 45 feet. The Fox Hills Sandstone was encountered at 45 feet. Total depth of the hole was 120 feet. Circulation was not lost. No mine workings were encountered.

Hole W-3 Light brown, sandy soil occurred from 0 to 14 feet. Light brown claystone was encountered from 14 feet to 45 feet. Interbedded gray claystones and light gray sandstones occurred from 45 to 85 feet. The “main” seam was penetrated from 85 to 91 feet. No caliper deflection occurred. The Fox Hills Sandstone was encountered at 91 feet. Total depth of the hole was 140 feet. Circulation was not lost. No mine workings were encountered.

Hole W-4 Light brown, sandy soil occurred from 0 to 12 feet. Light gray to brown claystone was encountered from 12 feet to 22 feet. Interbedded brown claystones occurred from 22 to 75 feet. The “main” seam occurred from 70 to 75 feet. No caliper deflection occurred. Total depth of the hole was 120 feet. Circulation was not lost.

Hole W-5 Light brown, sandy soil occurred from 0 to 10 feet. Brown and gray claystone was encountered from 10 to 100 feet. The “main” seam was penetrated from 100 to 110 feet. The Fox Hills Sandstone was encountered at 110 feet. Total depth of the hole was 140 feet.

Circulation was not lost. No mine workings were encountered.

Hole W-6 Light brown, sandy soil occurred from 0 to 20 feet. Brown and gray claystone with minor coal seams was encountered from 20 to 105 feet. The “main” seam interval was encountered at 105 feet. Maximum caliper deflection of 10 inches occurred at 106 feet. Total depth of the hole was 140 feet. Circulation was lost at 105 feet. Collapse was complete with no open voids.

Hole W-7 Light brown, sandy soil occurred from 0 to 10 feet. Interbedded gray claystone and gray sandstone occurred from 10 to 115 feet. The “main” seam was penetrated at 105 to 110 feet. Interbedded coal and sandstone occurred between 110 to 135 feet. The Fox Hills Sandstone occurred at 135 feet. Total depth of the hole was 140 feet. Circulation was not lost. No mine workings were encountered.

Hole W-8 Light brown, sandy soil occurred from 0-15 feet. Light gray to brown claystone was encountered from 15 feet to 36 feet. Carbonaceous gray claystone occurred from 36 to 55 feet. Interbedded gray claystone and light gray sandstone were drilled from 55 to 98 feet. The “main” seam interval was penetrated from 98 feet to 105 feet. The Fox Hills Formation occurred at 109 feet. Total depth of the hole was 140 feet. No mine workings were encountered.

Hole W-9 Light brown, sandy soil occurred from 0-13 feet. Light gray to brown claystone was encountered from 13 feet to 45 feet. Interbedded gray claystone occurred from 45 to 90 feet. Intermittent coal seams were penetrated from 42 feet to 49 feet and from 76 feet to 82 feet. The “main” seam occurred from 88 to 95 feet. Circulation was lost at 90 feet. Maximum caliper deflection was 8.2 inches at 81 feet. Total depth of the hole was 100 feet. Collapse was complete with no open voids.

Hole W-10 Light brown, sandy soil occurred from 0-30 feet. Light gray to brown claystone was encountered from 30 feet to 50 feet. Interbedded gray claystone and light gray sandstone occurred from 50 to 123 feet. The “main” seam interval was penetrated from 123 to 128 feet.

The Fox Hills Formation occurred at 132 feet. Total depth of the hole was 180 feet. Circulation was not lost. No mine workings were encountered.

Hole W-11 Light brown, sandy soil occurred from 0-22 feet. Light gray to brown claystone was encountered from 22 feet to 55 feet. Gray claystone occurred from 55 to 150 feet. An interbedded coal seam was penetrated at 95 feet. The "main" seam interval was penetrated from 132 to 137 feet. The Fox Hills Formation occurred at 140 feet. Total depth of the hole was 180 feet. Circulation was not lost. No mine workings were encountered.

Hole W-12 Light brown, sandy soil occurred from 0-15 feet. Light gray to brown claystone was encountered from 15 feet to 40 feet. Interbedded gray claystone and light gray sandstone occurred from 40 to 101 feet. The "main" seam interval was penetrated from 101 to 105 feet. The Fox Hills Formation occurred at 105 feet. Total depth of the hole was 120 feet. Circulation was not lost. No mine workings were encountered.

Hole W-13 Light brown, sandy soil occurred from 0-17 feet. Light gray to brown claystone was encountered from 17 feet to 60 feet. Interbedded gray claystone and light gray sandstones occurred from 60 to 78 feet. The "main" seam interval was penetrated from 93 to 98 feet. The Fox Hills Formation was not encountered. Total depth of the hole was 100 feet. Circulation was not lost. No mine workings were encountered.

Hole W-14 Light brown, sandy soil occurred from 0-20 feet. Light gray to brown claystone was encountered from 20 feet to 53 feet. Interbedded gray claystones and light gray sandstone and coal occurred from 53 to 137 feet. The "main" seam interval was penetrated from 137 to 142 feet. The Fox Hills Formation occurred at 147 feet. Total depth of the hole was 160 feet. Circulation was not lost. No mine workings were encountered.

9.0 POTENTIAL MECHANISMS OF COAL MINE ROOF FAILURE

The following presents what appears to be the most obvious progression for collapse and subsidence occurring within the Boulder-Weld Coal Field. This discussion is based upon research conducted by Western Environment personnel. However, it must be emphasized that all of the following explanations are theoretical and inferred interpretations.

The results of the numerous studies conducted by Western Environment show that when coal was removed, often no significant displacement of overlying beds occurred. Two possible explanations exist for this observation: 1) after mining enough natural roof strength remained across the span of rooms to support the load and not fail, or 2) after roof failure, the collapse is somehow confined to a specific interval. In the majority of Western Environment projects, the caliper logs show that the rooms are not open and that the “back” or roof of the mine is down. Therefore, the collapse and subsequent bed deflections are somehow limited to a specific horizon.

The idea of progressive collapse of overlying units continuing until a “pressure arch” or dome is formed above the collapsed workings is well-documented (U.S.G.S. Prof. Paper 969). Bell (1975) states that from his experiences in rock of similar character as those present in the Boulder-Weld Coal Field, upward migration is commonly one to two times the width of the intervening room. Ackenheil and Dougherty (1970) use a figure of twice the distance between supports for an approximation of arch development. Both of these estimates fit well with the observed results from the drilling on the site that show that collapse is confined to an interval of 20 to 40 feet above the workings. In addition to the “pressure arch”, the caliper log indicated that no void is present within the mined zone or at the top of the arch. It is then necessary to increase the volume (decrease the density) of the overlying material in order that the void and developing arch is filled, potentially resulting in additional support (Bell, 1975). Testing performed on the claystone bedrock has shown that the clays can “swell” upon wetting in excess of 20% (ATEC, 1985). Therefore, a five foot void could be filled by the fracturing, wetting, and swelling of 25 feet of claystone.

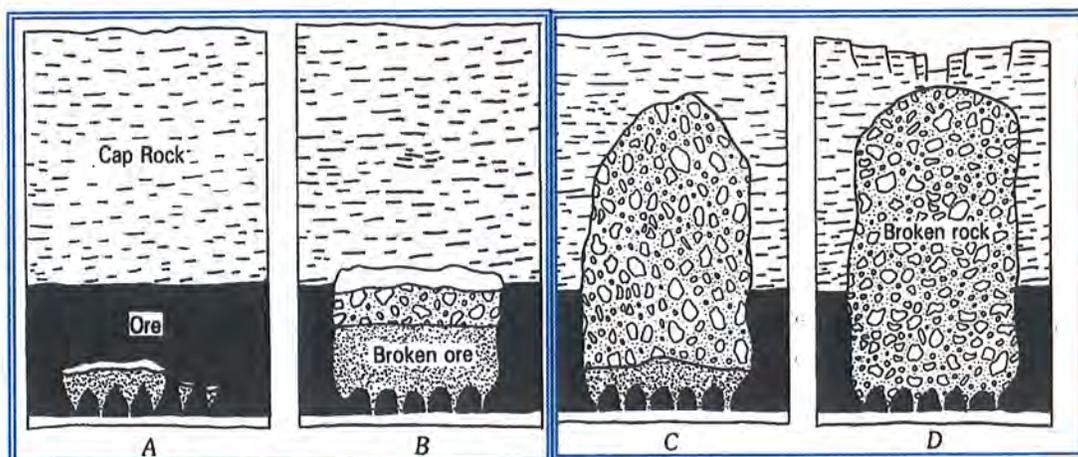
Jeff Hynes, senior engineering geologist with the CGS, has expressed his opinion that the “swelling” of the claystone observed by Western Environment may actually be a result of

expansion of the clays when the isostatic confining is removed during drilling. Additionally, Mr. Hynes had commented on his observation that floor “heave” is prevalent in operating Boulder-Weld coal mines. This is likely due to the higher uniaxial compressional strength of the coal (Western Environment, 2004) in relation to the claystone that commonly makes up the floor of the mine.

Regardless of the exact mechanism, it is evident that the following process involving collapse confinement and support are likely to occur within the Boulder-Weld Coal Field:

- 1) Formation of pressure arches approximately 20 to 40 feet above the mined seam, and
- 2) Increase in volume (by swelling, depressurizing, or floor heave) of claystone roof and floor rock.

The importance of the concept of the pressure arch increases as the depth to mining decreases. If mine geometry remains consistent, the pressure arch that forms 20-40 feet above the mine will encounter either weakened weathered rock or potential “fluid” soil at a mining depth of 80 feet or less. Should the top of the pressure arch contact either the weathered rock or soil, a “sink hole” can form. However, due to the depth of the workings beneath the Wise Property, **sinkhole development is unlikely.**



Progress of subsurface subsidence induced by the block caving method (Holzer, 1984).

10.0 STRAIN ANALYSIS

The strain analysis performed for this study is adapted from the United Kingdom National Coal Board’s graphical strain profiling system. This method of strain prediction was developed for on-going long wall mining operations. To make the method applicable to abandoned room and pillar mines, several modifications and assumptions were made.

The first modification is to define the thickness of the void space. To proceed with a “worst case” theoretical analysis, any increase in hole diameter greater than 9 inches (for a normal 5.25 inch hole) is treated as “theoretical” void. This produces an average of **1.8** feet of “theoretical void” (see table below).

The width of the extraction is also critical to the analysis, and several options are available to use in this assessment. They include a proportional distance between drill holes, actual width (length) of the workings, or arbitrary values to produce the maximum amount of subsidence. Due to the inaccuracies of the mine maps on the Wise Property, Western Environment chose to use an arbitrary value to produce the maximum amount of subsidence. This results in a width of workings distance of **130** feet. The depth to the top of the mined interval, **100.7** feet, was also incorporated into the analysis.

The reader is here encouraged to review both the United Kingdom National Coal Board’s Subsidence Handbook, and the previous studies for the mechanics of the process. By using this information, it is assumed that maximum “worst case” theoretical horizontal strains and surface subsidence would be **0.74%** and **1.1** feet, respectively.

Hole	Depth to Mine	Theoretical Void Thickness
W-1	108	4.5
W-6	106	1.0
W-9	88	0.0
Average	100.7	1.8

With the “inherent and unreconcilable uncertainties” associated with abandoned mine subsidence prediction, conservatism must be incorporated in proposed development. Therefore, we recommend that no structures be built in those areas of the Wise Property that are shown on Figure 2 as “restricted” development. With additional studies, including borings, it may be possible to locate structures in portions of the restricted area. Infrastructure, including utilities and roadways, should be located in known unmined areas as indicated using existing borings, or be constructed to withstand the 0.74% strain.



View to the west of Wise Property

11.0 CLOSURE

The recommendations provided herein were developed from the information obtained from field exploration which reflect subsurface conditions only at the specific locations, at the particular times designated. Subsurface conditions at other locations and times may differ from conditions occurring at these locations. The nature and extent of any variations between the drill holes may not become evident until or during the course of construction. If variations then appear, it may be necessary to re-evaluate the recommendations of this report after performing on-site observations during the excavation period and noting the characteristics of any variations.

This report was prepared by a Professional Geologist, not an engineer, and should not be construed as, or substituted for, engineering. This report is intended to inform geotechnical and structural engineers working on building design of the potential earth forces that could develop at the site, and to assist the client in determining whether to acquire and build on the site in question.

Our professional services have been performed, our findings, and our recommendations prepared in, accordance with generally accepted geological principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

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APPENDICES

APPENDIX A
LITHOLOGIC LOGS

HOLE NUMBER:	W-1	LOCATION:	Sec 14, T.1N., R.69W.	STATE:	Colorado
DRILLED BY:	Bideau Drilling	LOGGED BY:	Brian E. Crandall	TOTAL DEPTH:	140'
DATE:	December 14, 1998	BIT SIZE:	5 1/8"	DRILLED WITH:	AIR MUD X
DEPTH	SAMPLE DESCRIPTION				
5	SAND, light brown				
10	SAND, light brown				
15	SAND, light brown				
20	SAND, light brown				
25	CLAYSTONE, gray				
30	CLAYSTONE, gray / COAL				
35	CLAYSTONE, brown				
40	CLAYSTONE, gray				
45	SANDSTONE, light gray				
50	SANDSTONE, light gray				
55	SANDSTONE, light gray				
60	SANDSTONE, light gray				
65	CLAYSTONE, gray				
70	CLAYSTONE, gray				
75	CLAYSTONE, gray				
80	CLAYSTONE, gray				
85	CLAYSTONE, gray				
90	CLAYSTONE, gray				
95	CLAYSTONE, gray				
100	CLAYSTONE, gray / COAL				
105	COAL				
110	NO SAMPLES				
115	NO SAMPLES				
120	NO SAMPLES				
125	NO SAMPLES				
130	NO SAMPLES				
135	NO SAMPLES				
140	NO SAMPLES				
145	TOTAL DEPTH 140'				
150	LOST CIRCULATION AT 105', MAXIMUM CALIPER DEFLECTION 109'				
155					
160					
165					
170					
175					
180					
185					
190					
195					
200					

HOLE NUMBER:	W-2	LOCATION:	SEC 14, T 1N., R.69W	STATE:	Colorado
DRILLED BY:	Bideau Drilling	LOGGED BY:	Brian E. Crandall	TOTAL DEPTH:	120'
DATE:	December 14, 1998	BIT SIZE:	5 1/8"	DRILLED WITH:	AIR MUD X
DEPTH	SAMPLE DESCRIPTION				
5	SAND, light brown				
10	SAND, light brown				
15	SAND, light brown				
20	SAND, light brown				
25	SAND, light brown				
30	GRAVEL				
35	GRAVEL				
40	CLAYSTONE, gray / COAL				
45	SANDSTONE, light gray				
50	SANDSTONE, light gray				
55	SANDSTONE, light gray				
60	SANDSTONE, light gray				
65	SANDSTONE, light gray				
70	SANDSTONE, light gray				
75	SANDSTONE, light gray				
80	SANDSTONE, light gray				
85	SANDSTONE, light gray				
90	SANDSTONE, light gray				
95	SANDSTONE, light gray				
100	SANDSTONE, light gray				
105	SANDSTONE, light gray				
110	SANDSTONE, light gray				
115	SANDSTONE, light gray				
120	SANDSTONE, light gray				
125	TOTAL DEPTH 120'				
130	DID NOT LOSE CIRCULATION, COULD NOT PROBE DUE TO GRAVEL IN BORING				
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					
185					
190					
195					
200					

HOLE NUMBER:	W-3	LOCATION:	SEC 14, T.1N., R.69W.	STATE:	Colorado
DRILLED BY:	Bideau Drilling	LOGGED BY:	Brian E. Crandall	TOTAL DEPTH:	140'
DATE:	December 14, 1998	BIT SIZE:	5 1/8"	DRILLED WITH:	AIR MUD X
DEPTH	SAMPLE DESCRIPTION				
5	SAND, light brown				
10	SAND, light brown				
15	SAND, light brown				
20	CLAYSTONE, light brown				
25	CLAYSTONE, light brown				
30	CLAYSTONE, light brown				
35	CLAYSTONE, light brown / COAL				
40	CLAYSTONE, light brown				
45	CLAYSTONE, gray				
50	CLAYSTONE, gray				
55	CLAYSTONE, gray				
60	CLAYSTONE, gray				
65	CLAYSTONE, gray / COAL				
70	CLAYSTONE, gray				
75	CLAYSTONE, gray				
80	CLAYSTONE, gray				
85	COAL "MAIN" SEAM				
90	COAL / SANDSTONE, gray				
95	SANDSTONE, light gray				
100	SANDSTONE, light gray				
105	SANDSTONE, light gray				
110	SANDSTONE, light gray				
115	SANDSTONE, light gray				
120	SANDSTONE, light gray				
125	SANDSTONE, light gray				
130	SANDSTONE, light gray				
135	SANDSTONE, light gray				
140	SANDSTONE, light gray				
145	TOTAL DEPTH 140'				
150	DID NOT LOSE CIRCULATION, NO CALIPER DEFLECTION				
155					
160					
165					
170					
175					
180					
185					
190					
195					
200					

HOLE NUMBER:	W-4	LOCATION:	SEC 14, T.1N., R.69W.	STATE:	Colorado
DRILLED BY:	Bideau Drilling	LOGGED BY:	Brian E. Crandall	TOTAL DEPTH:	120'
DATE:	December 14, 1998	BIT SIZE:	5 1/8"	DRILLED WITH:	AIR MUD X
DEPTH	SAMPLE DESCRIPTION				
5	SAND, light brown				
10	SAND, light brown				
15	SAND, light brown				
20	GRAVEL				
25	CLAYSTONE, brown				
30	CLAYSTONE, brown				
35	CLAYSTONE, brown				
40	CLAYSTONE, brown				
45	CLAYSTONE, brown / COAL				
50	CLAYSTONE, gray				
55	CLAYSTONE, gray				
60	CLAYSTONE, gray				
65	CLAYSTONE, gray / COAL				
70	COAL. "MAIN" SEAM				
75	SANDSTONE, light gray				
80	SANDSTONE, light gray				
85	SANDSTONE, light gray				
90	SANDSTONE, light gray				
95	SANDSTONE, light gray				
100	SANDSTONE, light gray				
105	SANDSTONE, light gray				
110	SANDSTONE, light gray				
115	SANDSTONE, light gray				
120	SANDSTONE, light gray				
125	TOTAL DEPTH 120'				
130	DID NOT LOSE CIRCULATION, NO CALIPER DEFLECTION				
135					
140					
145					
150					
155					
160					
165					
170					
175					
180					
185					
190					
195					
200					

HOLE NUMBER: W-5		LOCATION SEC. 14 T. 1 N., R. 69 W	STATE: Colorado
DRILLED BY: Bideau Drilling		LOGGED BY: John Goggin	TOTAL DEPTH: 140'
DATE: 2/16/99		BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X
DEPTH	SAMPLE DESCRIPTION		
5	SAND, light brown		
10	SAND, light brown		
15	CLAYSTONE, gray/ brown		
20	CLAYSTONE, gray/ brown		
25	CLAYSTONE, gray/ brown		
30	CLAYSTONE, gray/ brown		
35	CLAYSTONE, gray/ brown		
40	CLAYSTONE, gray/ brown		
45	CLAYSTONE, gray		
50	CLAYSTONE, gray		
55	CLAYSTONE, gray		
60	CLAYSTONE, gray		
65	CLAYSTONE, gray		
70	CLAYSTONE, gray		
75	CLAYSTONE, gray		
80	CLAYSTONE, gray		
85	CLAYSTONE/ COAL		
90	CLAYSTONE, gray		
95	CLAYSTONE, gray		
100	CLAYSTONE, gray/ COAL		
105	CLAYSTONE, gray/ COAL		TOTAL DEPTH OF HOLE - 140 FEET. CIRCULATION WAS NOT LOST.
110	SANDSTONE, white		NO CALIPER DEFLECTION
115	SANDSTONE, white		
120	SANDSTONE, white		
125	SANDSTONE, white		
130	SANDSTONE, white		
135	SANDSTONE, white		
140	SANDSTONE, white		
145			
150			
155			
160			
165			
170			
175			
180			
185			
190			
195			
200			

HOLE NUMBER: W-6		LOCATION: SEC. 14, T.1N., R.69W	STATE: Colorado
DRILLED BY: Bideau Drilling		LOGGED BY: John Goggan	TOTAL DEPTH: 140'
DATE: 2/16/99		BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X
DEPTH	SAMPLE DESCRIPTION		
5	SAND, light brown		
10	SAND, light brown		
15	SAND, light brown		
20	CLAYSTONE, gray/ brown		
25	CLAYSTONE, gray/ brown		
30	CLAYSTONE, gray/ brown		
35	CLAYSTONE, gray/ brown		
40	CLAYSTONE, gray/ brown		
45	CLAYSTONE, gray/ brown		
50	COAL		
55	CLAYSTONE, gray		
60	CLAYSTONE, gray		
65	CLAYSTONE, gray		
70	CLAYSTONE, gray		
75	CLAYSTONE, gray		
80	CLAYSTONE, gray		
85	CLAYSTONE, carbonaceous		
90	CLAYSTONE, gray		
95	CLAYSTONE, gray		
100	CLAYSTONE, gray	SOFT DRILLING FROM 100 - 110 FEET	
105	LOST CIRCULATION @ 105		
110	NO SAMPLE		
115	NO SAMPLE		
120	NO SAMPLE		
125	NO SAMPLE	TOTAL DEPTH OF HOLE - 140 FEET..CIRCULATION WAS LOST.@ 105 FEET.	
130	NO SAMPLE	MAXIMUM CALIPER DEFLECTION - 10 INCHES @ 106 FEET	
135	NO SAMPLE		
140	NO SAMPLE		
145			
150			
155			
160			
165			
170			
175			
180			
185			
190			
195			
200			

HOLE NUMBER: W-7		LOCATION: SEC. 14, T.1N., R.69W	STATE: Colorado
DRILLED BY: Bideau Drilling		LOGGED BY: John Goggin	TOTAL DEPTH: 140'
DATE: 2/16/99		BIT SIZE: 5 1/8"	DRILLED WITH: AIR MUD X
DEPTH	SAMPLE DESCRIPTION		
5	SAND, light brown		
10	SAND, light brown		
15	CLAYSTONE, gray		
20	CLAYSTONE, gray		
25	CLAYSTONE, gray		
30	CLAYSTONE, gray		
35	CLAYSTONE, gray		
40	CLAYSTONE, carbonaceous		
45	CLAYSTONE, gray		
50	CLAYSTONE, gray		
55	CLAYSTONE, gray		
60	CLAYSTONE, gray		
65	CLAYSTONE, gray		
70	CLAYSTONE, gray		
75	CLAYSTONE, gray		
80	SANDSTONE, gray		
85	SANDSTONE, gray		
90	SANDSTONE, gray		
95	SANDSTONE, gray		
100	SANDSTONE, gray		
105	COAL		
110	SANDSTONE, CLAYSTONE, gray		
115	SANDSTONE, CLAYSTONE, gray		
120	COAL		
125	CLAYSTONE, carbonaceous TOTAL DEPTH OF HOLE - 140 FEET..CIRCULATION WAS NOT LOST..		
130	COAL NO CALIPER DEFLECTION..		
135	SANDSTONE, white		
140	SANDSTONE, white		
145			
150			
155			
160			
165			
170			
175			
180			
185			
190			
195			
200			

Hole Number: W-8
 Drilled by: Bideau Drilling
 Date: 04/18/2005

Location: N40° 03.070' W105° 04.492'
 Logged by: K. Abbott
 Bit Size: 5.25 inches

State: Colorado
 Total Depth: 140'
 Drilled with: Mud

Depth	Sample Description
5	Sand, silty, light brown
10	Sand, silty, light brown
15	Sand, silty, light brown
20	Claystone, light olive brown
25	Claystone, light olive brown
30	Claystone, light olive brown
35	Claystone, light olive brown
40	Claystone, light olive brown
45	Claystone, gray, slightly carbonaceous
50	Claystone, gray, slightly carbonaceous
55	Claystone, gray, slightly carbonaceous
60	Claystone, gray, slightly carbonaceous
65	Claystone with coal, gray
70	Claystone with coal, gray
75	Claystone with coal, gray
80	Claystone with coal, gray, slightly carbonaceous
85	Claystone with coal, gray, slightly carbonaceous
90	Claystone with coal, gray
95	Claystone, gray
100	Claystone, gray "Main" seam
105	Claystone with coal, gray
110	Sandstone, light gray, quartzose, Fox Hills Formation
115	Sandstone, light gray, quartzose, Fox Hills Formation
120	Sandstone, light gray, quartzose, Fox Hills Formation
125	Sandstone, light gray, quartzose, Fox Hills Formation
130	Sandstone, light gray, quartzose, Fox Hills Formation
135	Sandstone, light gray, quartzose, Fox Hills Formation
140	Sandstone, light gray, quartzose, Fox Hills Formation Total depth
	Circulation not lost, no mine workings encountered

Hole Number: W-9
Drilled by: Bideau Drilling
Date: 04/18/2005

Location: N40° 03.072' W105° 04.568'
Logged by: K. Abbott
Bit Size: 5.25 inches

State: Colorado
Total Depth: 100'
Drilled with: Mud

Depth	Sample Description
5	Sand, silty, light brown
10	Sand, silty, light brown
15	Sand, silty, light brown
20	Claystone, light olive brown
25	Claystone, light olive brown
30	Claystone, light olive brown
35	Claystone, light olive brown
40	Claystone, light olive brown
45	Claystone with coal, gray
50	Claystone with coal, gray
55	Claystone with coal, gray
60	Claystone with coal, gray
65	Claystone with coal, gray
70	Claystone with coal, gray
75	Claystone with coal, gray
80	Claystone with coal, gray
85	Claystone with coal, gray
90	No samples Lost circulation
95	No samples
100	No samples
	Circulation was lost at 90 feet

Hole Number: W-10
 Drilled by: Bideau Drilling
 Date: 04/19/2005

Location: N40° 02.940' W105° 04.563'
 Logged by: K. Abbott
 Bit Size: 5.25 inches

State: Colorado
 Total Depth: 180'
 Drilled with: Mud

Depth	Sample Description
5	Sand, silty, light brown
10	Sand, silty, light brown
15	Sand, silty, light brown
20	Claystone, silty, light olive brown
25	Claystone, silty, light olive brown
30	Claystone, silty, light olive brown
35	Claystone with sandstone, light olive brown
40	Claystone with sandstone, light olive brown
45	Claystone with sandstone, light olive brown, slightly carbonaceous
50	Claystone, gray
55	Claystone, gray
60	Claystone, gray
65	Claystone, gray
70	Claystone, gray
75	Claystone, gray, slightly carbonaceous
80	Claystone, gray
85	Claystone with coal, gray
90	Claystone with coal, gray
95	Claystone with coal, gray
100	Claystone with coal, gray
105	Claystone with coal, gray
110	Claystone with coal, gray
115	Claystone with coal, gray
120	Claystone with coal, gray "main" seam interval
125	Claystone with coal, gray
130	Claystone with coal, gray
135	Sandstone, light gray, quartzose, Fox Hills Formation
140	Sandstone, light gray, quartzose, Fox Hills Formation
145	Sandstone, light gray, quartzose, Fox Hills Formation
150	Sandstone, light gray, quartzose, Fox Hills Formation
155	Sandstone, light gray, quartzose, Fox Hills Formation
160	Sandstone, light gray, quartzose, Fox Hills Formation
165	Sandstone, light gray, quartzose, Fox Hills Formation
170	Sandstone, light gray, quartzose, Fox Hills Formation
175	Sandstone, light gray, quartzose, Fox Hills Formation
180	Sandstone, light gray, quartzose, Fox Hills Formation Total depth
	Circulation not lost, No mine workings encountered

Hole Number: W-11
 Drilled by: Bideau Drilling
 Date: 04/19/2005

Location: N40° 02.913' W105° 04.643'
 Logged by: K. Abbott
 Bit Size: 5.25 inches

State: Colorado
 Total Depth: 180'
 Drilled with: Mud

Depth	Sample Description
5	Sand, silty, light brown, tan
10	Sand, silty, light brown, tan
15	Sand, silty, light brown, tan
20	Sand, silty, light brown, tan
25	Claystone, light olive brown
30	Claystone, light olive brown, slightly carbonaceous
35	Claystone, light olive brown
40	Claystone, light olive brown
45	Claystone, light olive brown, iron stained
50	Claystone, light olive brown, iron stained
55	Claystone, gray
60	Claystone, gray
65	Claystone, gray
70	Claystone, gray
75	Claystone with coal, gray
80	Claystone with coal, gray
85	Claystone with coal, gray
90	Claystone with coal, gray
95	Claystone with coal, gray
100	Claystone with coal, gray
105	Claystone with coal, gray
110	Claystone with coal, gray
115	Claystone with coal, gray
120	Claystone with coal, gray
125	Claystone with coal, gray
130	Claystone with coal, gray "main" seam interval
135	Claystone, dark gray, slightly carbonaceous
140	Sandstone, light gray, quartzose, Fox Hills Formation
145	Sandstone, light gray, quartzose, Fox Hills Formation
150	Sandstone, light gray, quartzose, Fox Hills Formation
155	Sandstone, light gray, quartzose, Fox Hills Formation
160	Sandstone, light gray, quartzose, Fox Hills Formation
165	Sandstone, light gray, quartzose, Fox Hills Formation
170	Sandstone, light gray, quartzose, Fox Hills Formation
175	Sandstone, light gray, quartzose, Fox Hills Formation
180	Sandstone, light gray, quartzose, Fox Hills Formation Total Depth
	Circulation not lost, mine workings not encountered

Hole Number: W-12
 Drilled by: Bideau Drilling
 Date: 04/18/2005

Location: N40° 03.013' W105° 04.650'
 Logged by: K. Abbott
 Bit Size: 5.25 inches

State: Colorado
 Total Depth: 120'
 Drilled with: Mud

Depth	Sample Description
5	Sand, silty, light brown
10	Sand, silty, light brown
15	Sand, silty, light brown
20	Claystone, light olive brown
25	Claystone, light olive brown
30	Claystone with coal, light olive brown
35	Claystone, gray, iron stained
40	Claystone, gray, iron stained
45	Claystone, gray
50	Claystone with coal, gray
55	Claystone with coal, gray, slightly carbonaceous
60	Claystone with coal, gray, slightly carbonaceous
65	Claystone, gray, slightly carbonaceous
70	Claystone, gray, slightly carbonaceous
75	Claystone, gray
80	Claystone, gray
85	Claystone with sandstone, gray, slightly carbonaceous
90	Claystone with sandstone, gray
95	Claystone with sandstone, gray
100	Coal "Main" seam interval
105	Sandstone, light gray, quartzose, Fox Hills Formation
110	Sandstone, light gray, quartzose, Fox Hills Formation
115	Sandstone, light gray, quartzose, Fox Hills Formation
120	Sandstone, light gray, quartzose, Fox Hills Formation Total depth
	Circulation not lost, no mine workings encountered

Hole Number: W-13
 Drilled by: Bideau Drilling
 Date: 04/18/2005

Location: N40° 03.074' W105° 04.655'
 Logged by: K. Abbott
 Bit Size: 5.25 inches

State: Colorado
 Total Depth: 100'
 Drilled with: Mud

Depth	Sample Description
5	Sand, silty, light brown
10	Sand, silty, light brown
15	Sand, silty, light brown
20	Sand with claystone, silty, light brown
25	Claystone, light olive brown
30	Claystone with coal, light olive brown
35	Claystone, light olive brown
40	Claystone, light olive brown
45	Claystone, olive brown, iron stained
50	Claystone, olive brown, iron stained
55	Claystone, olive brown, iron stained, slightly carbonaceous
60	Claystone with coal, carbonaceous
65	Claystone with coal, gray
70	Claystone with sandstone, gray
75	Claystone with sandstone, gray
80	Claystone with sandstone, gray
85	Claystone with sandstone, gray
90	Claystone with sandstone, gray
95	Claystone with coal, carbonaceous "Grant" main seam interval
100	Claystone, gray Total depth
	Circulation not lost, no mine workings encountered

Hole Number: W-14
 Drilled by: Bideau Drilling
 Date: 04/20/2005

Location: N40° 02.898' W105° 04.557'
 Logged by: K. Abbott
 Bit Size: 5.25 inches

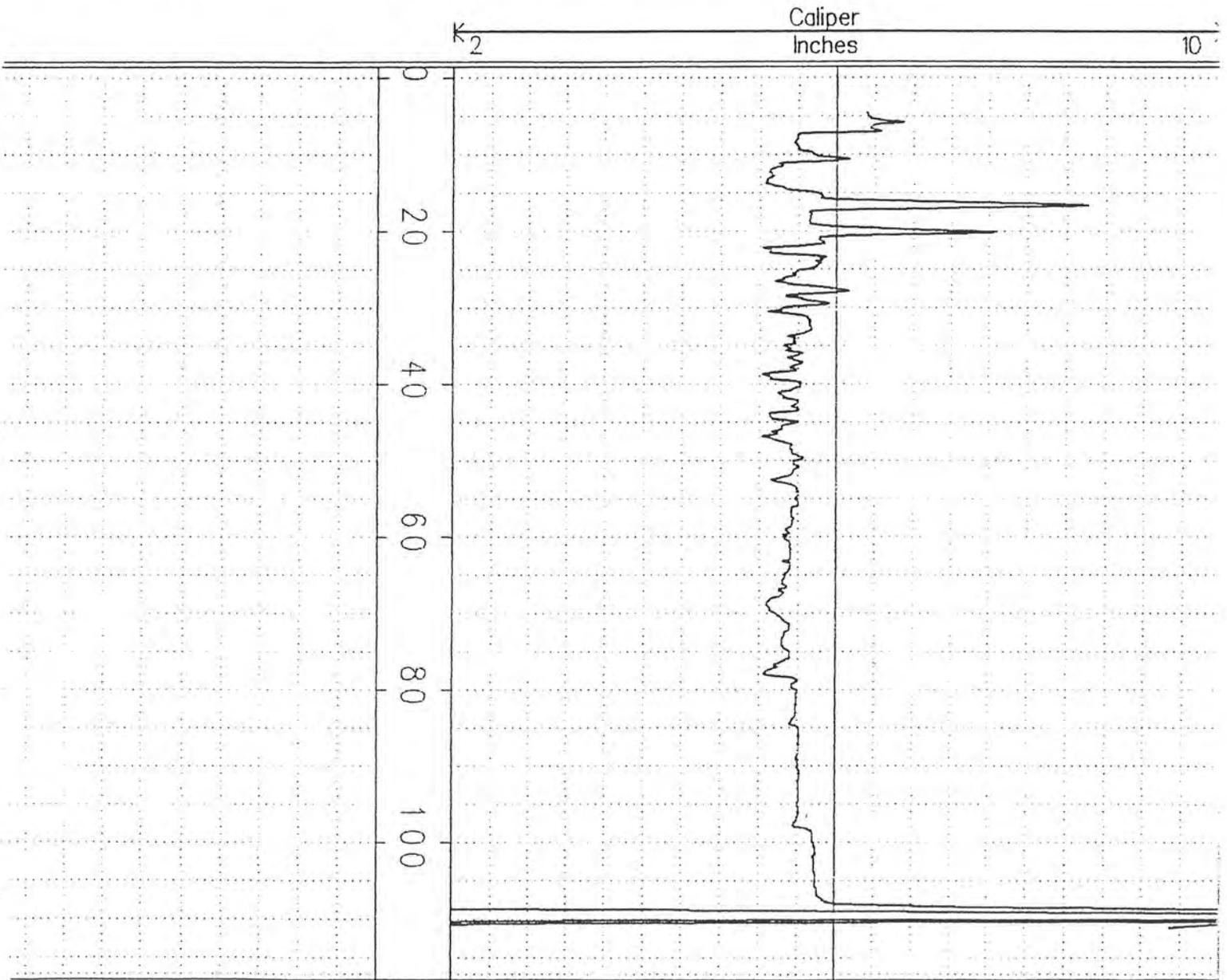
State: Colorado
 Total Depth: 160'
 Drilled with: Mud

Depth	Sample Description
5	Sand, silty, light brown
10	Sand, silty, light brown
15	Sand, silty, light brown
20	Sand, silty, light brown
25	Claystone, light olive brown
30	Claystone, light olive brown
35	Claystone, light olive brown
40	Claystone, light olive brown
45	Claystone, olive brown, iron stained
50	Claystone with coal, olive brown, iron stained
55	Claystone, gray
60	Claystone, gray
65	Claystone, gray
70	Claystone, gray
75	Claystone, gray
80	Claystone, gray
85	Claystone with coal, gray
90	Claystone, gray
95	Claystone, gray
100	Claystone, gray
105	Claystone, carbonaceous
110	Claystone, gray
115	Claystone, gray
120	Claystone with coal, gray, slightly carbonaceous
125	Claystone with coal, gray
130	Claystone with coal, gray
135	Claystone with coal, gray "Grant" main seam interval
140	Claystone with coal, gray
145	Claystone with sandstone, light gray
150	Sandstone, light gray, quartzose, Fox Hills Formation
155	Sandstone, light gray, quartzose, Fox Hills Formation
160	Sandstone, light gray, quartzose, Fox Hills Formation Total depth
	Circulation not lost, no mine workings encountered

APPENDIX B
GEOPHYSICAL LOGS

C: LSWISE W1.KB0)

Well W1, 14 December 1998



C: LSWISE W1.KB0)

Well W1, 14 December 1998

(C: LSWISE W3.KB0)

Well W3, 14 December 1998

K₂

Caliper
Inches

8

20

40

60

80

100

120

1400

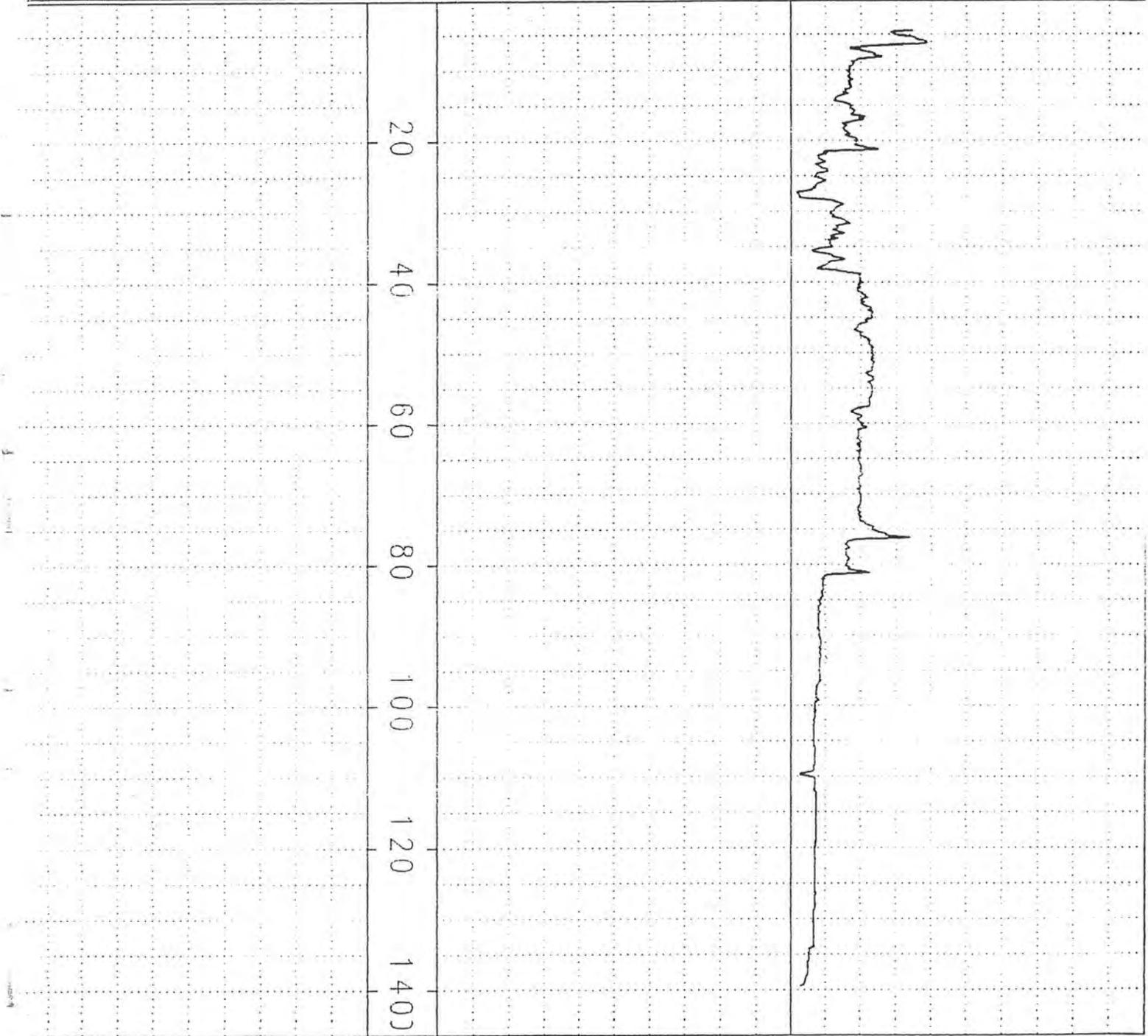
K₂

Caliper
Inches

8

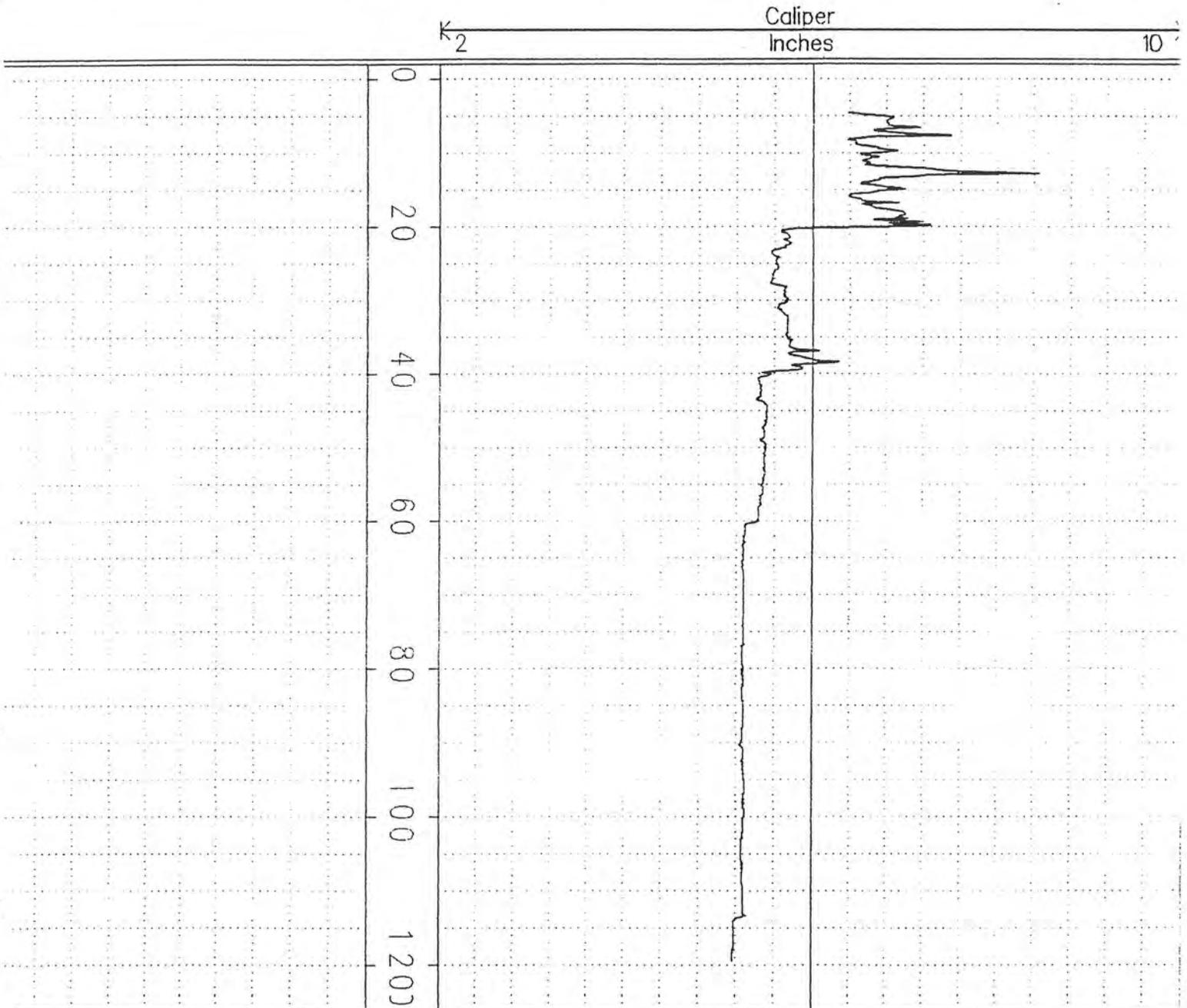
(C: LSWISE W3.KB0)

Well W3, 14 December 1998



(C: LSWISE W4.KB0)

Well W4, 14 December 1998



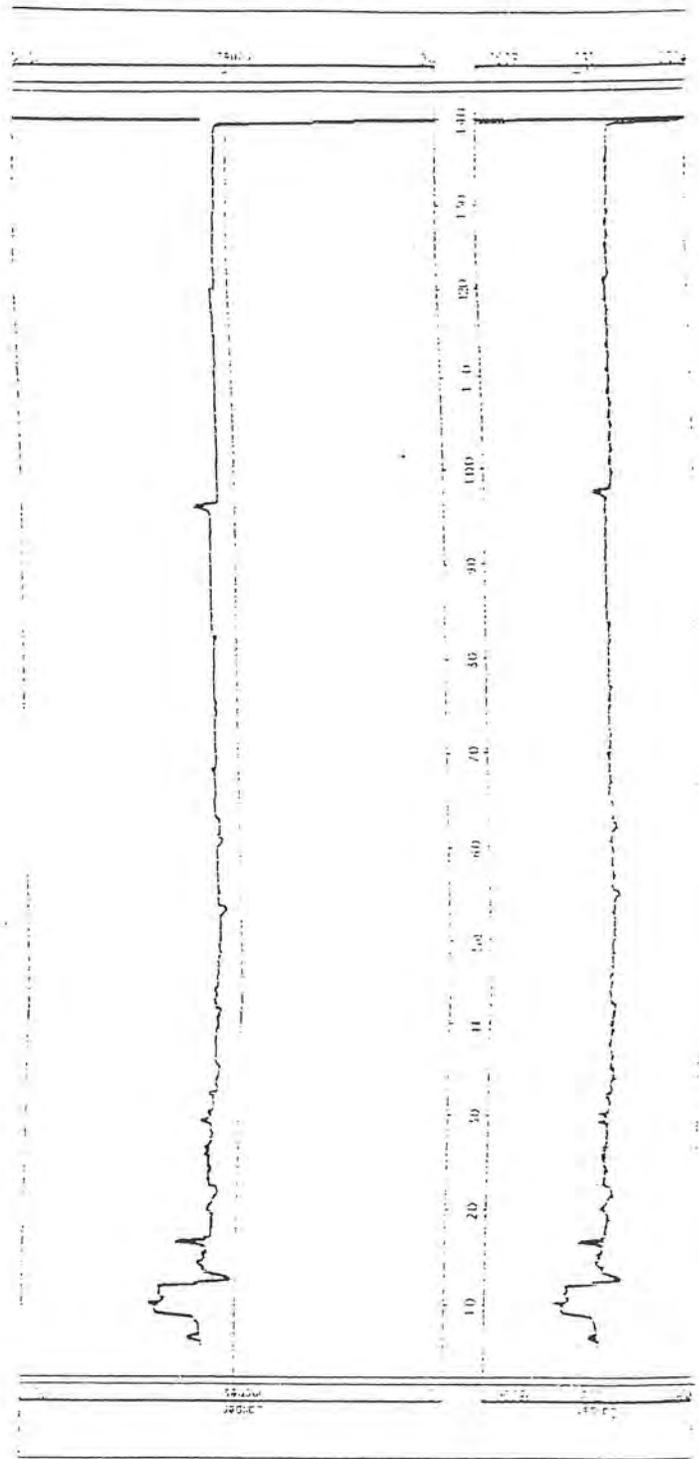
2

Caliper
Inches

10

(C: LSWISE W4.KB0)

Well W4, 14 December 1998



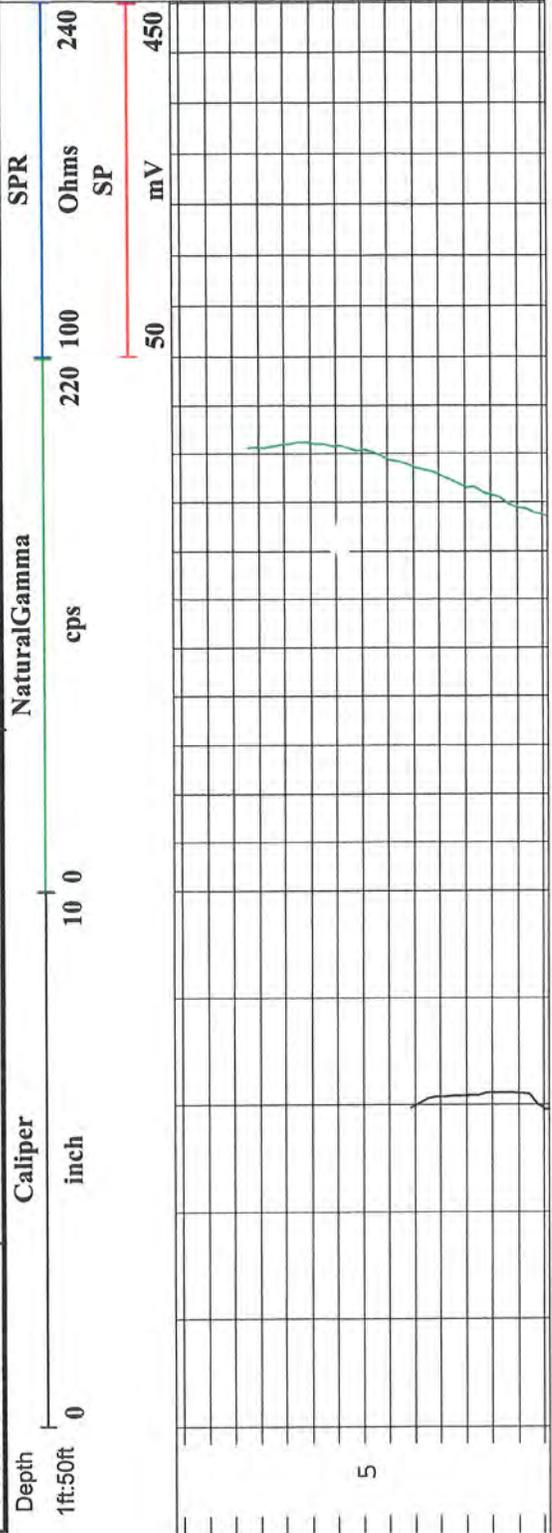
▲ ○

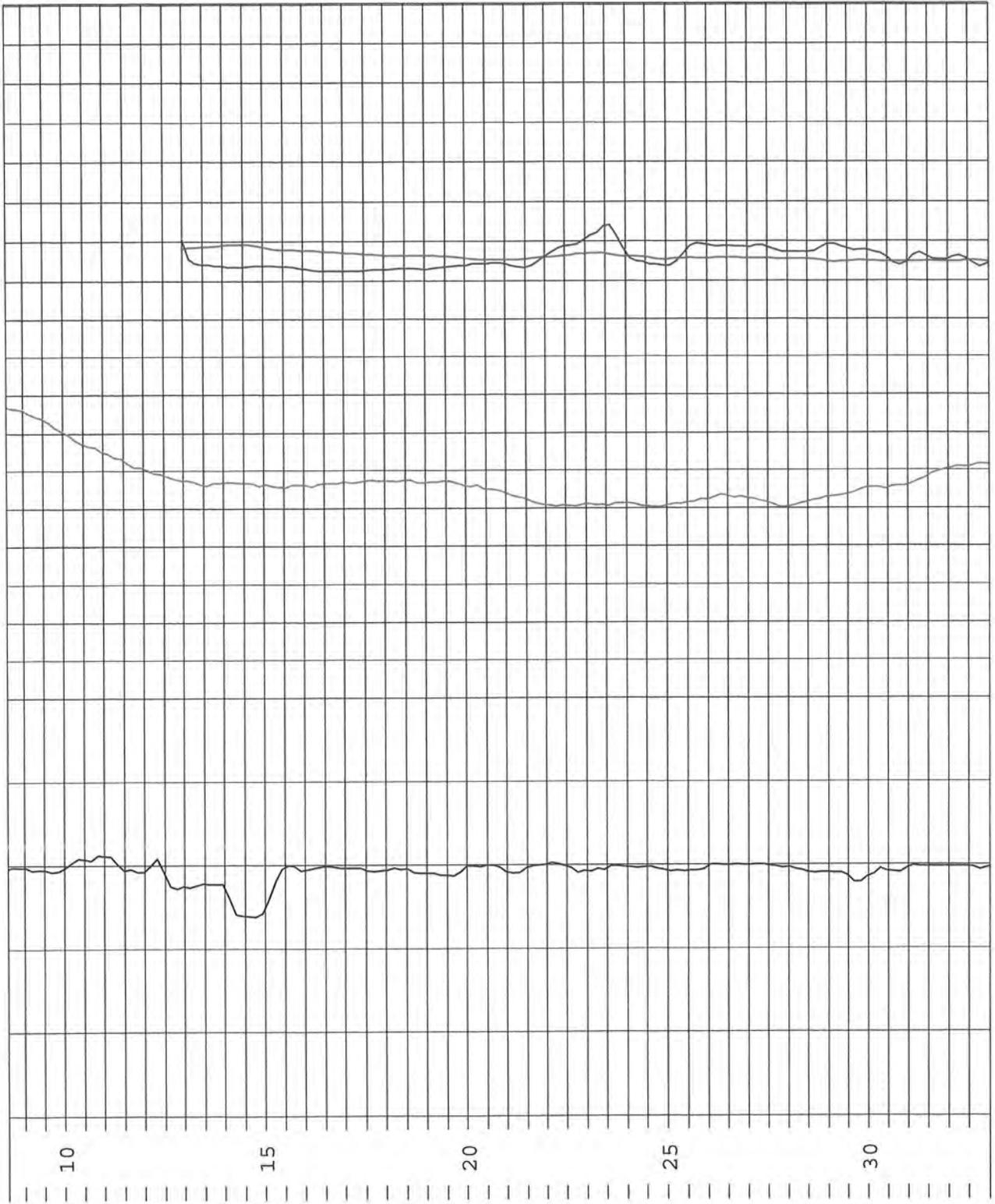
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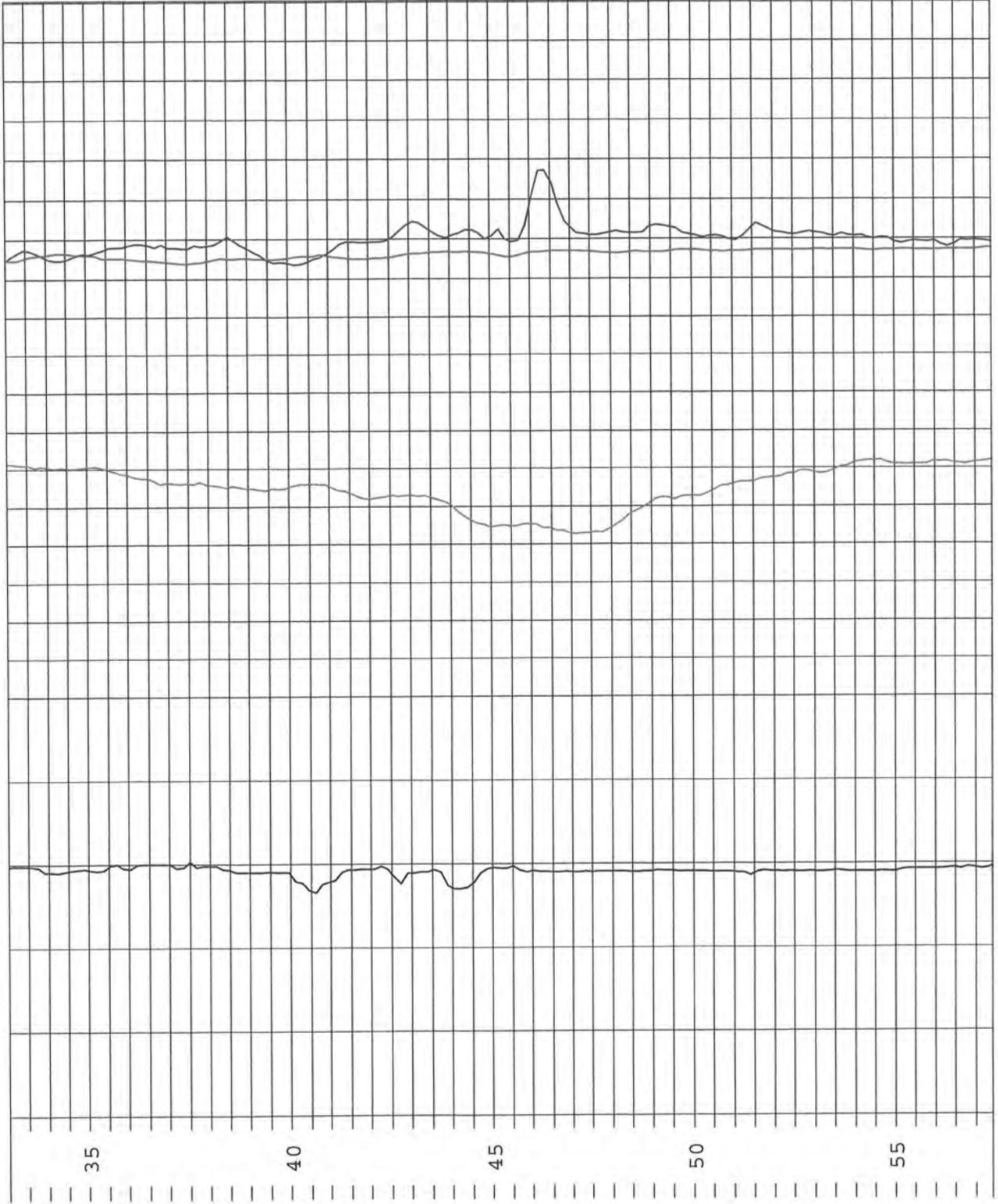
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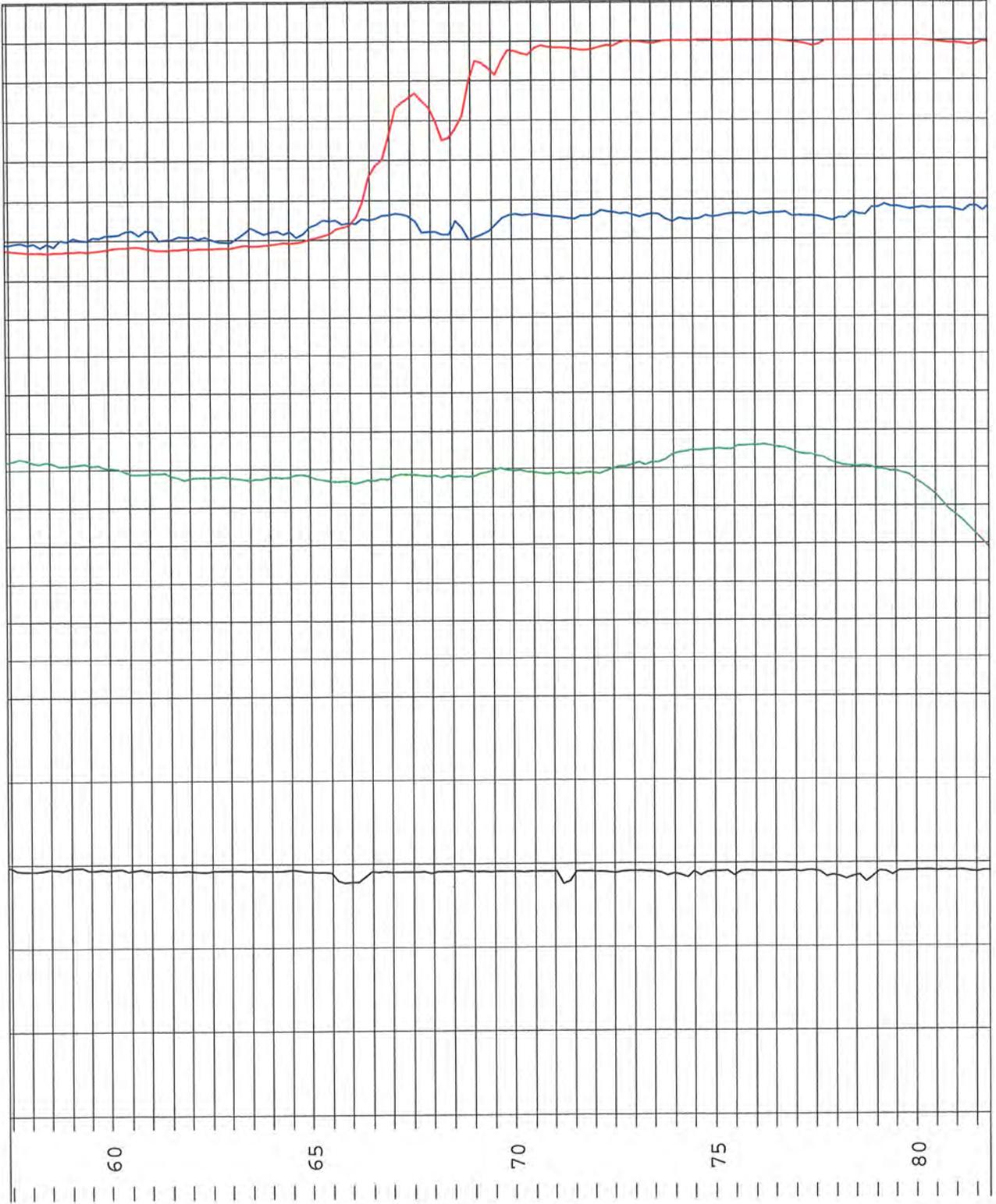
Location: Section 14, T1N, R69W, Boulder County, CO

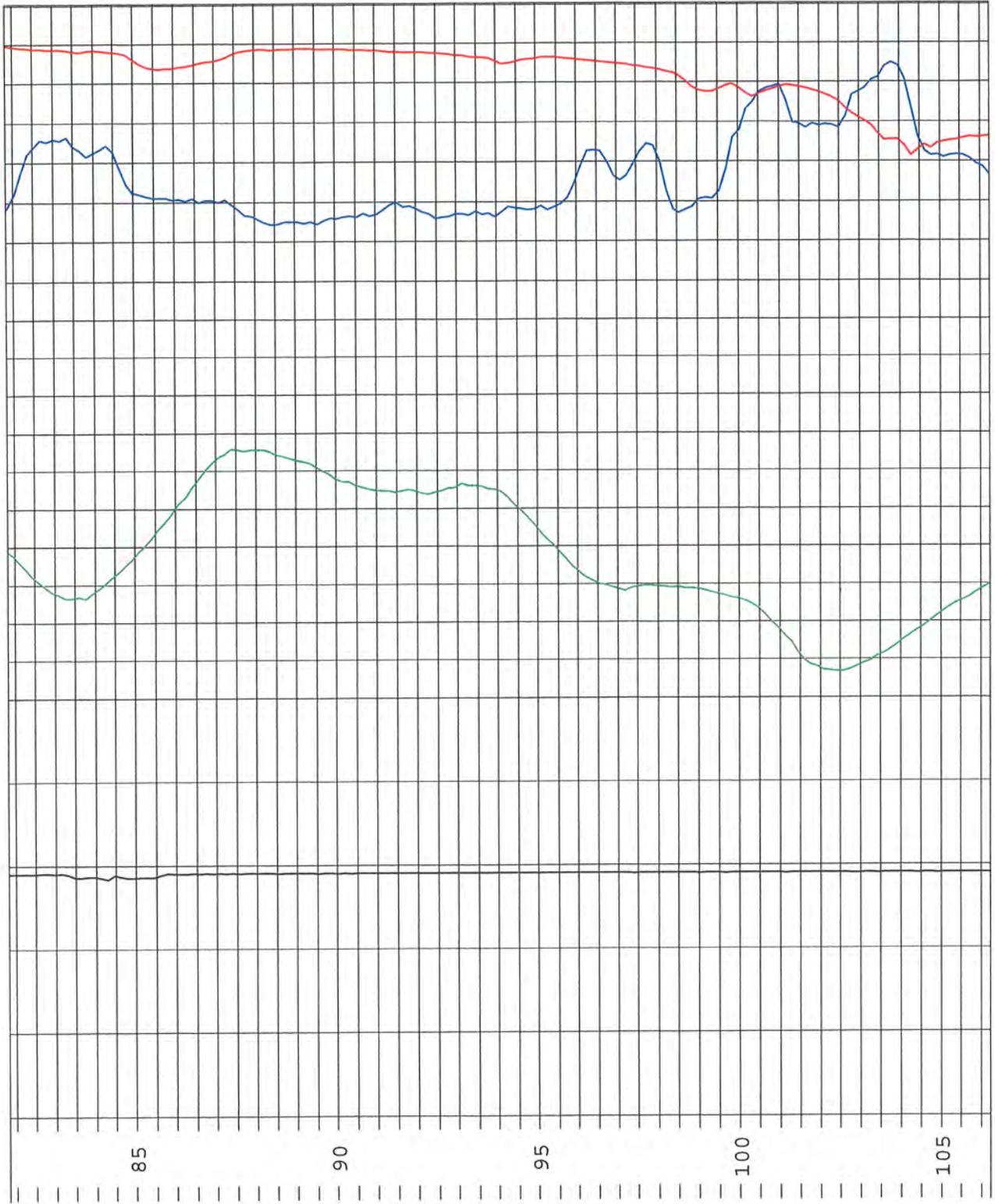
Well	W8			Comments	No Mine Workings
Date	4/18/2005	BH Fluid	Mud		
Casing	No				
File Name	W-8				
Depth Driller	140				
Depth Logger	139				
Logged by:	K. Abbott				
Witness:	N. Bideau				

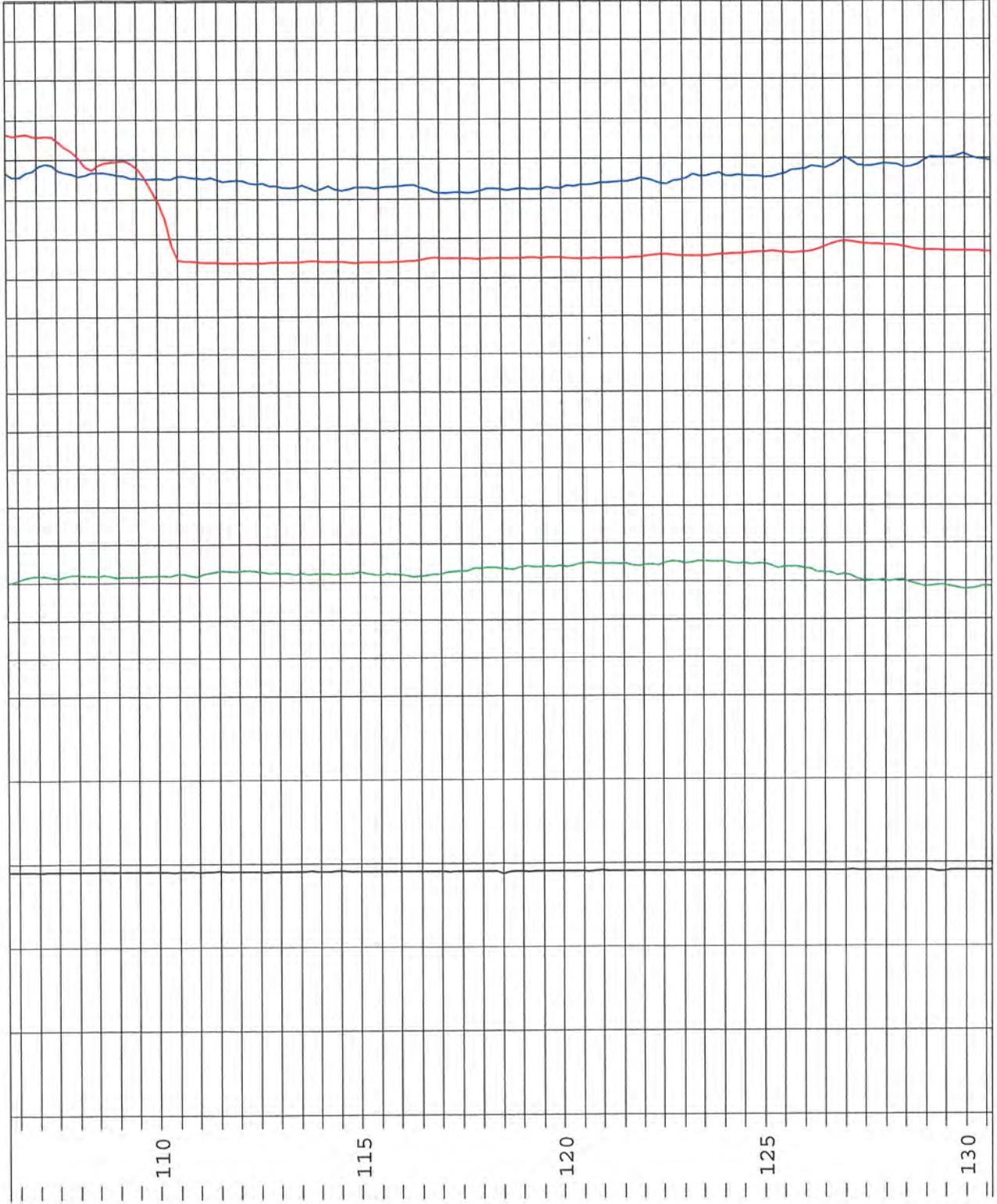


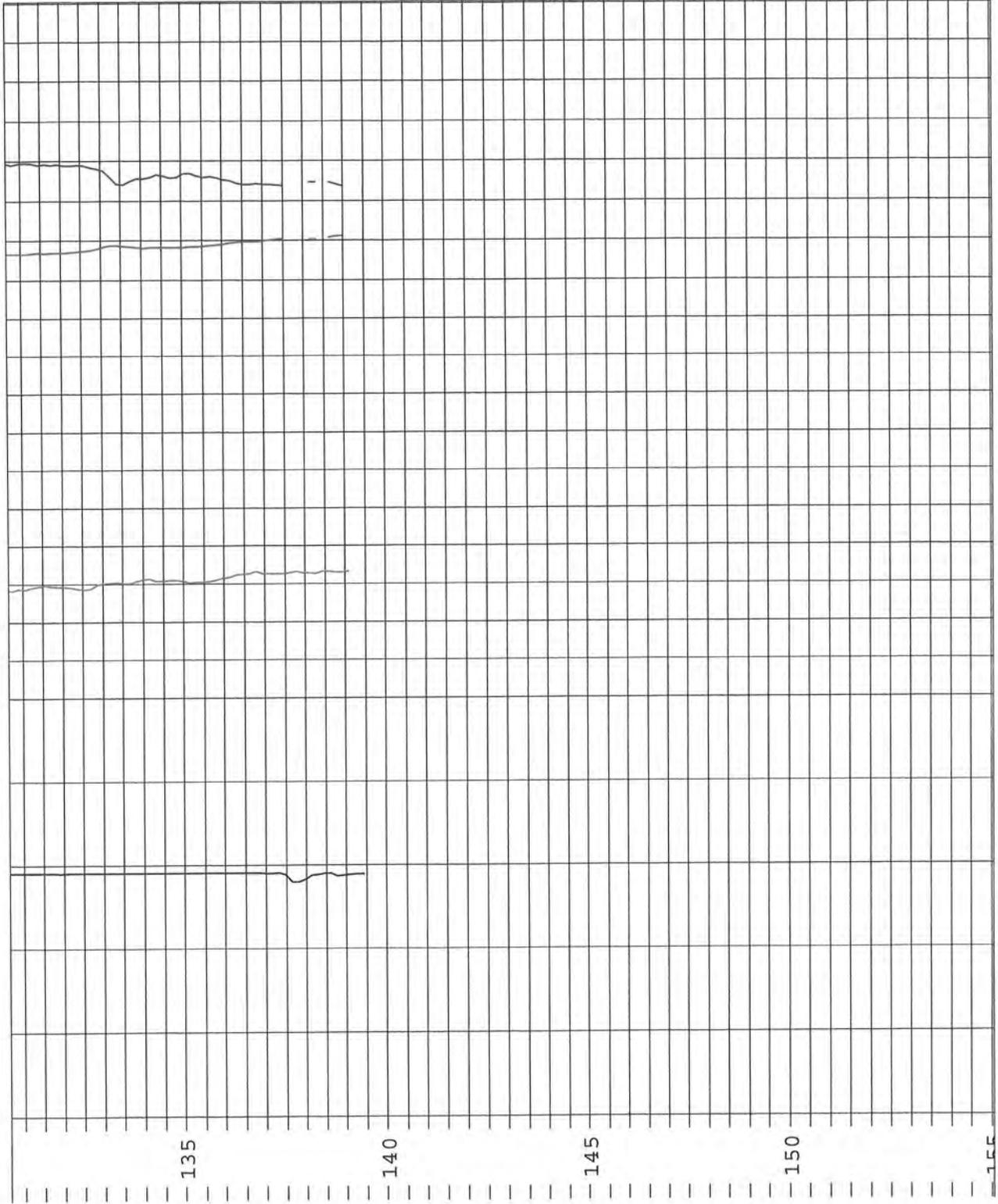












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Location: Section 14, T1N, R69W, Boulder County, CO

OTHER SERVICES

Well W9

Date 4/18/2005 BH Fluid Mud

Casing No

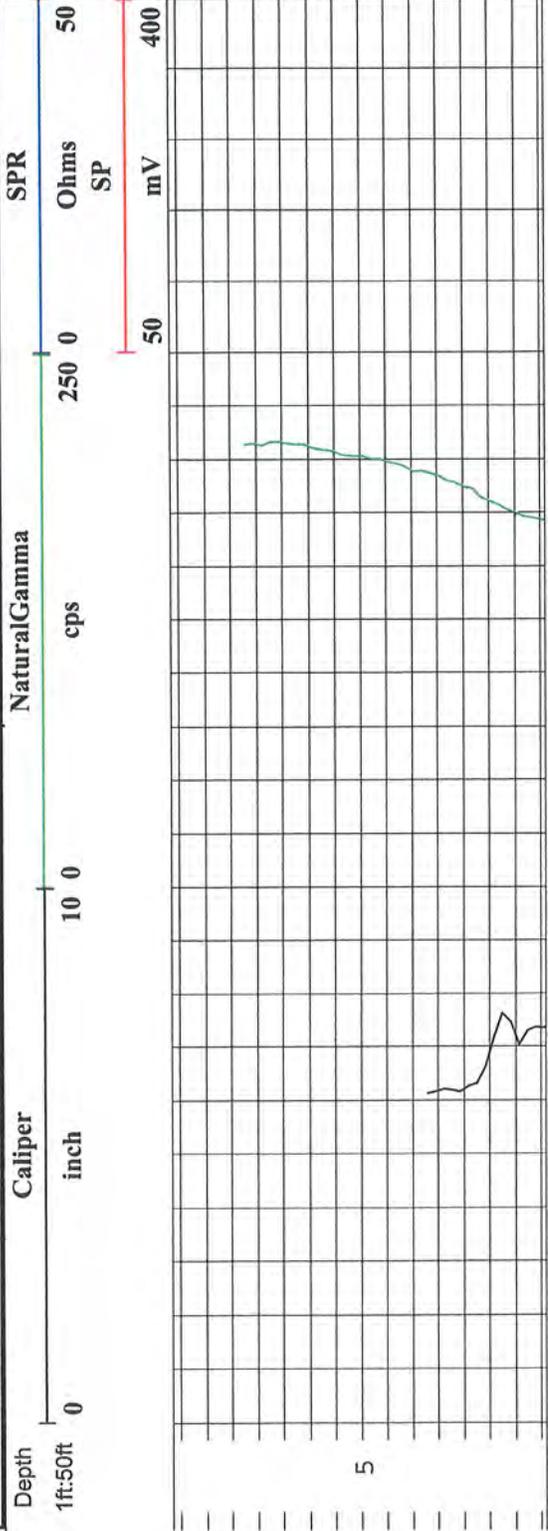
File Name W-9

Depth Driller 100 feet

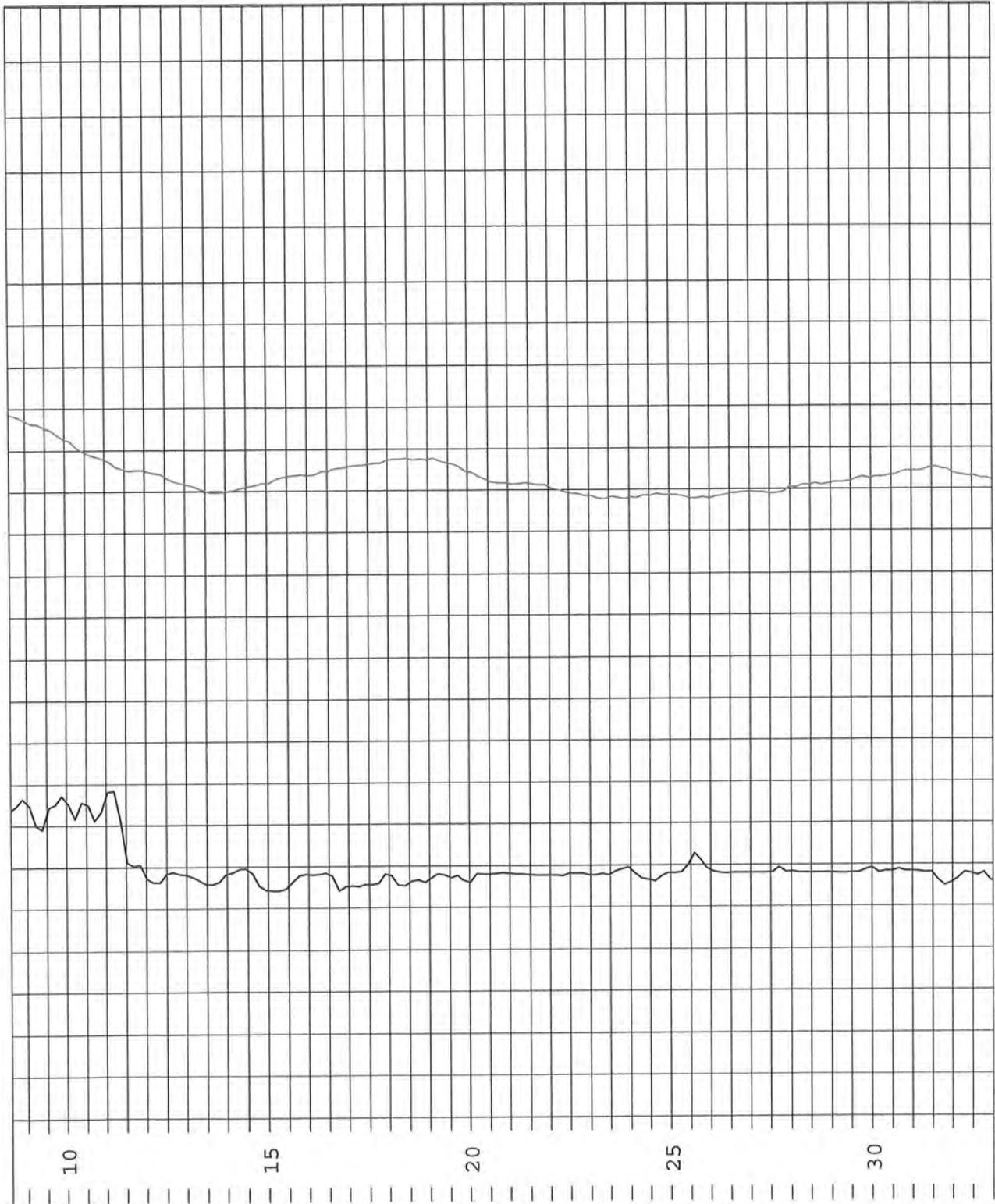
Depth Logger 99 feet

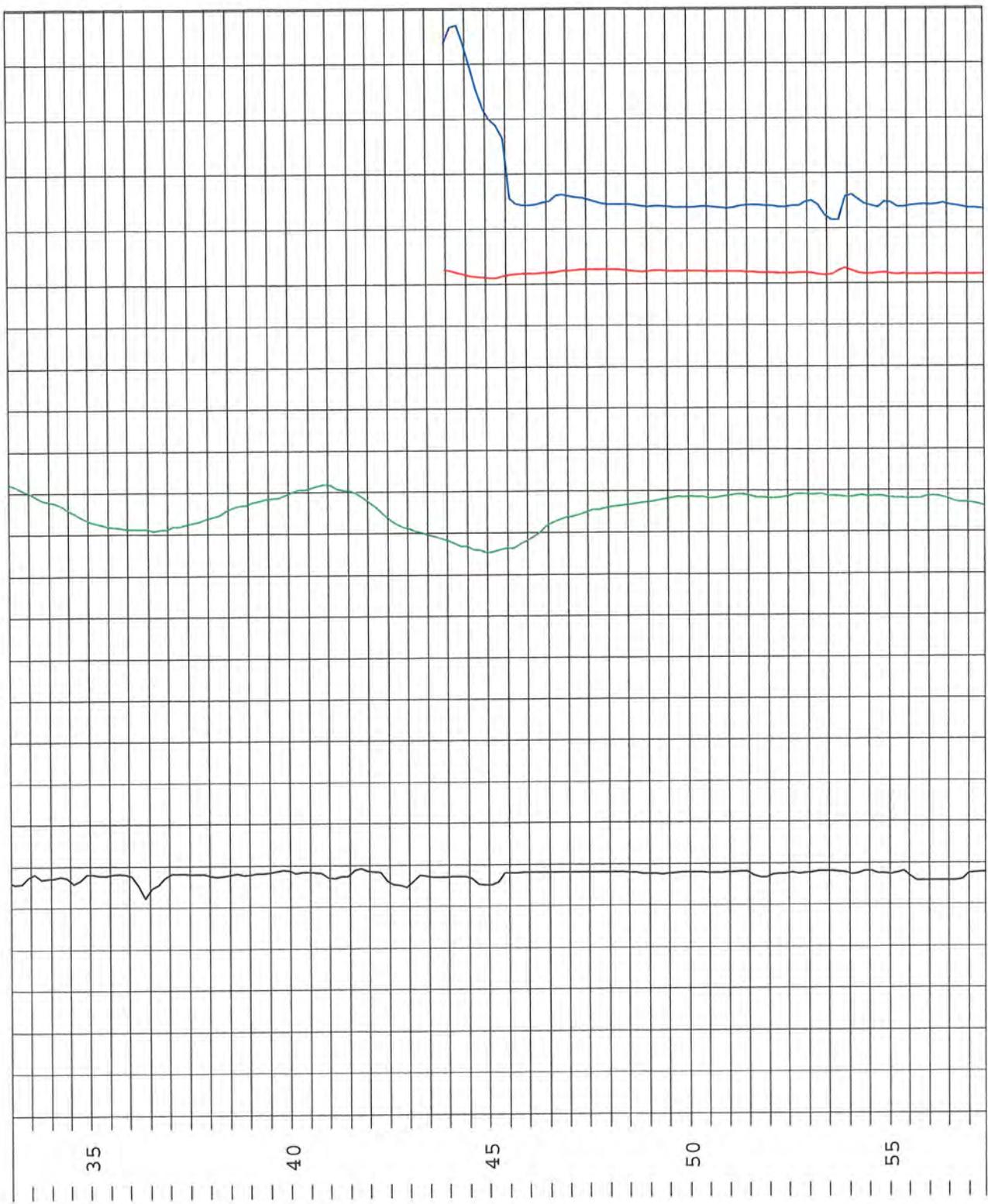
Logged by: K. Abbott

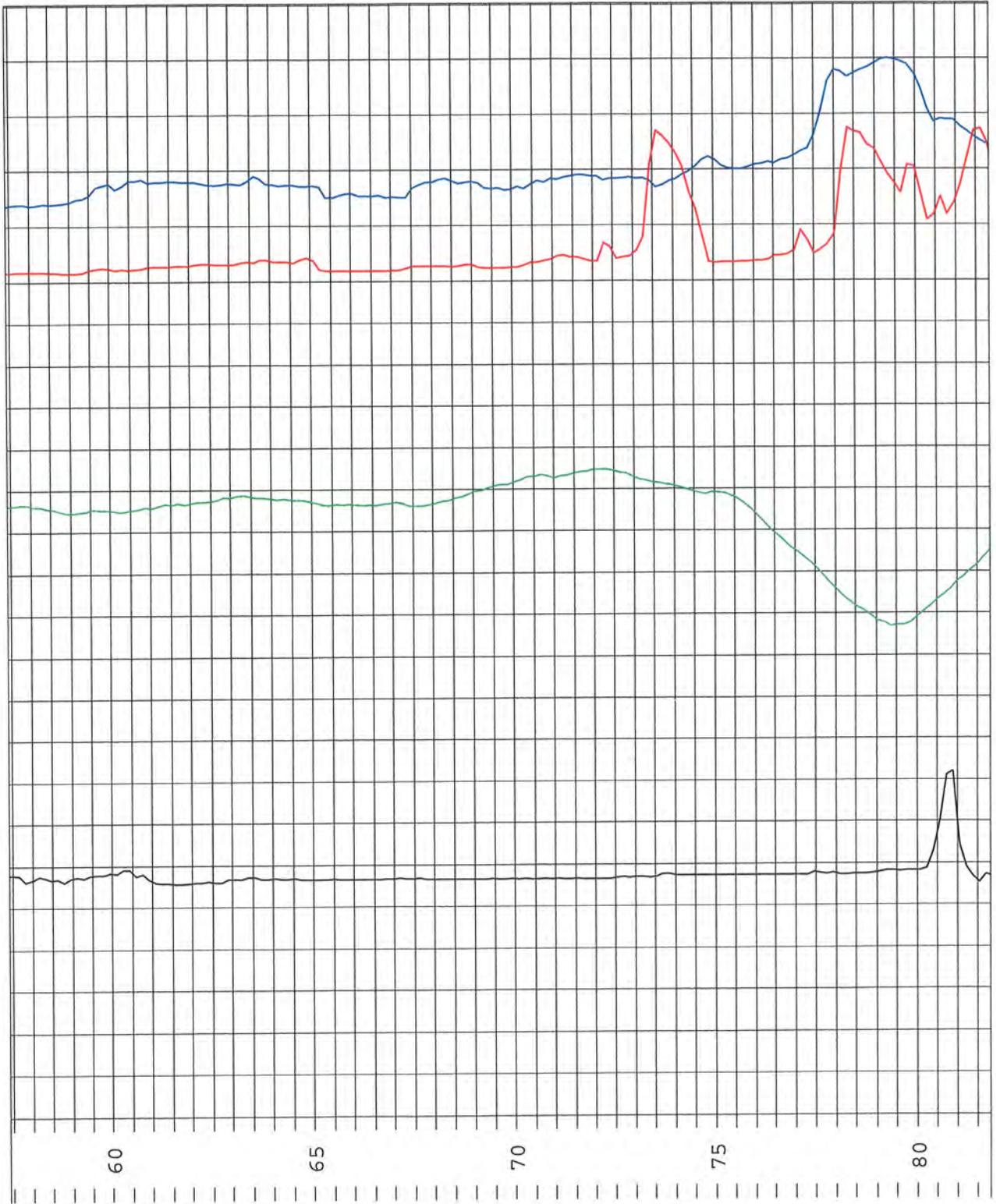
Witness: N. Bideau

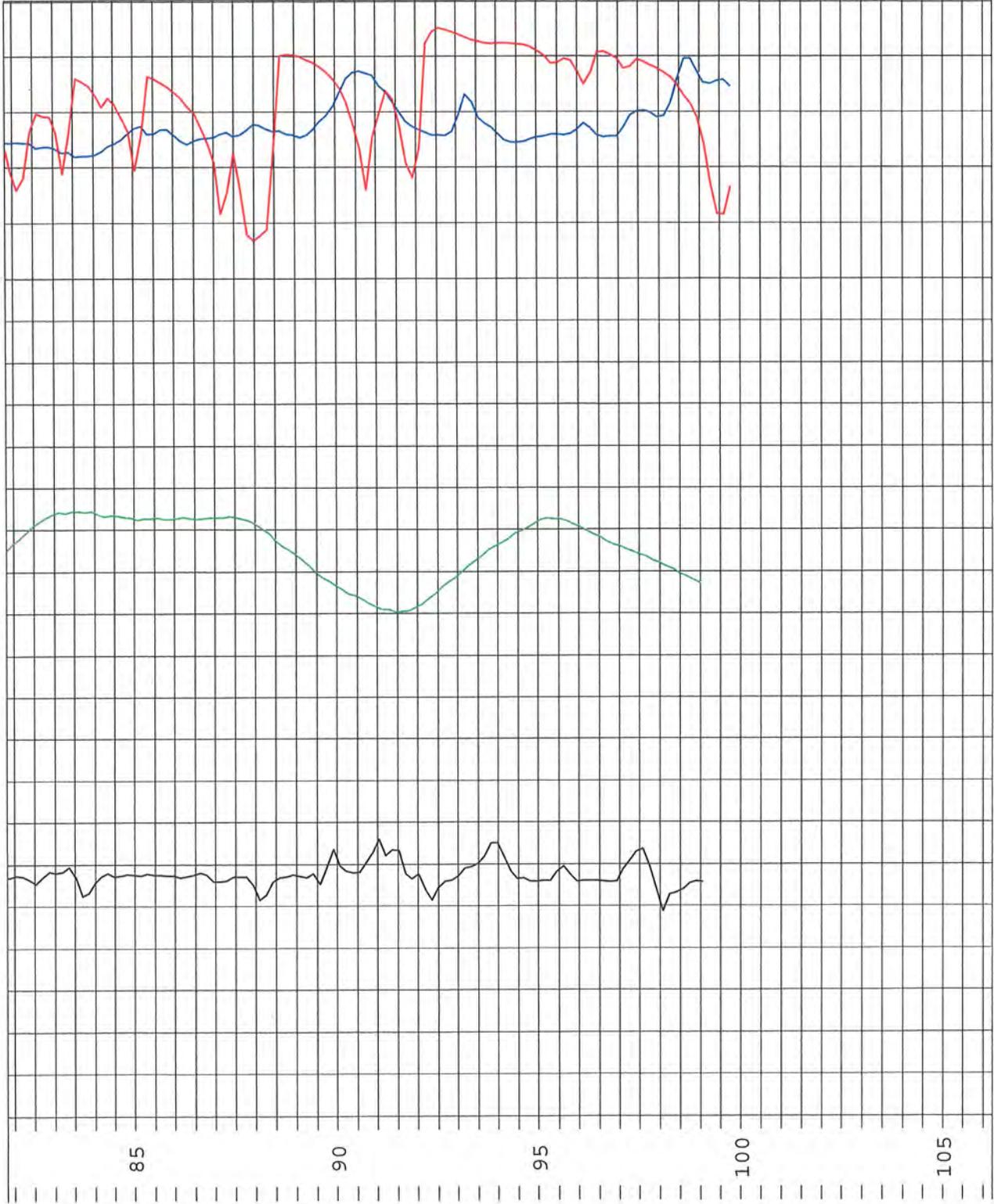


5





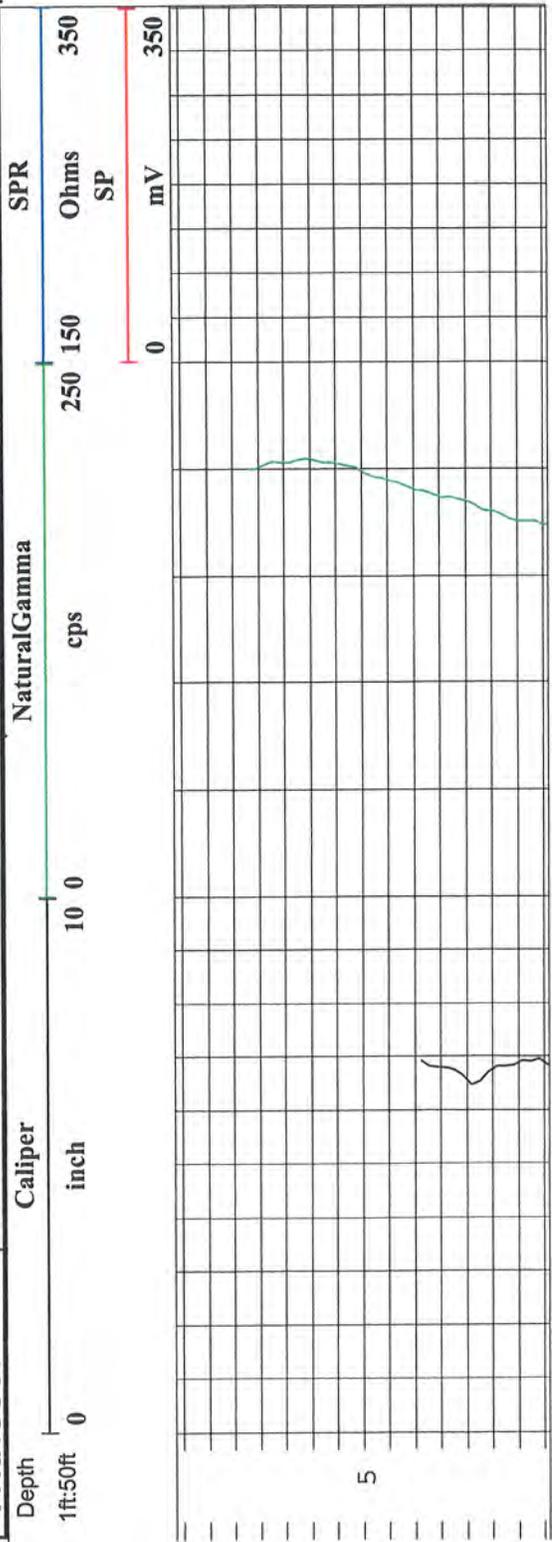


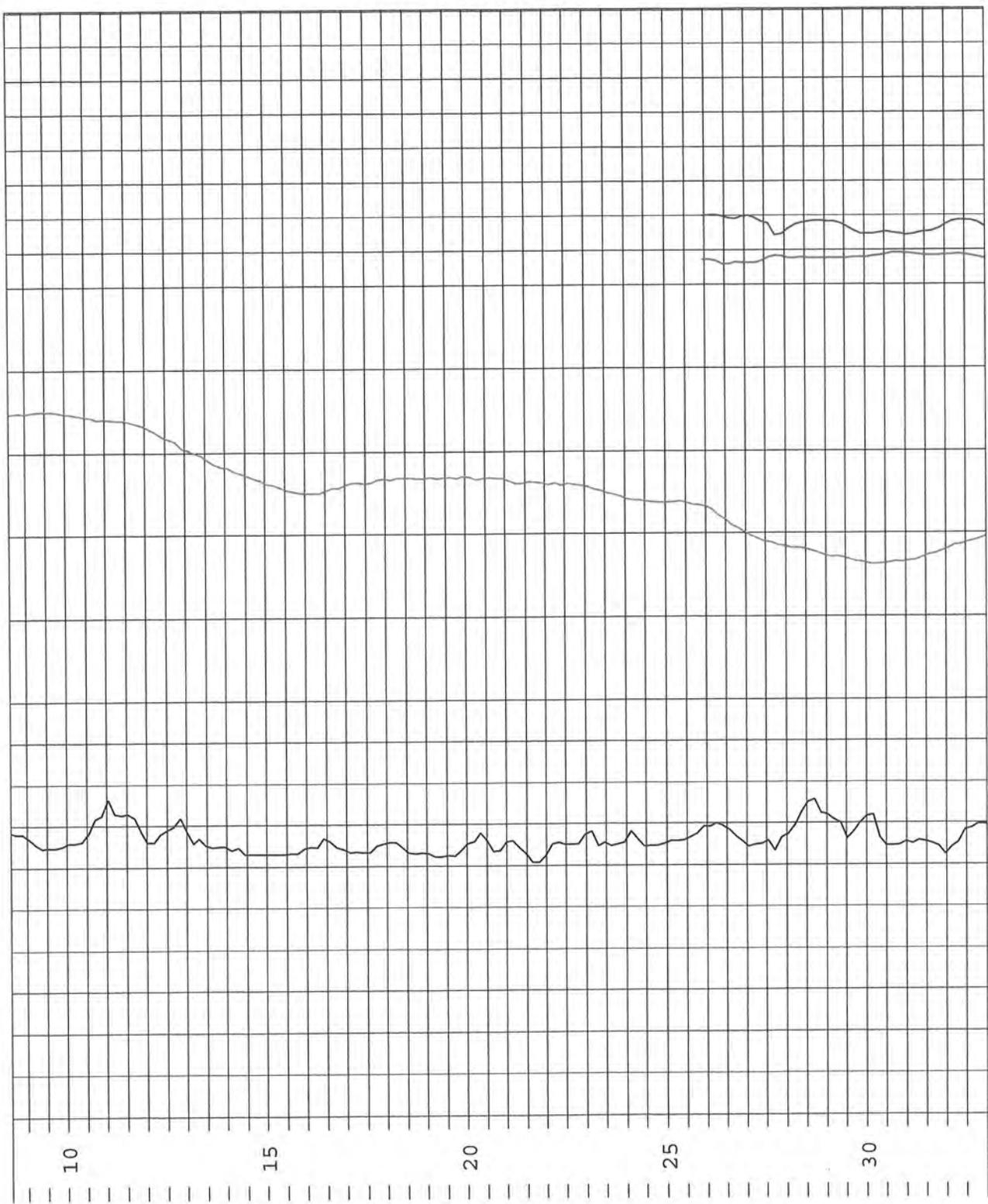


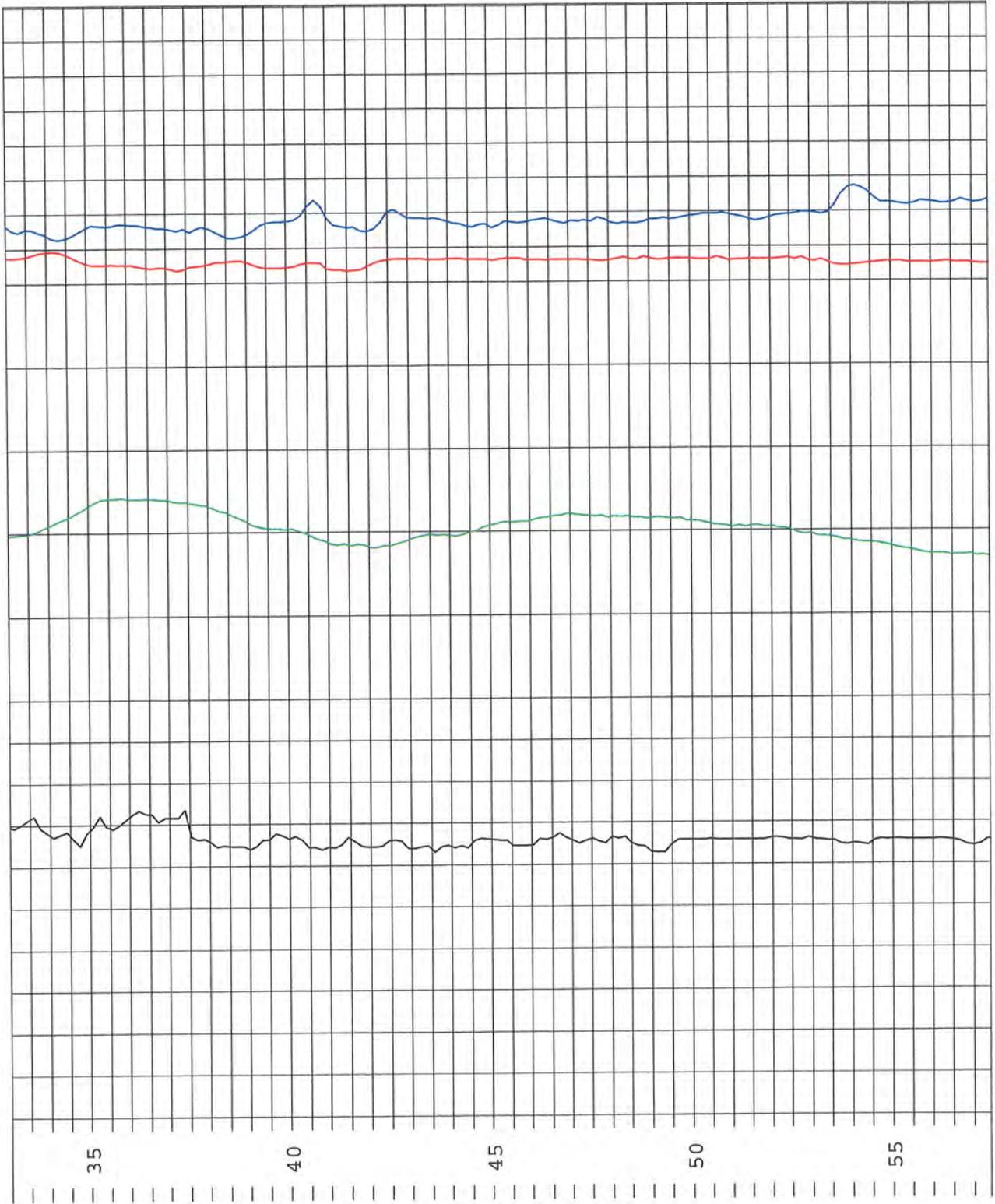
WESTERN ENVIRONMENT AND ECOLOGY, INC

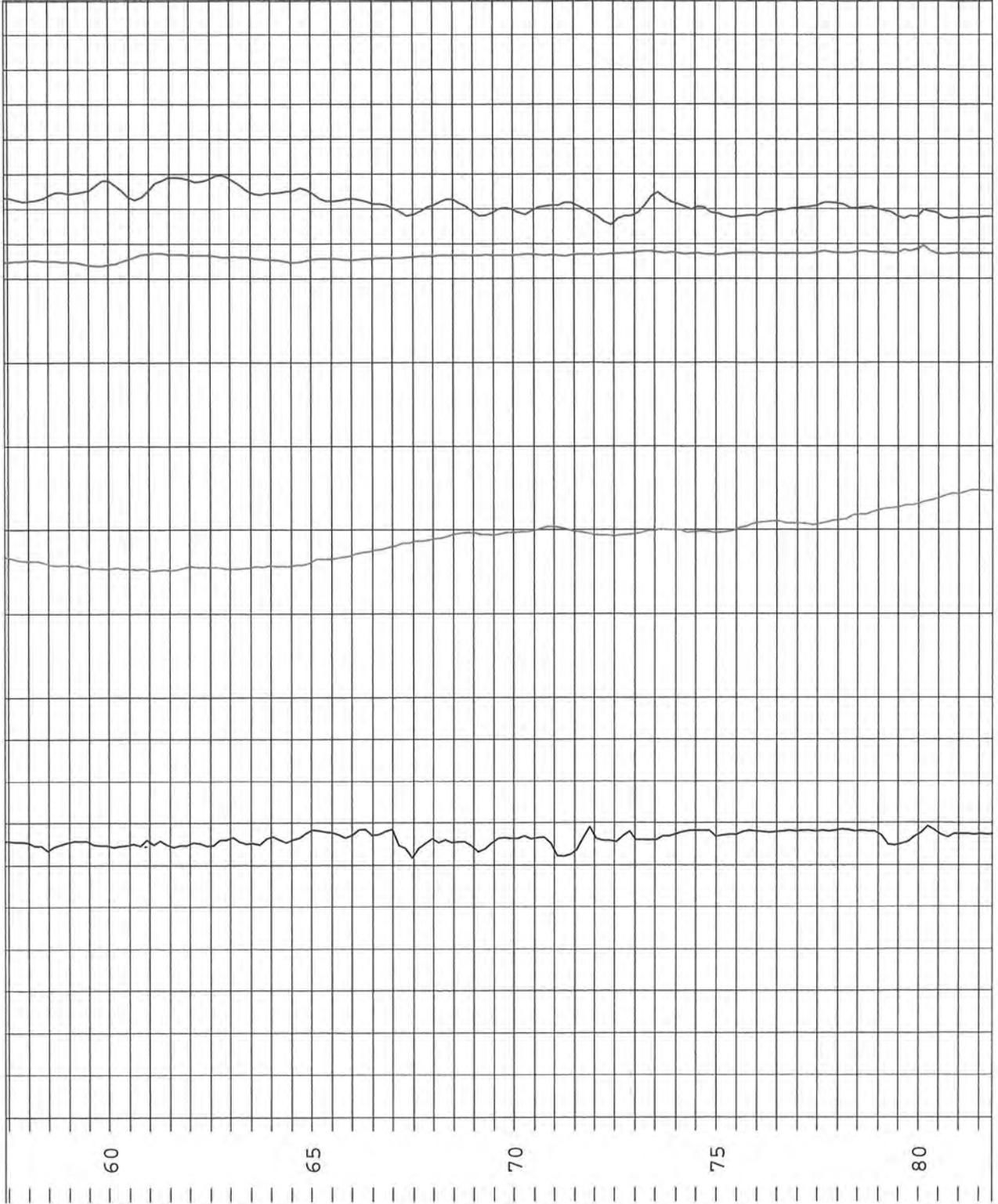
Location: Section 14, T1N, R69W, Boulder County, CO

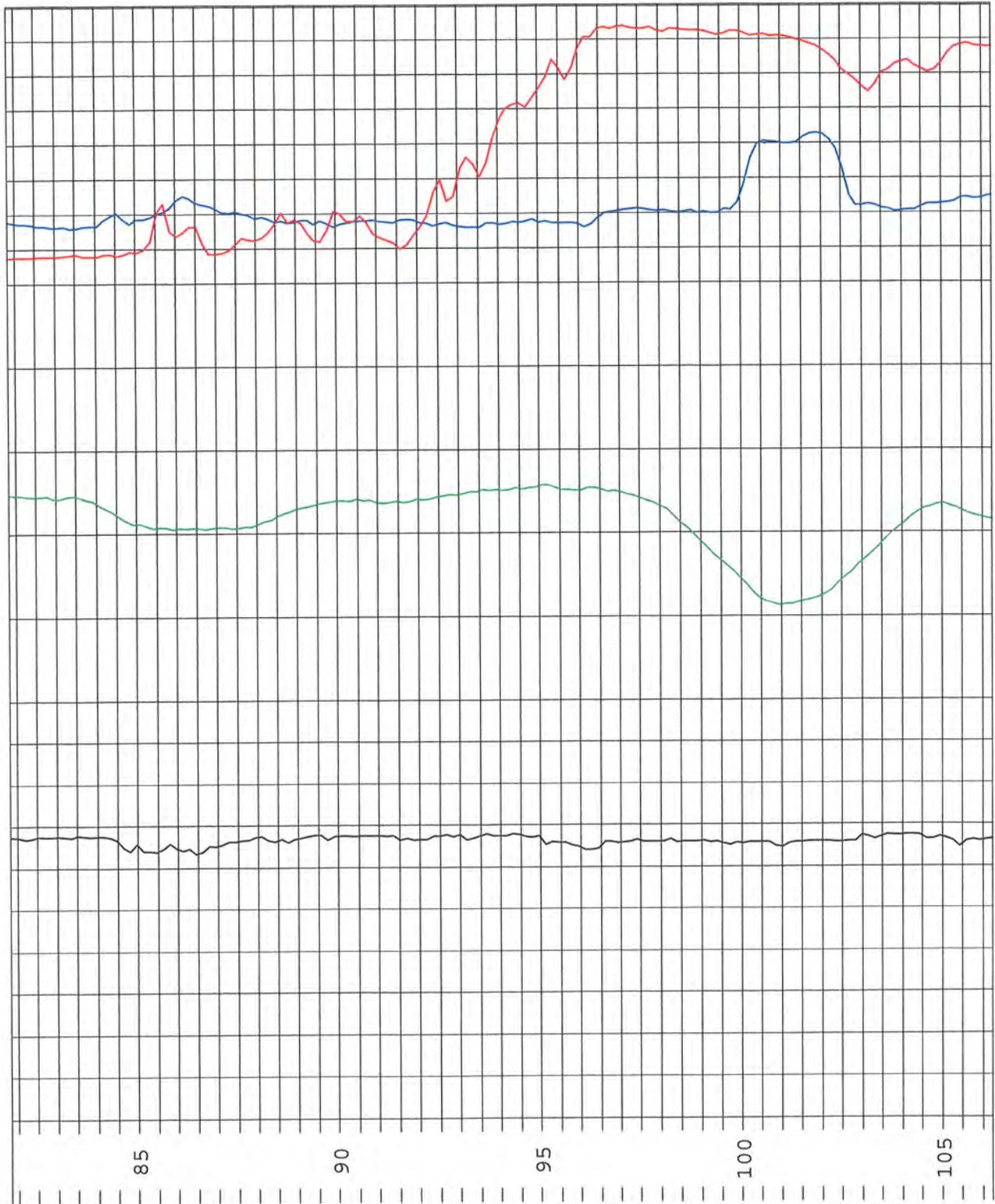
Well		W10		OTHER SERVICES	
Date	4/19/2005	BH Fluid	Mud		
Casing	No				
File Name	W-10				
Depth Driller	180 feet				
Depth Logger	179 feet				
Logged by:	K. Abbott				
Witness:	N. Bideau				

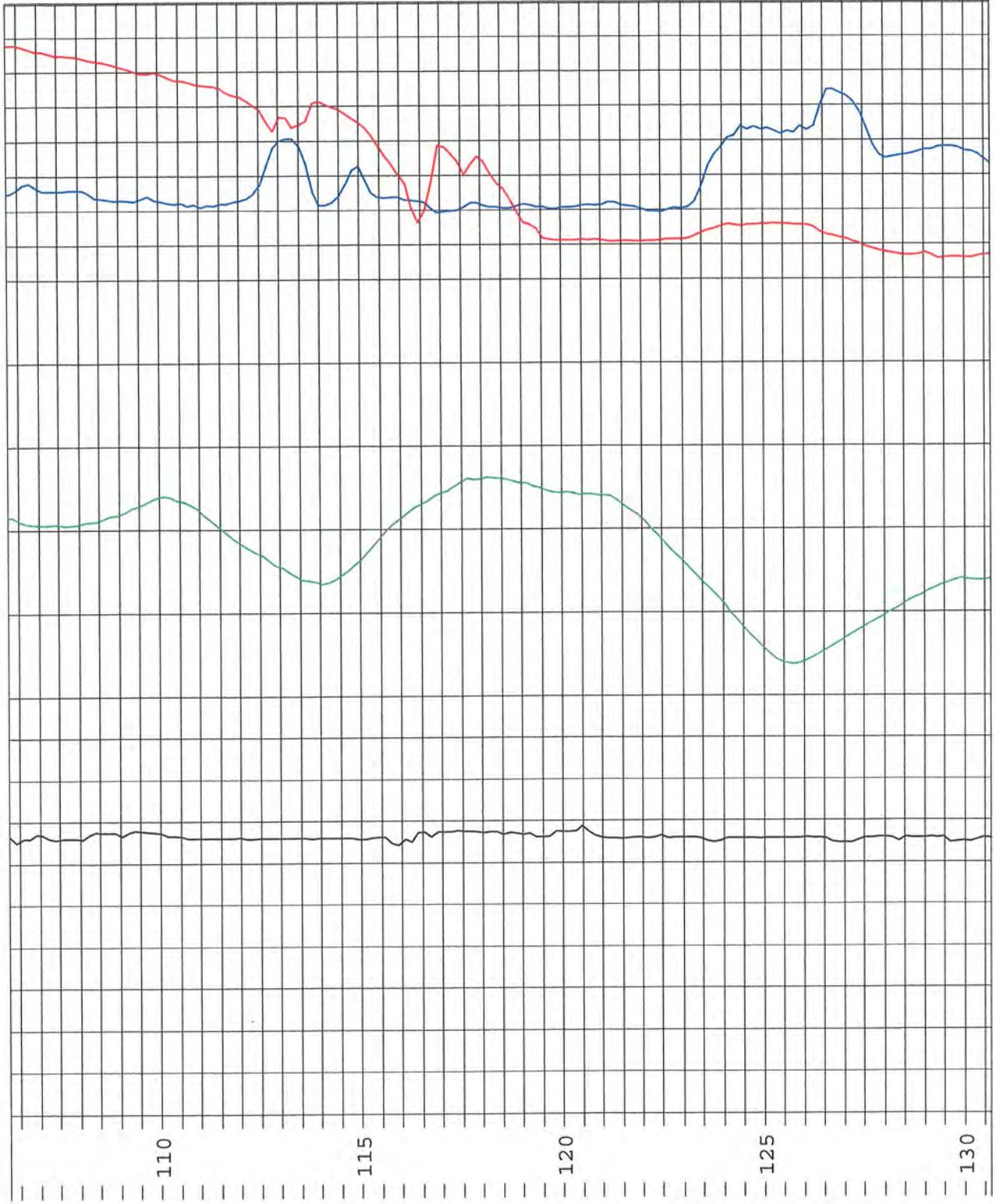


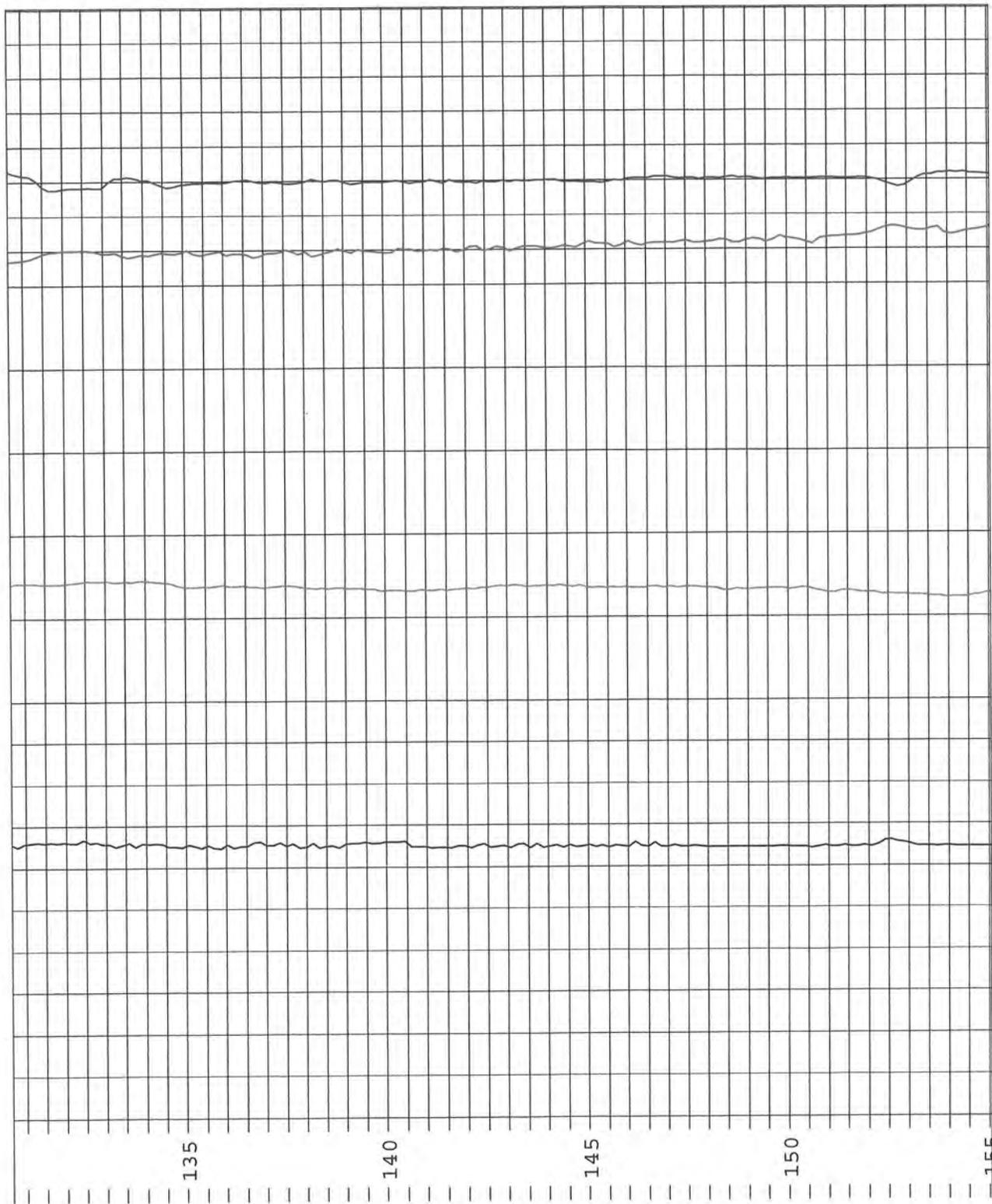


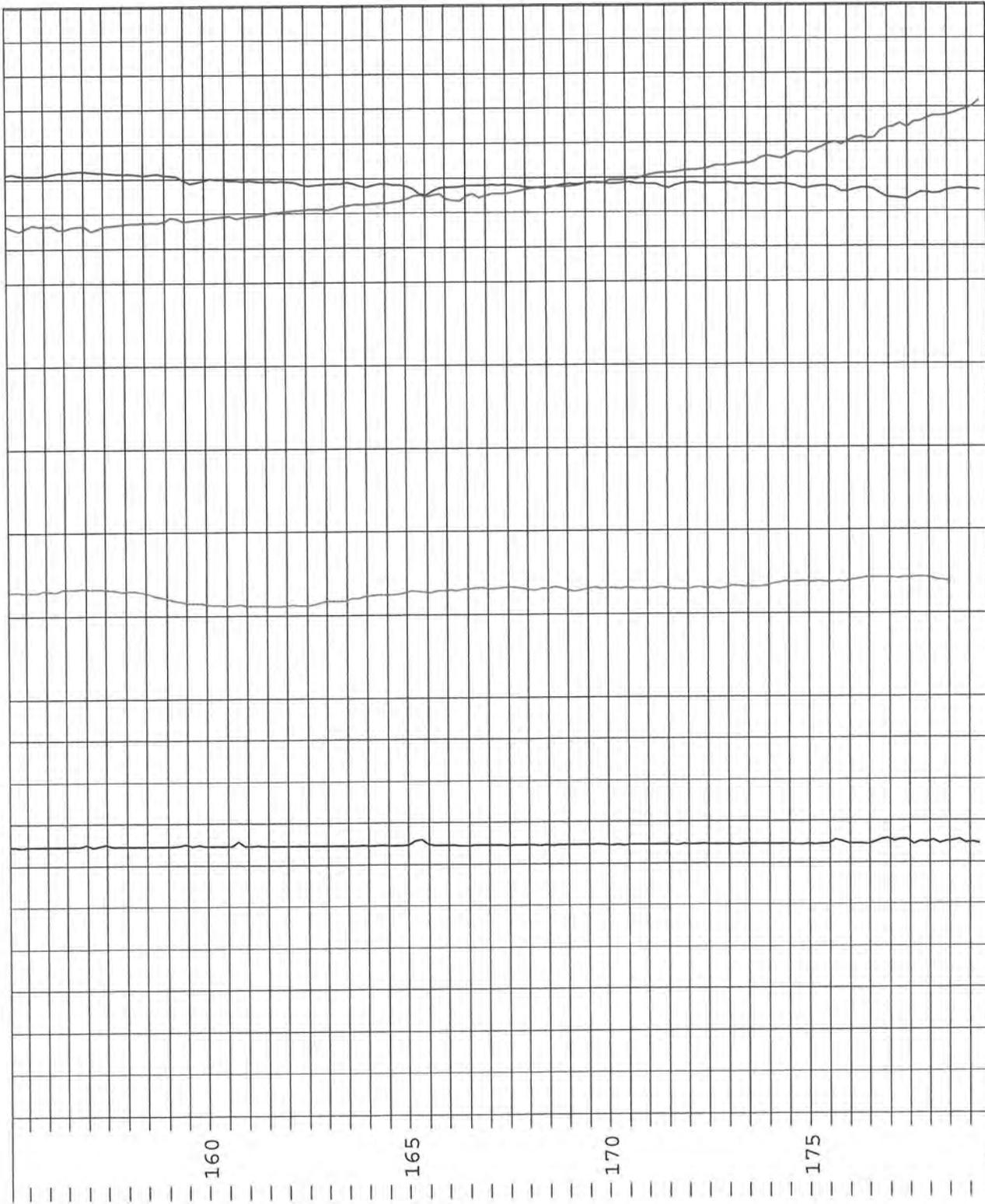


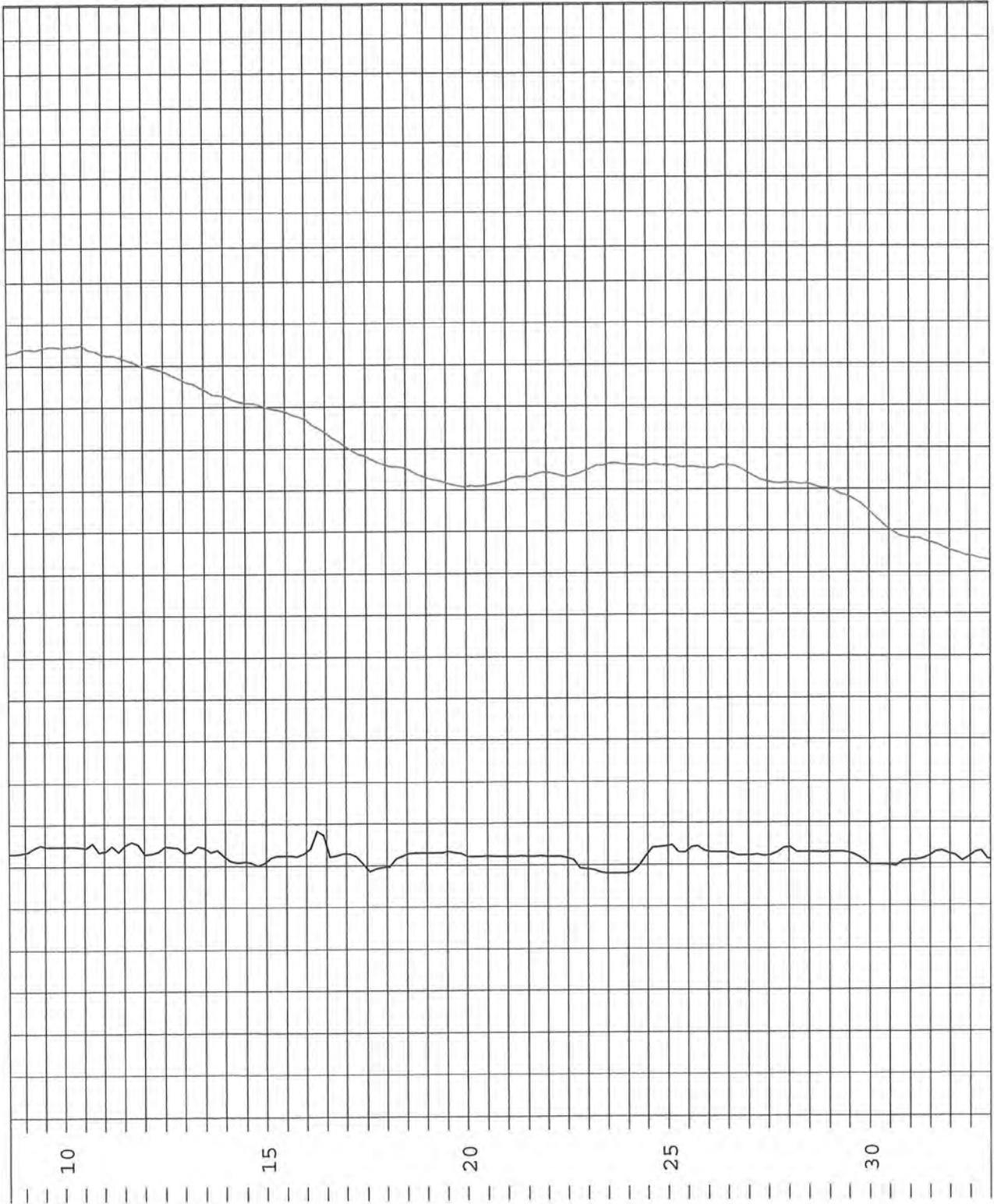


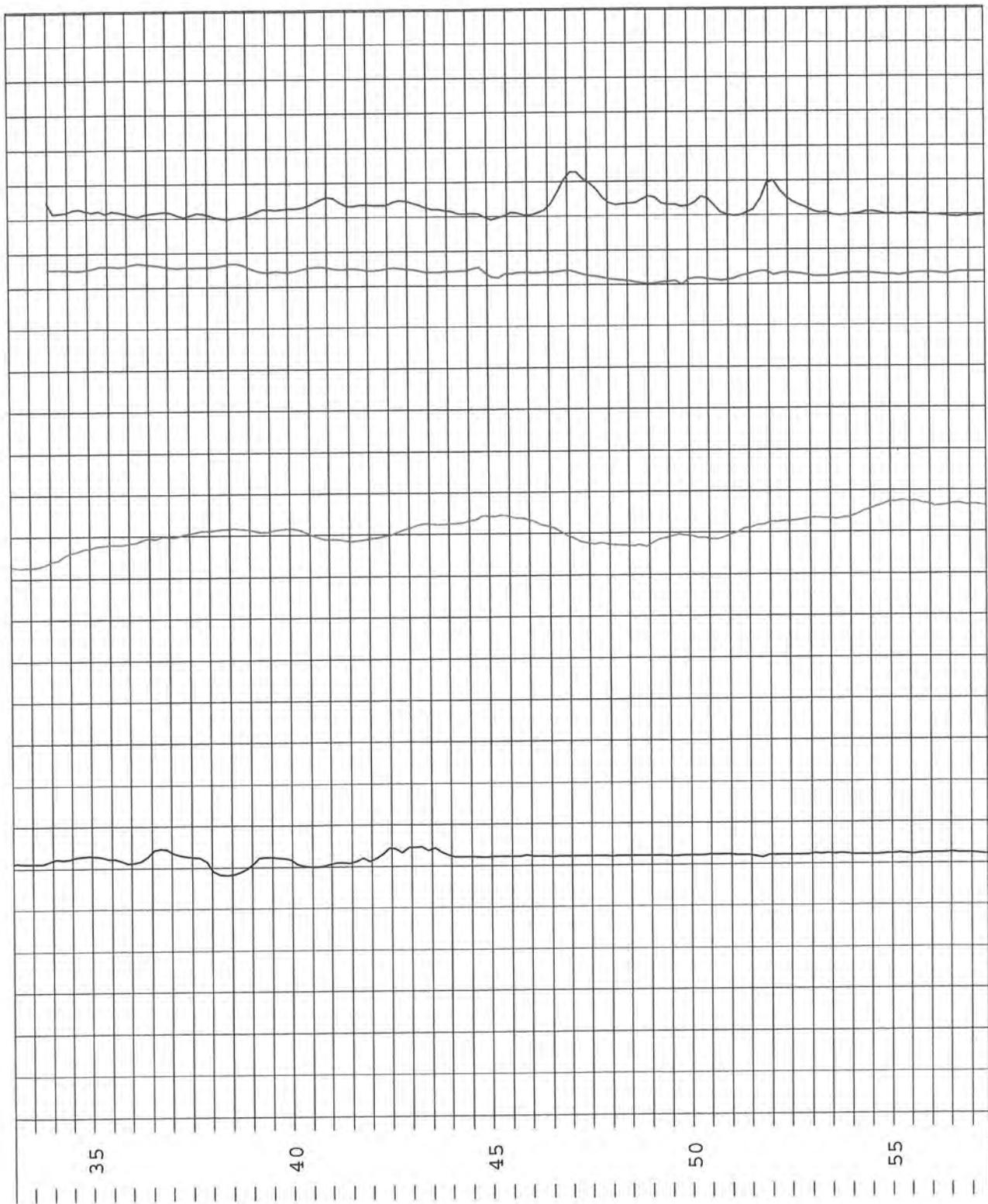


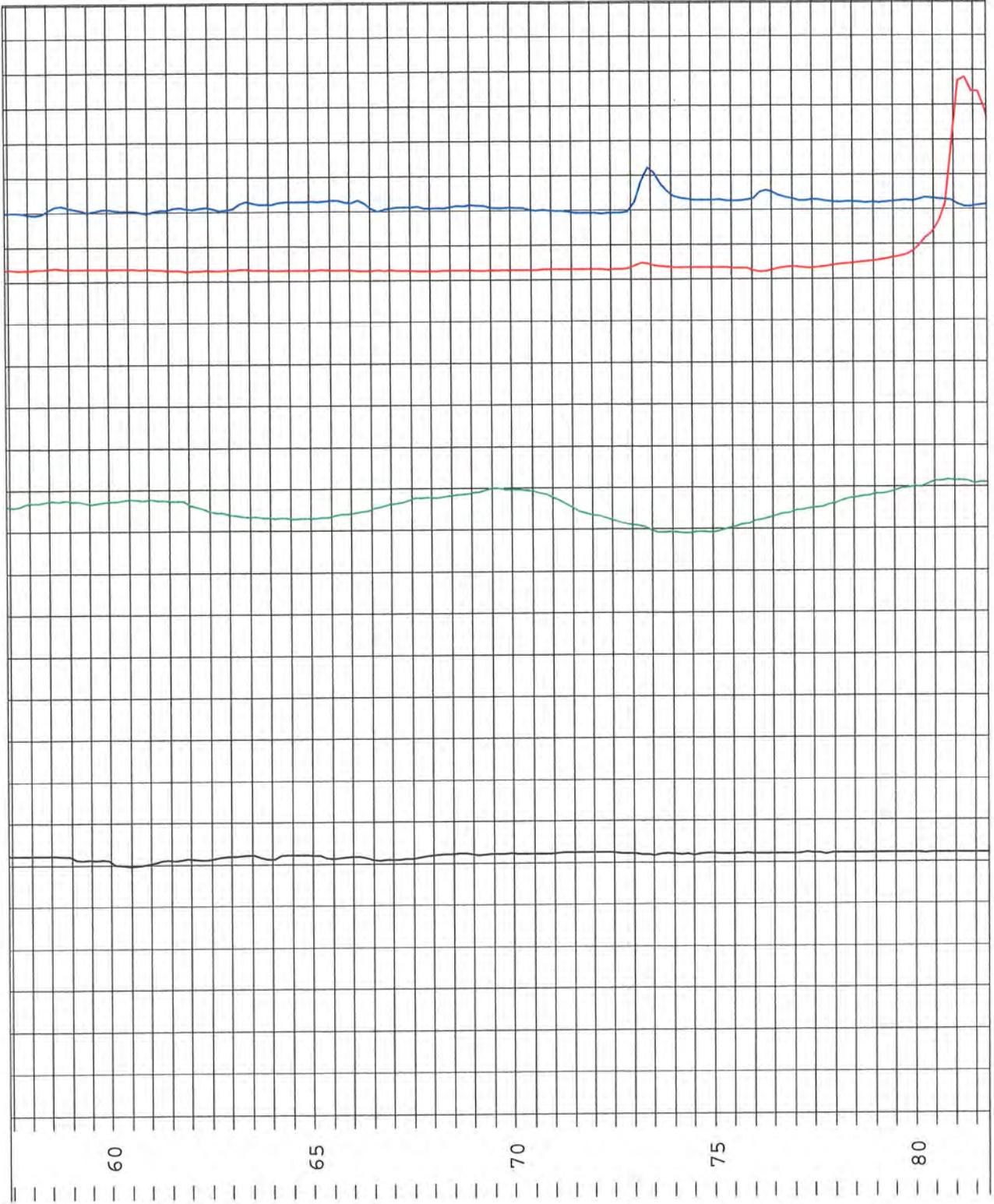


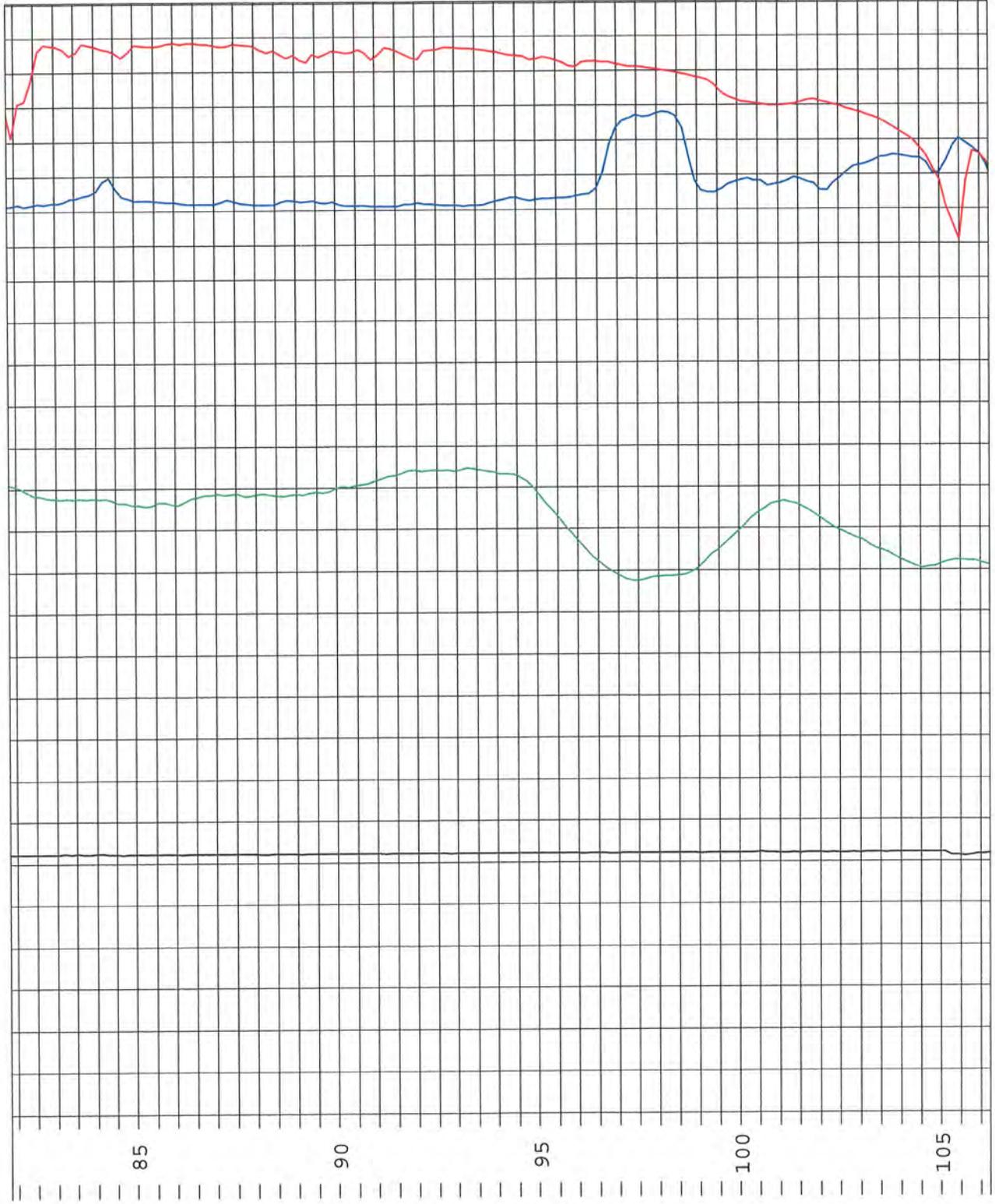


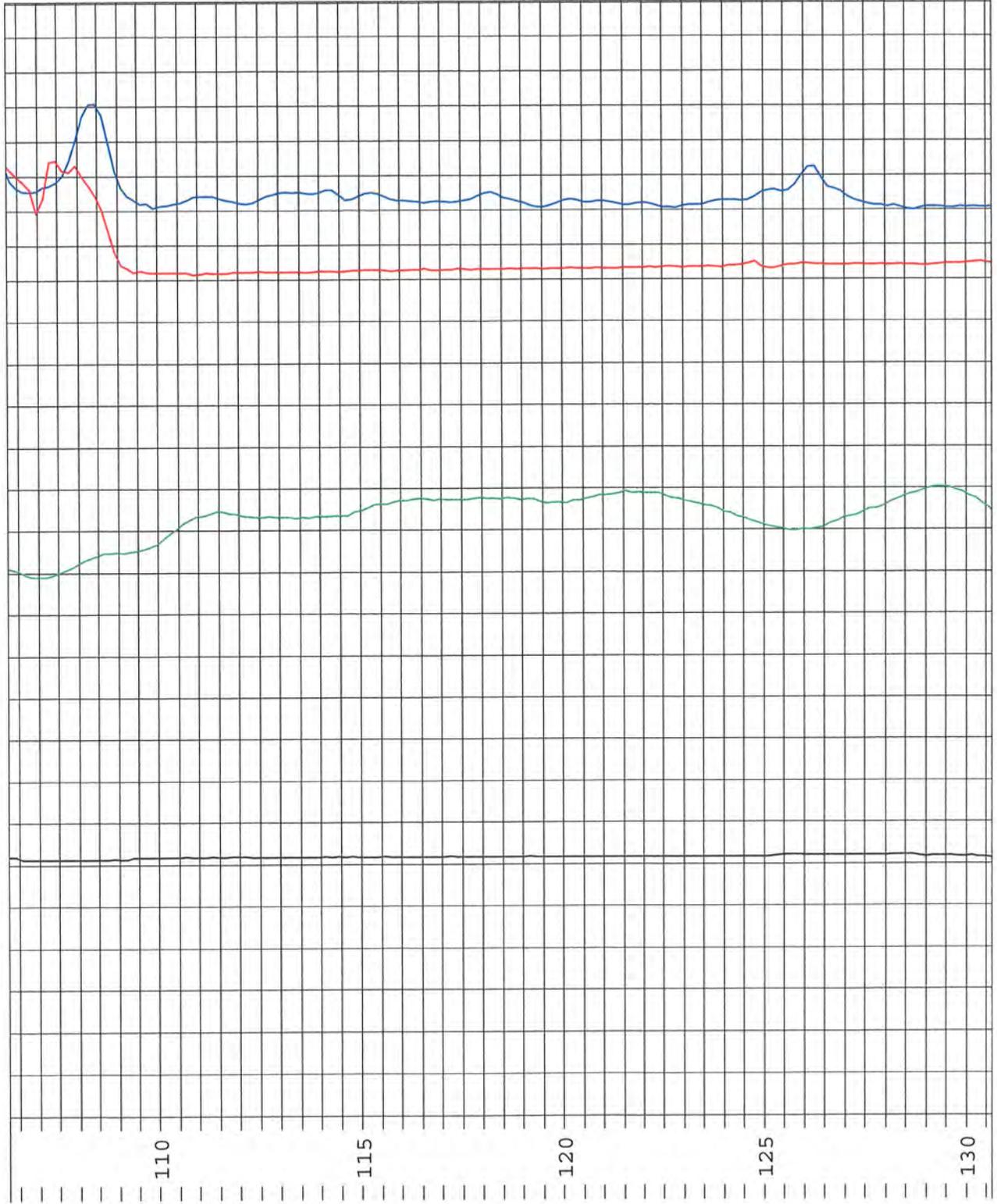


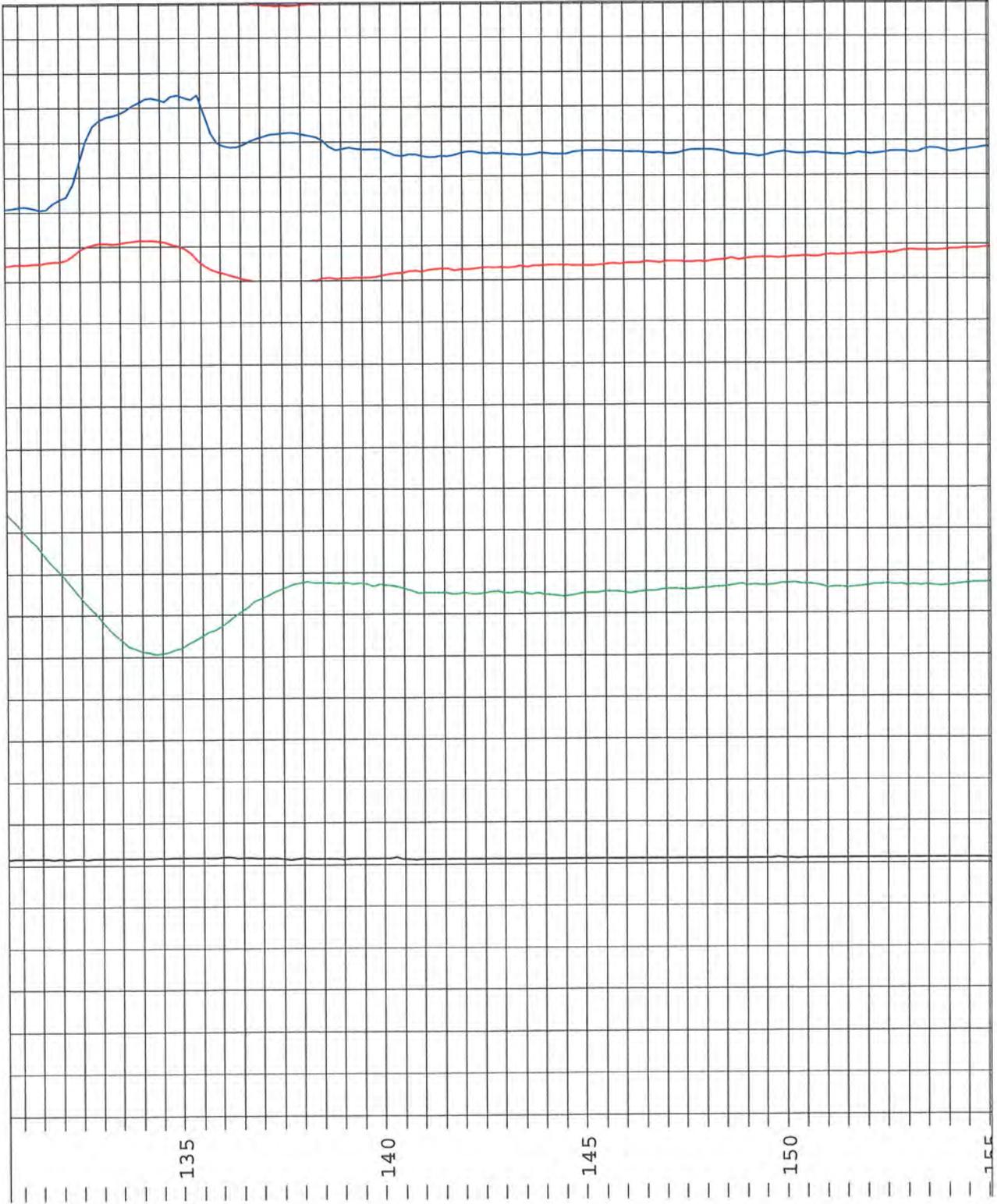


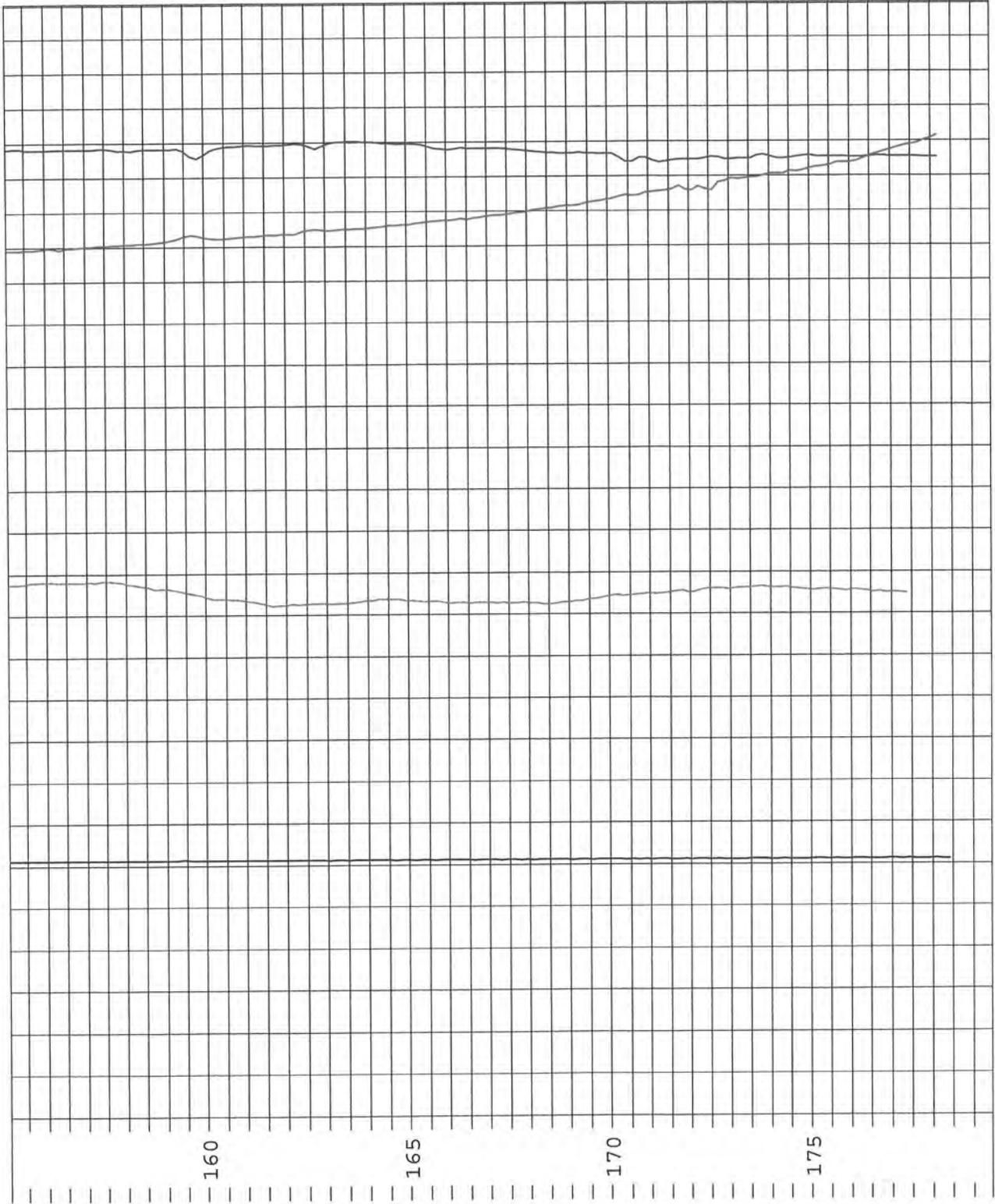












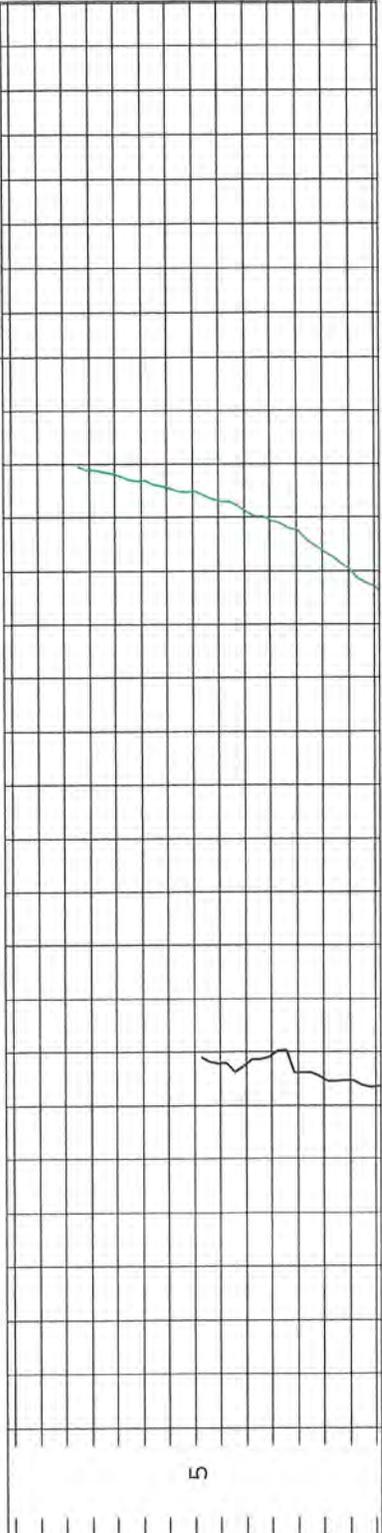
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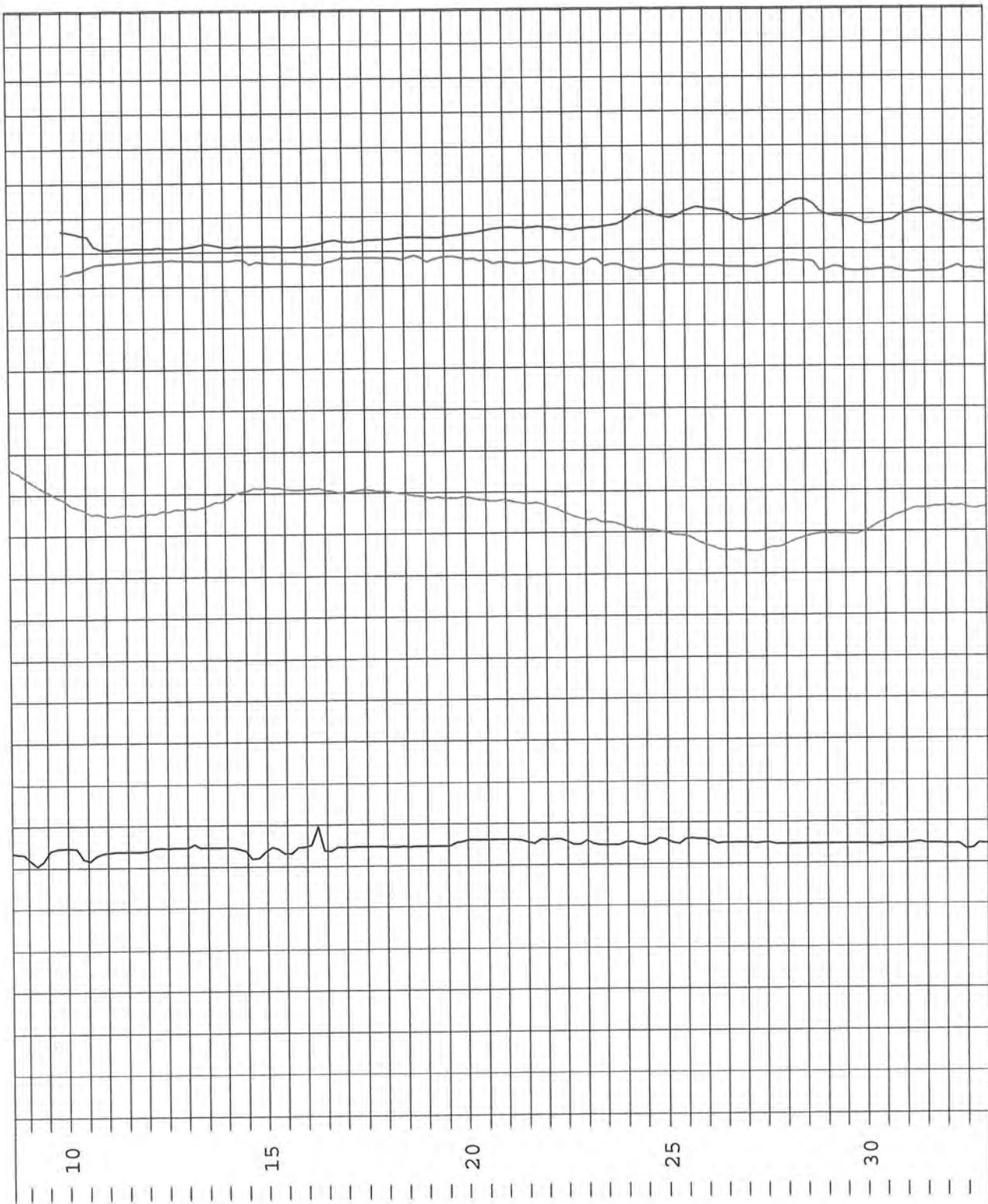
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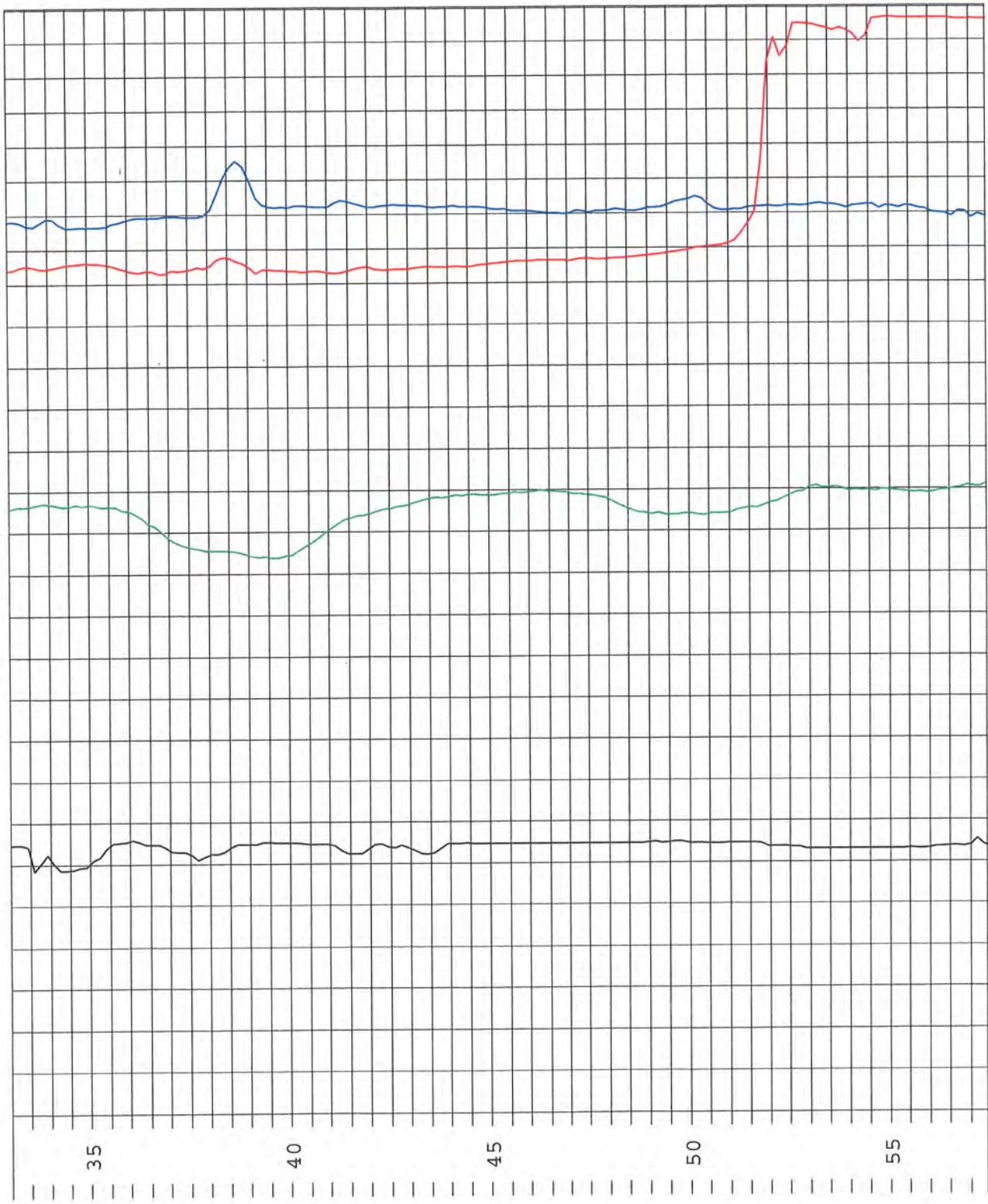
OTHER SERVICES

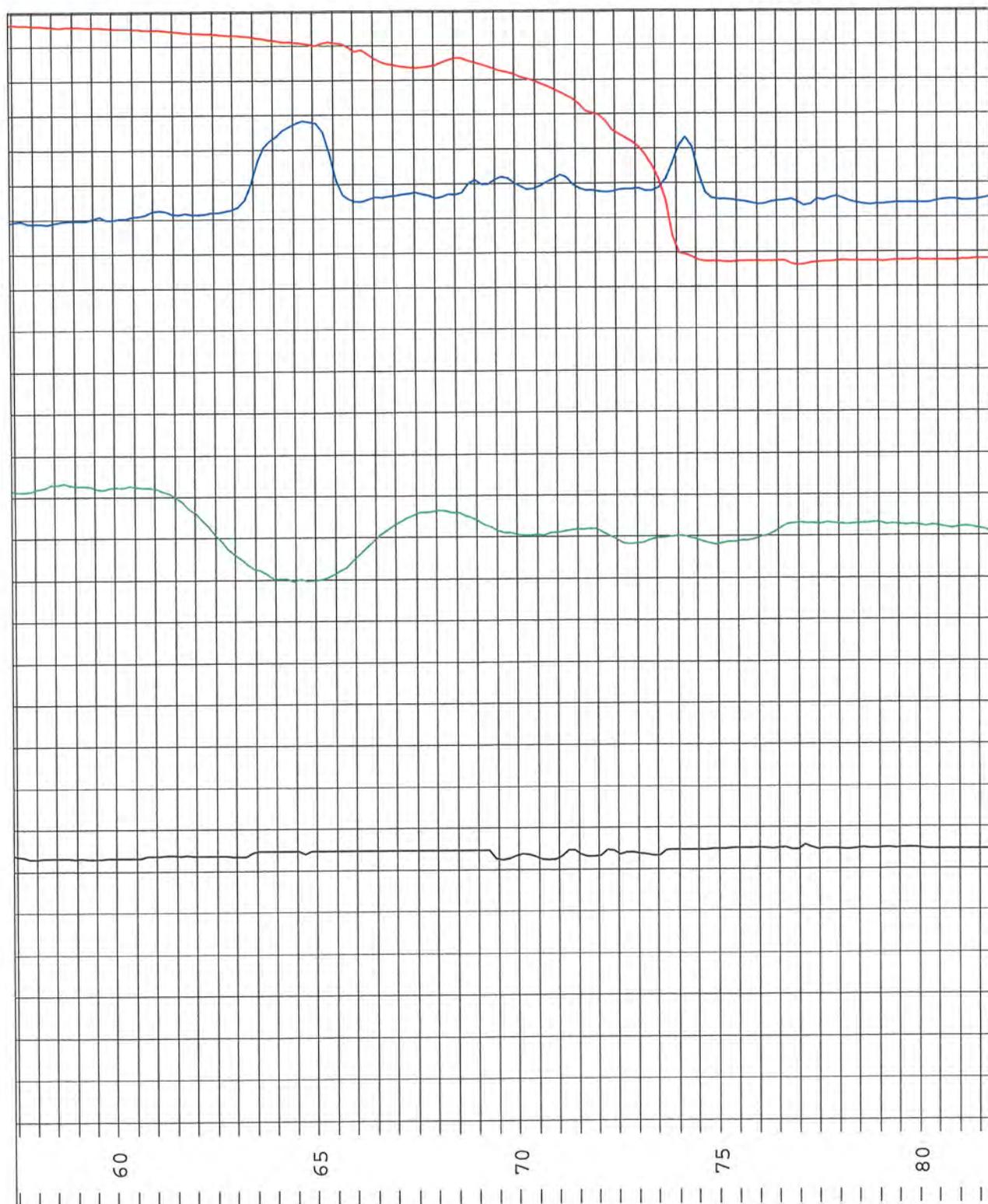
Well	W12		
Date	4/19/2005	BH Fluid	Mud
Casing	No		
File Name	W-12		
Depth Driller	120 feet		
Depth Logger	118 feet		
Logged by:	K. Abbott		
Witness:	N. Bideau		

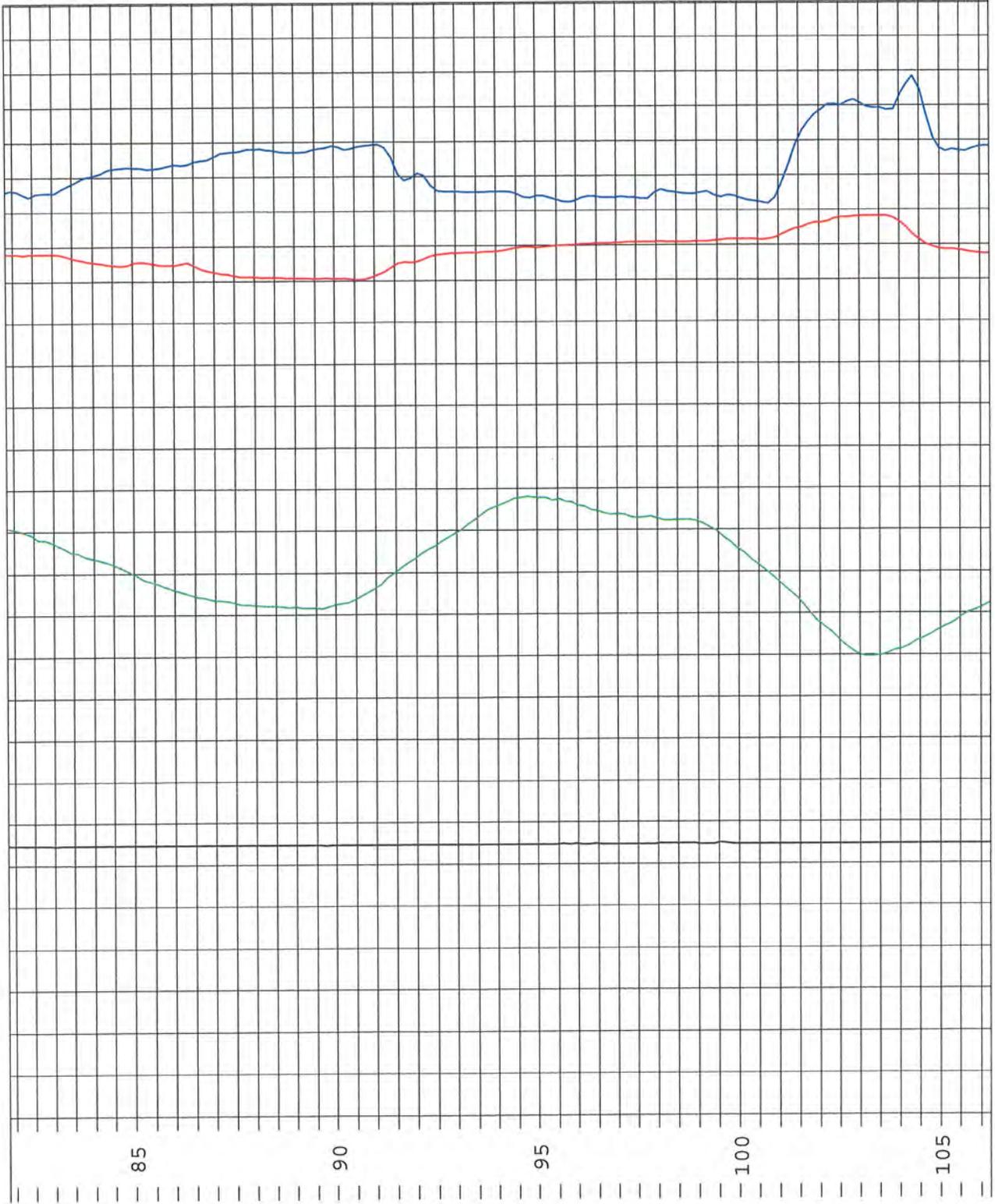
Depth	Caliper	NaturalGamma	SPR
1ft:50ft	inch	cps	Ohms
0	10 0	250	250
			SP
			-50 mV 300

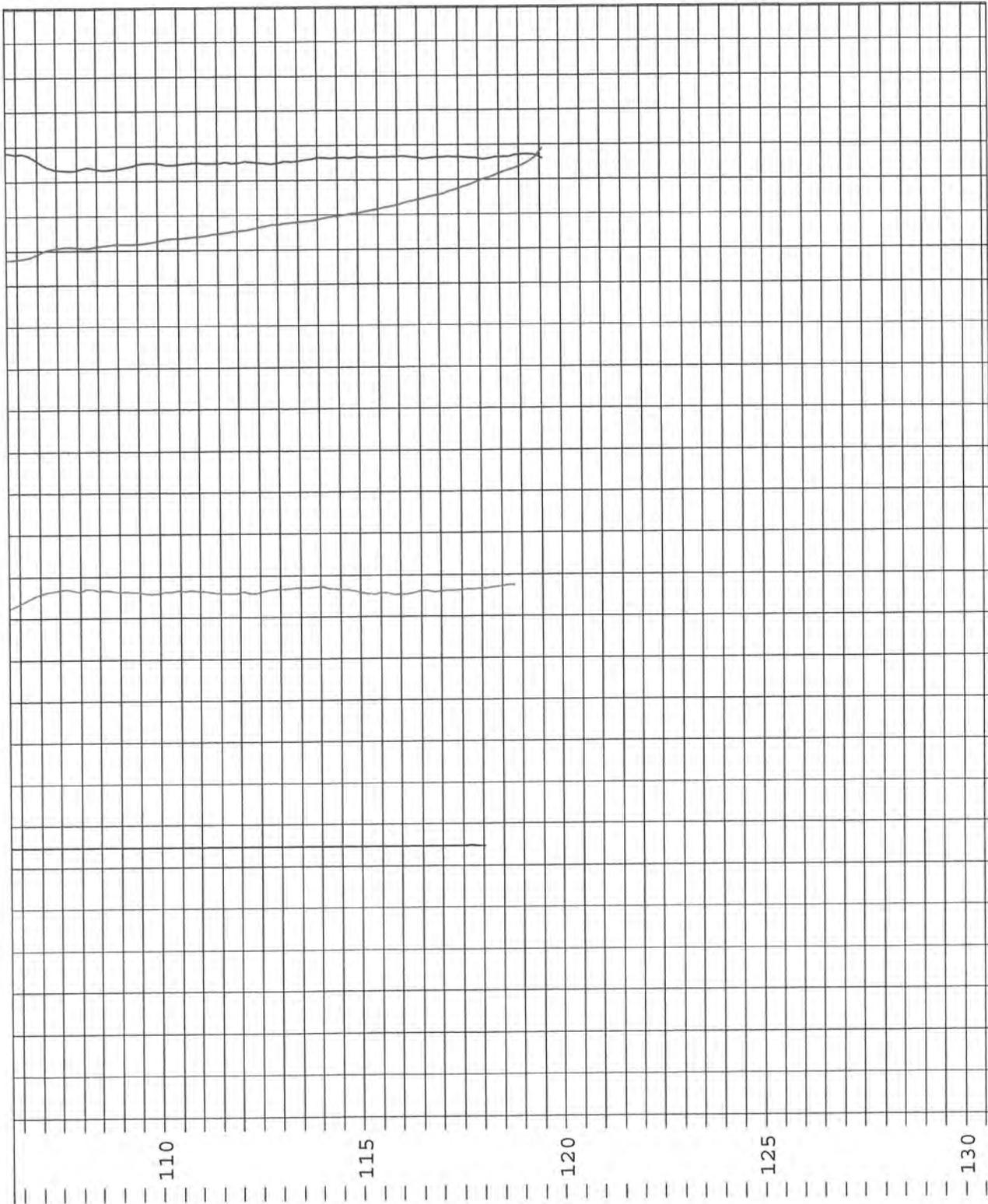












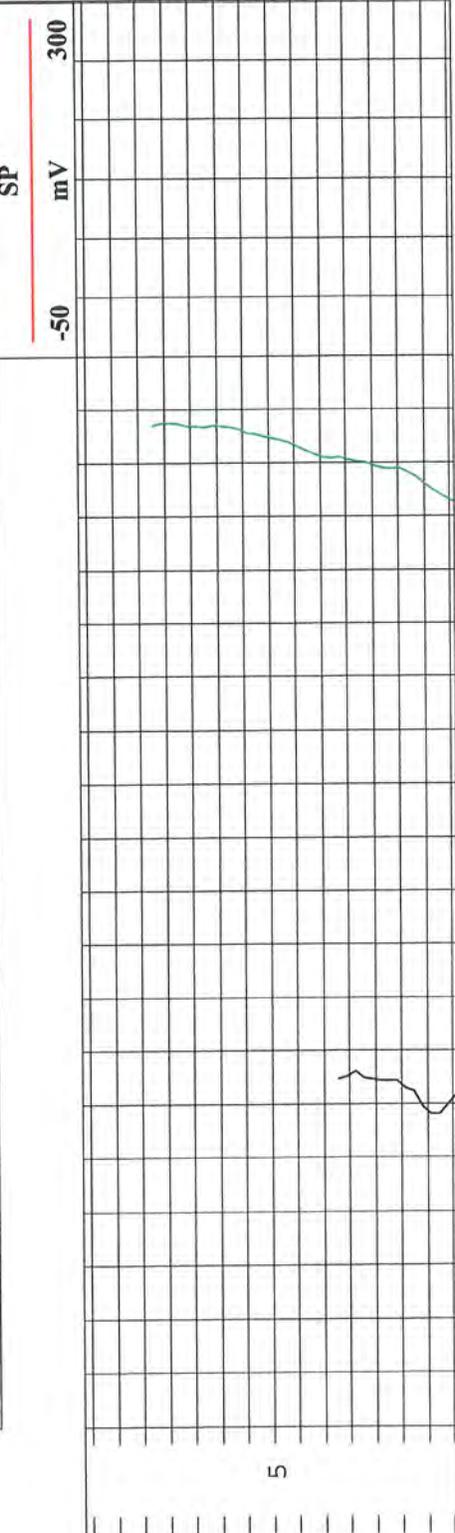
WESTERN ENVIRONMENT AND ECOLOGY, INC

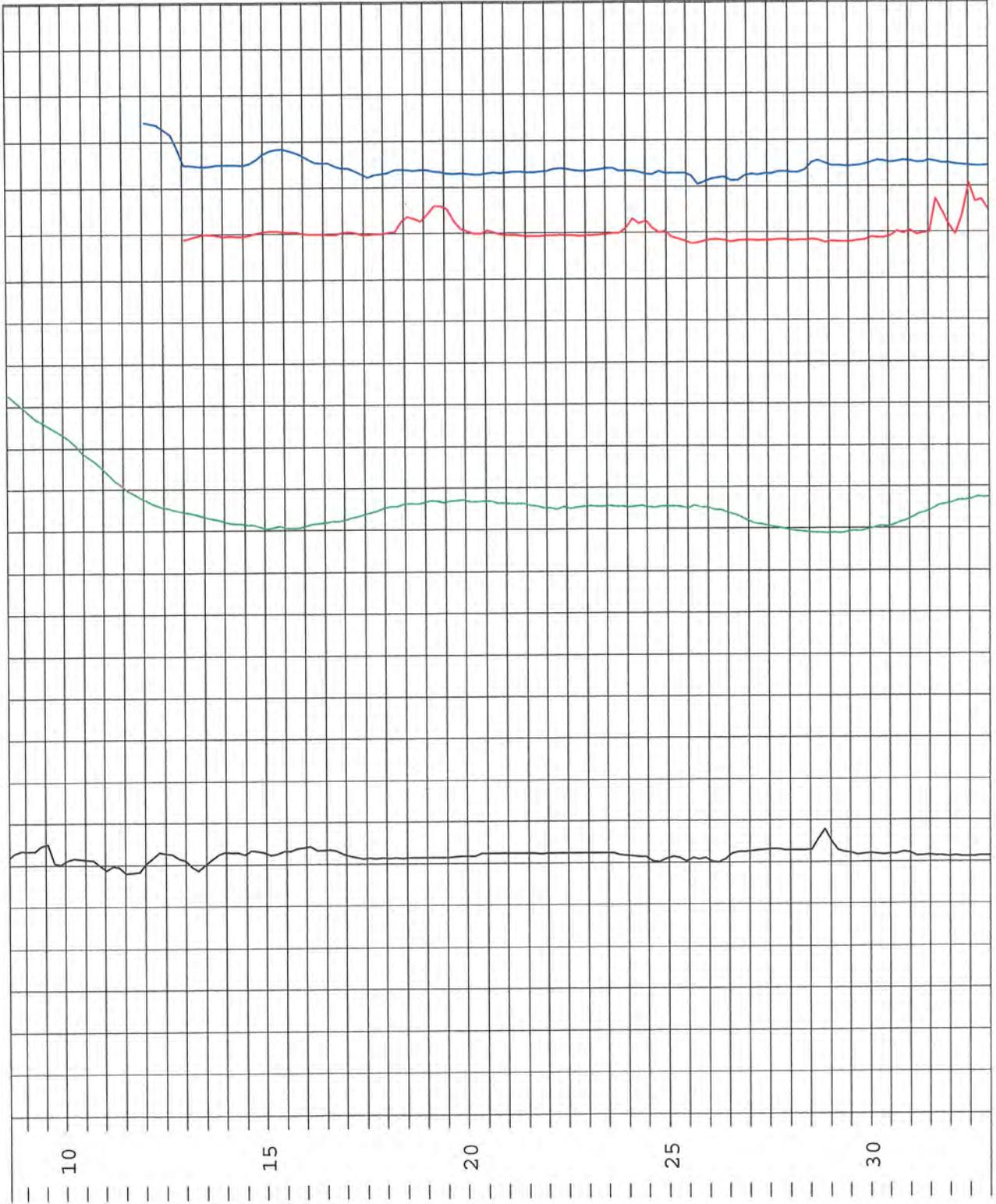
Location: Section 14, T1N, R69W, Boulder County, CO

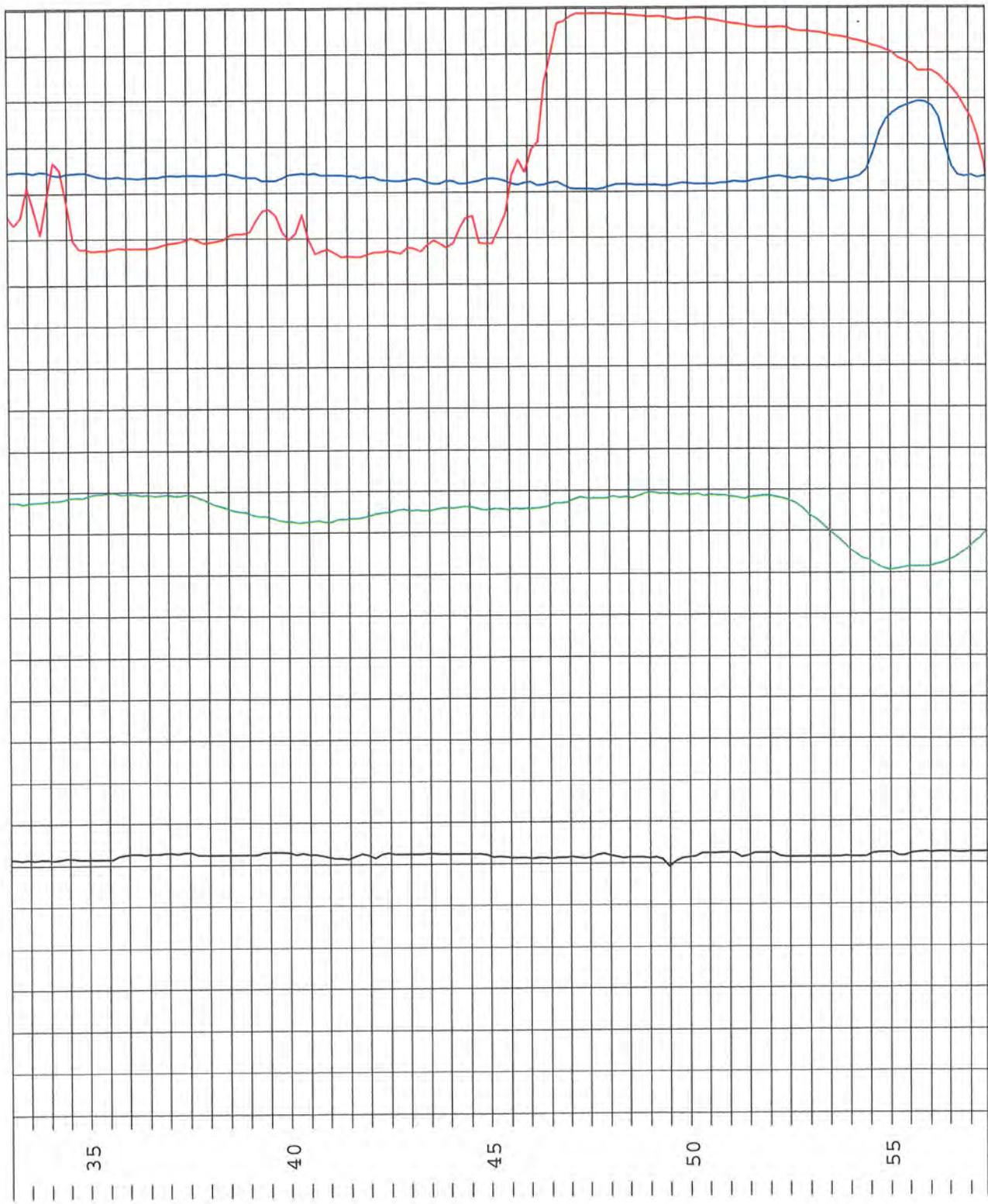
OTHER SERVICES

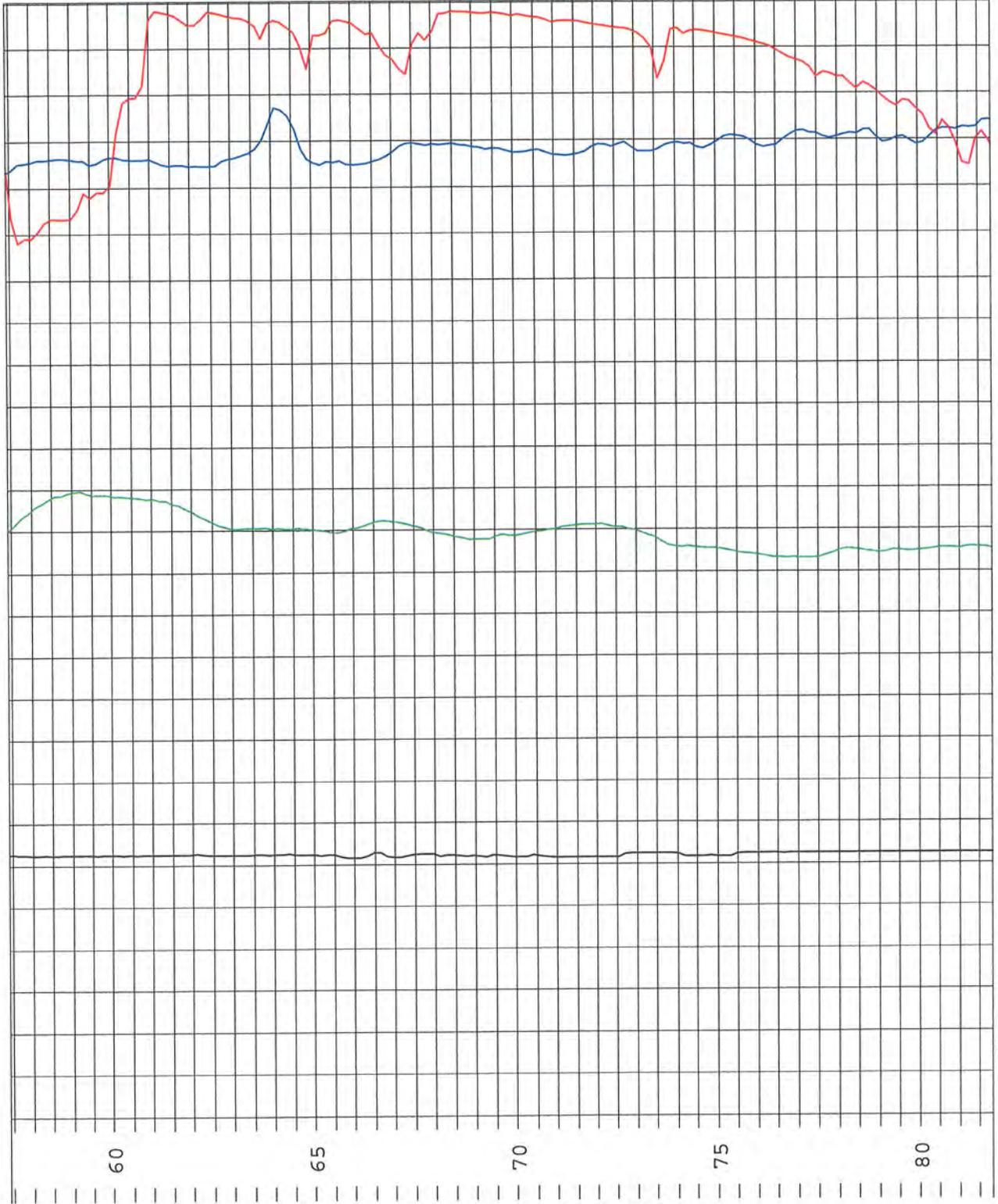
Well	W13	
Date	4/18/2005	BH Fluid Mud
Casing	No	
File Name	W-14	
Depth Driller	100 feet	
Depth Logger	99 feet	
Logged by:	K. Abbott	
Witness:	N. Bideau	

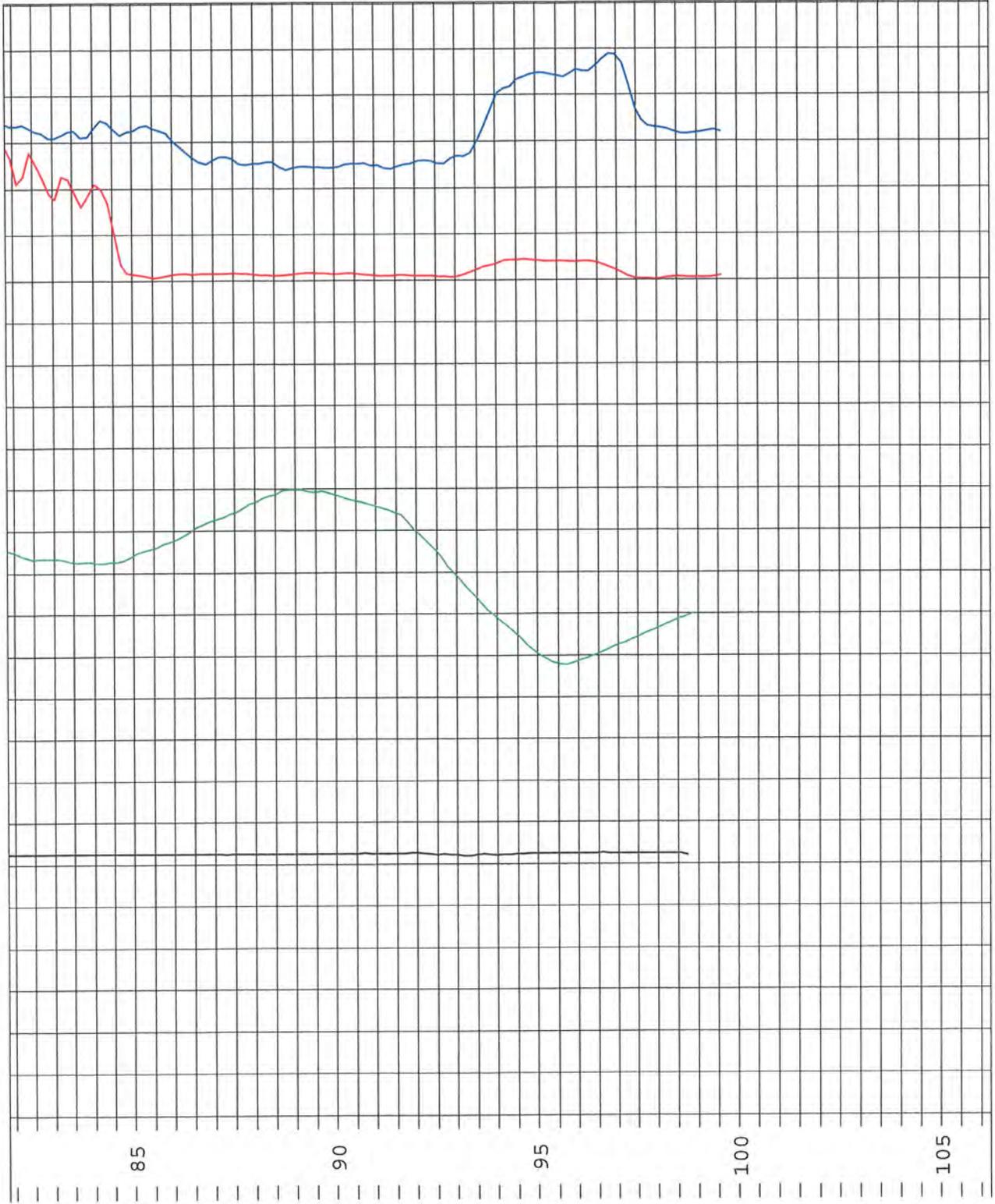
Depth	Caliper	NaturalGamma	SPR
1ft:50ft	inch	cps	Ohms
0	10 0	250	150
			SP
			mV
			300

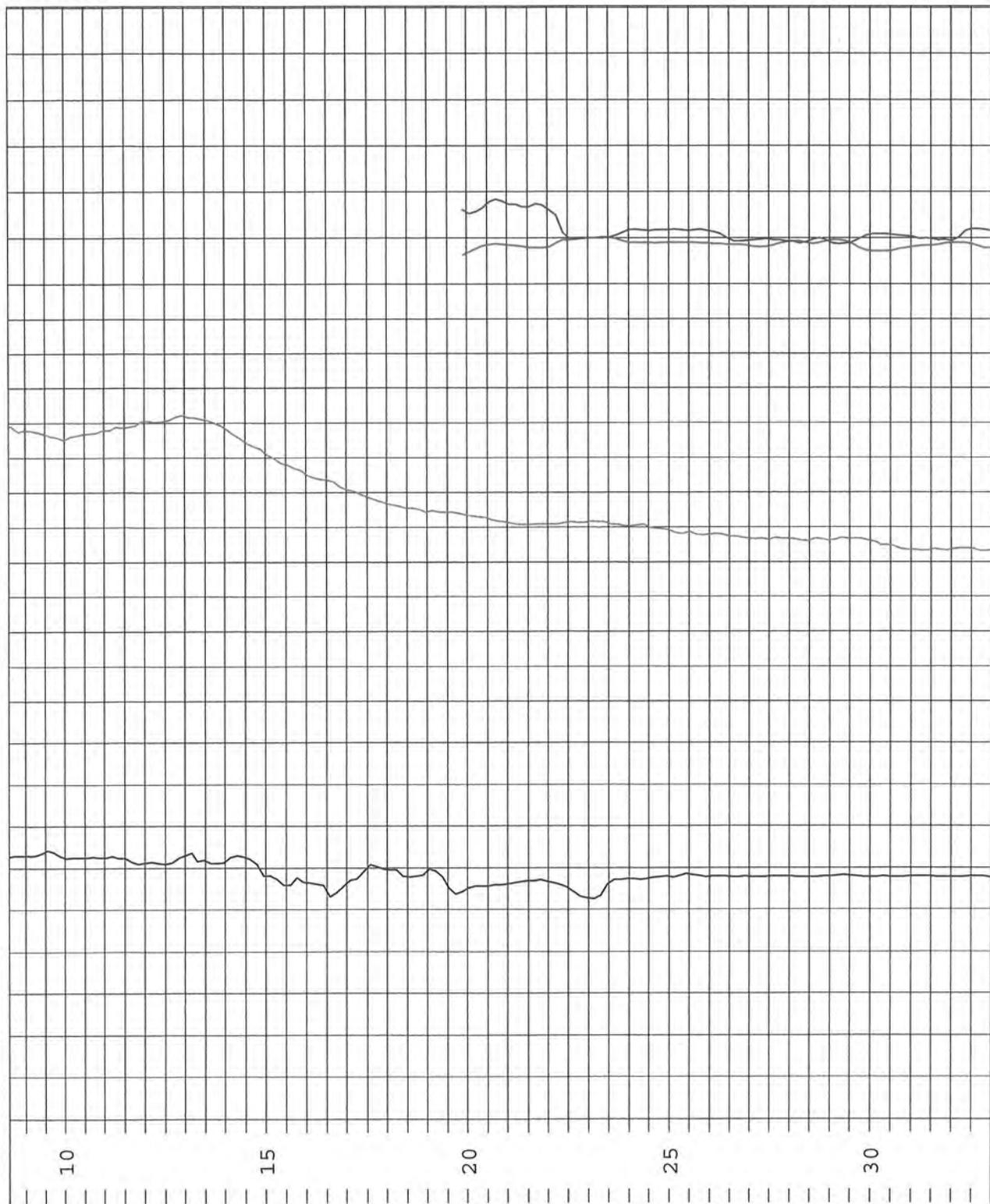


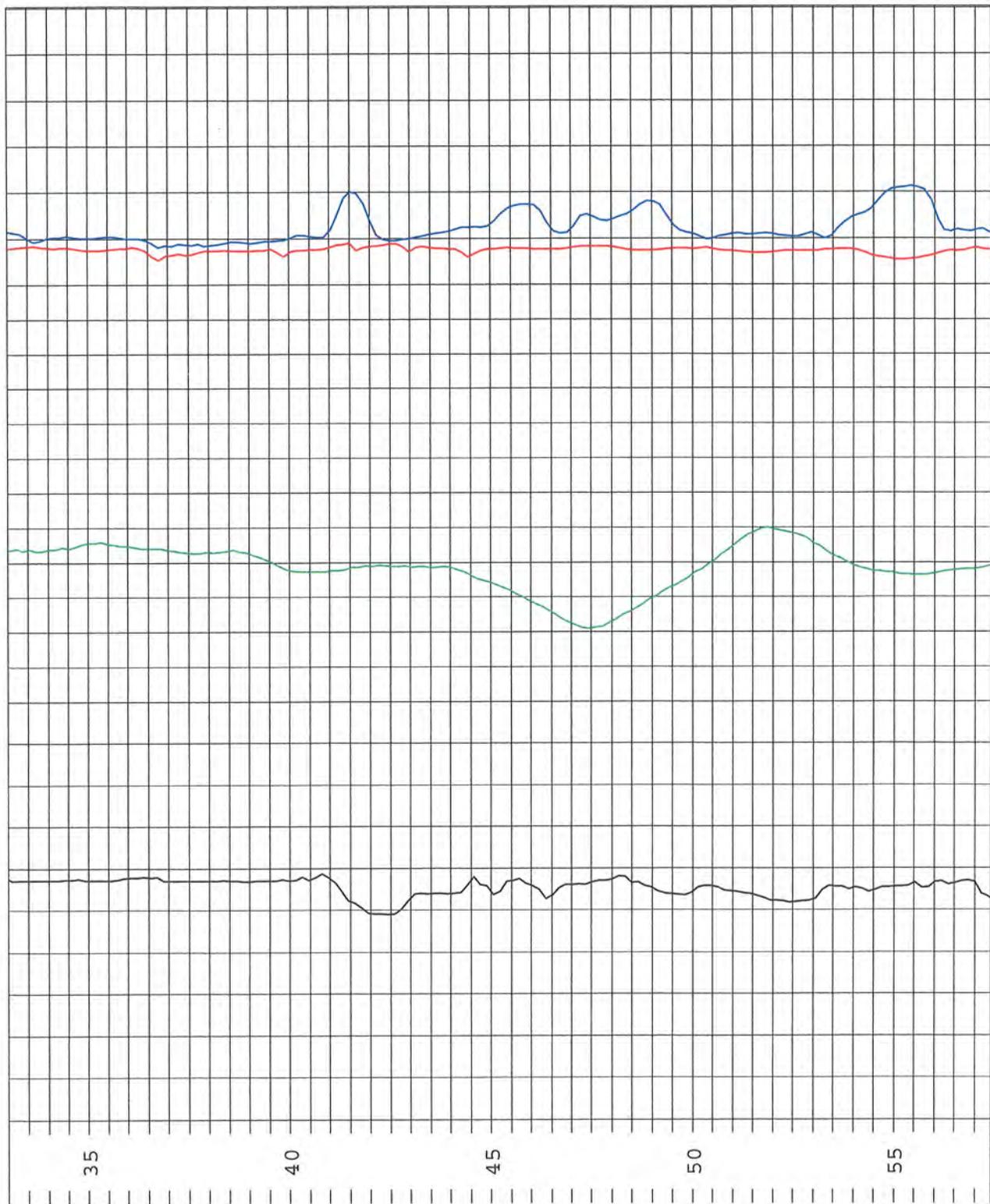


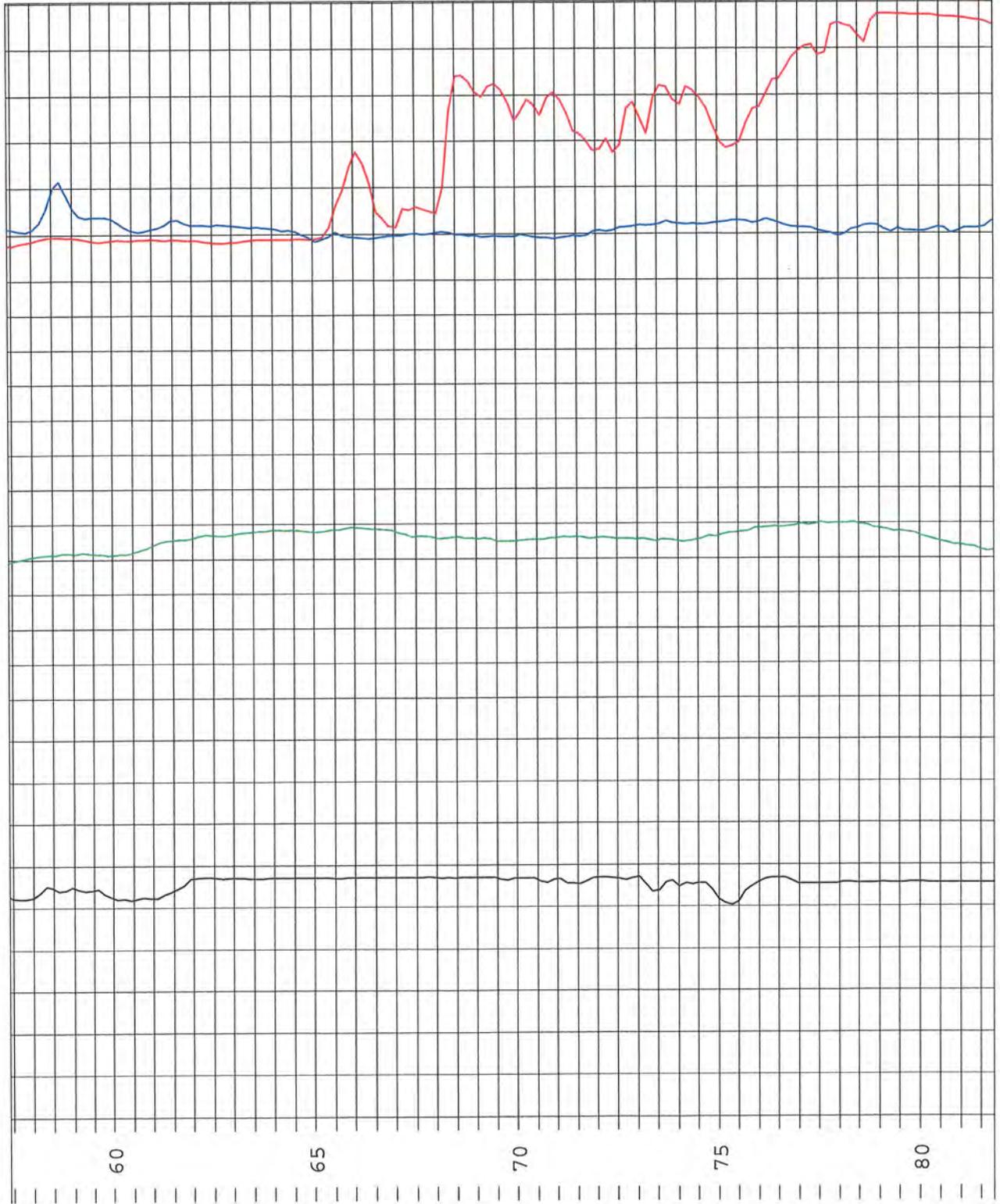


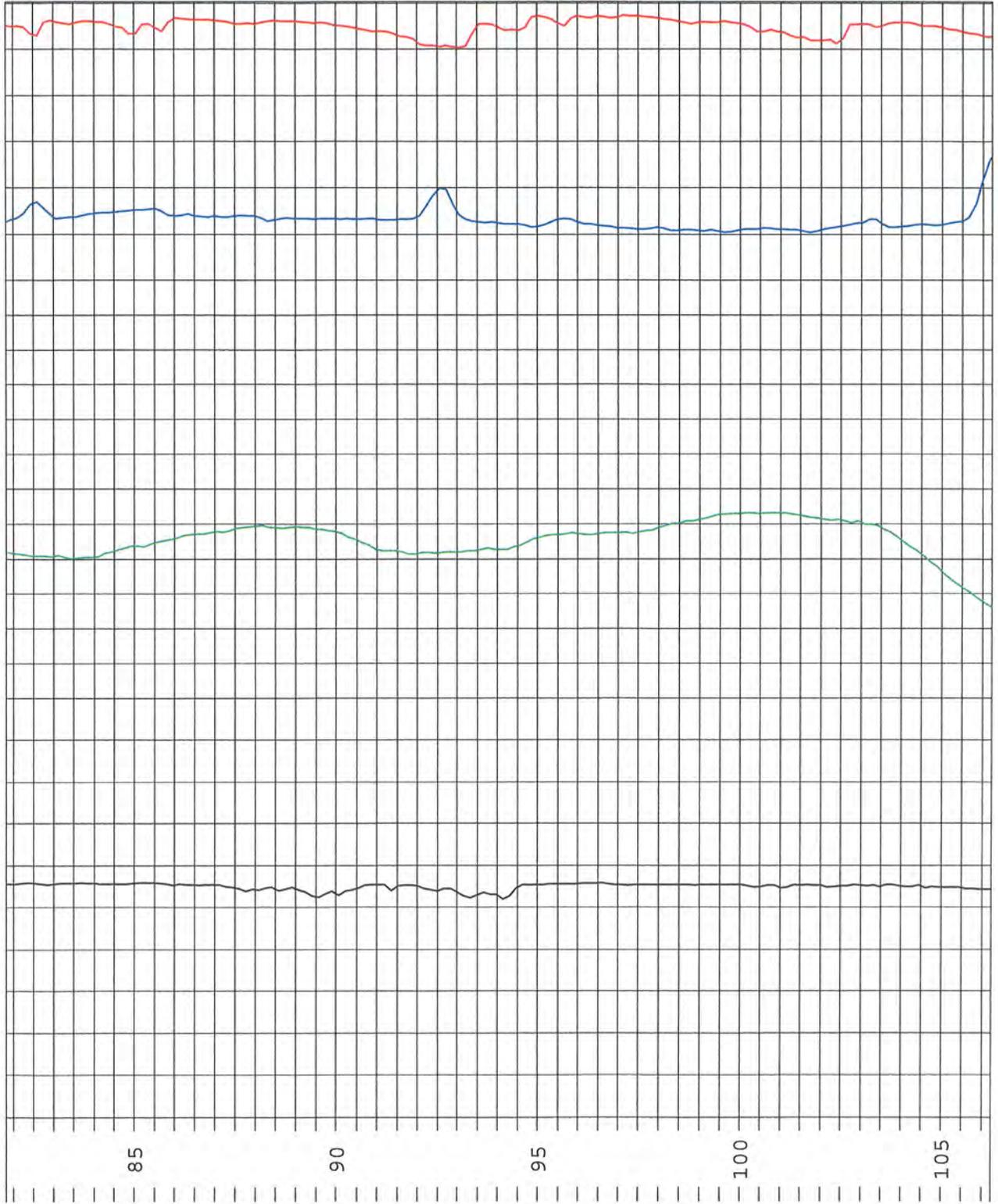


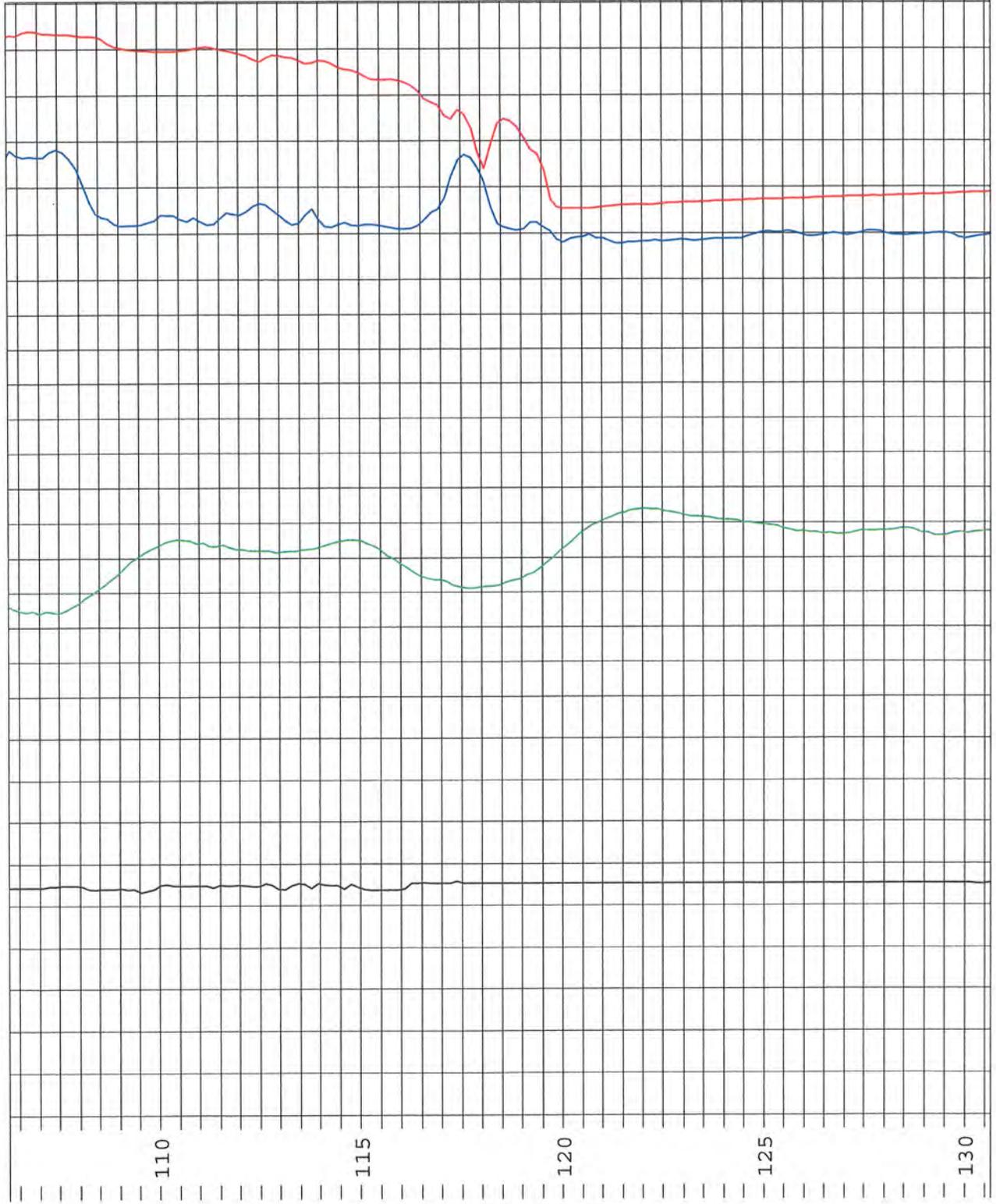


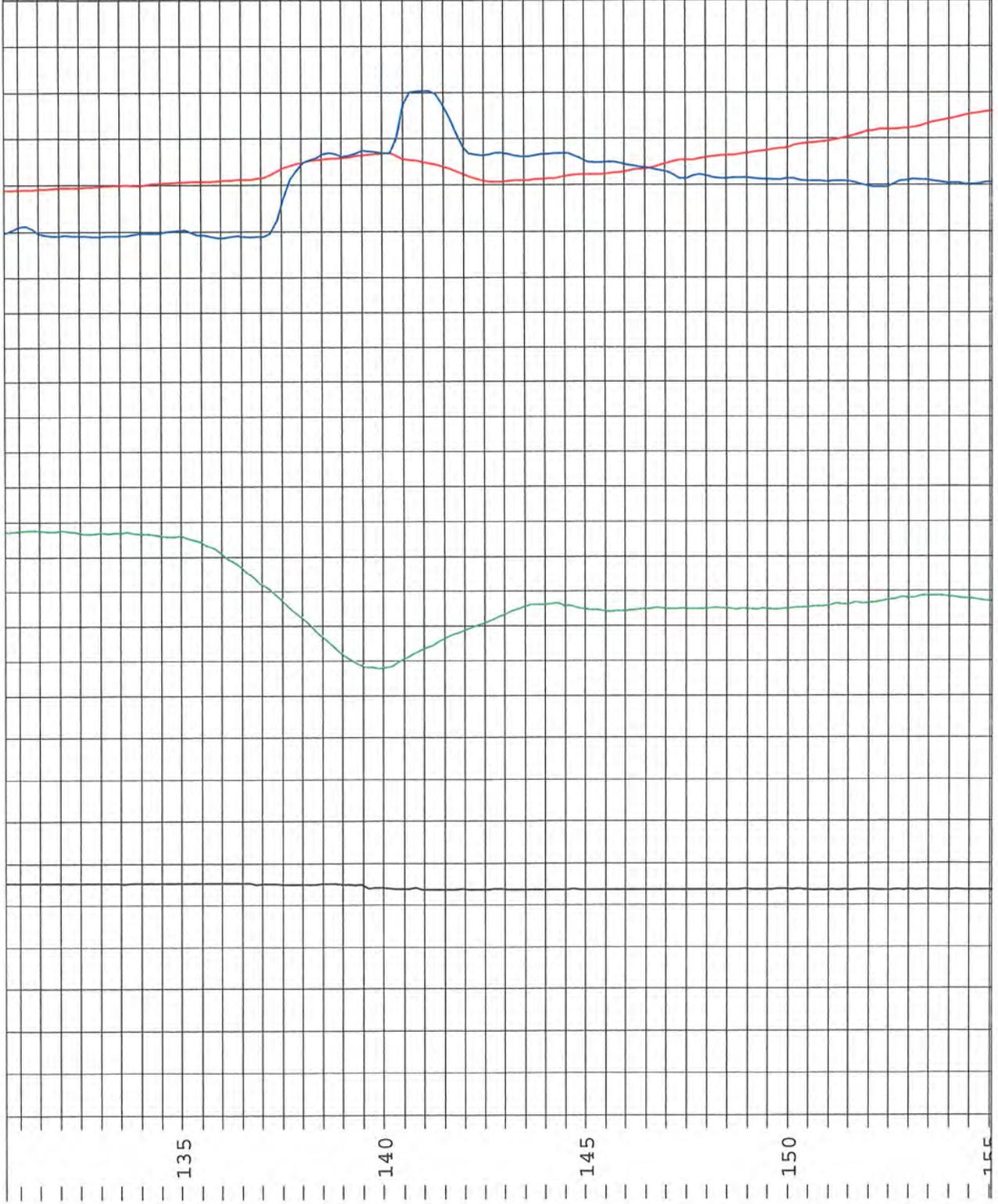












WESTERN ENVIRONMENT AND ECOLOGY, INC

July 21, 2012

Jim Dullea
Jasper Land Investments
9162 South Kenwood Court
Highlands Ranch, Colorado 80126

Subject: Wise Property Mine Subsidence Investigation. Western Environment and Ecology, Inc. Project Number 394-001-01.

Dear Mr. Dullea:

At your request, Western Environment and Ecology, Inc. (Western Environment) reviewed the above referenced report. This review was precipitated by your pending submittal to the Town of Erie regarding the proposed residential development of the site. The Western Environment report (Project Number 394-001-01) was entitled "Mine Subsidence Investigation Wise Property Section 14, Township 1 North, Range 69 West, Boulder County, Colorado" and dated May 31, 2005.

The Conclusions presented in the document were:

- The average depth to the top of the "main" seam is approximately 100.7 feet below the surface.
- Significant inaccuracies exist on the original mine maps.

Using these conclusions the following general recommendations for development were presented.

- No mine subsidence related development restrictions are required on those portions of the property indicated on Figure 2 as not effected by mining.
- If development of the "restricted" portions of the Wise Property is anticipated, additional studies, included drilling, will be required.
- Infrastructure, including roads and utilities, should utilize areas unaffected by mining. This includes a corridor within the "restricted" area that drilling indicated no mining has occurred.

Following review of the 2005 report, Western Environment remains confident that residential development of the property can occur by "careful" adherence to the recommendations presented in the report.

Please do not hesitate to contact us with any questions you may have or if we can provide further clarification as to the proposed development.

Sincerely,

Greg D. Sherman P.G.
President

October 25, 2013

Jasper Land Investments, LLC
9162 South Kenwood Court
Highlands Ranch, Colorado 80216

Attention: Jim Dullea

Subject: Supplemental Mine Subsidence Risk Investigation
Wise Farms
Erie, Colorado
Project No. DN41,199-110

At your request, we have completed additional subsurface investigation and geological/engineering analysis to evaluate risk of subsidence due to past underground coal mining at the Wise Farms property, a parcel planned for development of single-family homes. Our work was conducted to fulfill the scope of service described in our Contract Modification Proposal (No. DN-05-0900-CM3, dated July 24, 2013).

Previous Investigations

CTL|Thompson, Inc. completed a Preliminary Geotechnical Investigation of the Wise Farms property (Project No. DN41,199-115, report dated December 9, 2005). The study included 42 shallow borings for the purpose of characterizing the ground for potential residential development. We found that the site is suitable for development from a standpoint of the shallow geotechnical conditions. We did not evaluate the site for mine subsidence potential. We recently performed additional subsurface investigation that included 12 borings to help evaluate groundwater elevations on the northern portion of the property (report dated July 16, 2013).

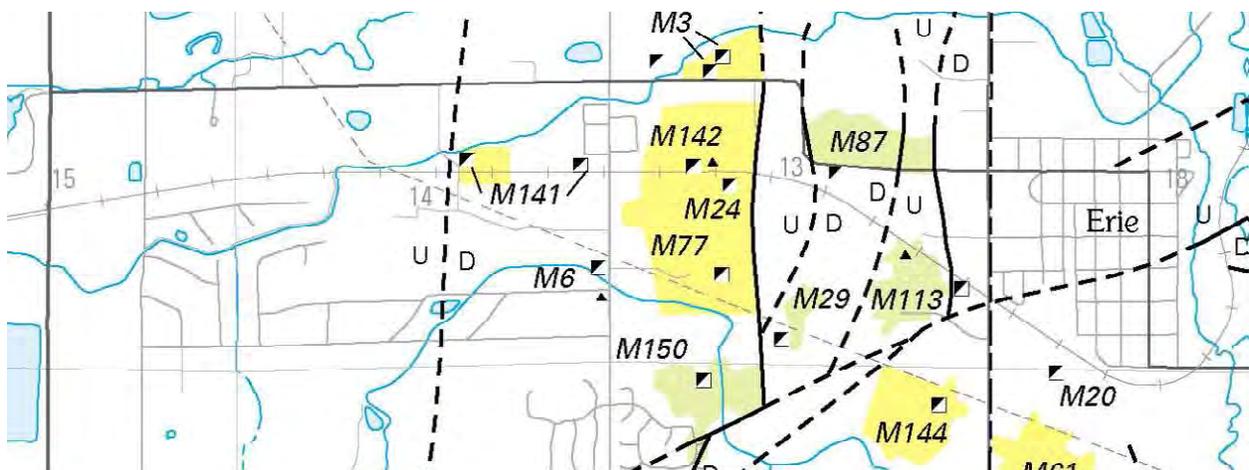
Western Environment and Ecology, Inc. (WEE) completed a Mine Subsidence Investigation for the Wise Property (WEE Project No. 394-001-01, report dated May 31, 2005). WEE used data and analysis from six borings they drilled on the property in 1998-1999, supplemented by eight additional borings they completed in April, 2005. Other data they used included records on file with Colorado Division of Mines (CDM) for the Banner, Standard, Star and Jackson Mines that operated between 1884 and 1890. WEE prepared a Map (their Fig. 2) that shows the old mine maps overlain on a recent topographic plan of the site, including locations of borings, mine features, restricted development areas and an inferred fault trace. WEE's Figure 2 is reproduced in as Figure 2 of this report. WEE's full report should be considered and reviewed with this current report.



Discussion

The Laramie formation is about 600 to 800 feet thick and contains two or three coal zones in the lower 200 feet. In this area, the lowest coal zone was mined and was reported to be about 5 to 10 feet thick including partings (non-coal rocks), for an average mined thickness of about 7 feet. Most of the Laramie formation has been removed by erosion at the Wise Property, leaving only the lower section, and a substantial thickness of sandy alluvium related to Boulder Creek is present over interbedded claystone, sandstone and coal. Underlying the Laramie formation is the Fox Hills Sandstone, recognizable as a fairly consistent fine to medium grained, partially cemented quartz sandstone with minor biotite particles. The Fox Hills Sandstone was deposited at a beach front as the Cretaceous Seaway regressed about 60 million years ago and has a “salt and pepper” appearance. The Fox Hills is much different than the intermixed clay-sand deposits common in the overlying Laramie formation that was deposited in a river delta-swamp that formed over the beach. Because of the consistency of the Fox Hills Sandstone, it is used to evaluate the geologic structure in the Denver Basin.

I reviewed WEE’s 2005 report as well as a map prepared by the United States Geological Survey (USGS) titled ***“Maps Showing the Extent of Mining, Locations of Shafts, and Bedrock Faults, and Thickness of Overburden Above Abandoned Coal Mines in the Boulder-Weld Coal Field, Boulder, Weld and Adams Counties, Colorado, Compiled by S. B. Roberts, J. L. Hynes, and C. J. Woodward, USGS Map I-2735, dated 2001.”*** This map was compiled from review of data by the authors, some of it previously published. An excerpt of the USGS map is shown below.



The symbols on the USGS map are keyed to a legend. Symbol M6 refers to the Banner Mine Shaft; Symbol M141 denotes the Standard Mine Shafts, and workings shown in yellow and Symbol M142 shows the shafts and workings of the Star Mine. Symbol M77 indicates the shaft and workings of the Jackson Mine. Using the Lower Boulder and Cottonwood Ditches, Jasper Road and 119th Street to orient the Wise Property, the USGS map implies three shafts, as well as workings of the Standard Mine are present. Because WEE does not reference USGS Map I-2735, and WEE’s maps



are somewhat different, I initially raised some concerns/questions to you that I believed should be answered prior to planning for development:

- WEE's report ties the Wise Farms site to the map of the Jackson Mine workings that they obtained from the CDM, showing that the workings underlie the eastern portion of the Wise Property (Fig. 2). The USGS map shows the Jackson Mine workings lie east of 119th Street. After verbal communication with Greg Sherman of WEE, I believe his interpretation is correct but I recommended some additional borings to provide a higher level of confidence that the USGS Map is wrong in this area. The USGS 2001 map was not available when WEE did their initial study of the site in 1999. There is no discussion of the USGS map in their 2005 report.
- WEE's report does not specifically discuss the western shaft and workings of the Standard Mine that are shown on the USGS Map. I discussed this with Mr. Sherman and it was his opinion that the USGS Map is likely in error with respect to the location of the western shaft and workings of the Standard Mine. I recommended a boring at the mapped location of the western Standard Shaft to verify WEE's interpretation that a fault is present that would have placed the coal seam too close to the ground surface to mine safely underground. While the chances that the boring would actually find the shaft are low, I felt it was at least possible to verify the depth of the Fox Hills Sandstone that underlies the coal-bearing Laramie formation.
- I felt that some additional borings to verify the location of the mapped underground workings would provide higher confidence the maps that WEE used were accurately registered with the current site boundaries.

Current Findings

CTL|Thompson, Inc. subcontracted with Dakota Drilling to drill six borings at the locations shown on the attached Fig. 1 (modified from WEE's Fig. 2). The borings were drilled by air-rotary methods. A summary of the strata and conditions we encountered in each boring are described below. For the borings we could obtain electric and caliper logs, these are included in Appendix B. The logs were made by COLOG at our request. We continued with WEE's numbering sequence, but named the borings starting at M-15 through M-20. A total of 20 deep borings have been drilled on the Wise Property to help evaluate the hazard due to subsidence.

- Boring M-15: Boring M-15 was targeted to penetrate a relatively small room of the workings of the Jackson Mine, as mapped by WEE. The target depth was 130 feet. We could not drill past 95 feet. Silty sand and sandy clay was encountered from the ground surface to a depth of 22 feet. Groundwater was found at 16 feet. Interbedded claystone and sandstone was penetrated from 22 to 43.5 feet. A 10-foot thick coal zone was be-



tween 43.5 and 53.5 feet deep, then claystone to 59 feet, a cemented sandstone lenses from 59 to 62 feet and interbedded sandstone and claystone to a total depth of 95 feet. The upper coal seam is not mined in this area, presumably for groundwater and safety reasons. The driller lost circulation at a depth of 85 feet and could not continue the boring past 95 feet. We could not obtain an electric log in this boring because the hole zngs above the main seam of the mine were penetrated at 85 feet at about the point where air circulation was disrupted and the actual workings are probably at a depth of about 110 to 120 feet. The disruption in air circulation above the targeted depth implies the coal zone was mined at the boring location and that the workings are probably caved in this location. The data does not dispute WEE's interpretation of the top of the Fox Hills Sandstone at about elevation 4940 at this location, or about 140 feet of depth.

- Boring M-16: Boring M-16 was targeted to penetrate the Jackson Mine and was planned to be 110 feet deep. The location was chosen to be about 50 feet inside the south edge of a large mined room, at the end of a haulage way. Sand and clay was encountered to a depth of 17 feet. Groundwater was 10 feet deep. Interbedded claystone and sandstone was penetrated from 17 to 65 feet. The upper (not produced) coal zone with several claystone partings was penetrated from 67 to 74 feet. From 74 to 85 feet the boring encountered interbedded claystone and sandstone. The driller could not drill past 85 feet because the bit kept plugging, presumably because of poor air circulation. We were able to get an electric log of the boring that clearly shows the upper coal seam. We interpret this boring as encountering the top of the caved zone above the Jackson Mine at 75 feet or elevation 4980. The top of the mine workings are probably about elevation 4968 feet, about 90 feet deep at this location. We believe the mine is present and the workings are caved at this location. The data does not dispute WEE's interpretation of the top of the Fox Hills at about elevation 4960 or about 95 feet deep at this location.
- Boring M-17: Boring M-17 was targeted just about 120 feet west of the west edge of the Jackson Mine workings, on the fault line mapped by WEE and was targeted to be 105 feet deep. Sand and clay was encountered from the ground surface to a depth of 28 feet, gravel from 28 to 30.5 and claystone with thin coal seams from 30.5 to 56 feet. Groundwater was 19 feet deep. Claystone with minor sandstone was found from 56 to 76 feet. Coal was penetrated from 76 to 81 feet, then claystone from 81 to 105 feet. Circulation was not lost. The electric log clearly shows the coal seam at about 73 to 77 feet and the caliper did not deflect in the coal. We interpret the conditions found in boring M-17 to indicate that the main seam would be too shallow to mine safely, as the seam dip (up to the west) brings it within 73 feet of the ground surface with insufficient cover. This confirms the mine is not present west of its mapped location. We be-



lieve the top of the Fox Hills Sandstone would be at about elevation 4948 in this location, consistent with WEE's interpretations.

- Boring M-18: Boring M-18 was intended to be located about 50 feet north of the north edge of the Standard Mine workings and was targeted to be 110 feet deep. Sand and clay was encountered to 32 feet, then gravel to 39 feet. Groundwater was 21 feet deep. Claystone bedrock was then encountered to a depth of 52 feet, where we penetrated a 7 foot thick coal seam, then claystone from 59 to 66 feet. From 66 to 110 feet we penetrated interbedded sandstone with minor claystone and minor thin coals. Circulation was not lost. The boring was not electric logged because the hole degraded over the weekend before COLOG was available. We interpret boring M-18 as having coal at a depth that would have been unsafe to mine. It is apparent the mine workings were stopped to the west and north because the coal was becoming too shallow to mine safely, while being too deep and wet to mine with surface methods. We interpret the top of the Fox Hills Sandstone to be at elevation 4964 feet. This is consistent with WEE's interpretations.
- Boring M-19: Boring M-19 was located at the northeast corner of the Wise Property to help verify the mine map is accurate and mine workings are not present. The boring was targeted to be 110 feet deep. We encountered sand and clay to 21 feet and gravel from 21 to 29 feet. Groundwater was at 15 feet. A 1-foot thick layer of sandstone began the bedrock interval at 29 feet, then coal from 30 to 35.5 feet. Interbedded claystone with thin coal seams was penetrated from 35.5 to 50.5 feet. Sandstone was penetrated from 50.5 to 140 feet, the total drilled depth. The electric log shows consistent sandstone below a depth of 50 feet, which we interpret to be the top of the Fox Hills Sandstone at about elevation 4966. This is consistent with WEE's interpretations. We should note that the hole was cleaned out and the upper coal interval from 30 to 35.5 feet was cased prior to electric logging. The lower coal is shown on the electric log. We interpret this boring to imply that the coal seam at was far too shallow to mine safely in this location.
- Boring M-20: Boring M-20 was intended to explore the area where the west shaft of the Standard Mine was plotted on the USGS Map. The target depth was 95 feet. The boring encountered clay and sand to a depth of 32.5 feet and gravel to 38 feet. Groundwater was at 18 feet. Claystone was penetrated from 38 to 50 feet, interbedded sandstone and claystone with cemented sandstone lenses from 50 to 97 feet and claystone from 97 to 105 feet. No coal was encountered. We believe the coal was removed by erosion and deposition of the alluvium in the Pleistocene. It is unlikely there is a mineshaft in the vicinity of Boring M-20, since there is no coal present. The top of the Fox Hills Sandstone is interpreted to be 4980 feet at Boring M-20.



Conclusions

Based on our current findings and analysis of the previous data I have the following conclusions:

1. Our data confirms the overlay of the mine map on the site features presented in WEE's Figure 2 is accurate. It is unlikely coal mine workings exist west of the limits WEE shows.
2. The geologic data show there is no mineable coal west of the mine workings shown on WEE's Figure 2. This is due to the coal zone dipping moderately up to the west-northwest, becoming closer to the surface. Very shallow coal would be very difficult to mine due to groundwater and little separation from the alluvium by impervious bedrock layers. Further west, the coal has been removed by pre-historic erosion.
3. I compared our data with WEE's interpretations of the elevation at the top of the Fox Hills Sandstone shown on their Figure 2. I believe WEE made an accurate interpretation of the geologic structure of the site. A fault may be present near the location and orientation mapped by WEE. Faulting in the Laramie formation is considered to be inactive and data shows these formed during and shortly after deposition of the coal and "die out" within the rocks deposited after the Laramide Orogeny more than 20 million years ago. The fault, if present is not considered a geologic hazard for this site.
4. I believe it is unlikely there is a western shaft related to the Standard Mine as shown on the USGS map. This is because there is no coal present in the area of boring M-20 and the Fox Hills Sandstone is shallow. The shaft, if present is probably within the mined areas. The data collected by WEE and CTL|Thompson indicates the USGS map has errors with respect to undermining at the Wise Property.
5. The reported location of the Banner Shaft in the extreme southeast corner of the Wise Property is probably erroneous. There remains a question about whether it really exists at the location shown on the USGS map (and WEE's map). Because boring M-15 indicates the mine is present as mapped, the shaft was likely at the end of the haulage way shown in the middle of the workings (near the location of M-15) and not outside the workings as shown on WEE's Fig. 2. Knowing whether the Banner Shaft is present in the mapped location could be important if an access road is needed for the site from 119th Street, through the southeast corner. It would take trenching along the axis of a potential roadway alignment to verify if a shaft is there. If a shaft is present, it could be mitigated with grouting. Figure 3 shows cross-hatched areas that appear to be good choices for access off of 119th Street.



6. I believe there is another potential access ROW off of 119th Street through the un-mined area between WEE's boring W-1 and our boring M-15. I see no reason not to allow construction of a road for use as access in the center of the area marked with cross-hatch on Fig. 3. If utilities are required in the road, we recommend they be situated to run down the middle of the un-mined area to reduce the potential that subsidence could cause distress to them. It would be best to avoid utilities in the road if an even lower risk approach must be taken. I have no reservations with construction of the road at the cross-hatched locations. Either of these potential access points are low risk with respect to subsidence. The mine is deepest in the southeast portion of the parcel and more overburden is present.
7. I believe WEE's conclusions and recommendations for restriction of development at the Wise Farms parcel are justifiable and conservative. I recommend avoiding development of structures within undermined areas and 150 feet beyond. I drew the recommended hazard restriction zone on the attached Figure 2. The line is somewhat less conservative than WEE's which I believe is justified by the additional information that confirms the location of the undermined area with more confidence.
8. I believe the existing mines are substantially caved, with potential for only small additional movements. For instance, at boring M-15, circulation was mostly lost at a depth of about 85 feet, about 35 feet above the mine. This leaves 63 feet of undisturbed claystone and sandstone above the caved zone. Based on a seam thickness of 6 to 7 feet, a bulking ratio of about 5 to 6 is estimated. This is within reported ranges of bulking factors of western coal mines of 5 to 10. The risk of significant future subsidence over these workings is expected to be low. However, new residential development and underground utilities should avoid undermined areas to mitigate for risk of subsidence.
9. Drainage patterns over the area mapped as undermined do not appear to be disturbed. This is evidence that subsidence has not affected the ground surface. A closed depression exists west of the undermined area that I believe is related to past activities that created an embankment that dammed an existing ephemeral drainage. I found no other areas that indicated drainage is interrupted or where ponding of surface water occurs. These type features are sometimes found in the Boulder-Weld Coal Field where mining occurred less than about 100 feet below the ground surface. I found no surface evidence on the parcel that indicates subsidence has affected the ground surface.

To summarize, provided development of habitable space occurs outside the hazard area shown on Figure 2, I believe there is nil risk of subsidence-related distress. Where an access road is needed from 119th Street, it appears there are one or two good options for its location across the low-risk hazard area.



Geotechnical Risk

The concept of risk is an important aspect with any geotechnical evaluation primarily because the methods used to develop geotechnical recommendations do not comprise an exact science. We never have complete knowledge of subsurface conditions. Our analysis must be tempered with engineering judgment and experience. Therefore, the recommendations presented in any geotechnical evaluation should not be considered risk-free.

Limitations

Our boring locations were chosen to obtain additional subsurface information to supplement data obtained by others. The borings are representative of conditions encountered only at the locations drilled. Subsurface variations not indicated by our borings are possible. We believe this investigation was conducted with that level of skill and care normally used by geologists and geotechnical engineers practicing in this area at this time. No warranty, express or implied, is made.

If we can be of further service in discussing the contents of this report or provide additional analysis of the influence of the geologic hazards on design of the structures and improvements, please call.

CTL | THOMPSON, INC.



David A. Glater, P.E., C.P.G.
Principal Geological Engineer

DAG/nt
(3 copies)

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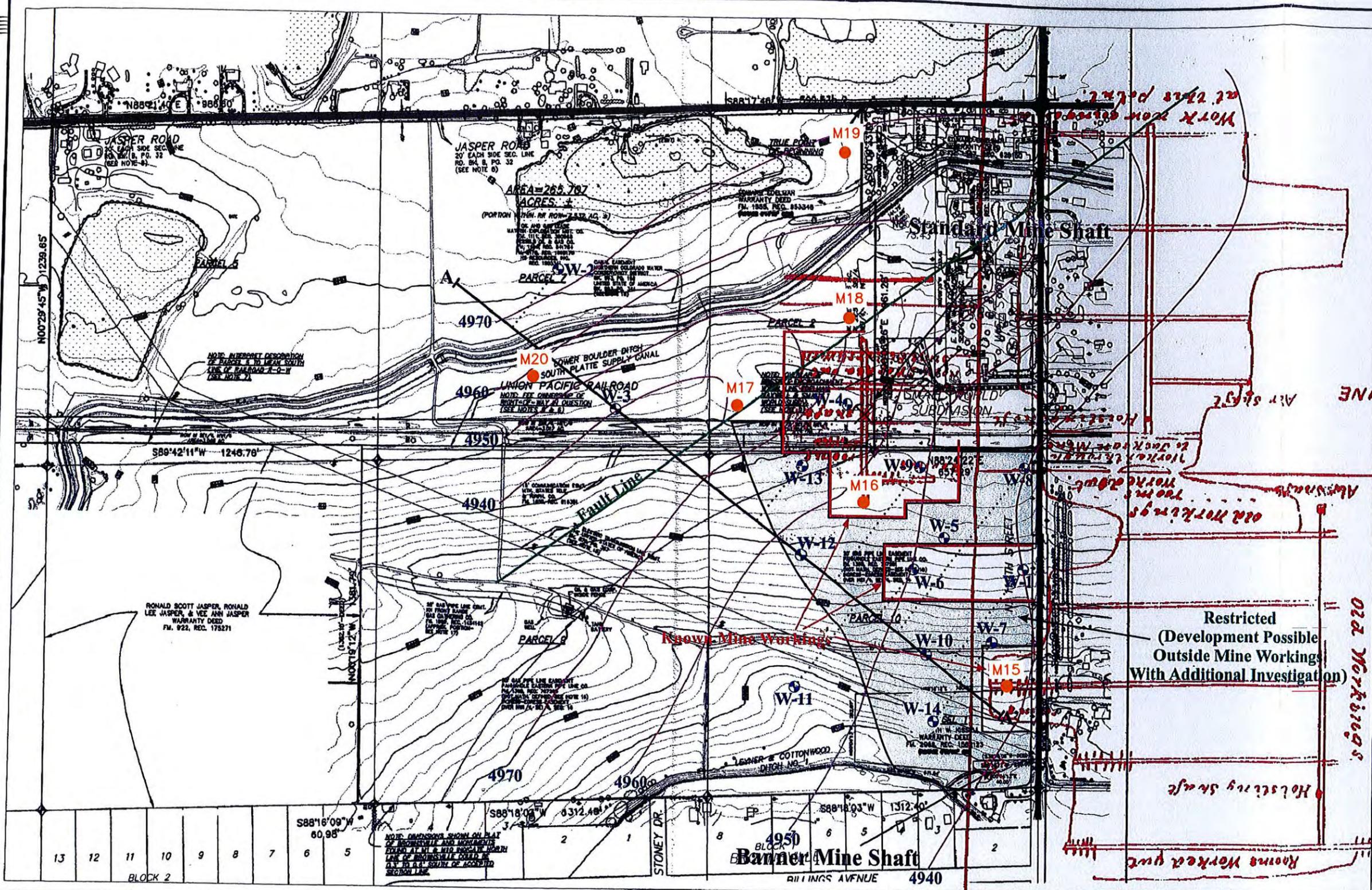
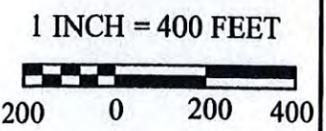


Figure 2
 Wise Property
 Section 14,
 Township 1 North, Range 69 West,
 Boulder County, Colorado

**WESTERN ENVIRONMENT
 AND ECOLOGY, INC.**
 2217 West Powers Avenue
 Littleton, Colorado 80120

Legend

	Borehole Location		Elevation of Laramie / Fox Hills Formation Contact		Known Mine Workings
	Approximate Fault Location		Development Possible with additional investigation		BORING DRILLED FOR THIS STUDY



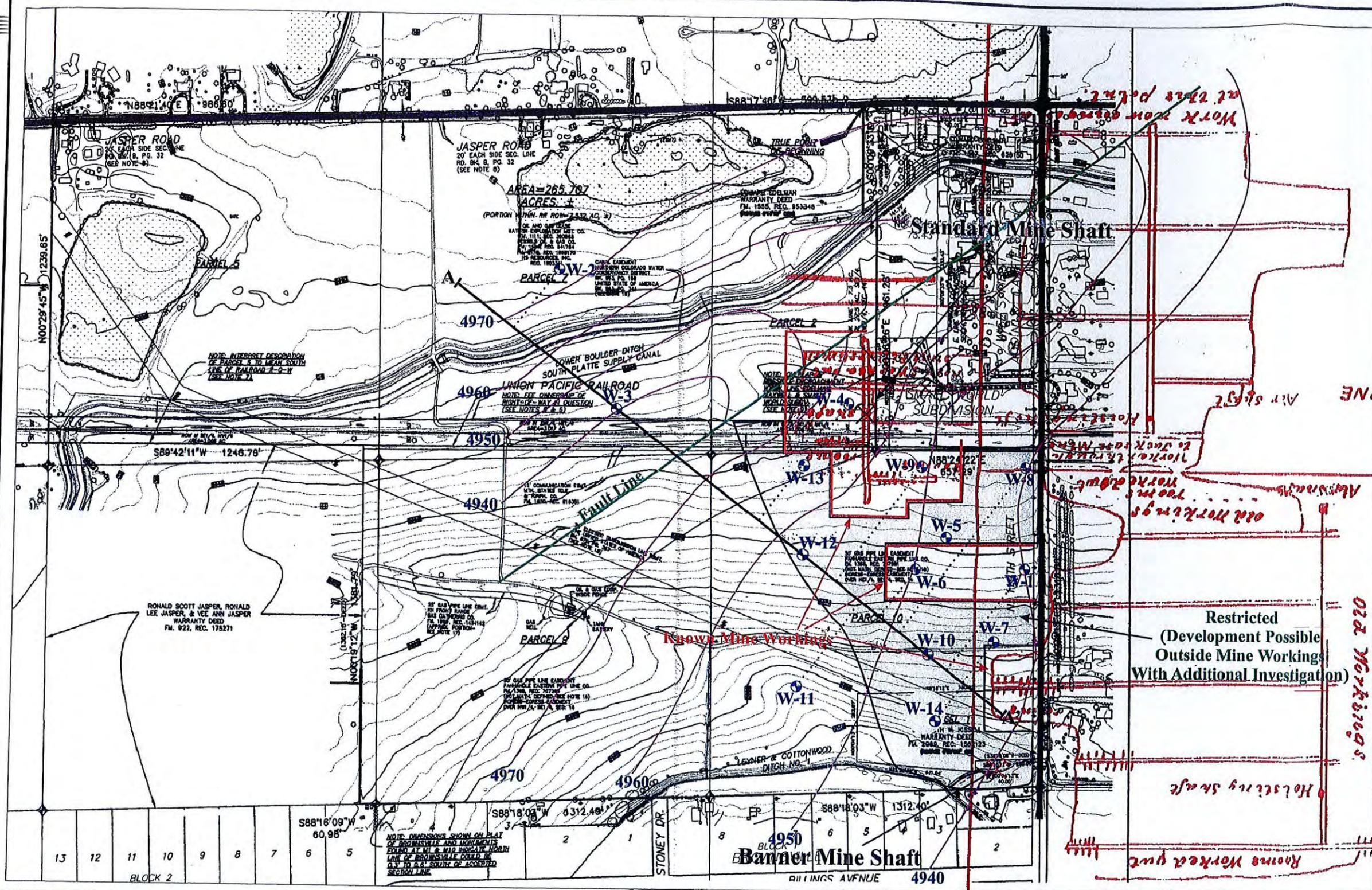
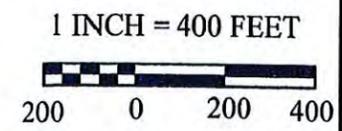


Figure 2
 Wise Property
 Section 14,
 Township 1 North, Range 69 West,
 Boulder County, Colorado

**WESTERN ENVIRONMENT
 AND ECOLOGY, INC.**
 2217 West Powers Avenue
 Littleton, Colorado 80120

Legend

- Borehole Location
- Elevation of Laramie / Fox Hills Formation Contact
- Approximate Fault Location
- Development Possible with additional investigation
- Known Mine Workings



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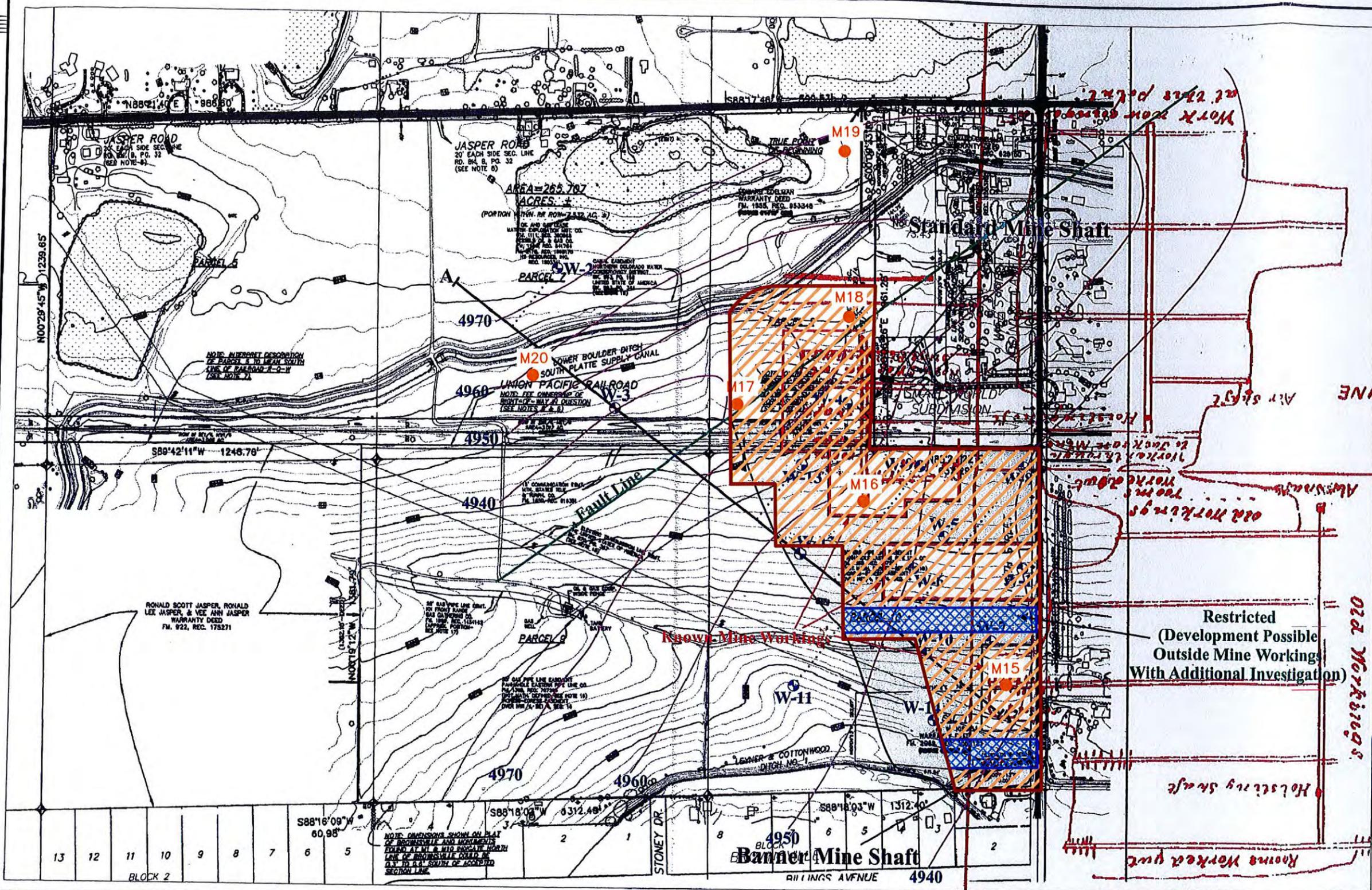


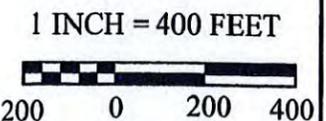
Figure 2
 Wise Property
 Section 14,
 Township 1 North, Range 69 West,
 Boulder County, Colorado

**WESTERN ENVIRONMENT
 AND ECOLOGY, INC.**
 2217 West Powers Avenue
 Littleton, Colorado 80120

JASPER LAND INVESTMENTS, LLC
 WISE FARMS
 Project No. DN41_199-110

Legend

- Borehole Location
- Approximate Fault Location
- 4970 Elevation of Laramie / Fox Hills Formation Contact
- Development Possible with additional investigation
- Known Mine Workings
- M15 BORING DRILLED FOR THIS STUDY
- LOW RISK SUBSIDENCE AREA TO BE AVOIDED FOR HOMES, AND UTILITIES IF POSSIBLE
- POTENTIAL ACCESS ROADS FROM 119TH STREET IN LOW-RISK SUBSIDENCE AREAS



A.G. Wassenaar

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Inc.

PHASE I ENVIRONMENTAL SITE ASSESSMENT

WISE PROPERTY
ERIE, COLORADO 80026

PREPARED FOR

JASPER LAND INVESTMENTS, LLC
9162 SOUTH KENWOOD COURT
HIGHLANDS RANCH, COLORADO 80126

JANUARY 2, 2012
PROJECT NUMBER E12776.E1

TABLE OF CONTENTS

<u>TITLE</u>	<u>PAGE</u>
EXECUTIVE SUMMARY.....	i
1.0 INTRODUCTION.....	1
2.0 PURPOSE AND SCOPE OF WORK.....	1
3.0 SITE DESCRIPTION.....	2
4.0 SITE RECONNAISSANCE.....	2
4.1 Property Grounds.....	3
4.2 Surrounding Properties.....	7
5.0 INTERVIEWS.....	7
6.0 SITE HISTORY.....	9
6.1 USGS Topographical Maps	10
6.2 Aerial Photographs.....	13
7.0 PUBLIC RECORDS REVIEW.....	15
7.1 Oil and Gas Production Wells.....	16
7.2 Unmapped Sites.....	18
8.0 ENVIRONMENTAL LIENS.....	18
9.0 FINDINGS AND OPINION.....	18
10.0 CONCLUSION.....	21
11.0 LIMITATIONS.....	22
12.0 DEVIATIONS.....	23

FIGURES

1. VICINITY MAP
2. SITE MAP

ATTACHMENTS

- A. PHOTOGRAPHS
- B. USER QUESTIONNAIRE
- C. TOPOGRAPHIC MAPS AND AERIAL PHOTOGRAPHS
- D. PUBLIC RECORDS RESEARCH
- E. QUALIFICATIONS
- F. REFERENCES

EXECUTIVE SUMMARY

As requested, A. G. Wassenaar, Inc. (AGW) has conducted a Phase I Environmental Site Assessment (ESA) for the subject property identified as the Wise Property located in Erie, Colorado. The subject property was evaluated for potentially significant on-site environmental contamination through a property inspection, a review of historical property uses, interviews with individuals associated with the property, and a review of environmental records available from government agencies.

AGW's inspection included visual and physical observations of the subject property to identify possible contamination or contamination sources, and a drive-by survey of the nearby area. The site is positioned southwest of the intersection of Jasper Road and North 119th Street in Erie, Colorado. The site is approximately 180 acres in size. Future development plans for the property include 313 lots within a residential community. The majority of the property is agricultural land, with a farm homestead located in the northwest corner, and a small residence present near the center of the northern boundary. A historic mill is located east of the smaller residence and includes two buildings.

The remainder of the property is agricultural land that is currently dry and wet land farmed (for additional information see Section 5.0). A dry canal traverses the eastern portion of the southern boundary, and intersects one of several irrigation canals on the property. Overhead utilities traverse the entire site and the northeastern portion of the property near the small residence and historic mill. The abandoned Union Pacific Railroad tracks and the Lower Boulder Ditch traverse the central portion of the site. Numerous unimproved roads traverse the property including two that lead to the currently producing, on-site Wise 1-14 X oil and gas well. Due to the age of the well and concrete

tank used to store the condensate, **AGW identifies the Wise 1-14 X producing oil and gas well and associated tank battery as a recognized environmental condition in relation to the subject property.**

The subject property is positioned within a mixed use neighborhood. Jasper Road delineates the northern property boundary, while vacant, agricultural fields and rural residences are located further north. Overhead utilities are in place immediately east of North 119th Street, and the town of Tabor is located within one mile east of the subject property. A residential neighborhood is in place immediately south of the site. Vacant land and an oil and gas well comprise the area immediately west of the property, while residential homes are in place further west. None of the properties surrounding the site are identified as recognized environmental conditions in relation to the subject property.

The historical research conducted for the subject property indicated that the property has been primarily vacant agricultural fields traversed by irrigation ditches, the Lower Boulder Ditch, and the Union Pacific Railroad. Two rural residences have been in place on the northern portion of the property since at least 1902. Unimproved roads have traversed the site since approximately 1937. The two Historic Mill structures, overhead utilities, and detention ponds have been in place since at least 1948. Additional structures associated with the farming operation were first erected on the property sometime prior to 1978. AGW does not identify the historical uses of the subject property as a recognized environmental condition.

The area surrounding the property has historically been vacant agricultural land traversed by streams and drainages, including Boulder Creek and Cottonwood No. 1 Ditch. Several rural residences/farms and the town of Canfield have been in place since at least 1902. Rural residences located immediately south of the site first appeared in 1966. Residential neighborhood development in this area, and the area southwest of the property, began sometime after 1966 and significantly increased until 1978. None of the past uses of the surrounding properties are identified as recognized environmental conditions in relation to the subject property.

Records maintained by the U. S. Environmental Protection Agency (EPA), the Colorado Department of Public Health & Environment (CDPHE), the Colorado Department of Labor and Employment, Division of Oil and Public Safety (OPS), and the Colorado Oil and Gas Conservation Commission, were evaluated for information on hazardous materials and land sources of pollutants/hazards of potential concern, including known complaints and spills. A review of public records from these government agencies revealed three potential sources of contamination. One producing oil and gas well, one abandoned location, and one plugged and abandon oil and gas well are located on the subject property. Records maintained by regulatory agencies were reviewed, and **the producing Wise 1-14 X oil and gas well and associated tank battery, are recognized environmental conditions in relation to the subject property.**

We have performed a Phase I ESA in general conformance with the scope-of-work and limitations of American Standard of Testing Materials (ASTM) Standard Practice Designation E 1527-05 for the property identified as the Wise Property located in Erie, Colorado. Any exceptions, or deletions from this practice are described in Section 12.0 of this report.

This assessment has revealed no evidence of recognized environmental conditions in connection with the property with the exception of the following:

- **The on-site and producing Wise 1-14 X oil and gas well and associated tank battery.**

The following items are not considered recognized environmental conditions; however, AGW has determined these issues to be important environmental considerations which should be understood in connection with the property:

- Oil and gas wells raise a concern from a land development standpoint. Structures should not be constructed within the required setback of operational wells and production equipment. Prior to development, AGW recommends that appropriate setbacks be placed from all oil and gas wells located on the property.
- While not an environmental concern, former underground coal mining operations in the area have led to subsidence issues on the eastern portion of the subject property. AGW strongly recommends reviewing available reports such as: Western Environment and Ecology Inc.'s "Mine Subsidence Investigation, Wise Property, Section 14, Township 1 North, Range 69 West, Boulder County, Colorado" dated May 31, 2005; CTL Thompson, Inc. "Preliminary Geotechnical Investigation, Wise Farms, Southwest of Jasper Road and 119th Street, Erie, Colorado" dated December 9, 2005, regarding subsidence issues in the area.

This report was written to summarize AGW's findings during a Phase I ESA of the subject property. Although AGW completes thorough studies, no warranty is made of the accuracy, completeness, and timeliness of information obtained from government or third party sources. No parties, except the Client, are authorized to review this report unless they agree to waive any possible claims against A.G. Wassenaar, Inc., arising from such use.

Phase I Environmental Site Assessment
Wise Property
Erie, Colorado
January 2, 2012

1.0 INTRODUCTION

As requested, A. G. Wassenaar, Inc. (AGW) has completed a Phase I Environmental Site Assessment (ESA) for the subject property, identified as the Wise Property in Erie, Colorado. The project was conducted for Jasper Land Investments, LLC.

2.0 PURPOSE AND SCOPE OF WORK

AGW's assessment is designed to be in general accordance with Phase I ESAs as established by the American Society of Testing and Materials (ASTM), Standard Practice Designation E 1527-05. The assessment consists of a site reconnaissance to identify potential environmental problems; interviews with individuals having knowledge of the subject site; a review of publicly available records pertaining to environmental resources at the subject site; and a report documenting AGW's findings, opinion, and conclusions.

This report will identify *recognized environmental conditions* which have been identified in relation to the subject property (if any) and provide recommendations for any further action. The term recognized environmental condition is defined as the presence or likely presence of any hazardous substances or petroleum products on the property under conditions that indicate an existing release, past release, or material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term

is not intended to include de minimus conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of enforcement action if brought to the attention of appropriate government agencies.

3.0 SITE DESCRIPTION

The subject property can be described as a portion of the Section 14; Township 1 North, Range 69 West of the Sixth Principal Meridian. The site is approximately 180 acres in size and is positioned southwest of the intersection of North 119th Street and Jasper Road in Erie, Colorado. Physical setting information for the site is described in Table I below.

**Table I
Physical Setting**

Elevation of Subject Property	Approximately 5,020 to 5,100 feet above sea level	Source: USGS Topographic Map, Erie, Colorado, 1967 (revised 1979)
Topographic Gradient	Gentle slope to northwest.	
Closest Surface Water	The Lower Boulder Ditch traverses the subject property	

4.0 SITE RECONNAISSANCE

The property was inspected by Ms. Kristin Schwartz on December 17, 2012. The inspection included a thorough visual survey of the subject property (including a physical inspection of the property grounds for visible signs of contamination or contamination sources), as well as a drive-by survey of the nearby area. Site maps of the property are included as Figures 1 and 2 in this report, and photographs taken during the site visit are included in Attachment A.

4.1 Property Grounds

The subject property is located south of Jasper Road and West of North 119th Street in Erie, Colorado. The site is approximately 180 acres in size and is irregular in shape. Future development plans for the property include 313 lots within a residential community. The majority of the property is agricultural land with a farm homestead located in the northwest corner, and a small residence present near the center of the northern boundary. A historic mill that includes two buildings is located just east of this smaller residence. There are no future plans to demolish or develop these structures and associated parcels of land. Features associated with the farm homestead include, but are not limited to: 1 main residence, 3 outbuildings/sheds, 1 barn, 2 outhouses, 5+ tractors, 5-6 corrals/pastures, 3 trucks, old farming equipment, small quantities of agricultural chemicals and motor oil, three large aboveground storage tanks (ASTs), and environmentally inert debris. Minimal soil staining was observed beneath the ASTs, however, these releases are assumed to be de minimus and therefore, are not considered a recognized environmental condition. AGW recommends that the owner removes and properly disposes of all chemicals and oils currently located on the site prior to acquisition of the property. In addition to the small residence and historic mill located near the center of the northern boundary, the following features are located on the property: 4 RV campers, 2 RV pop-ups, 1 two-car garage, one abandoned and lifted structure, four outbuildings/sheds, old tractors, a collection of porcelain toilets and sinks, numerous tires, approximately 15 old vehicles, and additional inert junk. Minimal oil and diesel stains associated with the numerous vehicles on the property were observed during site reconnaissance. These are likely de minimus and therefore, are not considered a recognized environmental conditions in relation to the property.

The remainder of the property is agricultural land that is currently dry and wet land farmed (for more info see Section 5). A dry canal traverses the eastern portion of the southern boundary, and intersects an irrigation canal. Cinder blocks and concrete diversions were observed within both of the canal features. Overhead utilities traverse the entire site and the northeastern portion of the site near the small residence and historic mill. Abandoned Union Pacific Railroad tracks traverse the central portion of the site and a delapidated treehouse was observed near the tracks on the western portion of the property. Additionally, the Lower Boulder Ditch traverses the central portion of the property and a sediment catchment basin is maintained by the Northern Colorado Water Conservancy District, which is located within the ditch. Numerous unimproved roads traverse the property including one that follows the north side of the ditch, and two that lead to the currently producing, on-site Wise 1-14 X oil and gas well. This oil and gas well is located on the southern portion of the property. Additional features associated with this well include: a separator, a tank battery, and a concrete condensate storage tank. Due to the age of the well and concrete tank used to store the condensate, **AGW identifies the Wise 1-14 X producing oil and gas well and associated tank battery as a recognized environmental condition in relation to the subject property.** Further discussion of the on-site oil and gas wells can be found in Section 7.1 of this report.

Site reconnaissance observations are detailed in Table II below, and shown in Figure 1, Figure 2, and Attachment A of this report.

Table II

<i>Site Reconnaissance Observations</i>	
Current Use of Subject Property	The majority of the property is agricultural land. A farm homestead including a main residence, barn, and outbuildings, are located on the northwest corner of the site. A small residence with associated outbuildings, and historic mill are located near the center of the northern boundary. The Lower Boulder Ditch, abandoned Union Pacific Railroad tracks, and several unimproved roads traverse the subject property. One producing oil and gas well is located on the southern portion of the property.
Configuration	Irregular shaped parcel of land.
Boundaries	North: Jasper Road, rural residential properties, vacant and agricultural land, Wise #31-14 oil and gas well, and stream outlets. East: North 119 th Street, overhead utilities, residential properties, the town of Tabor, and additional oil and gas wells. South: Residential properties, a sheep farm, and Billings Avenue. West: Vacant agricultural land, Jasper #23-14 oil and gas well, rural and residential properties, and North 107 th Street.
Vegetation	Dried wheat plants, short grasses, trees, and shrubs.
Topography	Relatively flat with a gentle slope to the northwest.
Structures or other improvements on the subject property	A farm homestead with associated outbuildings, a small residence with associated outbuildings, and two buildings which comprise a Historic Mill. One oil and gas well with associated tank battery, separator, and concrete condensate storage tank, overhead utility lines, abandoned railroad tracks, and a sediment catchment basin are also located on the property.
Roads adjoining the property and roads, streets, parking facilities on subject property	Jasper Road to the north, North 119 th Street to the east, three unimproved roads extending from the property boundaries toward the oil well, and a turnaround area near the oil well.
Debris	Debris included, but was not limited to: old tractors, vehicles, tires, rusted farming equipment, porcelain toilets and sinks, empty containers, wood scraps, clear plastic material, and cans.

Table II (continued)

<i>Site Reconnaissance Observations</i>	
Hazardous substances and petroleum products stored on the subject property	Small quantities of agricultural chemicals were observed in the sheds surrounding the farm operation. No staining was observed around these containers however, AGW recommends that the current owner properly disposes of all chemicals prior to acquisition of the property.
Storage Tanks	Concrete condensate storage tanks in place adjacent the oil well. Aboveground storage tanks were also noted within the farm homestead. Minimal soil staining was observed near these tanks and any releases are likely to be considered de minimus.
Vent pipes	None observed
Utility lines	Overhead utility lines are in place traversing the entire subject property and traversing the northeast portion of the site.
Odors	None observed
Pools of Liquid	None observed
Drums	Empty 55 gallon drums were observed near the farm homestead. No staining was observed near the drums.
Unidentified Substance Containers	Several of the chemical containers in the sheds near the farm residence did not have labels. All containers should be removed and properly disposed of by the owner prior to acquisition of the property.
PCBs	None observed
Pits, ponds, or lagoons	A dried up detention pond was observed just south of the historic mill.
Wetlands	None observed
Stained soil or pavement	Stained soils were noted beneath the ASTs located at the farm homestead and next to two of the vehicles located near the small, northern residence. These releases are likely to be de minimus and therefore, are not considered recognized environmental conditions.
Stressed vegetation	None observed
Wells	One oil and gas well and associated tank battery is located on the southern portion of the property.

A review of previous investigations conducted for the property indicated that portions of the underground mine shafts for the Banner, Standard, Star, and Jackson Mines underlie a small portion

of the eastern section of the subject property. The Jackson Mine operated from 1884 through 1890, and produced a total of 98,831 tons of coal. AGW recommends reviewing available reports, including: Western Environment and Ecology Inc.'s "Mine Subsidence Investigation, Wise Property, Section 14, Township 1 North, Range 69 West, Boulder County, Colorado" dated May 31, 2005; CTL Thompson, Inc. "Preliminary Geotechnical Investigation, Wise Farms, Southwest of Jasper Road and 119th Street, Erie, Colorado" dated December 9, 2005, regarding subsidence issues on the subject property.

4.2 Surrounding Properties

The subject property is positioned within a mixed use neighborhood. Jasper Road delineates the northern property boundary, while vacant, agricultural fields and rural residences are located further north. Overhead utilities are in place immediately east of North 119th Street, with additional residences present further east. The town of Tabor is located within one mile east of the subject property. Residential homes are in place immediately south of the subject property, one of which includes a sheep farm. Vacant land comprises the area immediately west of the property and includes the Jasper # 23-14 producing oil and gas well. Horse stables and residential homes are in place further west of the site. None of the properties surrounding the site are identified as recognized environmental conditions in relation to the subject property.

5.0 INTERVIEWS

Alan and Sarah Wise, Property Owners

Alan and Sarah Wise were interviewed in person during the site visit on December 17, 2012. The Wise family has owned the entire subject property since 1870, and the property has mainly been used for agricultural purposes/ farmland. In years past, wet and dry land farming has been used to grow corn,

alfalfa, wheat, sugar beets, and tomatoes on the site. The Wise family indicated that small amounts of chemicals have been stored on the property for their small batch agricultural operation. The farming operation and homestead is located on the northwest corner of the site, and has been in existence since the early 1900's. Jess Alexander is the current farmer whom lives in this residence and looks after 15-20 cattle. The Wise's indicated that he no longer farms the land himself but has a CO-OP come in and apply chemicals and pesticides to the crops.

The second residence is adjacent to the historic mill on the property, and they are both located near the center of the northern boundary. Alan Wise indicated that these buildings have been in place since at least 1920, and his brother Philip Wise currently lives in the small residence. During the site reconnaissance, AGW observed approximately 15 abandoned cars near the residence, and Alan Wise indicated that his brother has conducted small maintenance and restoration operations on these cars. AGW observed some soil staining from the oil and gasoline associated with these vehicles, however, these releases are considered to be de minimus and therefore, are not considered recognized environmental conditions.

The Wise's confirmed the presence of the three oil and gas well locations, and their associated spud dates (where applicable) on the property. Sarah Wise indicated that the abandoned location well was never drilled, and the plugged and abandoned well was drilled but found to have a leaking valve and leaking casing. Subsequently, the well was plugged and never produced (additional information on the oil and gas wells can be found in section 7.1). Ms. Wise also stated that shallow ground water is present across the site. The Wise's are unaware of any hazardous waste disposal, landfills, or other environmental concerns for the property and surrounding area.

Mr. Jim Dullea, Jasper Land Investments, LLC

AGW corresponded with Mr. Jim Dullea of Jasper Land Investments, LLC on December 20, 2012. Mr. Dullea is interested in purchasing the subject property. Mr. Dullea is unaware of any environmental cleanup liens, activity and use limitations (AULs), chemical storage, illegal dumping, or hazardous material spills associated with the subject property. Additionally, Mr. Dullea completed the “User Questionnaire for Landowner Liability Protections” in accordance with the ASTM Standard Practice Designation E1527-05. A copy of the completed questionnaire is included as Attachment B.

Nancy Parker, Erie Town Clerk

Ms. Kristin Schwartz contacted Ms. Nancy Parker, Town Clerk for the Town of Erie, to request a search of environmental health department records to determine if any hazardous material spills or other incidents of environmental concern have been reported for the subject property. The Town of Erie is still processing the request. Any pertinent information will be forwarded under separate cover.

6.0 SITE HISTORY

The historic land use of the subject property and the surrounding areas were examined with the purpose of interpreting, where possible, the past activities that have or may have negatively impacted the natural resources of the site. The references reviewed included: USGS Topographic Maps of Niwot, Colorado, dated 1902; and Erie, Colorado, dated 1948, 1966, 1971, and 1978; and aerial photographs dated 1937, 1966, and 1979. Copies of Topographic Maps and Aerial Photographs are included in Attachment D.

6.1 USGS Topographical Maps

**Table III
Topographical Maps**

USGS Topographical Map	Direction	Description
Niwot, Colorado: 1902	Subject Property	Two structures are in place on the site; one near the northwest corner and one near the central portion of the northern boundary. The Boulder Branch Railroad and a stream outlet are also in place and traverse the central portion of the site. Otherwise, vacant land.
	North	An improved road is in place and delineates the sites northern boundary. Three structures are in place directly north of the site, with several additional buildings and an unimproved road in place further north and northeast. Several drainages traverse the area within one mile north of the site.
	East	The town of Canfield is in place immediately east of the site with associated roads and buildings. Additional structures and stream outlets, the town of Erie, and the Burlington and Missouri River Railroad comprise the area east of the subject property.
	South	Primarily vacant land traversed by stream outlets and drainages. Multiple structures with associated roads are visible approximately one mile south and southwest of the property.
	West	Two structures are in place immediately west of the site with additional structures and a road in place further west. Otherwise, vacant land traversed by stream outlets.
Erie, Colorado: 1948	Subject Property	The stream outlet is now depicted as Lower Boulder Ditch. Two outbuildings are in place near a detention pond located near the northeast corner of the site. An additional pond is depicted on the western portion of the site. An unimproved road traverses the site, just south of the railroad tracks, which are now designated as the Union Pacific Railroad. Overhead utilities traverse the entire property.
	North	The road delineating the site's northern boundary is depicted as CO Road 240 (present day Jasper Road). Two of the former structures are no longer in place however three additional outbuildings are depicted. Additional structures are in place to the northeast.

Table III (continued)

USGS Topographical Map	Direction	Description
	East	The town of Tabor is in place, just south of Canfield. An additional unimproved road is visible within one mile, as well as a stream outlet from Cottonwood No. 1 Ditch.
	South	Additional structures are in place near the Tynan Mine (Inactive) which is depicted approximately one-half mile southeast of the property. The Cottonwood No. 1 Ditch traverses the area to the south. One additional structure is in place within one-mile, with several more depicted to the southwest.
	West	The town of Leyner is in place near an improved road depicted as State Highway 287. Additional structures and two unimproved roads are in place, otherwise, no significant changes.
Erie, Colorado: 1966	Subject Property	An unimproved road traverses the center of the site. Otherwise, no significant changes.
	North	CO Road 240 is now depicted as Jasper Road. The outbuildings are no longer in place but two additional buildings are in place directly north. Several ponds surround Boulder Creek which traverses the area north of the site. Additional structures, unimproved roads, and Mountain View Lakes are in place to the northeast.
	East	Additional dwellings and roads are in place near Canfield and Tabor, otherwise, no significant changes.
	South	Significant development including numerous buildings and roads are in place immediately south and southwest of the site. Two detention ponds within this development are also depicted. Isabelle Road is in place approximately one mile south.
	West	The two structures immediately west of the site are no longer in place. An additional stream outlet and several structures are in place further west, otherwise, no significant changes.
Erie, Colorado: 1971	Subject Property	No significant changes.
	North	Several more structures are depicted to the northeast and northwest. Kenosha Road is in place approximately one mile north, otherwise, no significant changes.
	East	Two additional structures are depicted east of Canfield, otherwise, no significant changes.

Table III (continued)

USGS Topographical Map	Direction	Description
	South	Several additional structures are in place immediately south of the site, with additional roads and structures also in place to the southwest.
	West	Three structures are in place directly west of the site with two additional dwellings depicted further west. Otherwise, no significant changes.
Erie, Colorado: 1978	Subject Property	Five more structures are in place on the property; three near the northwest residence and two near the residence on the northern boundary. Otherwise, no significant changes.
	North	Two additional structures are in place directly north of Jasper Road, with several additional structures also depicted to the northwest and northeast of the property. An intricate land surface area is depicted within one-quarter mile to the northeast.
	East	Additional structures and unimproved roads are depicted within the towns of Canfield and Tabor.
	South	A significant amount of additional structures are in place throughout the area immediately south of the site. Additional dwellings are also present just north of Isabelle road
	West	Multiple additional structures are in place immediately, and further west of the site. An associated road leading to these buildings is present within one-quarter mile of the property.

6.2 Aerial Photographs

Table VI
Aerial Photographs

Aerial Photograph	Direction	Description
1937	Subject Property	Primarily agricultural land with farming equipment located across the site at various places. The farmhouse and associated buildings are in place at the northwest corner of the property with a detention pond visible just southeast of the residence. The residence near the center of the northern boundary also appears to be in place with the historic mill adjacent to the east. A detention pond is present immediately south of the property. The Lower Boulder Ditch, Pacific Union Railroad, an unimproved road, and irrigation ditches traverse the property. Additionally, a canal traverses a portion of the southern boundary.
	North	Primarily vacant agricultural land traversed by stream outlets and irrigation ditches. The future Jasper Road appears to be in place with several structures depicted immediately north of the road. A homestead is visible to the northeast of the site with additional development present further north.
	East	The town of Canfield is in place directly east of the site with multiple structures and roadways associated with the town present. The future North 119 th Street appears to be in place and delineates the site's eastern boundary.
	South	Vacant agricultural land with several pieces of farming equipment visible. A canal traverses most of the area south of the property and several irrigation canals and unimproved roads appear to be in place. A structure is visible to the southeast of the property.
	West	Primarily vacant agricultural land with farming equipment visible across the area to the west. A structure with associated unimproved roads appears to be in place immediately west of the property.
1966	Subject Property	Several of the irrigation ponds are no longer depicted and the path of the Lower Boulder Ditch has changed. Otherwise, no visible changes.
	Surrounding Properties	Several additional properties and a detention pond are present to the north and northeast, respectively. Additional structures are present within the town of Canfield, located immediately east of the property, and within the town of Tabor, located further east of the property. Approximately fifteen structures with associated unimproved roads are in place immediately south of the property.

Table VI (continued)

Aerial Photograph	Direction	Description
1979	Subject Property	The detention pond located south of the northern residence appears to have increased in size. Otherwise, no visible changes.
	Surrounding Properties	Additional structures are in place immediately north of the property and within the town of Canfield, located immediately east of the property. Significant residential development has occurred in the area directly south and southwest of the property.

The historical research conducted for the subject property indicated that the property has been primarily vacant agricultural fields traversed by irrigation ditches, the Lower Boulder Ditch, and the Union Pacific Railroad. Two rural residences have been in place on the northern portion of the property since at least 1902. Unimproved roads have traversed the site since approximately 1937. The two Historic Mill structures, overhead utilities, and detention ponds have been in place since at least 1948. Additional structures associated with the farming operation were first erected on the property sometime prior to 1978. AGW does not identify the historical uses of the subject property as a recognized environmental condition.

The area surrounding the property has historically been vacant agricultural land traversed by streams and drainages, including Boulder Creek and Cottonwood No. 1 Ditch. Several rural residences/farms and the town of Canfield have been in place since at least 1902. Rural residences located immediately south of the site first appeared in 1966. Residential neighborhood development in this area, and the area southwest of the property, began sometime after 1966 and significantly increased until 1978. None of the past uses of the surrounding properties are identified as recognized environmental conditions in relation to the subject property.

7.0 PUBLIC RECORDS REVIEW

A review of public records was completed by Satisfi Environmental Information (Satisfi) of Castle Rock, Colorado. This record search was defined to meet or exceed the ASTM guidelines for a Phase I ESA records search. The search area defined by ASTM varies from adjacent properties to a maximum of a one mile radius.

The information reviewed for this assessment includes the following: National Priorities List (NPL) Superfund sites; State equivalent NPL sites (SPL); facilities investigated for potential releases of hazardous materials to the environment (Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS); hazardous waste facilities (RCRA); documented spills or hazardous releases; leaking underground storage tanks (LUST); registered USTs and ASTs; and solid or hazardous waste landfills. Summarized data follows with specific information and mapping details contained in Attachment E.

Table V
Summary of Publicly Available Environmental Records

Federal Databases		Approximate Minimum Search Distance	Results
NPL	The National Priorities List (NPL) is the USEPA's database of uncontrolled or abandoned hazardous waste facilities that have been listed for priority remedial actions under the Superfund Program.	1.0	0
CORRACT	The USEPA maintains a database of RCRA facilities that are undergoing "corrective action". A "corrective action" order is issued when there has been a release of hazardous waste or constituents into the environment from a RCRA facility.	1.0	0
TSD	The USEPA maintains a database of RCRA facilities associated with treatment, storage, or disposal (TSD) of hazardous waste.	0.50	0
CERCLIS	The CERCLIS database is a compilation of facilities that USEPA has or is currently investigating for a release or threatened release of hazardous substances subject to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980.	0.50	0
Spill	The Emergency Response Notification System (ERNS) is a listing compiled by the USEPA and the Coast Guard's National Response Center of reported releases of petroleum and hazardous substances to the air, soil and/or water.	0.25	0
Generator	The US EPA's Resource Conservation and Recovery Act (RCRA) database identifies facilities that generate hazardous waste. Large quantity generators (LQG) produce at least 1,000 kg/month of hazardous waste or	0.25	0

Table V (continued)

Federal Databases		Approximate Minimum Search Distance	Results
	1 kg/ month of acutely hazardous waste. Small quantity generators (SQG) produce 100 to 1,000 kg/ month of hazardous waste. Conditionally exempt small quantity generators (CESQG) generate less than 100 kg/month of hazardous waste.		
Other	The US EPA's Resource Conservation and Recovery Act (RCRA) database also identifies facilities that are transporters of hazardous waste, former generators, and suspected generators. Non-generators that have been inspected or have sent in notifications are also included.	0.25	0
State Databases			
VCL	State Voluntary Cleanup Lists include sites that are being cleaned up or that have applied for a No Action Determination from the State.	0.50	0
Solid Waste	State lists of solid waste facilities. This category also includes lists compiled from various local agencies.	0.50	0
Tank Leak	State list of leaking underground storage tanks (LUSTs) and above-ground tank leaks. This category also includes LUST Trust sites where no responsible party has been identified.	0.50	0
Tank	State list of registered underground storage tanks (USTs) and above-ground storage tanks (ASTs).	0.25	0
AUL	Activity and Use Limitations include sites with either Engineering Controls or Institutional Controls that are intended to prevent exposure to contamination that has been left in place.	0.25	0
Oil and Gas Wells	Colorado Oil and Gas Commission- In general, oil and gas production wells present an environmental hazard during all stages of their use, including: initial construction and development, production, and through underground or surface transport. At each stage of the process of oil and gas production, significant potential for hydrocarbon release is present	On Site	3

7.1 Oil and Gas Production Wells

The Colorado Oil and Gas Commission (COGCC) maintains a database record of all oil and gas wells located within the state. In general, oil and gas production wells present an environmental hazard during all stages of their use, including: initial construction and development, production, and through underground or surface transport. At each stage of the process of oil and gas production, significant potential for hydrocarbon release is present. Three oil and gas wells; one currently active, one abandoned location, and one plugged and abandoned well, are documented on the subject property. The producing oil and gas well Wise 1-14X is located on the southern portion of the property along an unimproved road. According to the COGCC, the abandoned location well Wise # 43-14 is located southeast of the active well, and the plugged and abandoned well Wise # 1-14

location is east of all well locations, near the unimproved road that traverses the southern portion of the site. Approximate locations for all three wells are depicted on Figure 2 of this report. The oil and gas wells located on the subject property are summarized in Table VI below:

**Table VI
Oil and Gas Wells**

Map ID	Well Name	Location	Operator	Spud Date	Status
1	Wise 1-14 X	NWSE 14 1N 69W 6PM	Noble Energy Inc.	1984	PR- Producing
2	Wise # 43-14	NESE 14 1N 69W 6PM	Basin Exploration Inc.	N/A	AL- Abandoned Location
3	Wise # 1-14	NESE 14 1N 69W 6PM	Gerrity Oil and Gas Corp.	1983	AB/PA- Plugged and Abandoned

After review of the information contained within the COGCC (spud dates and statuses), and a site visit to the currently producing on-site oil and gas well indicating that the condensate is stored in a concrete tank, **AGW identifies the Wise 1-14 X producing well and associated tank battery as a recognized environmental conditions in relation to the subject property.**

Oil and gas wells raise a concern from a land development standpoint. Structures should not be constructed within a certain distance of operational wells and production equipment. Prior to development, AGW recommends that appropriate setbacks be placed from all oil and gas wells located on the property.

7.2 Unmapped Sites

Four unmapped sites were listed during the Satisfi records search. These sites could not be mapped accurately because of inadequate addresses or street maps. Unmapped listings are reported by Satisfi on the chance that their location might be revealed during the course of a site visit or other research. However, unless there is some specific reason to believe that a listing is nearby and of potential concern, there is no requirement in the ASTM standard to attempt to verify the location of these listings. Based on available information, there is no reason to believe this listing is within one mile of the subject property.

8.0 ENVIRONMENTAL LIENS

On December 20, 2012 AGW corresponded with Mr. Jim Dullea of Jasper Land Investments, LLC, to inquire about any known environmental liens associated with the subject property. Mr. Dullea indicated that he is unaware of any existing environmental liens associated with the subject property. A review of public records was completed by Satisfi. This record search was defined to meet or exceed the ASTM guidelines for a Phase I ESA record search. The search area defined by ASTM for activity and use limitations (AULs) is from adjacent properties to a maximum of a quarter-mile radius. The information reviewed for this assessment did not identify AULs associated with the subject property.

9.0 FINDINGS AND OPINION

- The site is positioned southwest of the intersection of Jasper Road and North 119th Street in Erie, Colorado. The site is approximately 180 acres in size. Future development plans for the property include 313 lots within a residential community.

The majority of the property is agricultural land, with a farm homestead located in the northwest corner, and a small residence present near the center of the northern boundary. A historic mill is located east of the smaller residence and includes two buildings.

- The remainder of the property is agricultural land that is currently dry and wet land farmed (for additional information see Section 5.0). A dry canal traverses the eastern portion of the southern boundary, and intersects one of several irrigation canals on the property. Overhead utilities traverse the entire site and the northeastern portion of the property near the small residence and historic mill. The abandoned Union Pacific Railroad tracks and the Lower Boulder Ditch traverse the central portion of the site. Numerous unimproved roads traverse the property including two that lead to the currently producing, on-site Wise 1-14 X oil and gas well. Due to the age of the well and concrete tank used to store the condensate, **AGW identifies the Wise 1-14 X producing oil and gas well and associated tank battery as a recognized environmental condition in relation to the subject property.**
- The subject property is positioned within a mixed use neighborhood. Jasper Road delineates the northern property boundary, while vacant, agricultural fields and rural residences are located further north. Overhead utilities are in place immediately east of North 119th Street, and the town of Tabor is located within one mile east of the subject property. A residential neighborhood is in place immediately south of the site. Vacant land and an oil and gas well comprise the area immediately west of the property, while residential homes are in place further west. None of the properties

surrounding the site are identified as recognized environmental conditions in relation to the subject property.

- The historical research conducted for the subject property indicated that the property has been primarily vacant agricultural fields traversed by irrigation ditches, the Lower Boulder Ditch, and the Union Pacific Railroad. Two rural residences have been in place on the northern portion of the property since at least 1902. Unimproved roads have traversed the site since approximately 1937. The two Historic Mill structures, overhead utilities, and detention ponds have been in place since at least 1948. Additional structures associated with the farming operation were first erected on the property sometime prior to 1978. AGW does not identify the historical uses of the subject property as a recognized environmental condition.
- The area surrounding the property has historically been vacant agricultural land traversed by streams and drainages, including Boulder Creek and Cottonwood No. 1 Ditch. Several rural residences/farms and the town of Canfield have been in place since at least 1902. Rural residences located immediately south of the site first appeared in 1966. Residential neighborhood development in this area, and the area southwest of the property, began sometime after 1966 and significantly increased until 1978. None of the past uses of the surrounding properties are identified as recognized environmental conditions in relation to the subject property.
- Records maintained by the U. S. Environmental Protection Agency (EPA), the Colorado Department of Public Health & Environment (CDPHE), the Colorado Department of Labor and Employment, Division of Oil and Public Safety (OPS), and the Colorado Oil and Gas Conservation Commission, were evaluated for information

on hazardous materials and land sources of pollutants/hazards of potential concern, including known complaints and spills. A review of public records from these government agencies revealed three potential sources of contamination. One producing oil and gas well, one abandoned location, and one plugged and abandon oil and gas well are located on the subject property. Records maintained by regulatory agencies were reviewed, and **the producing Wise 1-14 X oil and gas well and associated tank battery, are recognized environmental conditions in relation to the subject property.**

10.0 CONCLUSION

We have performed a Phase I ESA in general conformance with the scope-of-work and limitations of American Standard of Testing Materials (ASTM) Standard Practice Designation E 1527-05 for the property identified as the Wise Property located in Erie, Colorado. Any exceptions, or deletions from this practice are described in Section 12.0 of this report.

This assessment has revealed no evidence of recognized environmental conditions in connection with the property with the exception of the following:

- **The on-site and producing Wise 1-14 X oil and gas well and associated tank battery.**

The following items are not considered recognized environmental conditions; however, AGW has determined these issues to be important environmental considerations which should be understood in connection with the property:

- Oil and gas wells raise a concern from a land development standpoint. Structures should not be constructed within the required set back of operational wells and production equipment. Prior to development, AGW recommends that appropriate setbacks be placed from all oil and gas wells located on the property.
- While not an environmental concern, former underground coal mining operations in the area have led to subsidence issues on the eastern portion of the subject property. AGW strongly recommends reviewing available reports such as: Western Environment and Ecology Inc.'s "Mine Subsidence Investigation, Wise Property, Section 14, Township 1 North, Range 69 West, Boulder County, Colorado" dated May 31, 2005; CTL Thompson, Inc. "Preliminary Geotechnical Investigation, Wise Farms, Southwest of Jasper Road and 119th Street, Erie, Colorado" dated December 9, 2005, regarding subsidence issues in the area.

11.0 LIMITATIONS

The professional judgements expressed in this report meet the standard of care for our profession. Environmental issues (among others) not included in the scope of work for this project include radon, lead-based paint, and asbestos testing, and wetlands and endangered species evaluations. The collection and specific laboratory analyses of environmental samples were not part of the scope of this Phase I ESA; therefore, no specific quantitative environmental data was generated.

AGW's assessment is limited to identifying potential environmental liabilities associated with the property of concern. Not identifying hazardous or toxic materials on the property should not be interpreted as a guarantee that these materials do not exist. It is merely a statement indicating that

the probability of contamination on the subject property should be minimal based on site characteristics, and the historical and current uses of the site and surrounding areas. This opinion is rendered based upon property inspection, information from interviews with knowledgeable persons regarding property history, and information provided by governmental and regulatory agencies. Information is obtained on a reasonably ascertainable basis as it pertains to costs, timeliness, and availability, and is believed to be from reliable sources; however no responsibility is assumed for its accuracy since AGW was not retained to verify publicly available information. Parties who wish to qualify for use of the landowner liability protections will need to know whether they are in compliance with activity and use limitations (AULs), including land use restrictions that were relied upon in connection with a response action. A determination of compliance with AULs is beyond the scope of this practice.

12.0 DEVIATIONS

This Phase I ESA has been completed in general accordance with ASTM Practice E 1527-05. We are aware of no significant deviations from this standard with the exception of the following:

- AGW was unable to conduct historical research back to the first developed use of the property, however, we do not believe this will impact the findings of our study.

Thank you for the opportunity to serve you on this project. If you have any questions regarding the contents of this report or should you require additional information, please do not hesitate to call.

Sincerely,

A. G. WASSENAAR, INC.



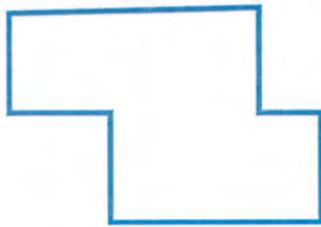
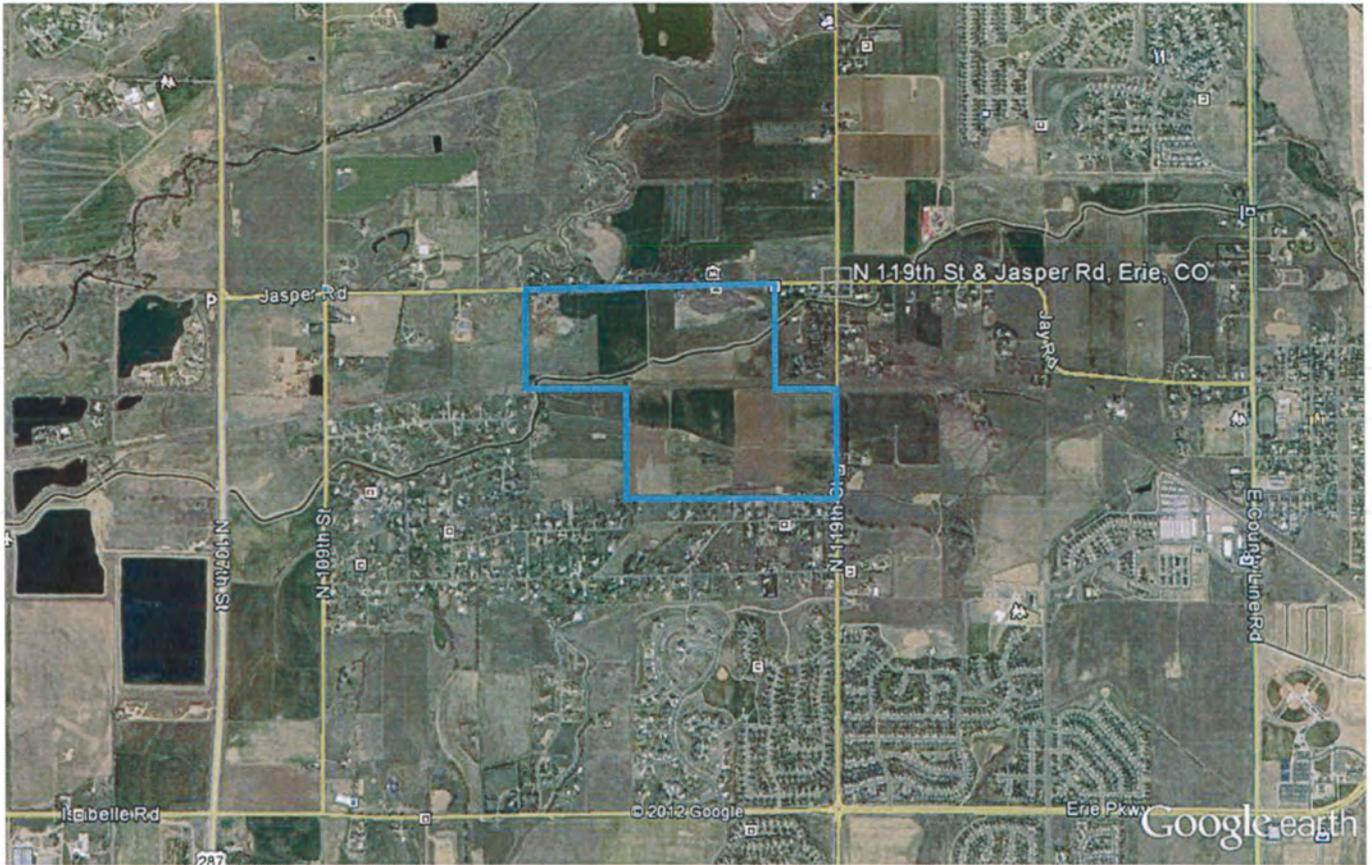
Kristin A. Schwartz
Environmental Scientist



Brian J. Glade, P.E.
Vice President

I, Brian J. Glade, declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in 312.10 of 40 CFR 312 and I have specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

KAS/JAB/dd



Approximate Subject Property

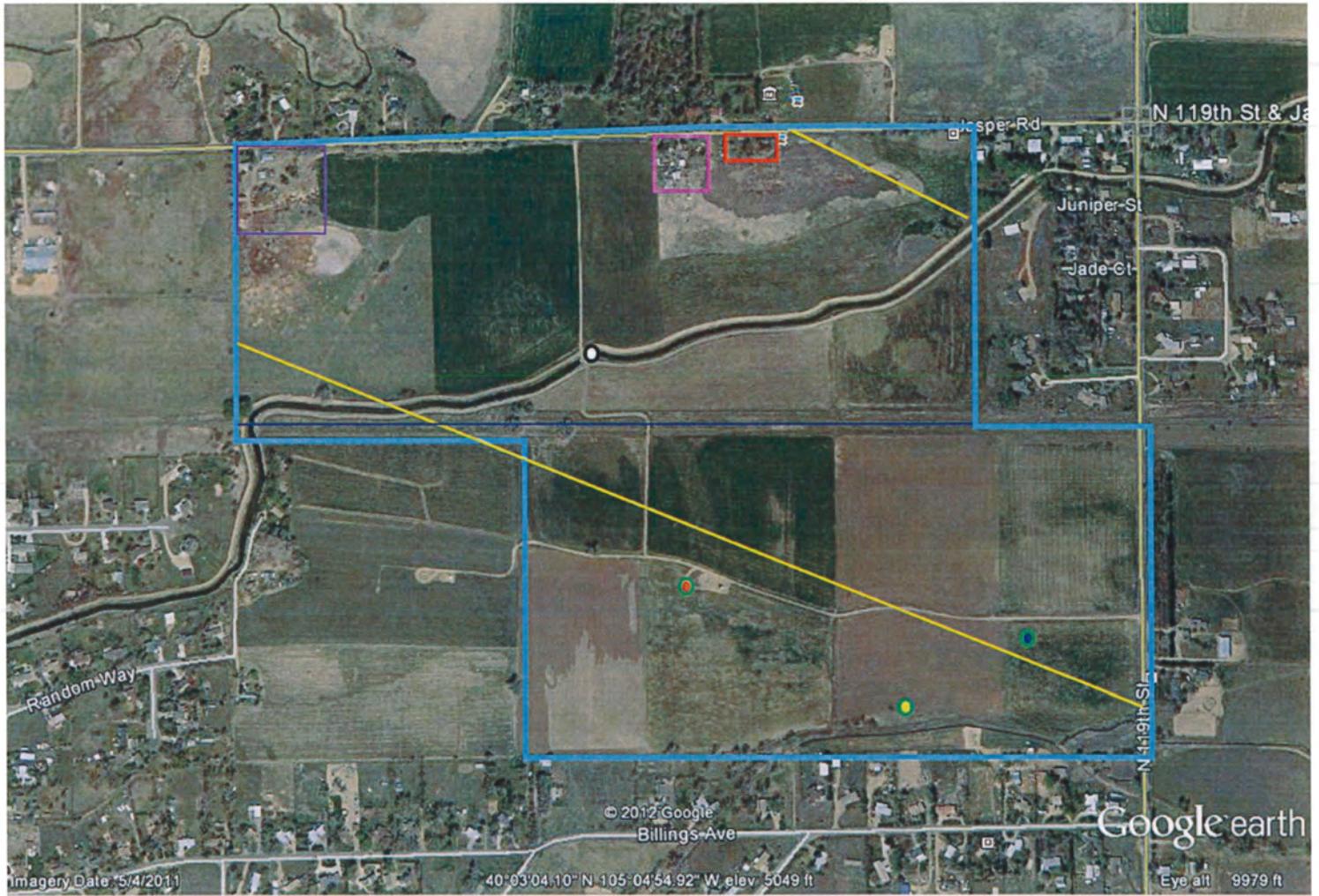
NOTE: ALL LOCATIONS ARE APPROXIMATE

A.G. Wassenaar
 Geotechnical and Environmental Consultants **Inc.**

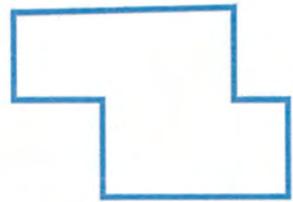
Wise Property
 Erie, Colorado

Project No. E12776.E1
 Figure 1
 Vicinity Map





Legend



Approximate Subject Property

-  Abandoned Union Pacific Railroad Tracks
-  Overhead Utilities/ Power Lines
-  Farm Homestead
-  Small Residence
-  Historic Mill
-  Sediment Catchment Basin
-  Wise 1-14 X Oil and Gas Well
-  Wise # 43-14 Oil and Gas Well
-  Wise # 1-14 Oil and Gas Well

NOTE: ALL LOCATIONS ARE APPROXIMATE

<p>A.G. Wassenaar Geotechnical and Environmental Consultants <i>Inc.</i></p>	
<p>Wise Property Erie, Colorado</p>	<p>Project No. E12776.E1 Figure 2 Site Map</p>



**ATTACHMENT A
PHOTOGRAPHS**



The three large ASTs within the farm homestead located at the northwest site corner are depicted.



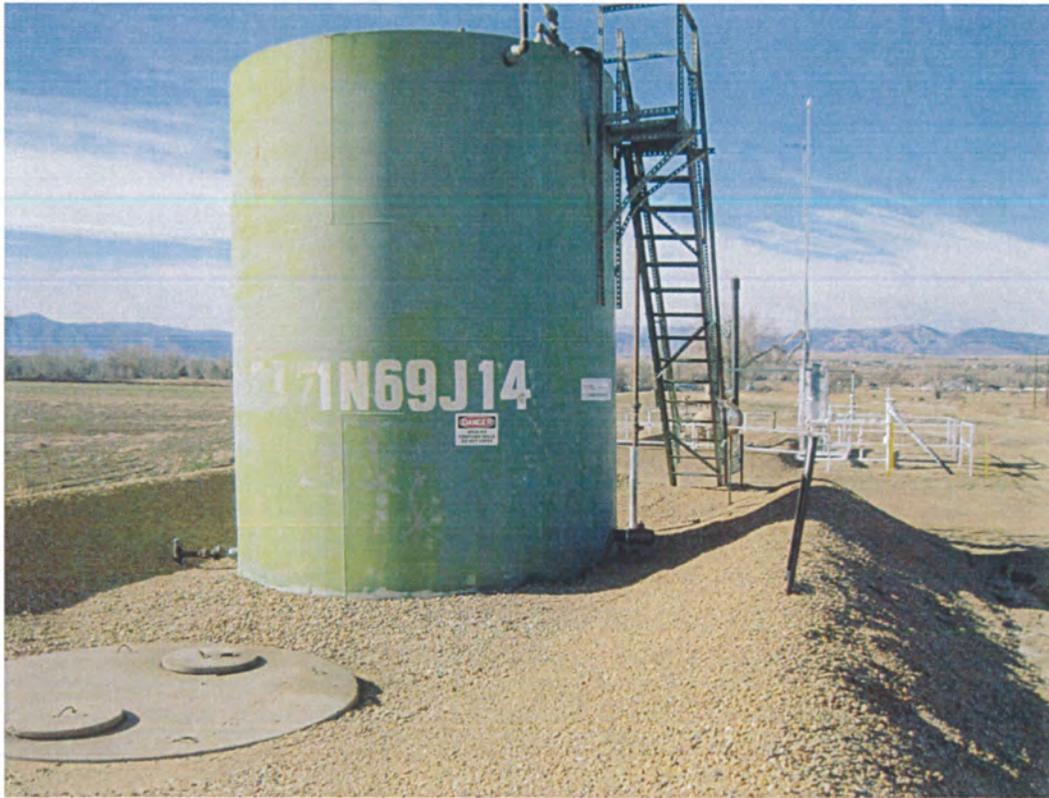
Outbuildings, debris, and a vehicle located at the farm homestead are depicted.



The smaller residence and associated outbuildings located near the center of the northern boundary are visible.



The historic mill, located east of the smaller residence, is portrayed.



The Wise 1-14 X oil and gas well tank battery, condensate holding tank, and separator are all depicted.



Looking northwest across the majority of the site. The overhead utilities that traverse the entire property, a drainage, and the smaller residence denoted by the white buildings are visible.



View to the southeast across the site.

**ATTACHMENT B
USER QUESTIONNAIRE**

USER QUESTIONNAIRE

INTRODUCTION

In order to qualify for on of the *Landowner Liability Protections (LLPs)*³⁵ offered by the Small Business Liability Relief and Brownfields Revitalization Act of 2001 (the "*Brownfields Amendments*"),³⁶ the *user* must provide the following information (if available) to the *environmental professional*. Failure to provide this information could result in a determination that "*all appropriate inquiry*" is not complete

(1.) Environmental cleanup liens that are filed or recorded against the site (40 CFR 312.25).

Are you aware of any environmental cleanup liens against the *property* that are filed or recorded under federal, tribal, state or local law?

No

(2.) Activity and land use limitations that are in place on the site or that have been filed or recorded in a registry (40 CFR 312.26).

Are you aware of any AULs, such as *engineering controls*, land use restrictions or *institutional controls* that are in place at the site and/or have been filed or recorded in a registry under federal, tribal, state or local law?

No

(3.) Specialized knowledge or experience of the person seeking to qualify for the LLP (40 CFR 312.28).

As the user of this ESA do you have any specialized knowledge or experience related to the *property* or nearby *properties*? For example, are you involved in the same line of business as the current or former *occupants* of the *property* or an adjoining *property* so that you would have specialized knowledge of the chemicals and processes used by this type of business?

No

(4.) Relationship of the purchase price to the fair market value of the *property* if it were not contaminated (40 CFR 312.29).

Does the purchase price being paid for this *property* reasonably reflect the fair market value of the *property*? If you conclude that there is a difference, have you considered whether the lower purchase price is because contamination is known or believed to be present at the *property*?

Yes

(5.) Commonly known or reasonably ascertainable information about the *property* (40 CFR 312.30).

Are you aware of commonly known or *reasonably ascertainable* information about the *property* that would help the *environmental professional* to identify conditions indicative of releases or threatened releases? For example, as *user*,

(a.) Do you know the past uses of the *property*? No

(b.) Do you know of specific chemicals that are present or once were present at the *property*? No

(c.) Do you know of spills or other chemical releases that have taken place at the *property*? No

(d.) Do you know of any environmental cleanups that have taken place at the *property*? No

(6.) The degree of obviousness of the presence of likely presence of contamination at the *property*, and the ability to detect the contamination by appropriate investigation (40 CFR 312.31).

As the *user* of this ESA, based on your knowledge and experience related to the *property* are there any *obvious* indicators that point to the presence or likely presence of contamination at the *property*?

No

COMPLETED BY:

DATE:

James A. Dulica, member Jasper Land Investment LLC
James A. Dulica
12/20/2012

³⁵ *Landowner Liability Protections*, or LLPs, is the term used to describe the three types of potential defenses to Superfund liability in EPA's *Interim Guidance Regarding Criteria Landowners Must Meet in Order to Qualify for Bona Fide Prospective Purchaser, Contiguous Property Owner, or Innocent Landowner Limitations on CERCLA Liability* ("Common Elements" Guide) issued on March 6, 2003.

³⁶ P.L. 107-118.

ATTACHMENT C
TOPOGRAPHIC MAPS AND AERIAL PHOTOGRAPHS

TOPOGRAPHIC MAPS

Subject Property

Wise Property
SW of Jasper Road & N 119th Street
Erie, CO 80026

December 17, 2012

Performed For: A.G. Wassenaar, Inc
2180 S Ivanhoe Street
Denver, CO 80222
Attn: Kristin Schwartz
Ref: E12776.E1

The following maps were found:

Year	Map Name	Size	1:Scale	Note
1978	Erie	7.5'	24,000	
1971	Erie	7.5'	24,000	
1966	Erie	7.5'	24,000	
1948	Erie	7.5'	24,000	
1902	Niwot	15.'	62,500	Earliest found.

These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

Please note that the accuracy and suitability of public and private records cannot be guaranteed, nor can this research. No warranty is made or implied. By using this report, the reader agrees to assume all related risk and to release Satisfi from liability for any damages. However, if this report is not 100% satisfactory, a full refund will be issued.



This Key to Symbols is also available at <http://mac.usgs.gov/isb/pubs/booklets/symbols/buildings.html>

BUILDINGS AND RELATED FEATURES

Building	
School; church	
Built-up Area	
Racetrack	
Airport	
Landing strip	
Well (other than water); windmill	
Tanks	
Covered reservoir	
Gaging station	
Landmark object (feature as labeled)	
Campground; picnic area	
Cemetery: small; large	

MINES AND CAVES

Quarry or open pit mine	
Gravel, sand, clay, or borrow pit	
Mine tunnel or cave entrance	
Prospect; mine shaft	
Mine dump	
Tailings	

RIVERS, LAKES, AND CANALS

Intermittent stream	
Intermittent river	
Disappearing stream	
Perennial stream	
Perennial river	
Small falls; small rapids	
Large falls; large rapids	
Masonry dam	
Dam with lock	
Dam carrying road	
Perennial lake; Intermittent lake or pond	
Dry lake	
Narrow wash	
Wide wash	
Canal, flume, or aqueduct with lock	
Elevated aqueduct, flume, or conduit	
Aqueduct tunnel	
Well or spring; spring or seep	

ROADS AND RELATED FEATURES

Roads on Provisional edition maps are not classified as primary, secondary, or light duty. They are all symbolized as light duty roads.

Primary highway	
Secondary highway	
Light duty road	
Unimproved road	
Trail	
Dual highway	
Dual highway with median strip	
Road under construction	
Underpass; overpass	
Bridge	
Drawbridge	
Tunnel	

RAILROADS AND RELATED FEATURES

Standard gauge single track; station	
Standard gauge multiple track	
Abandoned	
Under construction	
Narrow gauge single track	
Narrow gauge multiple track	
Railroad in street	
Juxtaposition	
Roundhouse and turntable	

TRANSMISSION LINES AND PIPELINES

Power transmission line: pole; tower	
Telephone line	
Aboveground oil or gas pipeline	
Underground oil or gas pipeline	

CONTOURS

Topographic	
Intermediate	
Index	
Supplementary	
Depression	
Cut; fill	
Bathymetric	
Intermediate	
Index	
Primary	
Index Primary	
Supplementary	

This Key to Symbols is also available at <http://mac.usgs.gov/isb/pubs/booklets/symbols/buildings.html>

SUBMERGED AREAS AND BOGS

Marsh or swamp	
Submerged marsh or swamp	
Wooded marsh or swamp	
Submerged wooded marsh or swamp	
Rice field	
Land subject to inundation	

GLACIERS AND PERMANENT SNOWFIELDS

Contours and limits	
Form lines	

COASTAL FEATURES

Foreshore flat	
Rock or coral reef	
Rock bare or awash	
Group of rocks bare or awash	
Exposed wreck	
Depth curve; sounding	
Breakwater, pier, jetty, or wharf	
Seawall	

MARINE SHORELINE

Topographic maps	
Approximate mean high water	
Indefinite or unsurveyed	

Topographic-bathymetric maps	
Mean high water	
Apparent (edge of vegetation)	

BATHYMETRIC FEATURES

Area exposed at mean low tide; sounding datum	
Channel	
Offshore oil or gas; well; platform	
Sunken rock	

VEGETATION

Woods	
Scrub	
Orchard	
Vineyard	
Mangrove	

SURFACE FEATURES

Levee	
Sand or mud area, dunes, or shifting sand	
Intricate surface area	
Gravel beach or glacial moraine	
Tailings pond	

BOUNDARIES

National	
State or territorial	
County or equivalent	
Civil township or equivalent	
Incorporated city or equivalent	
Park, reservation, or monument	
Small park	

LAND SURVEY SYSTEMS

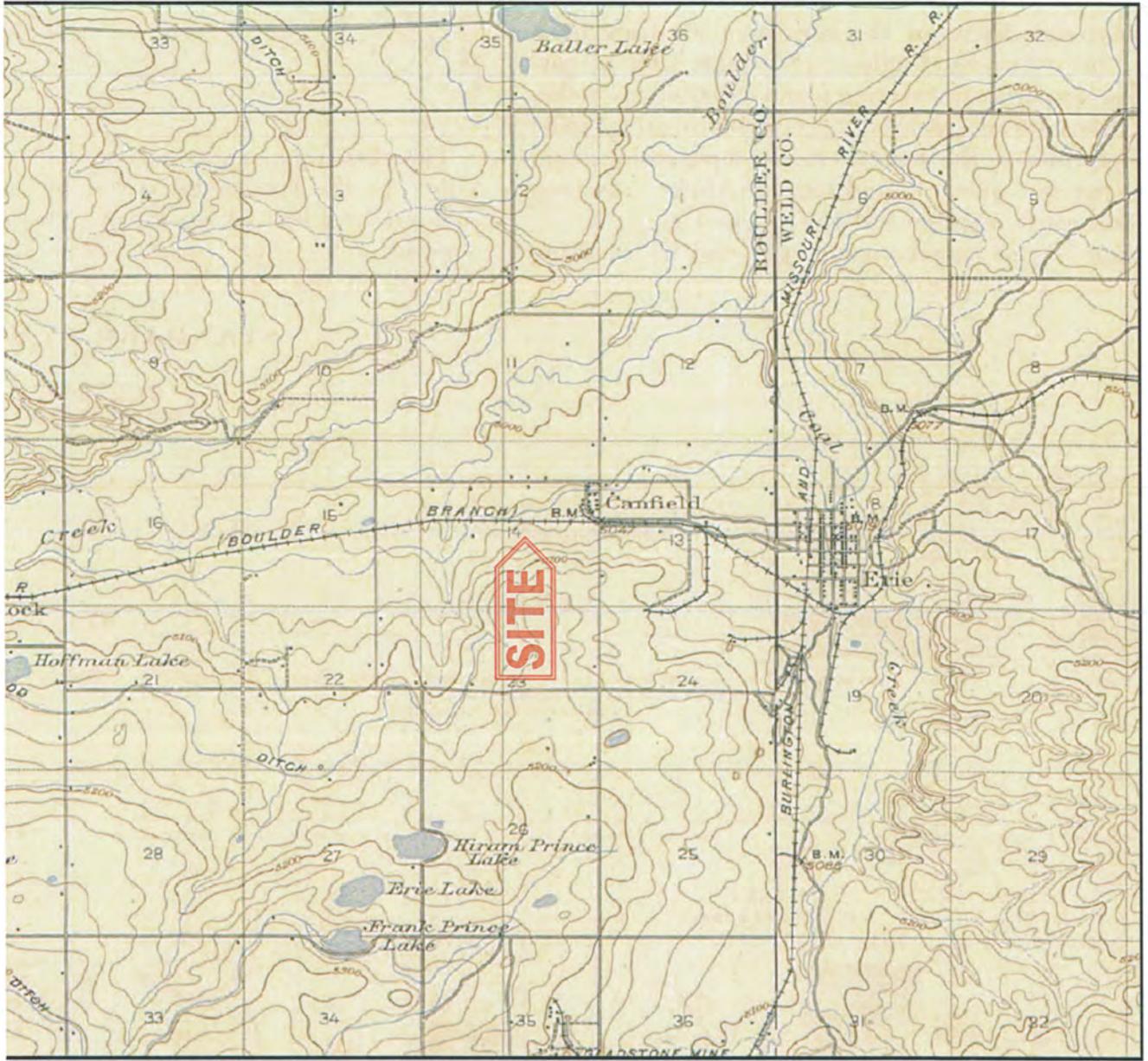
U.S. Public Land Survey System	
Township or range line	
Location doubtful	
Section line	
Location doubtful	
Found section corner; found closing corner	
Witness corner; meander corner	
Other land surveys	
Township or range line	
Section line	
Land grant or mining claim; monument	
Fence line	

CONTROL DATA AND MONUMENTS

Aerial photograph roll and frame number*		3 - 20
Horizontal control		
Third order or better, permanent mark		Neace
With third order or better elevation		BM 45.1
Checked spot elevation		79.5
Coincident with section corner		Cactus
Unmonumented*		
Vertical control		
Third order or better, with tablet		BM 16.3
Third order or better, recoverable mark		120.0
Bench mark at found section corner		BM 18.6
Spot elevation		6.3
Boundary monument		
With tablet		BM 21.6 71
Without tablet		171.3
With number and elevation		67 301.1
U.S. mineral or location monument		

1902 15' Niwot Quadrangle

Earliest found.



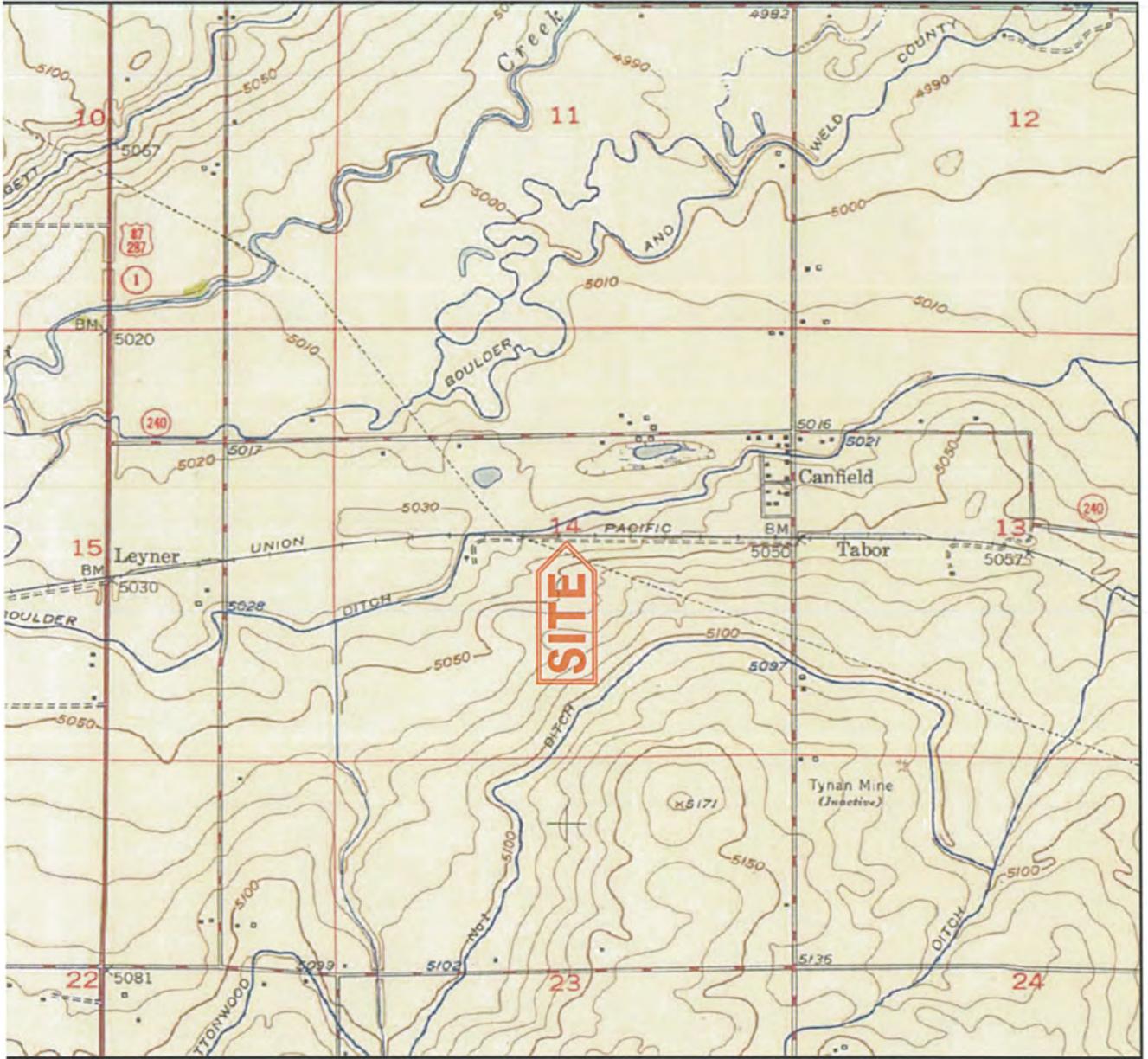
These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

[See Symbol Key](#)

Original scale = 1:62500 |----- ~1 mile -----|



1948 7.5' Erie Quadrangle



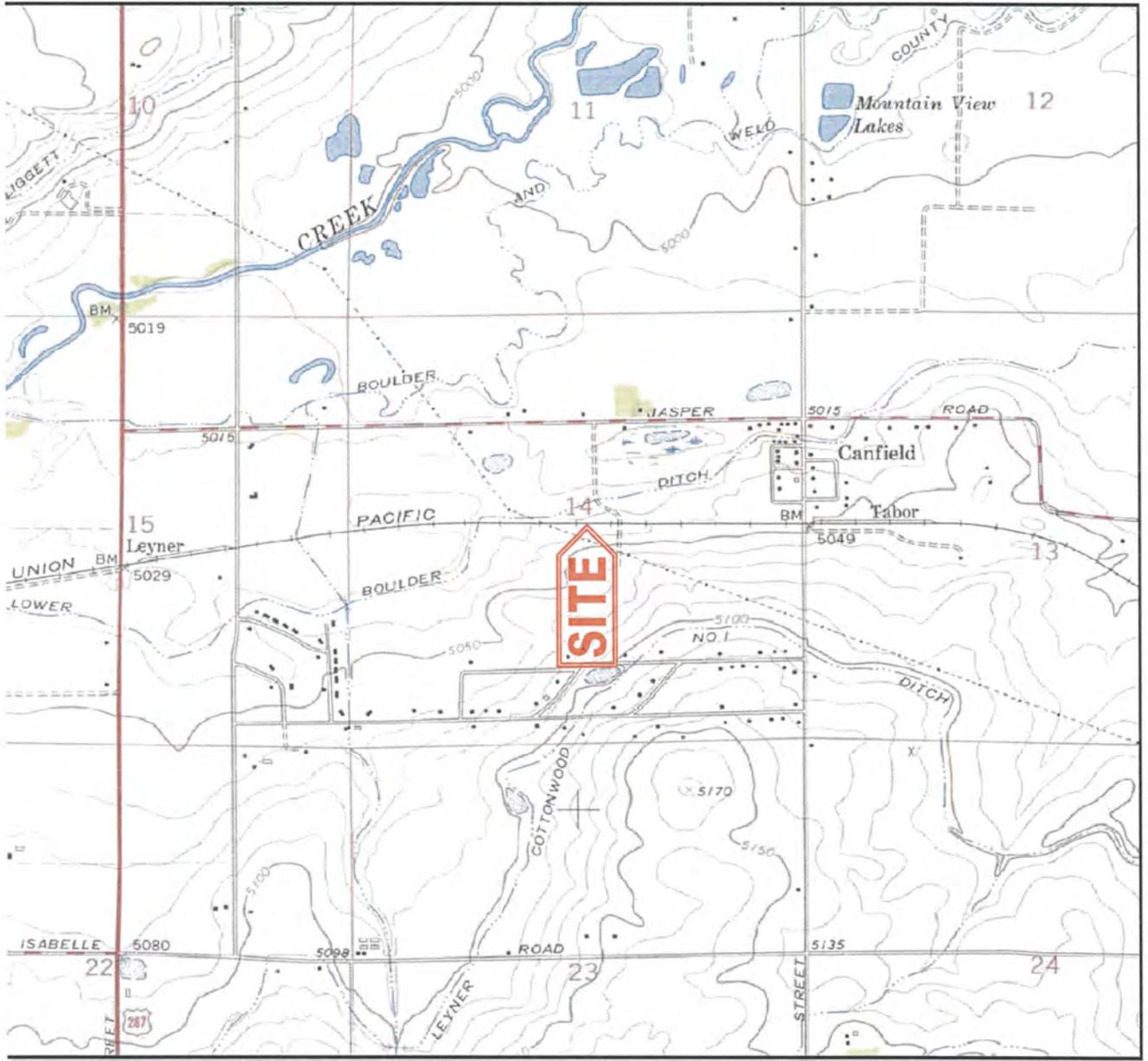
These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

[See Symbol Key](#)

Original scale = 1:24000 |-----~1 mile-----|



1966 7.5' Erie Quadrangle



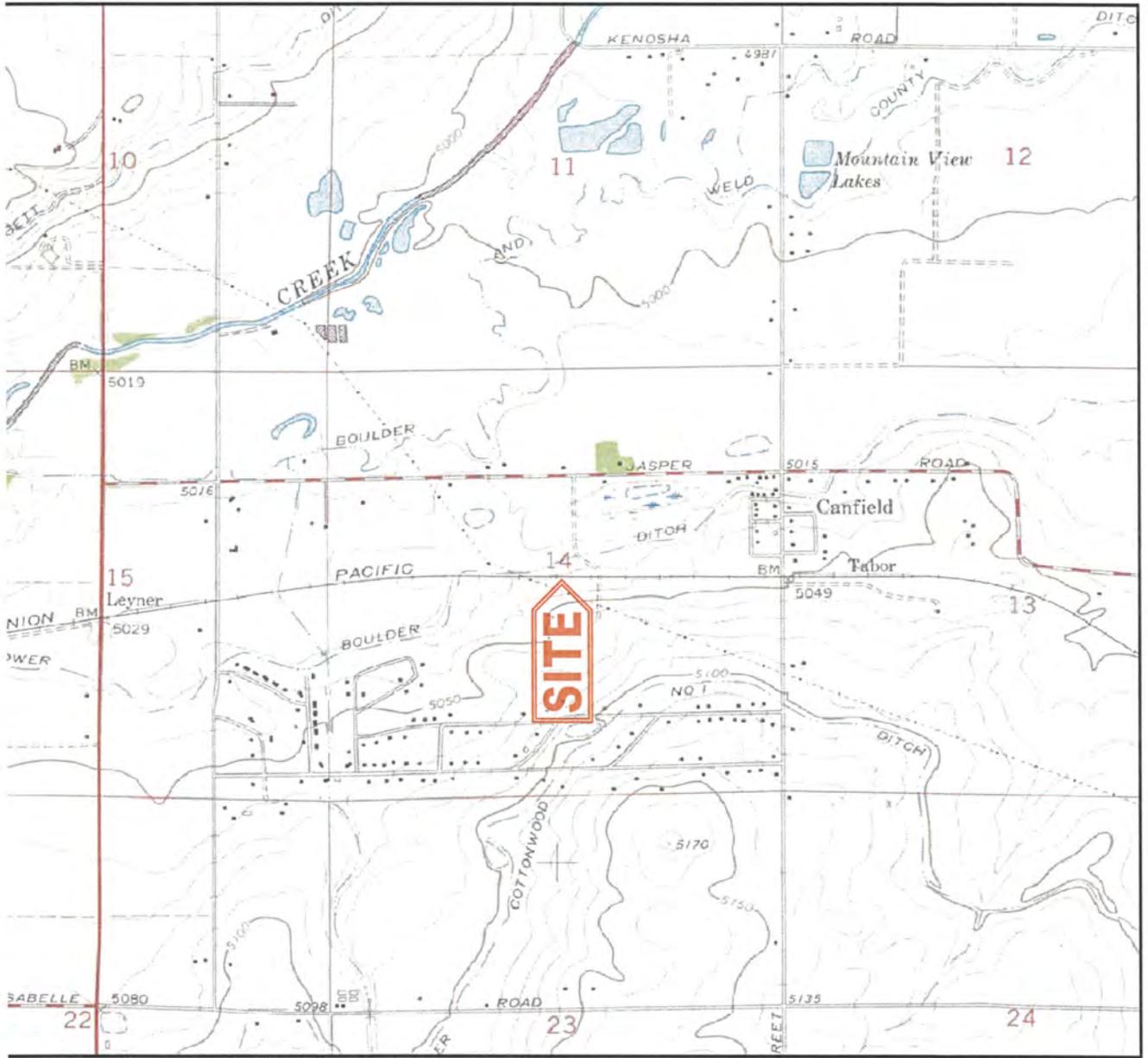
These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

[See Symbol Key](#)

Original scale = 1:24000 |----- ~1 mile -----|



1971 7.5' Erie Quadrangle



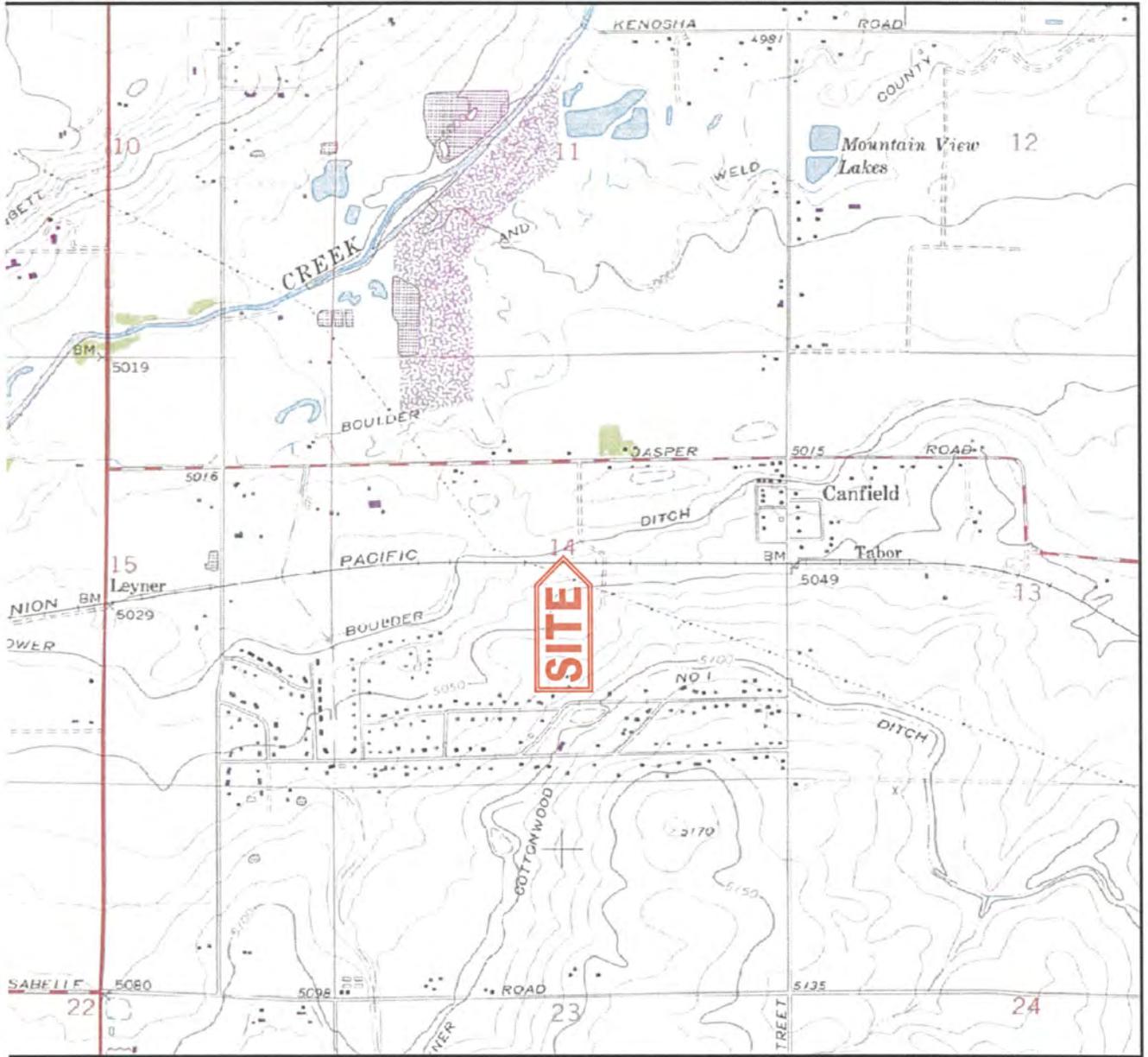
These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

[See Symbol Key](#)

Original scale = 1:24000 |----- ~1 mile -----|



1978 7.5' Erie Quadrangle



These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

[See Symbol Key](#)

Original scale = 1:24000 |----- ~1 mile -----|



AERIAL PHOTOGRAPHS

Subject Property

Wise Property
SW of Jasper Road & N 119th Street
Erie, CO 80026

December 17, 2012

Performed For: A.G. Wassenaar, Inc
2180 S Ivanhoe Street
Denver, CO 80222
Attn: Kristin Schwartz
Ref: E12776.E1

The following photos were ordered:

Year	Note
1979	
1966	
1937	Earliest found.

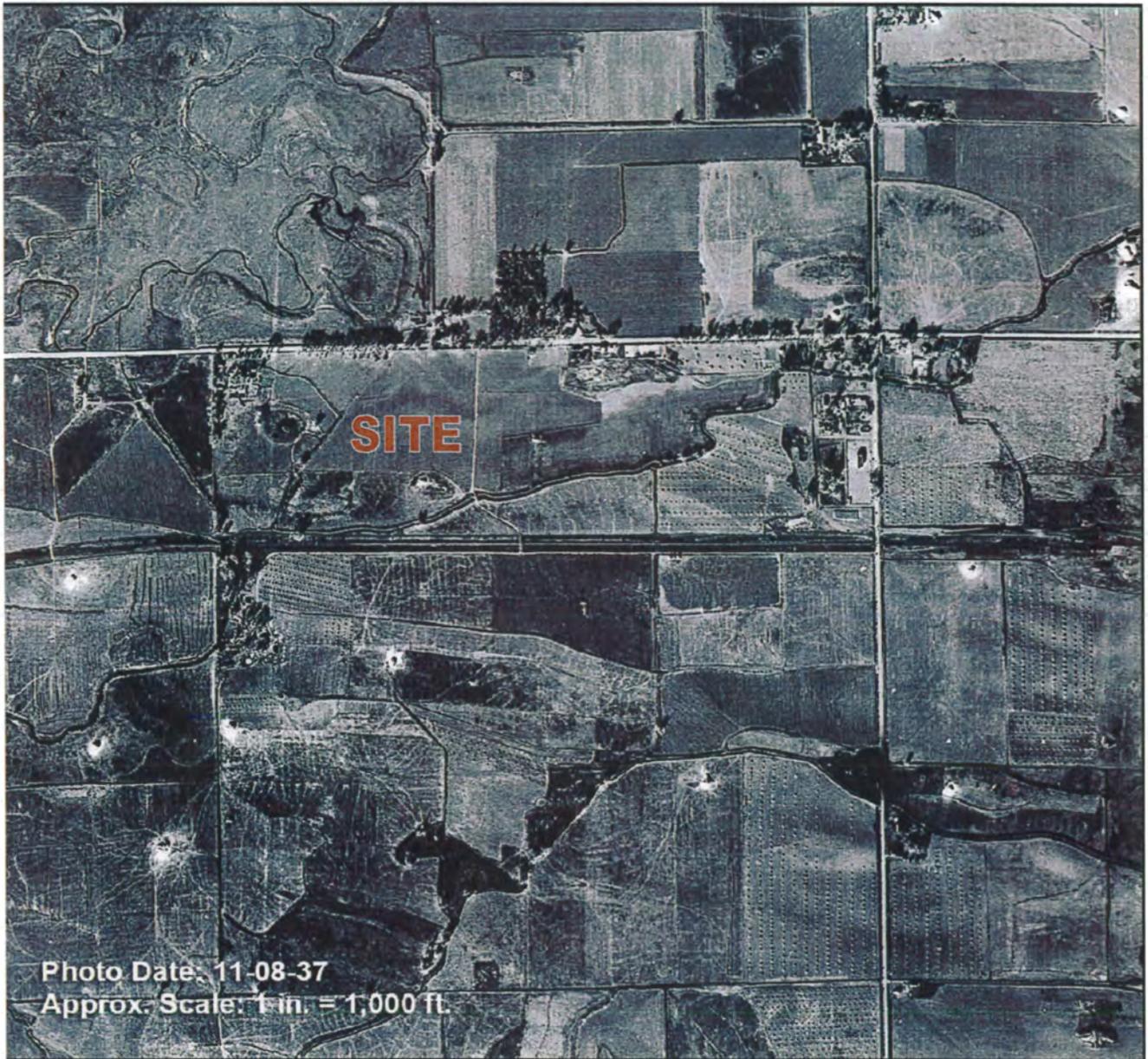
The Colorado Aerial Photo Service (CAPS) collection covers most developed areas of the Front Range annually from 1948. The originals are enlarged to a scale that is intended to show the Subject Property and the properties that surround it. The originals can be viewed in stereo and under high-power magnification at CAPS, 2757 W. Second Avenue in Denver, for a minimal handling fee. Call CAPS at 303-934-2419 or 800-215-2681 to have prints pulled and waiting.

Please note that the accuracy and suitability of public and private records cannot be guaranteed, nor can this research. No warranty is made or implied. By using this report, the reader agrees to assume all related risk and to release Satisfi from liability for any damages. However, if this report is not 100% satisfactory, a full refund will be issued.



1937

Earliest found.

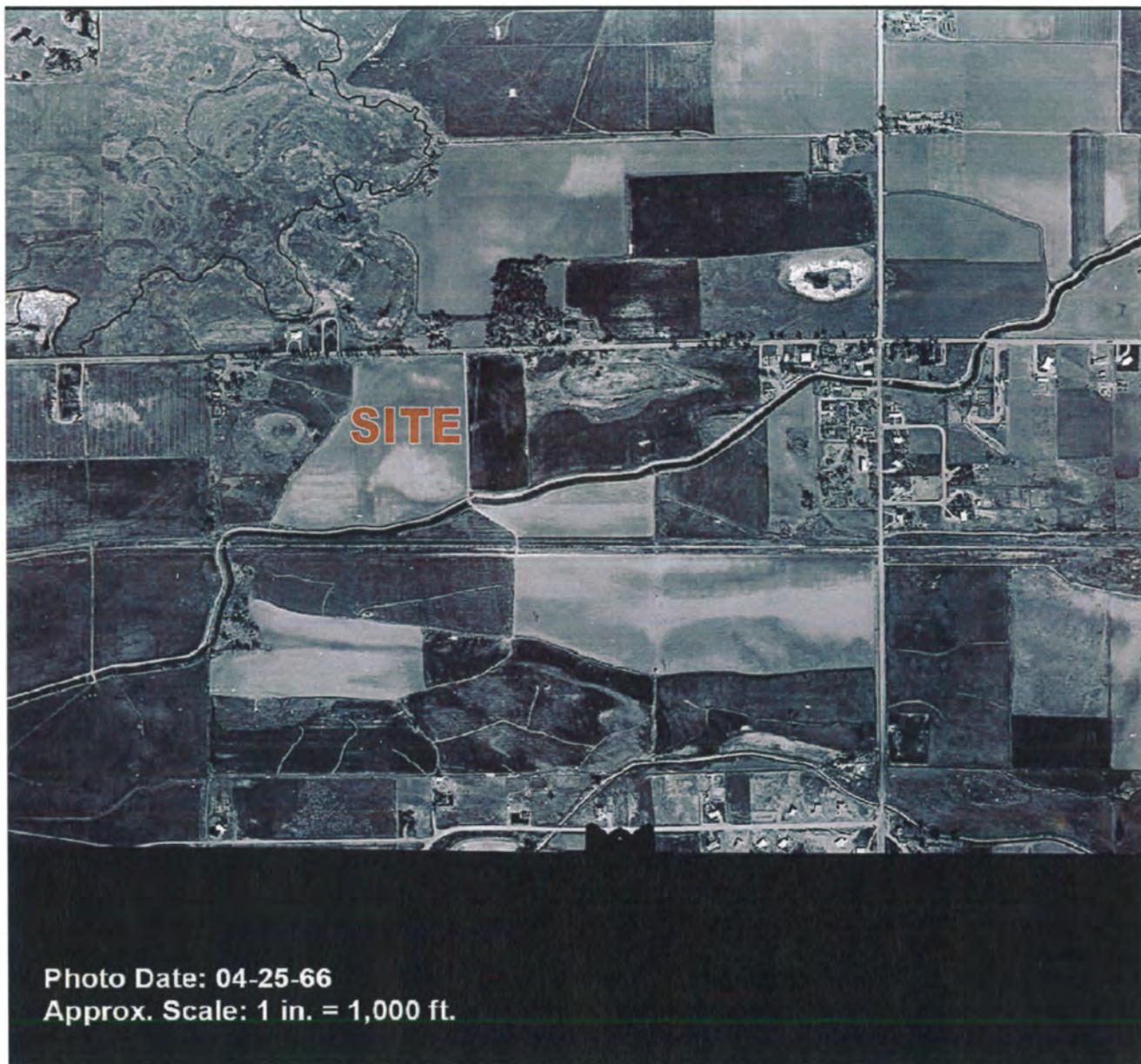


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NORTH

1966

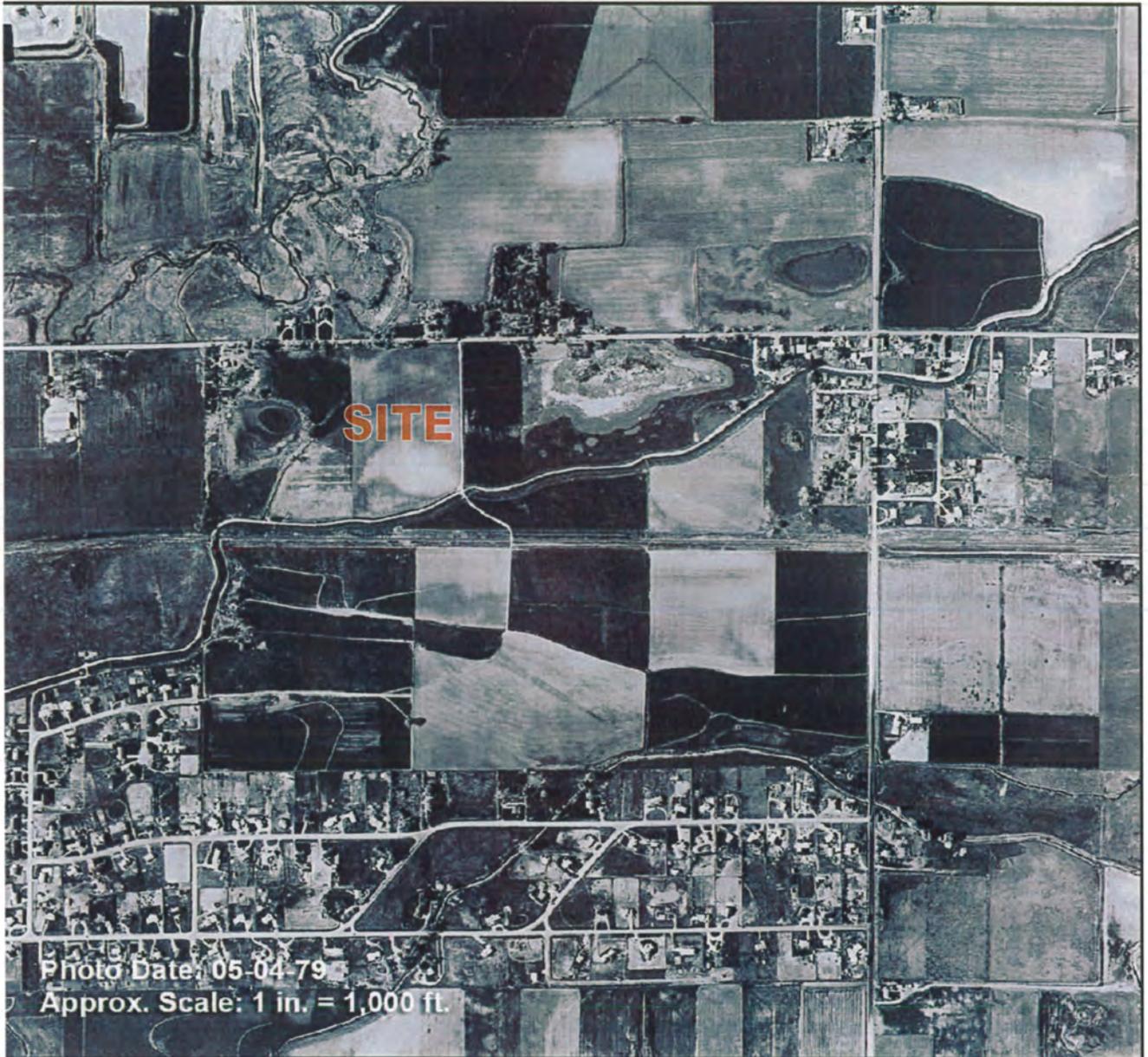


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 NORTH

1979



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NORTH

ATTACHMENT D
PUBLIC RECORDS RESEARCH

InfoMap

Technologies Incorporated

Environmental FirstSearch™ Report

Target Property: WISE PROPERTY

JASPER RD AND N 119TH ST

ERIE CO 80026

Job Number: E12776.E1

PREPARED FOR:

A.G. Wassenaar, Inc
2180 S Ivanhoe Street
Denver, CO 80222

by Satisfi, Inc

720-200-9472

12-17-12



Tel: (610) 430-7530

Fax: (610) 430-7535

**Environmental FirstSearch
Site Information Report**

Request Date: 12-17-12
Requestor Name: Brian Peterson
Standard: ASTM-05

Search Type: AREA
 0.29 sq mile(s)
Job Number: E12776.E1
Filtered Report

Target Site: JASPER RD AND N 119TH ST
 ERIE CO 80026

Demographics

Sites: 4	Non-Geocoded: 4	Population: NA
Radon: 2.2 - 4.7 PCI/L		

Site Location

	<u>Degrees (Decimal)</u>	<u>Degrees (Min/Sec)</u>		<u>UTMs</u>
Longitude:	-105.081747	-105:4:54	Easting:	493027.121
Latitude:	40.051104	40:3:4	Northing:	4433222.35
Elevation:	N/A		Zone:	13

Comment

Comment:

Additional Requests/Services

Adjacent ZIP Codes: 1 Mile(s)					Services:	
ZIP Code	City Name	ST	Dist/Dir	Sel	Requested?	Date
80504	LONGMONT	CO	0.11 NW	Y	Fire Insurance Maps	No
80516	ERIE	CO	0.00 --	Y	Aerial Photographs	No
					Historical Topos	No
					City Directories	No
					Title Search/Env Liens	No
					Municipal Reports	No
					Online Topos	No

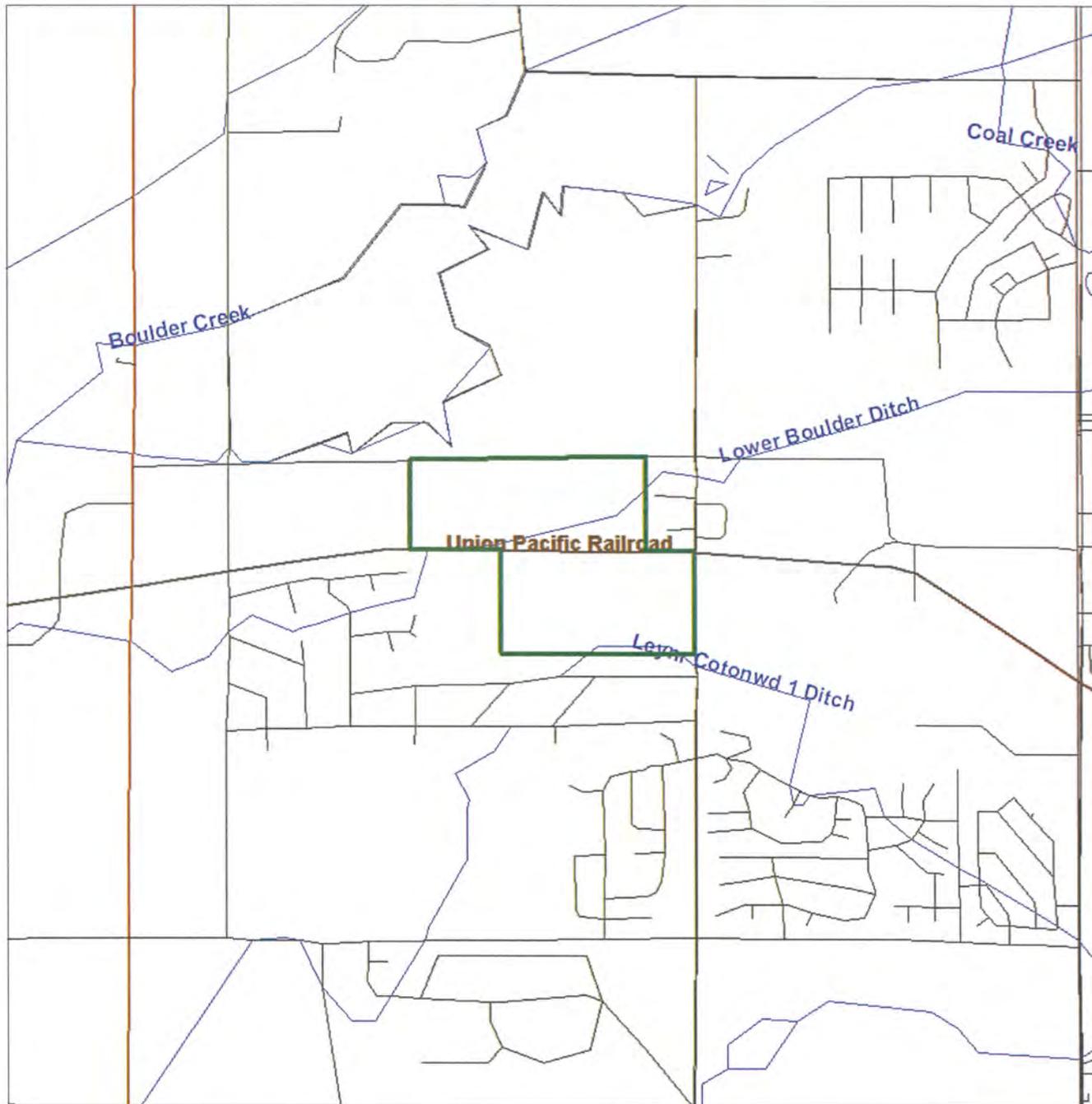


Environmental FirstSearch

1 Mile Radius from Area
Single Map:



JASPER RD AND N 119TH ST, ERIE CO 80026



Source: 2005 U.S. Census TIGER Files

Area Polygon	
Identified Site, Multiple Sites, Receptor	
NPL, DELNPL, Brownfield, Solid Waste Landfill (SWL), Hazardous Waste	
Triballand	
Railroads	

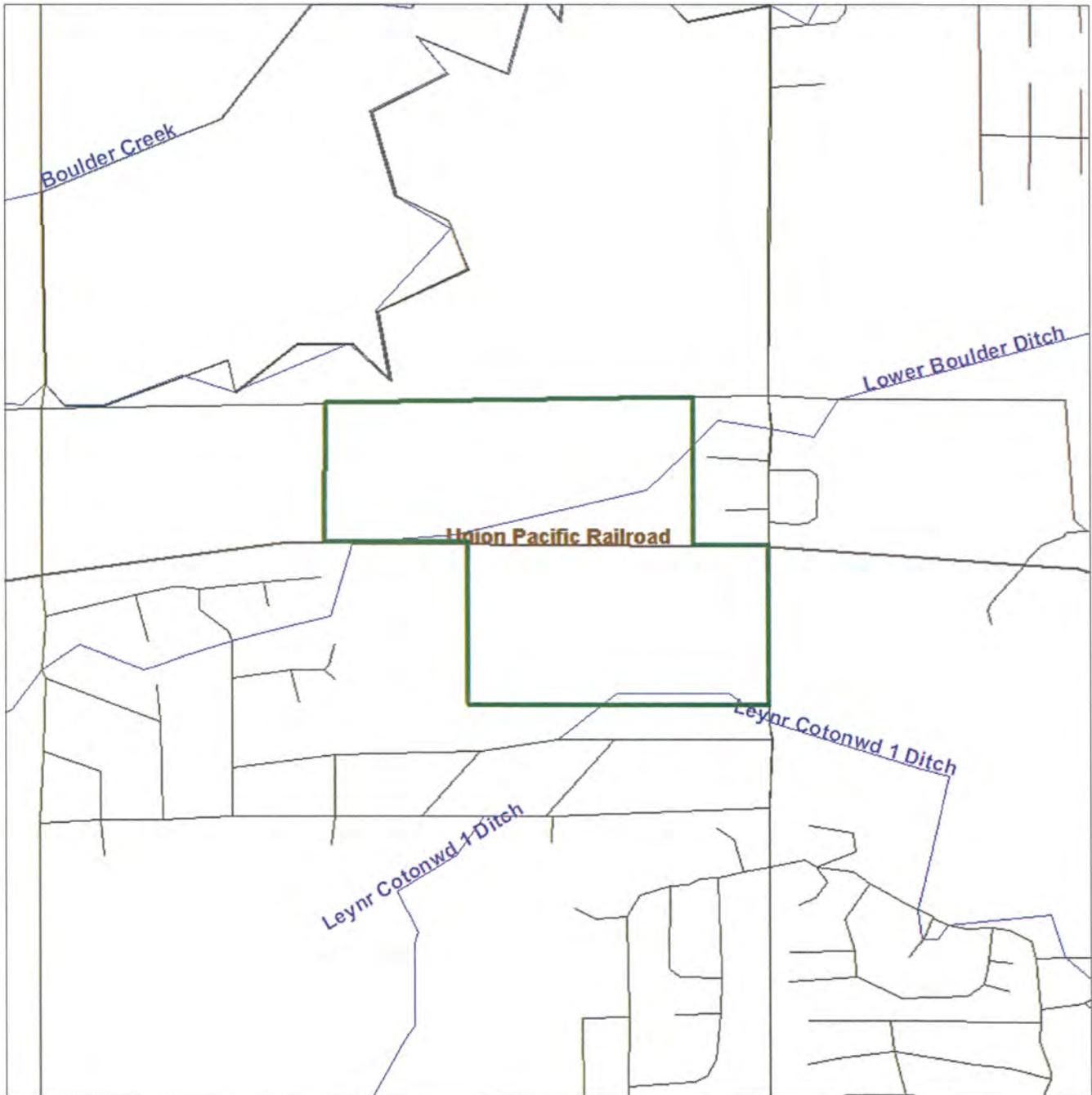


Environmental FirstSearch

.5 Mile Radius from Area
Single Map:



JASPER RD AND N 119TH ST, ERIE CO 80026



Source: 2005 U.S. Census TIGER Files

Area Polygon	
Identified Site, Multiple Sites, Receptor	
NPL, DELNPL, Brownfield, Solid Waste Landfill (SWL), Hazardous Waste	
Triballand	
Railroads	

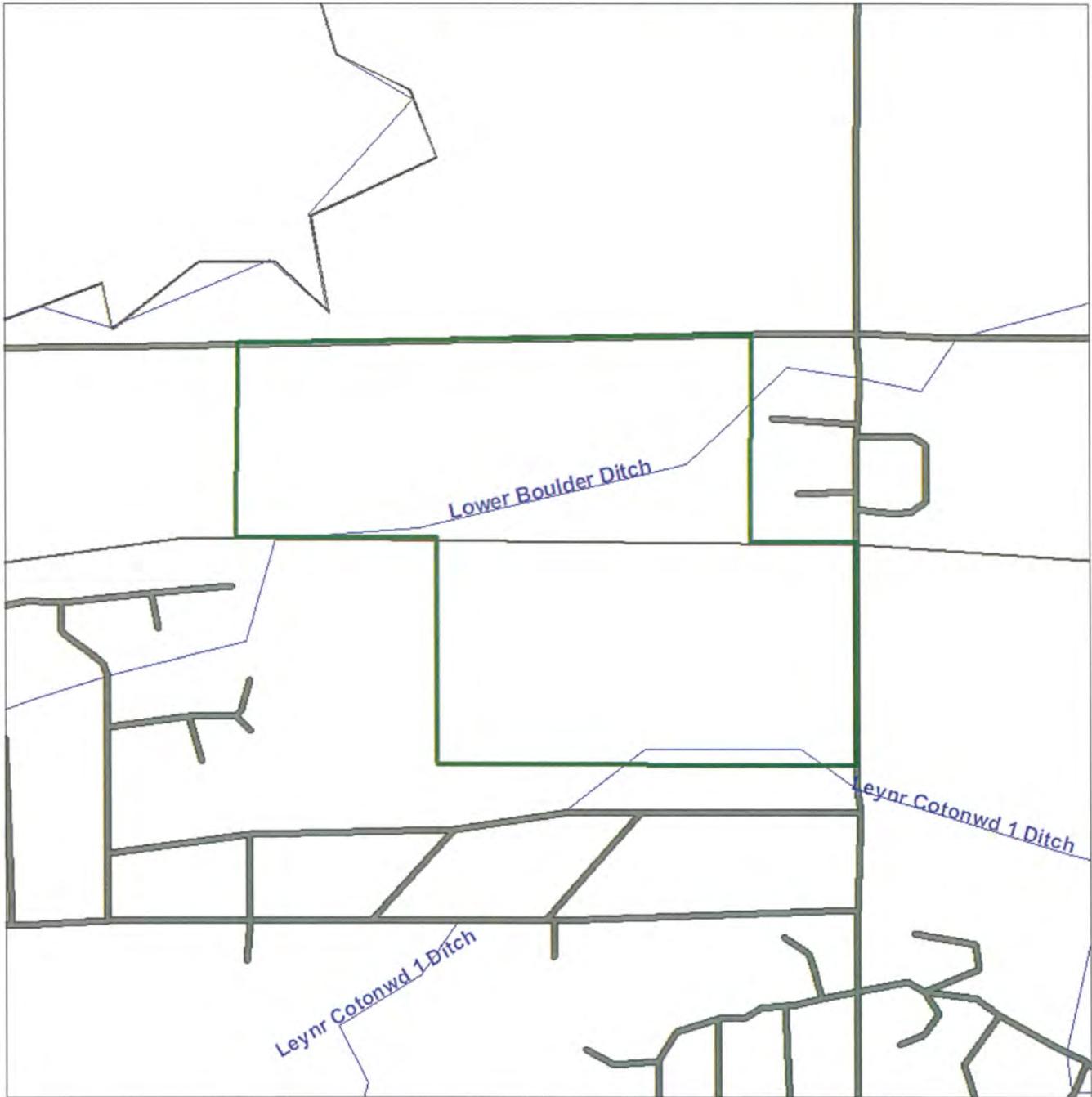


Environmental FirstSearch

.25 Mile Radius from Area
Single Map:



JASPER RD AND N 119TH ST, ERIE CO 80026



Source: 2005 U.S. Census TIGER Files

Area Polygon	
Identified Site, Multiple Sites, Receptor	
NPL, DELNPL, Brownfield, Solid Waste Landfill (SWL), Hazardous Waste	
Triballand.....	
Railroads	

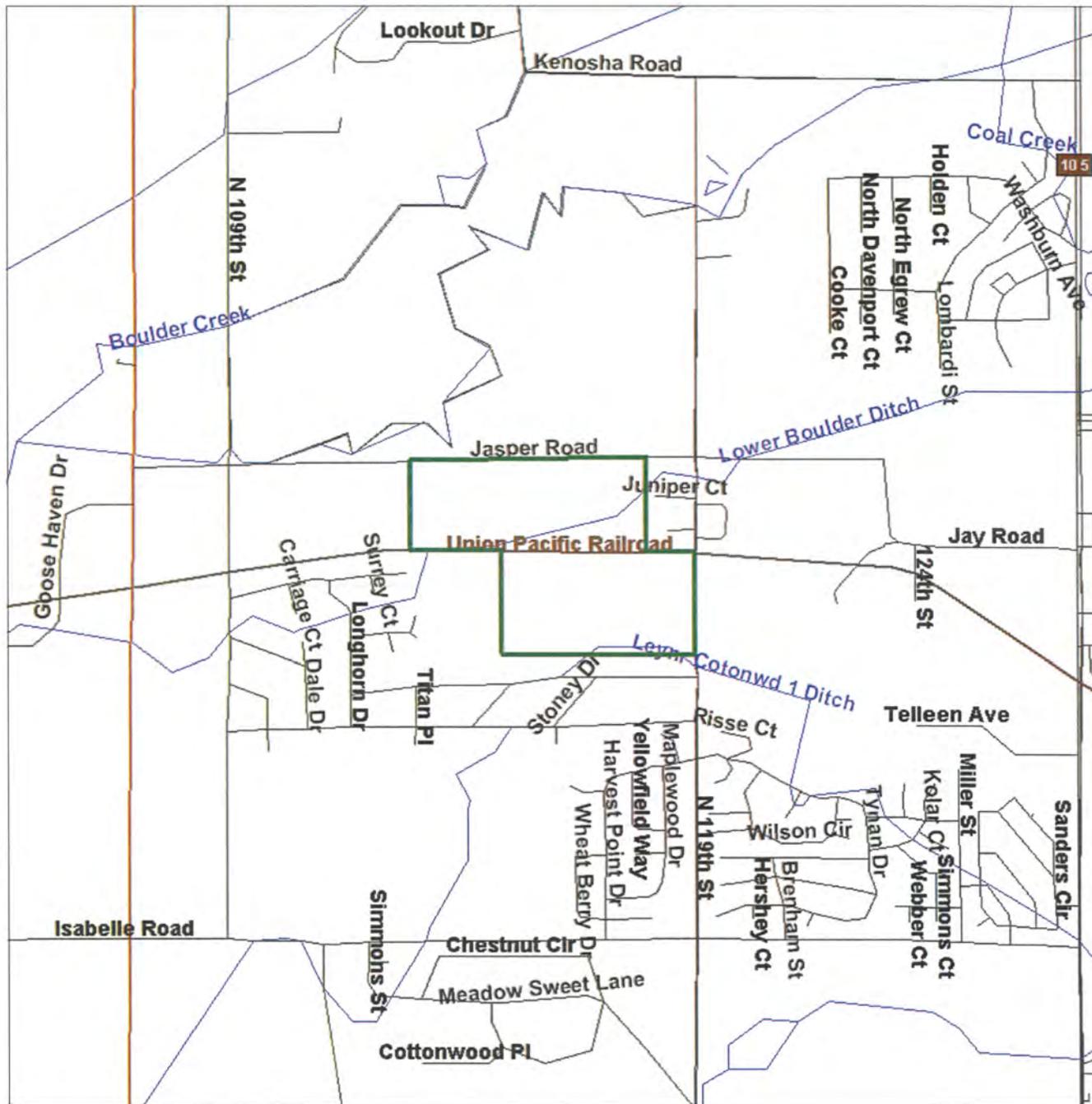


Environmental FirstSearch

1 Mile Radius from Area
Site Locus Map:



JASPER RD AND N 119TH ST, ERIE CO 80026



Source: 2005 U.S. Census TIGER Files

Area Polygon	
Identified Site, Multiple Sites, Receptor	
NPL, DELNPL, Brownfield, Solid Waste Landfill (SWL), Hazardous Waste	
Triballand	
Railroads	

Environmental FirstSearch Search Summary Report

Target Site: JASPER RD AND N 119TH ST
ERIE CO 80026

FirstSearch Summary

Database	Sel	Updated	Radius	Site	1/8	1/4	1/2	1/2>	ZIP	TOTALS
NPL	Y	09-20-12	1.00	0	0	0	0	0	0	0
NPL Delisted	Y	09-20-12	0.50	0	0	0	0	-	0	0
CERCLIS	Y	10-01-12	0.50	0	0	0	0	-	0	0
NFRAP	Y	10-01-12	0.50	0	0	0	0	-	0	0
RCRA COR ACT	Y	09-11-12	1.00	0	0	0	0	0	0	0
RCRA TSD	Y	09-11-12	0.50	0	0	0	0	-	0	0
RCRA GEN	Y	09-11-12	0.25	0	0	0	-	-	0	0
RCRA NLR	Y	09-11-12	0.25	0	0	0	-	-	0	0
Federal Brownfield	Y	10-14-12	0.25	0	0	0	-	-	0	0
ERNS	Y	10-04-12	0.25	0	0	0	-	-	0	0
Tribal Lands	Y	12-15-08	1.00	0	0	0	0	0	0	0
State/Tribal Sites	Y	08-01-07	1.00	0	0	0	0	0	0	0
State Spills 90	Y	10-15-12	0.25	0	0	0	-	-	0	0
State/Tribal SWL	Y	07-01-11	0.50	0	0	0	0	-	4	4
State/Tribal LUST	Y	10-17-12	0.50	0	0	0	0	-	0	0
State/Tribal UST/AST	Y	10-17-12	0.25	0	0	0	-	-	0	0
State/Tribal EC	Y	04-24-12	0.25	0	0	0	-	-	0	0
State/Tribal VCP	Y	10-17-12	0.50	0	0	0	0	-	0	0
Federal IC/EC	Y	12-13-12	0.25	0	0	0	-	-	0	0
Meth Labs	Y	12-02-11	0.25	0	0	0	-	-	0	0
- TOTALS -				0	0	0	0	0	4	4

Notice of Disclaimer

Due to the limitations, constraints, inaccuracies and incompleteness of government information and computer mapping data currently available to InfoMap Technologies, certain conventions have been utilized in preparing the locations of all federal, state and local agency sites residing in InfoMap Technologies's databases. All EPA sites are depicted by a rectangle approximating their location and size. The boundaries of the rectangles represent NPL and state landfill the eastern and western most longitudes; the northern and southern most latitudes. As such, the mapped areas may exceed the actual areas and do not represent the actual boundaries of these properties. All other sites are depicted by a point representing their approximate address location and make no attempt to represent the actual areas of the associated property. Actual boundaries and locations of individual properties can be found in the files residing at the agency responsible for such information.

Waiver of Liability

Although InfoMap Technologies uses its best efforts to research the actual location of each site, InfoMap Technologies does not and can not warrant the accuracy of these sites with regard to exact location and size. All authorized users of InfoMap Technologies's services proceeding are signifying an understanding of InfoMap Technologies's searching and mapping conventions, and agree to waive any and all liability claims associated with search and map results showing incomplete and or inaccurate site locations.

*Environmental FirstSearch
Sites Summary Report*

Target Property: JASPER RD AND N 119TH ST
ERIE CO 80026

JOB: E12776.E1

TOTAL: 4 **GEOCODED:** 0 **NON GEOCODED:** 4 **SELECTED:** 4

Map ID	Dist/Dir	DB Type	Site Name/ID/Status	Address	ElevDiff	Page No.
<i>NON GC</i>	<i>SWL</i>	<i>SWL</i>	<i>OLD ERIE LANDFILL 12-1367/HISTORIC</i>	<i>UNKNOWN ERIE CO</i>	<i>N/A</i>	<i>1</i>
<i>NON GC</i>	<i>SWL</i>	<i>SWL</i>	<i>NEUHAUSER DUMP 12-1371/HISTORIC</i>	<i>UNKNOWN ERIE CO</i>	<i>N/A</i>	<i>2</i>
<i>NON GC</i>	<i>SWL</i>	<i>SWL</i>	<i>HORST/DEAMIN 12-137/HISTORIC</i>	<i>UNKNOWN ERIE CO</i>	<i>N/A</i>	<i>3</i>
<i>NON GC</i>	<i>SWL</i>	<i>SWL</i>	<i>AL CARTON DUMP 12-1368/HISTORIC</i>	<i>UNKNOWN ERIE CO</i>	<i>N/A</i>	<i>4</i>

Environmental FirstSearch
Site Detail Report

Target Property: JASPER RD AND N 119TH ST
ERIE CO 80026

JOB: E12776.E1

SWL

SEARCH ID: 4 **DIST/DIR:** NON GC **ELEVATION:** **MAP ID:**

NAME: OLD ERIE LANDFILL
ADDRESS: UNKNOWN
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-1367
ID2: 00070-0002197
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

AT FORMER LANDFILL NUMEROUS CHEMICALS. HAZARD TYPE: METHANE. IMPACT: GW.; Acres- 10 - 50
Type- LANDFILL
Fill- SLUDGE
Oper/Ownr/Othr- // PRATT PROPERTY LANDF., ,

*Environmental FirstSearch
Site Detail Report*

Target Property: JASPER RD AND N 119TH ST
ERIE CO 80026

JOB: E12776.E1

SWL

SEARCH ID: 3	DIST/DIR: NON GC	ELEVATION:	MAP ID:
---------------------	-------------------------	-------------------	----------------

NAME: NEWHAUSER DUMP	REV: 12/01/08
ADDRESS: UNKNOWN	ID1: 12-1371
ERIE CO	ID2: 00070-0002201
WELD	STATUS: HISTORIC
CONTACT:	PHONE:
SOURCE: CDPHE/COUNTY	

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

: Acres- 10 - 50
Type- LANDFILL
Fill- REFUSE.
Oper/Ownr/Othr- // NEWHAUSER, ,

*Environmental FirstSearch
Site Detail Report*

Target Property: JASPER RD AND N 119TH ST
ERIE CO 80026

JOB: E12776.E1

SWL

SEARCH ID: 2	DIST/DIR: NON GC	ELEVATION:	MAP ID:
---------------------	-------------------------	-------------------	----------------

NAME: HORST/DEAMIN
ADDRESS: UNKNOWN
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-137
ID2: 00070-0002200
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

; Acres- 50 - 100
Type- LANDFILL
Fill- REFUSE
Oper/Ownr/Othr- , ,

*Environmental FirstSearch
Site Detail Report*

Target Property: JASPER RD AND N 119TH ST
ERIE CO 80026

JOB: E12776.E1

SWL

SEARCH ID: 1	DIST/DIR: NON GC	ELEVATION:	MAP ID:
---------------------	-------------------------	-------------------	----------------

NAME: AL CARTON DUMP
ADDRESS: UNKNOWN
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-1368
ID2: 00070-0002198
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

USED FOR SEPTIC TANK and GREASE TRAP CLE. IMPACT: SW.; Acres- 1 - 10
Type- LANDFILL
Fill- LIQUIDS.
Oper/Ownr/Othr- , ,

Environmental FirstSearch Descriptions

NPL: *EPA* NATIONAL PRIORITY LIST - The National Priorities List is a list of the worst hazardous waste sites that have been identified by Superfund. Sites are only put on the list after they have been scored using the Hazard Ranking System (HRS), and have been subjected to public comment. Any site on the NPL is eligible for cleanup using Superfund Trust money.

A Superfund site is any land in the United States that has been contaminated by hazardous waste and identified by the Environmental Protection Agency (EPA) as a candidate for cleanup because it poses a risk to human health and/or the environment.

FINAL - Currently on the Final NPL

PROPOSED - Proposed for NPL

NPL DELISTED: *EPA* NATIONAL PRIORITY LIST Subset - Database of delisted NPL sites. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

DELISTED - Deleted from the Final NPL

CERCLIS: *EPA* COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY INFORMATION SYSTEM (CERCLIS)- CERCLIS is a database of potential and confirmed hazardous waste sites at which the EPA Superfund program has some involvement. It contains sites that are either proposed to be or are on the National Priorities List (NPL) as well as sites that are in the screening and assessment phase for possible inclusion on the NPL.

PART OF NPL- Site is part of NPL site

DELETED - Deleted from the Final NPL

FINAL - Currently on the Final NPL

NOT PROPOSED - Not on the NPL

NOT VALID - Not Valid Site or Incident

PROPOSED - Proposed for NPL

REMOVED - Removed from Proposed NPL

SCAN PLAN - Pre-proposal Site

WITHDRAWN - Withdrawn

NFRAP: *EPA* COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY INFORMATION SYSTEM ARCHIVED SITES - database of Archive designated CERCLA sites that, to the best of EPA's knowledge, assessment has been completed and has determined no further steps will be taken to list this site on the National Priorities List (NPL). This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

NFRAP - No Further Remedial Action Plan

P - Site is part of NPL site

D - Deleted from the Final NPL

F - Currently on the Final NPL

N - Not on the NPL

O - Not Valid Site or Incident

P - Proposed for NPL

R - Removed from Proposed NPL

S - Pre-proposal Site

W - Withdrawn

RCRA COR ACT: *EPA* RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM SITES - Database of hazardous waste information contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984.

RCRAInfo facilities that have reported violations and subject to corrective actions.

RCRA TSD: *EPA* RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM TREATMENT, STORAGE, and DISPOSAL FACILITIES. - Database of hazardous waste information contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984.

Facilities that treat, store, dispose, or incinerate hazardous waste.

RCRA GEN: *EPA/MA DEP/CT DEP* RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM GENERATORS - Database of hazardous waste information contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984.

Facilities that generate or transport hazardous waste or meet other RCRA requirements.

LGN - Large Quantity Generators

SGN - Small Quantity Generators

VGN – Conditionally Exempt Generator.

Included are RAATS (RCRA Administrative Action Tracking System) and CMEL (Compliance Monitoring & Enforcement List) facilities.

CONNECTICUT HAZARDOUS WASTE MANIFEST – Database of all shipments of hazardous waste within, into or from Connecticut. The data includes date of shipment, transporter and TSD info, and material shipped and quantity. This data is appended to the details of existing generator records.

MASSACHUSETTES HAZARDOUS WASTE GENERATOR – database of generators that are regulated under the MA DEP.

VQN-MA = generates less than 220 pounds or 27 gallons per month of hazardous waste or waste oil.

SQN-MA = generates 220 to 2,200 pounds or 27 to 270 gallons per month of waste oil.

LQG-MA = generates greater than 2,200 lbs of hazardous waste or waste oil per month.

RCRA NLR: *EPA* RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM SITES - Database of hazardous waste information contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984.

Facilities not currently classified by the EPA but are still included in the RCRAInfo database. Reasons for non classification:

Failure to report in a timely matter.

No longer in business.

No longer in business at the listed address.

No longer generating hazardous waste materials in quantities which require reporting.

ERNS: *EPA/NRC* EMERGENCY RESPONSE NOTIFICATION SYSTEM (ERNS) - Database of incidents reported to the National Response Center. These incidents include chemical spills, accidents involving chemicals (such as fires or explosions), oil spills, transportation accidents that involve oil or chemicals, releases of radioactive materials, sightings of oil sheens on bodies of water, terrorist incidents involving chemicals, incidents where illegally dumped chemicals have been found, and drills intended to prepare responders to handle these kinds of incidents. Data since January 2001 has been received from the National Response System database as the EPA no longer maintains this data.

Tribal Lands: *DOI/BIA* INDIAN LANDS OF THE UNITED STATES - Database of areas with boundaries established by treaty, statute, and (or) executive or court order, recognized by the Federal Government as territory in which American Indian tribes have primary governmental authority. The Indian Lands of the United States map layer shows areas of 640 acres or more, administered by the Bureau of Indian Affairs. Included are

Federally-administered lands within a reservation which may or may not be considered part of the reservation.
BUREAU OF INDIAN AFFIARS CONTACT - Regional contact information for the Bureau of Indian Affairs offices.

State/Tribal Sites: *CDPHE* CO SPL - Colorado does not have an official State Priority List (SPL). However, there are a number of sites that the state seems to place in this sort of category. Some are officially a Natural Resource Damages Site (NRDS) or Private Cleanup Site (Non-Superfund), but they're listed on the state's web page of Superfund sites (www.cdphe.state.co.us/hm/sf_sites.htm). Others are UMTRA (Uranium Mill Tailing Remedial Action) mill tailing cleanup sites (www.cdphe.state.co.us/hm/umsites.htm). Thousands of UMTRA "vicinity properties" have also been identified where mill tailings were used as sand in concrete, roadbase, trenches, bricks, etc. Such properties have been remediated in Durango, Grand Junction, Fruita, Palisade, Gunnison, Maybell, Naturita and Rifle, but some unidentifed tailings may still remain in and around these communities. CDPHE's list of vicinity properties is not publicly available and was not searched for this report. Property-specific information is available through the CDPHE Grand Junction office. See www.cdphe.state.co.us/hm/rptailng.htm.

State Spills 90: *CDPHE* ENVIRONMENTAL RELEASE AND INCIDENT DATABASE - This is a database of reported spills in Colorado.

State/Tribal SWL: *CDPHE* DATABASE OF ACTIVE SOLID WASTE MANAGEMENT FACILITIES - Listing of Active solid waste facilities and transfer stations.

DATABASE OF ACTIVE SOLID WASTE MANAGEMENT FACILITIES - Listing of Active solid waste facilities and transfer stations.

CO Historic Landfills - This proprietary database represents a compilation of eleven local, regional and state agency sources. The agencies generated these lists on a one-time basis and do not expect to update them. A more detailed description of the applicable source is included with any findings reported from this database. The eleven sources are:

1. Adams County CO Old Landfills
2. Arapahoe County CO Old Landfills
3. Douglas County CO Old Landfills
4. Weld County CO Old Landfills
5. Boulder County CO Old Landfills
6. Jefferson County CO Old Landfills
7. Denver CO Methane Study
8. CO Methane Study
9. DRCOG Methane Study
10. Denver CO Old Fil Sites
11. CO Old Waste Sites

State/Tribal LUST: *COSTIS* DATABASE OF LEAKING UNDERGROUND STORAGE TANKS - Colorado Department of Labor and Employment's Colorado Storage Tank Information System (COSTIS) provides this data.

LUST Trust Tanks - This is an old list of locations where tank leaks were suspected and LUST (Leaking Underground Storage Tank) Trust funds were used in an effort to identify the source. Often, the facility responsible for the leak was found nearby, and that facility was then entered into the LUST database. In other cases, however, the source was never identified, and nothing was ever entered into the LUST database. When responsibility for the tank program was transferred from CDPHE (Colorado Department of Public Health & Environment) to CDLE (Colorado Department of Labor & Employment) in the '90s, this old LUST Trust list was never entered into the new COSTIS database (Colorado Storage Tank Information System). Few people at CDLE are aware of this old list, and any files associated with the listings have apparently been discarded or misplaced.

State/Tribal UST/AST: *COSTIS* DATABASE OF UNDERGROUND STORAGE TANKS - Colorado Department of Labor and Employment's Colorado Storage Tank Information System (COSTIS) provides this data.

State/Tribal EC: *CDPHE* ENVIRONMENTAL COVENANTS - Senate Bill 01-145 gave authority to the Colorado Department of Public Health and Environment to approve requests to restrict the future use of a property using an enforceable agreement called an environmental covenant. When a contaminated site is not cleaned up completely, land use restrictions may be used to ensure that the selected cleanup remedy is

adequately protective of human health and the environment.

State/Tribal VCP: *CDPHE* THE VOLUNTARY CLEANUP AND REDEVELOPMENT PROGRAM PROGRAM - The Voluntary Cleanup and Redevelopment program was created in 1994. The objective of the program is to facilitate the redevelopment and transfer of contaminated properties. Cleanup decisions are based on existing standards and the proposed use of the property. The actual cleanup and verification is the owner's responsibility.

RADON: *NTIS* NATIONAL RADON DATABASE - EPA radon data from 1990-1991 national radon project collected for a variety of zip codes across the United States.

Meth Labs: *US DOJ* NATIONAL CLANDESTINE LABORATORY REGISTER - Database of addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the U.S. Department of Justice ("the Department"), and the Department has not verified the entry and does not guarantee its accuracy. All sites that are included in this data set will have an id that starts with NCLR.

Environmental FirstSearch Database Sources

NPL: *EPA* Environmental Protection Agency

Updated quarterly

NPL DELISTED: *EPA* Environmental Protection Agency

Updated quarterly

CERCLIS: *EPA* Environmental Protection Agency

Updated quarterly

NFRAP: *EPA* Environmental Protection Agency.

Updated quarterly

RCRA COR ACT: *EPA* Environmental Protection Agency.

Updated quarterly

RCRA TSD: *EPA* Environmental Protection Agency.

Updated quarterly

RCRA GEN: *EPA/MA DEP/CT DEP* Environmental Protection Agency, Massachusetts Department of Environmental Protection, Connecticut Department of Environmental Protection

Updated quarterly

RCRA NLR: *EPA* Environmental Protection Agency

Updated quarterly

ERNS: *EPA/NRC* Environmental Protection Agency

Updated annually

Tribal Lands: *DOI/BIA* United States Department of the Interior

Updated annually

State/Tribal Sites: *CDPHE* The Colorado Department of Public Health and Environment Hazardous Materials and Waste Management Division

Updated annually

State Spills 90: *CDPHE* CDPHE Hazardous Materials and Waste Management Division

Updated annually

State/Tribal SWL: *CDPHE* The Colorado Department of Public Health and Environment Hazardous Materials and Waste Management Division Public Safety

Updated annually

State/Tribal LUST: *COSTIS* The Colorado Department of Labor and Employment/Division of Oil and Public Safety

Updated semi-annually

State/Tribal UST/AST: *COSTIS* The Colorado Department of Labor and Employment/Division of Oil and Public Safety

Updated semi-annually

State/Tribal EC: *CDPHE* Colorado Department of Public Health and Environment Hazardous Materials and Waste Management Division

Updated annually

State/Tribal VCP: *CDPHE* The Colorado Department of Public Health and Environment Hazardous Materials and Waste Management Division

Updated annually

RADON: *NTIS* Environmental Protection Agency, National Technical Information Services

Updated periodically

Meth Labs: *US DOJ* U.S. Department of Justice

Updated when available

**ATTACHMENT E
QUALIFICATIONS**

RESUME

KRISTIN A. SCHWARTZ
Environmental Scientist

EDUCATION:

B.S., Environmental Engineering, University of Colorado at Boulder 2011.

EXPERIENCE:

Ms. Schwartz joined A.G. Wassenaar in July 2012 as a staff Environmental Scientist for the Environmental Department. Ms. Schwartz's field experience includes assisting with characterizing and monitoring surface water contamination due to acid mine draining; conducting site investigations to determine how to most effectively remediate abandon mine shafts and adits; and determining bioremediation and chemical treatment solutions for wastewater treatment plants. This involves: water and soil sampling for identification and analysis, core sampling preparation, GPS site mapping, characterizing and measuring site specifications, oversight of remedial construction activities, and coordinating with landowners and contractors.

In addition to fieldwork, her responsibilities included technical report writing, review, and presentation, data analysis, analytical review and interpretation, proposal preparation, and regulatory compliance.

Previous to joining A.G. Wassenaar, Inc., Ms. Schwartz gained environmental remediation and government regulatory experience working as an Environmental Protection Specialist Intern for the Department of Natural Resources Inactive Mines program.

TRAINING:

40 Hour OSHA HAZWOPER certified
Engineer in Training (EIT) status

MEMBERSHIPS:

American Water Works Association (AWWA)
World Environment Federation (WEF)

RESUME

JULIE A. BRUNGARDT
Environmental Scientist

EDUCATION:

Bachelor's Degree in Environmental Studies, University of Colorado, Boulder, CO, 2002

EXPERIENCE:

Ms. Brungardt began working with A.G. Wassenaar, Inc. in May 2003. She was hired as a staff environmental scientist for the Environmental Department. Responsibilities include the following:

Industrial Hygiene

- Mold growth and moisture intrusion evaluations in response to water losses
- Initial and conformance mold inspections of basement subfloor and crawl spaces
- Indoor air quality investigations pertaining to mold and fungal growth
- Inspections following fires in residential or commercial buildings

Asbestos

- Air Monitoring Specialist (AMS) duties for asbestos abatement projects
- Asbestos surveys of commercial and residential buildings
- Asbestos sample collection including soil and building materials

Lead Based Paint

- Lead based paint testing within commercial and residential buildings

Phase I

- Site assessments for both buyers and sellers of commercial, industrial and residential real estate

TRAINING:

- EPA-Approved AHERA Asbestos Inspector
- Colorado State Certified Asbestos Building Inspector
- EPA-Approved AHERA Air Monitoring Specialist
- Colorado State Certified Air Monitoring Specialist
- Colorado State Certified Lead Based Paint Inspector
- Colorado State Certified Lead Risk Assessor
- National Environmental Health Association, Residential Radon Measurement Provider

MEMBERSHIPS:

- American Industrial Hygiene Association
- Colorado Environmental Professionals Association

ATTACHMENT F
REFERENCES

REFERENCES

Colorado Oil and Gas Conservation Commission. COGCC GIS Online. <<http://www.oil-gas.state.co.us/>>

CTL/Thompson, Inc. "Preliminary Geotechnical Investigation, Wise Farms, Southwest of Jasper Road and 119th Street, Erie, Colorado". 9 December 2005.

Dullea, Jim. Jasper Land Investments. Written Correspondence and Personal Interview. 20 December 2012.

Parker, Nancy. Town of Erie. Town Clerk. Written Records Request. 17 December 2012.

Satisfi Environmental Information. Environmental Database Search. "Wise Property, Erie, CO 80516". 17 December 2012.

Satisfi Environmental Information. Aerial Photographs. Dated 1937, 1979, and 1985.

Satisfi Environmental Information. Topographic Maps, Erie Quadrangle dated 1948, 1966, 1971, and 1978. 9 October 2012.

Satisfi Environmental Information. Topographic Maps, Niwot Quadrangle dated 1902. 9 October 2012.

Western Environment and Ecology, Inc. "Mine Subsidence Investigation, Wise Property, Section 14, Township 1 North, Range 68 West, Boulder County, Colorado". 31 May 2005.

Wise, Alan and Sarah. Personal Interview. 17 December 2012.



CTL | THOMPSON
INCORPORATED

**PRELIMINARY
GEOTECHNICAL INVESTIGATION
WISE FARMS
SOUTHWEST OF JASPER ROAD
AND 119TH STREET
ERIE, COLORADO**

Prepared For:

**177 JASPER INVESTMENTS, LLC
9162 South Kenwood Court
Highlands Ranch, Colorado 80216**

Attention: Mr. Jim Dullea

Project No. DN41,199-115

December 9, 2005



TABLE OF CONTENTS

SCOPE.....	1
SUMMARY AND FINDINGS OF CONCLUSIONS.....	1
SITE CONDITIONS.....	3
PROPOSED CONSTRUCTION	3
SUBSURFACE CONDITIONS	4
ESTIMATED POTENTIAL SWELL	5
SITE DEVELOPMENT.....	6
Overlot Grading.....	6
Underdrain	7
Utility Construction.....	7
Pavements	8
BUILDING CONSTRUCTION CONSIDERATIONS.....	8
Foundations.....	9
Floor Systems and Below-Grade Construction.....	9
Surface Drainage	9
CONCRETE	10
RECOMMENDED FUTURE INVESTIGATIONS.....	10
LIMITATIONS	11
FIG. 1 – LOCATIONS OF EXPLORATORY BORINGS	
FIG. 2 – ESTIMATED DEPTH TO BEDROCK	
FIG. 3 – ESTIMATED BEDROCK ELEVATION	
FIG. 4 – ESTIMATED DEPTH TO GROUND WATER	
FIG. 5 – ESTIMATED GROUND WATER ELEVATION	
FIG. 6 – PRELIMINARY EVALUATION OF SWELL RISK	
FIG. 7 – SEWER UNDERDRAIN DETAIL	
APPENDIX A – LOGS OF EXPLORATORY BORINGS	
APPENDIX B – LABORATORY TEST RESULTS	
APPENDIX C – GUIDELINE SITE GRADING SPECIFICATIONS	



SCOPE

This report presents the results of our Preliminary Geotechnical Investigation of Wise Farms (approximately 180 acres), located southwest of the intersection of Jasper Road and 119th Street in Erie, Colorado (Fig. 1). Our purpose was to evaluate the subsurface conditions to assist in planning and development of the site. The report includes descriptions of subsoil and ground water conditions found in our exploratory borings, and discussions of site development as influenced by geotechnical considerations. The scope was described in our proposal (No. DN 05-0900) dated September 30, 2005.

The report was prepared based on conditions disclosed by our exploratory borings, results of laboratory tests, engineering analysis of field and laboratory data and our experience with similar conditions. The criteria presented in the report are intended for preliminary planning purposes. Additional investigations will be required to design building foundations and pavements. A summary of our conclusions is presented below with more complete descriptions and results of field and laboratory tests included in the report.

SUMMARY OF FINDINGS AND CONCLUSIONS

1. The site is judged suitable for development. The primary geotechnical concern for this site is relatively shallow ground water. Based on current ground water levels and grades only about 30 percent of the site is available for basement construction. Relatively soft soil is present in shallow ground water areas. These concerns can be mitigated with proper planning, engineering, design and construction. We believe there are no geotechnical constraints at this site that would preclude development.
2. Subsoils found in the borings generally consisted of 3.5 to more than 35 feet of sandy clay and/or clean to silty, clayey, and gravelly sand and gravel underlain by weathered to comparatively unweathered claystone, sandstone and interbedded claystone/sandstone bedrock. Bedrock is comparatively shallow in the south-central portion of the site. Samples of the clay exhibited predominantly low swell. Sand and gravel is judged non-expansive. Claystone bedrock samples were moderate or high swelling, but typically at depths not likely to influence performance of foundations. The sandstone is judged to be non-expansive.



3. Ground water was encountered during drilling in 34 of the 42 borings at depths ranging from 5 to 24 feet below the existing ground surface. When the holes were checked several days after drilling, ground water was measured in 29 borings at depths ranging from 3.5 to 21 feet. Some of the borings had caved, likely near the depth of ground water. Ground water was measured at depths less than 11 feet in 50 percent of the borings. The site is crossed by two active irrigation canals. The canals are likely responsible for the relatively shallow ground water levels we noted. Ground water levels are expected to vary seasonally and may rise after development as irrigation of landscaping begins.
4. Preliminary information indicates an option for development in shallow ground water areas would be to raise existing grades in areas where ground water is within about 3 feet of foundation levels to avoid very moist, soft soils. Basement levels should be no less than 3 feet and preferably at least 5 feet above ground water. Footing or post-tensioned slab (PTS) foundations will likely be appropriate for the majority of the site. Drilled pier foundations may be required for some sites in the south portion of the site where expansive bedrock is relatively shallow. Fill placed during site grading may influence the type of foundation required for each building site. Design-level investigations should be performed for each structure and for pavements.
5. We judge most of the site is at low risk for poor basement slab-on-grade performance. This site has comparatively good soil conditions for slab-on-grade floors, compared to most sites in the Denver area. We estimate potential heave due to swelling soil will likely be about 1 inch for most of the site, and about 1 to 3 inches for about 15 percent of the site in the southeast portion.
6. Control of surface and subsurface water helps mitigate ground water related problems. We recommend an underdrain system be considered at this site to provide a means to control ground water, particularly if below grade spaces are planned. We recommend foundation drains be installed around below-grade construction and connected to the underdrain in a manner allowing gravity discharge.
7. Overall surface drainage should be designed to provide rapid run-off of surface water away from the proposed structures. Water should not be allowed to pond near the crest of slopes, or on or adjacent to pavements. All permanent slopes should be re-vegetated to reduce erosion.



SITE CONDITIONS

The subject 180-acre parcel is located southwest of the intersection of Jasper Road and 119th Street in Erie, Colorado (Fig. 1). The property is divided into two portions, north and south, separated by a 100-foot railroad right-of-way. Several residences and farm structures are located in the north portion of the site, accessed via Jasper Road. The west third of this portion is currently occupied by cows and pigs. A canal crosses the north section west to east, with a wetlands area located in the northeast corner. The remainder of the north portion is utilized as farmland. A dirt road accesses the site, south of the canal. The south half of the site is currently used for farming. Dirt roads across the site lead to an oil and gas well (WISE #1-14X) in the western portion of the south half of the site. Records for production of the well are available from January 1999 to May 2005, and show mostly gas production with minimal oil production. An electric transmission line transverses the site from the southeast to the northwest. The site slopes gently down towards the north. Slopes in the north portion are 1 to 3 percent. Slopes in the south portion range from 2 to 6 percent. Residences surround the site beyond 119th Street to the east and to the south. Farmland and associated structures lie to the west, and to the north beyond Jasper Street. Topographic relief across the site is on the order of 90 feet.

PROPOSED CONSTRUCTION

Plans are preliminary at this time. Grading plans were not available. A conceptual layout by PCS Group shows mixed single and multi-family development, with large, single family lots in the southern portion of the site. We anticipate grades will remain within about 5 feet of existing grade, possibly with exception of areas of shallow ground water where grades may be raised to provide more separation between ground water and the ground surface. However, there are no obvious borrow areas that could be cut substantially and result in adequate depth to ground water. We should review grading plans once available. The conceptual layout for the site indicates single- and multi-family residences are planned. We anticipate the residences will be wood-framed, one and two story structures, typically with basements. For non-basement product, excavations are likely to be about 3 feet from grade. We anticipate



excavations of 6 to 8 feet will be required for slab-on-grade basement floor construction. Where structurally supported basement floors are installed, excavation depths of 8 to 10 feet may be necessary.

SUBSURFACE CONDITIONS

Subsurface conditions were investigated by drilling 42 borings to depths of 20 to 35 feet at the approximate locations shown on Fig. 1. Borings were spaced about 300 to 400 feet apart and were located using portable GPS. Borings were drilled using 4-inch diameter, continuous-flight auger and a truck-mounted drill rig. The drilling operations were observed by our field representative who logged the soils and obtained samples for laboratory testing. Summary logs of the soils and bedrock found in the borings and results of field penetration resistance tests are presented in Appendix A.

Samples obtained during drilling were returned to our laboratory where they were visually classified and samples were selected for testing. The results of laboratory testing are presented in Appendix B and summarized in Table B-1.

Subsoils found in the borings generally consisted of 3 to more than 35 feet of sandy clay and/or clean to silty, clayey, and gravelly sand and gravel underlain by weathered to comparatively unweathered claystone, sandstone and interbedded claystone/sandstone bedrock. One to 2 foot thick lenses of cemented sandstone were encountered in two borings (TH-3 and TH-27) at depths of 28 and 16 feet below the ground surface, respectively. Bedrock is comparatively shallow below the south-central portion of the site (Figs. 2 and 3).

The clay was soft to very stiff, the sand and gravel was very loose to very dense and bedrock was weathered to very hard based on field penetration resistance test results. Fifteen of eighteen samples of sandy clay exhibited slight compression or low swell (0.3 percent compression to 1.2 percent swell) after wetting under an applied pressure of 1,000 psf. Three clay samples were moderate swelling (2.4 to 3.8 percent). Four samples of sandy clay had moderate to high plasticity, with liquid limits between



24 and 56 percent, a plasticity indices of between 7 and 38 percent and 58 to 97 percent silt and clay-size particles (passing the No. 200 sieve). Unconfined compressive strength test results on five sandy clay samples ranged from 700 to 1,600 psf. The clean to silty or clayey sand and gravel is considered to be non-expansive.

Weathered to comparatively unweathered claystone samples were low to very high swelling (0.4 to 7.6 percent). A sample of interbedded claystone/sandstone had low plasticity, with a liquid limit of 28 percent, a plasticity index of 3 percent and 51 percent silt and clay-size particles (passing the No. 200 sieve). We believe most of the claystone with high to very high swell is below current ground water levels and unlikely to affect the performance of foundations. Grading could affect the risk of swell damage. The sandstone bedrock is considered to be typically non-expansive. Figure 2 shows our estimate of depth to bedrock, and Fig. 3 exhibits estimated bedrock elevation.

Ground water was encountered during drilling in 34 of the 42 borings at depths ranging from 5 to 24 feet below the existing ground surface. When the holes were checked several days after drilling, ground water was measured in 29 borings at depths ranging from 3.5 to 21 feet. Some of the borings had caved, likely near the depth of ground water. Figure 4 shows the estimated depth to ground water, and Fig. 5 shows our estimate of approximate ground water elevation. Our data indicate ground water is at depths of about 12 feet or less in about 70 percent of the north portion of the site, and about 60 percent of the south part (Fig. 4). Ground water levels are expected to vary seasonally, fluctuate with water levels in the ditch, and may rise after development as irrigation of landscaping begins.

ESTIMATED POTENTIAL SWELL

Based on the subsoil profiles, swell test results, and our experience, we believe this site has generally low risk for poor basement slab-on-grade performance. Due to relatively shallow bedrock, we judge a part of the south part of the site is low to moderate risk. We prepared Fig. 6, Preliminary Swell Risk Evaluation. Due to widely spaced borings and limited testing, variation in our estimate should be anticipated.



SITE DEVELOPMENT

The primary geotechnical concerns we believe will influence development of this site are relatively shallow ground water and very moist, soft soil near the ground water level. These concerns can be mitigated with proper planning, engineering, design and construction. We believe there are no geotechnical constraints at this site that would preclude development, particularly if basements are not planned or grades will be raised in areas with shallow ground water. The following sections discuss our opinions and recommendations for site development.

Overlot Grading

Preliminary data indicate ground water at depths of 12 feet or less over more than 60 percent of the site. We recommend where basement construction is desired, excavations should be limited to at least 3 feet and preferably 5 feet above ground water. An option for development would be to raise existing grades in areas where ground water is within about 3 to 5 feet of foundation levels to avoid moist, soft soils. Grading plans for this site were not available at the time of this investigation.

The ground surface in areas to be filled should be stripped of vegetation, scarified, and moisture conditioned to between optimum and 3 percent above optimum moisture content for clay and within 2 percent of optimum for sand. Areas to receive fill should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698). We anticipate stripping will require cuts of 2 to 4 inches for the majority of the site.

The properties of the fill will affect the performance of foundations, slabs-on-grade, utilities, and pavements. If imported soil is needed to achieve site grades, the material should be tested and approved by our firm prior to bringing to the site. The on-site soils are suitable for use as site grading fill. Fill should be placed in thin loose lifts, moisture conditioned and densely compacted prior to placement of the next lift. Our experience has shown clay fill moisture treated to optimum moisture content or above



will exhibit lower swell compared to clay fill receiving the same compactive effort but moisture treated below optimum moisture content. Clay fill should be moisture conditioned to between optimum and 3 percent above optimum moisture content and compacted to at least 95 percent of maximum (ASTM D 698) dry density. Sand fill should be moisture conditioned to within 2 percent of optimum moisture content. The placement and compaction of site grading fill should be observed and density tested by our representative during construction. Guideline overlot grading specifications are presented in Appendix C.

Underdrain

Ground water is relatively shallow over most of the parcel. Basement construction will be limited in shallow ground water areas, unless grades are raised. With long-term development and subsequent irrigation, ground water levels could rise. We believe this water should be controlled. The water could lead to dewatering requirements for crawl spaces, basements and utilities. We recommend an underdrain system be incorporated into the design of sanitary sewer systems to provide a means to control water and allow gravity discharge from foundation drains. A sewer underdrain detail is provided on Fig. 7. We are available to assist in design of the underdrain system.

Utility Construction

We believe excavations for utility installation can be performed with heavy-duty trenchers or large backhoes. Ground water will likely be encountered in deep excavations, and bracing or temporary dewatering may be required during utility construction. Dewatering can likely be accomplished by sloping excavations to occasional sumps where water can be removed by pumping. The sumps should be several feet below the bottoms of the excavations so that water is pumped down through the soils rather than up through the bottoms of the excavations, which could potentially compromise the bearing capacity of the subsoils. Constructing underdrains from outfall to upstream can allow water to flow from excavations.



Utility trenches should be sloped or shored to meet local, State and Federal safety regulations. Based on our investigation, we believe the site soils can be classified as Type C soil, based on Occupational Safety and Health Administration (OSHA) standards. For temporary excavations, Type C soil requires a maximum slope inclination of 1.5:1(horizontal:vertical). Excavation slopes specified by OSHA are dependent upon soil types and ground water conditions encountered. Seepage and ground water conditions in trenches may downgrade the soil type. Trench excavations in wet or soft soils may be unstable and require flatter slopes than required by OSHA. Contractors should identify the soils encountered in the excavation and refer to OSHA standards to determine appropriate slopes. Excavations deeper than 20 feet should be designed by a professional engineer.

Water and sewer lines are usually constructed beneath paved roads. Compaction of trench backfill can have a significant effect on the life and serviceability of floor slabs, pavements, and exterior flatwork. We recommend trench backfill be placed, moisture conditioned, and compacted as discussed in Overlot Grading.

Pavements

Clay soil possesses relatively poor pavement support qualities. Silty sand is slightly better subgrade. If the clay soil is predominant at subgrade levels, we anticipate about 6 to 7 inches of asphalt pavement for local streets. Chemical amendment of site soils with flyash or lime to increase strength and stability may be beneficial where soft soils are encountered and would merit thinner asphalt sections. A subgrade investigation and pavement design should be performed after overlot grading is complete.

BUILDING CONSTRUCTION CONSIDERATIONS

The following discussions are preliminary and are not intended for design or construction. After grading is completed, design-level investigations should be performed on a lot-specific basis.



Foundations

Preliminary information indicates footing or post-tensioned slab (PTS) foundations will likely be appropriate for the majority of the site. Drilled pier foundations may be necessary in the south-central portion of the site where comparatively shallow expansive bedrock was encountered (Fig. 6). Fill placed during site grading may influence the type of foundation required for each residence.

Floor Systems and Below-Grade Construction

We judge the swell risk will be generally low for most of this site. Our preliminary evaluation of swell risk is presented on Fig. 6. Soil conditions are comparatively good for slab-on-grade floors, compared to most sites in the Denver area. Slabs-on-grade will likely be appropriate for most basement floors provided some heave, on the order of about 1 inch (low risk sites) and 1 to 3 inches (low to moderate risk sites), is acceptable. Finished floors should be structurally supported or PTS foundations can be used.

Below-grade walls should be designed to resist lateral earth pressure. Foundation drains will be necessary around all below-grade areas. Where basements will be within about 5 feet of ground water, we recommend a continuous gravel layer below floor slabs. Foundation drains with gravity flow should be connected to an underdrain system or to sumps for pumping or discharge to the ground surface.

Surface Drainage

The performance of this development will be significantly influenced by surface drainage. When developing an overall drainage scheme, consideration should be given to drainage around each residence. Drainage should be planned so that surface runoff is directed away from foundations and is not allowed to pond adjacent to or between residences, or over pavements. Attention should be paid to compact the soils behind curb and gutter adjacent to the streets and in utility trenches. If surface drainage between preliminary development and construction phases is neglected,



future performance of the roadways, flatwork and foundations may be poor. When considering landscaping for common areas and yards, we recommend the use of xeriscaping, which requires little long-term watering.

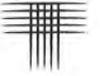
CONCRETE

Concrete in contact with soils can be subject to sulfate attack. We measured water-soluble sulfate concentrations in six samples from this site. Concentrations were measured between 0.004 and 0.016 percent. Sulfate concentrations less than 0.1 percent indicate Class 0 exposure to sulfate attack for concrete in contact with the subsoils, according to the American Concrete Institute (ACI). For sulfate concentrations less than 0.1 percent, ACI indicates any type of cement can be used for concrete in contact with the subsoils. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious material ratio should not exceed 0.50 for concrete in contact with soils that are likely to stay moist due to surface drainage or high water tables. Concrete should be air entrained.

RECOMMENDED FUTURE INVESTIGATIONS

Based on the results of this investigation and the proposed development, we recommend the following investigations be performed:

- 1. Review of site grading plans by our firm, to evaluate possible geotechnical concerns;**
- 2. Further investigation of specific areas of the site to better delineate areas of shallow ground water for design of an underdrain system;**
- 3. Subgrade investigation and pavement design after grading;**
- 4. Design-level Soils and Foundation Investigation for each residence; and,**
- 5. Construction testing and observation during site development and building or pavement construction, including compaction testing of grading fill, utility trench backfill, pavements, and foundation installation observations.**



LIMITATIONS

Our borings were widely spaced to provide a general characterization of subsurface conditions for preliminary assessment and planning of site development and residence construction. Conditions between borings will likely vary. We believe this investigation was conducted in a manner consistent with that level of care and skill ordinarily used by geotechnical engineers practicing in this area at this time. No warranty, express or implied, is made.

If we can be of further service in discussing either the contents of this report or the analysis of the influence of subsurface conditions on the design of the proposed development, please call.

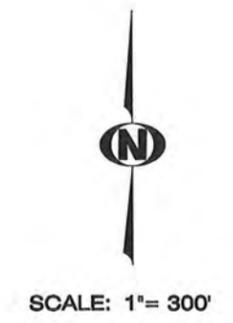
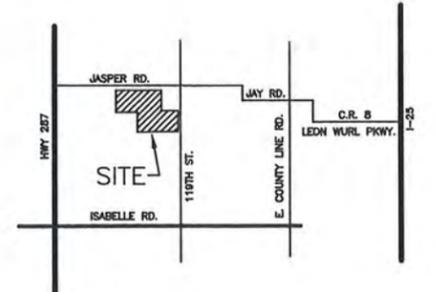
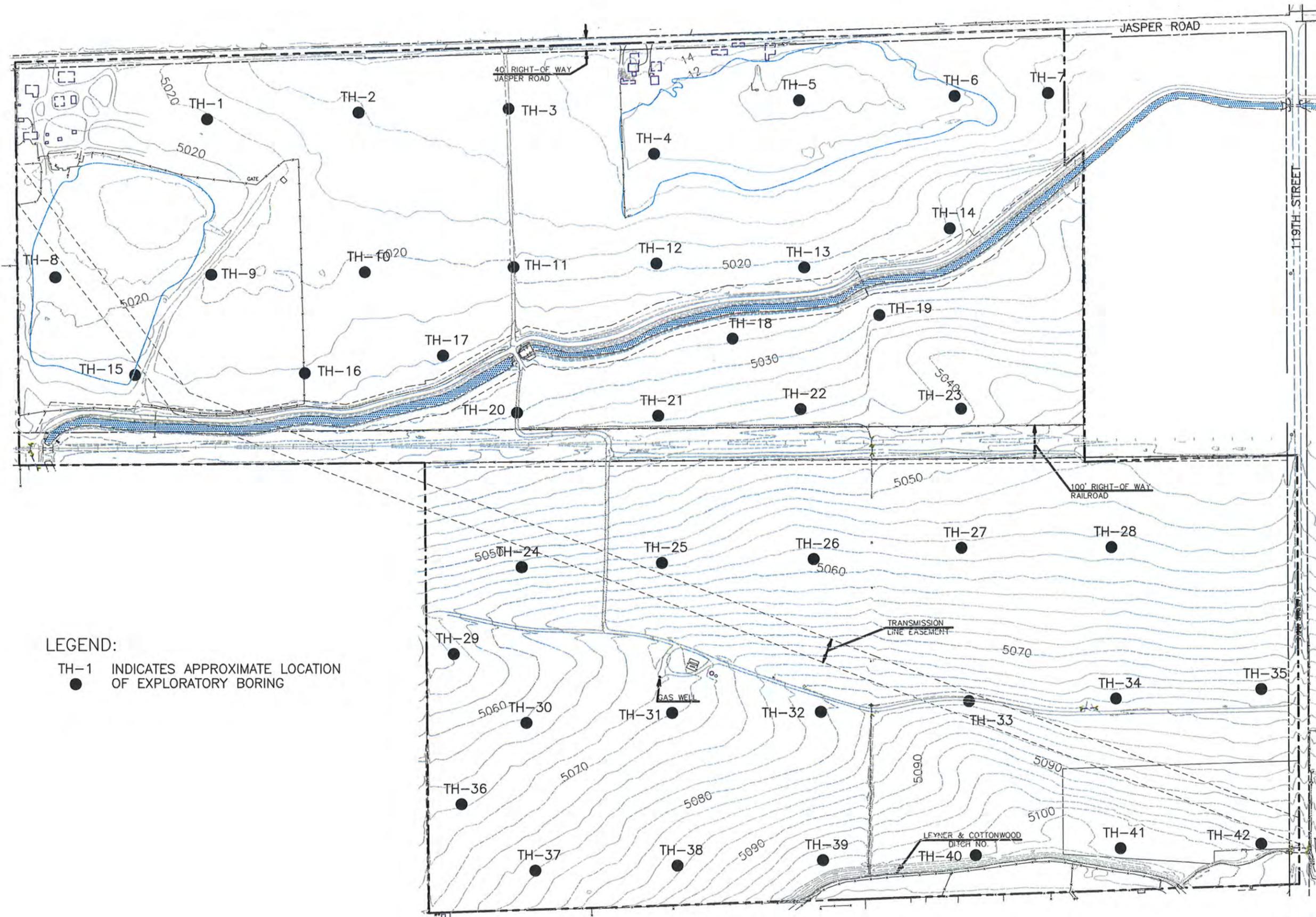
CTL | THOMPSON, INC.

Jocasta Champion
Staff Geologist

Reviewed By:

David A. Glater, P.E., C.P.G.
Principal Geological Engineer

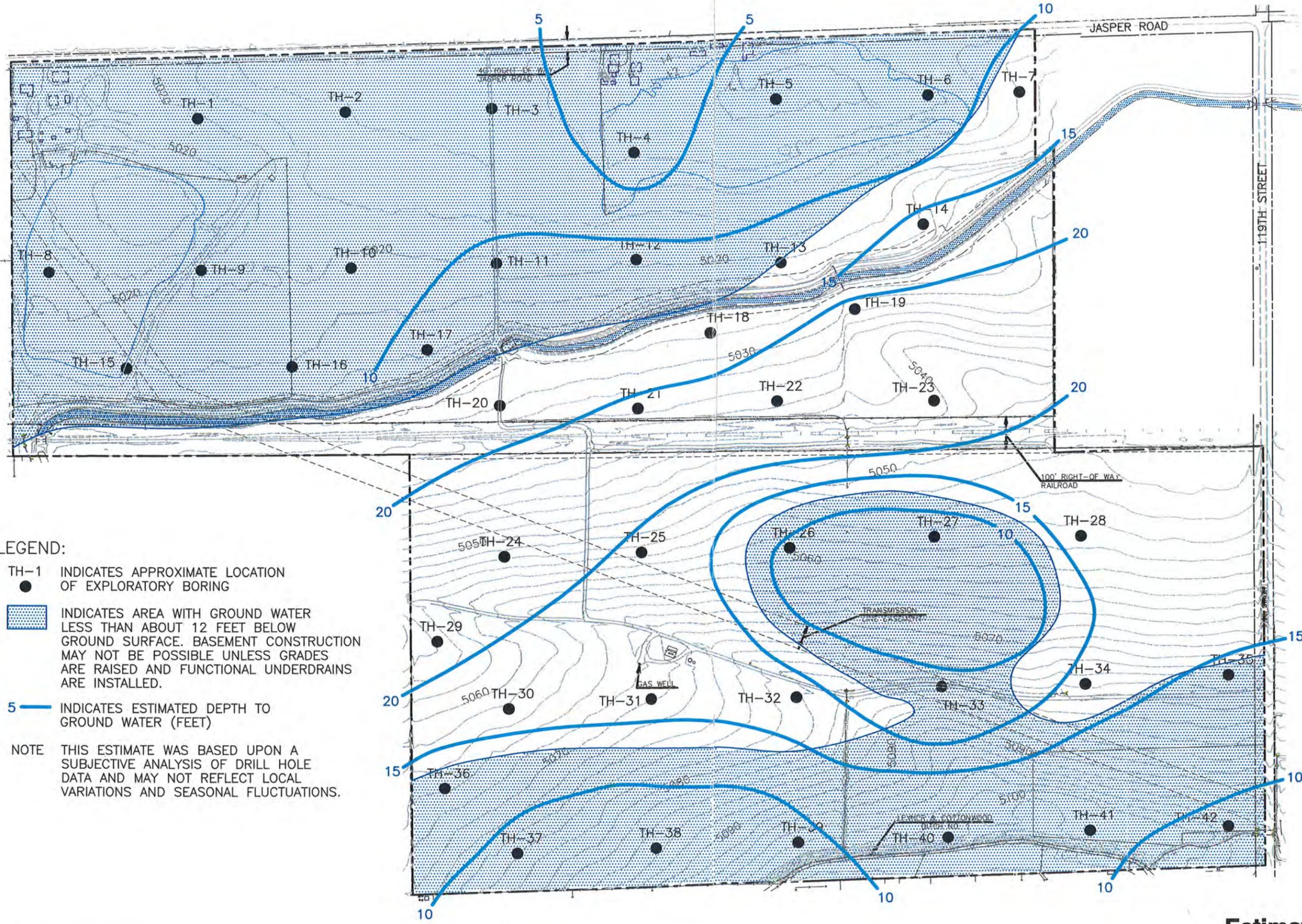
JC:DAG/bg/jbj
(5 copies sent)



LEGEND:
 ● TH-1 INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING

1199- 01-0 15 /X

**Locations of
 Exploratory
 Borings**



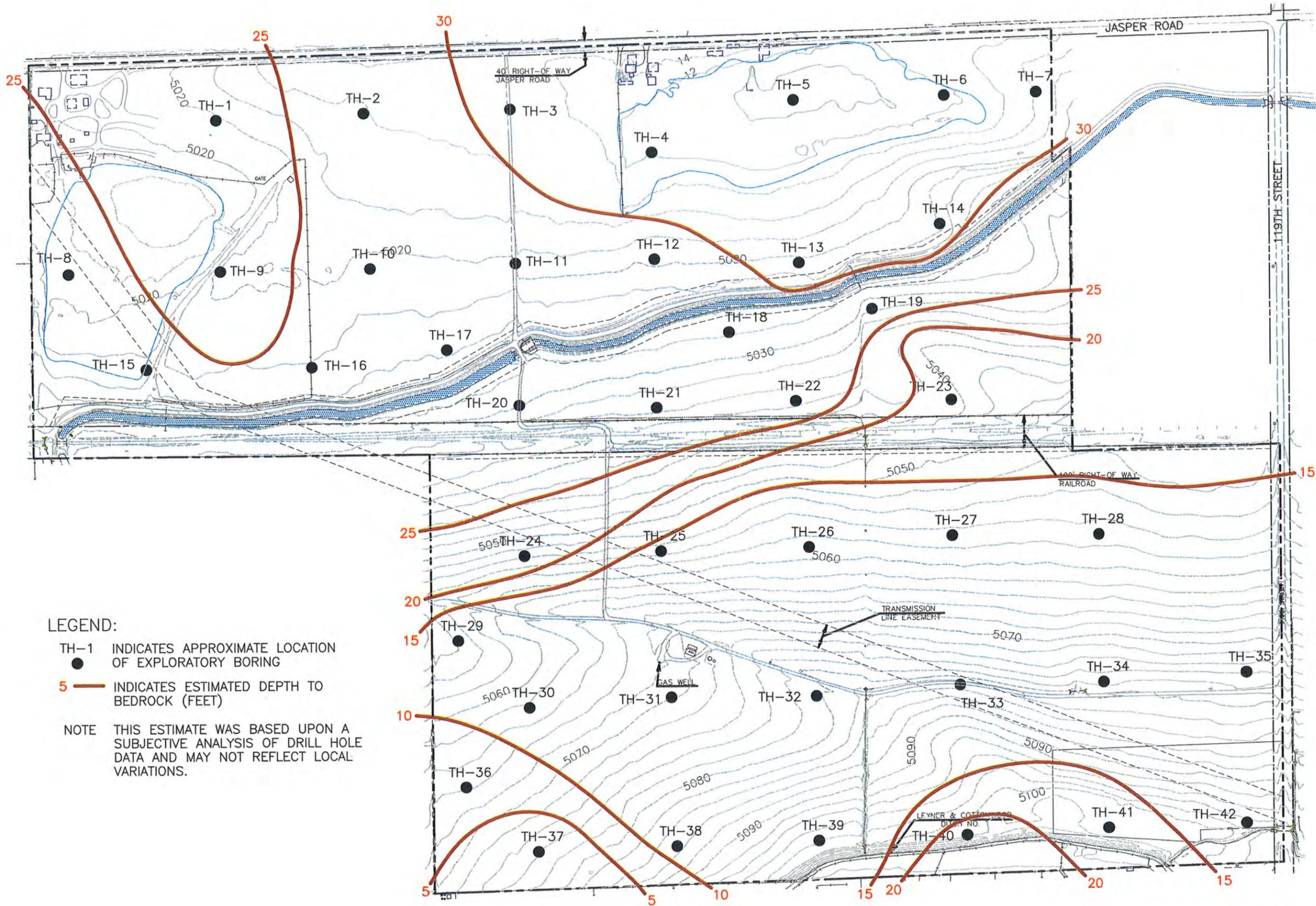
LEGEND:

- TH-1 INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING
- INDICATES AREA WITH GROUND WATER LESS THAN ABOUT 12 FEET BELOW GROUND SURFACE. BASEMENT CONSTRUCTION MAY NOT BE POSSIBLE UNLESS GRADES ARE RAISED AND FUNCTIONAL UNDERDRAINS ARE INSTALLED.
- 5 INDICATES ESTIMATED DEPTH TO GROUND WATER (FEET)

NOTE THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS AND SEASONAL FLUCTUATIONS.

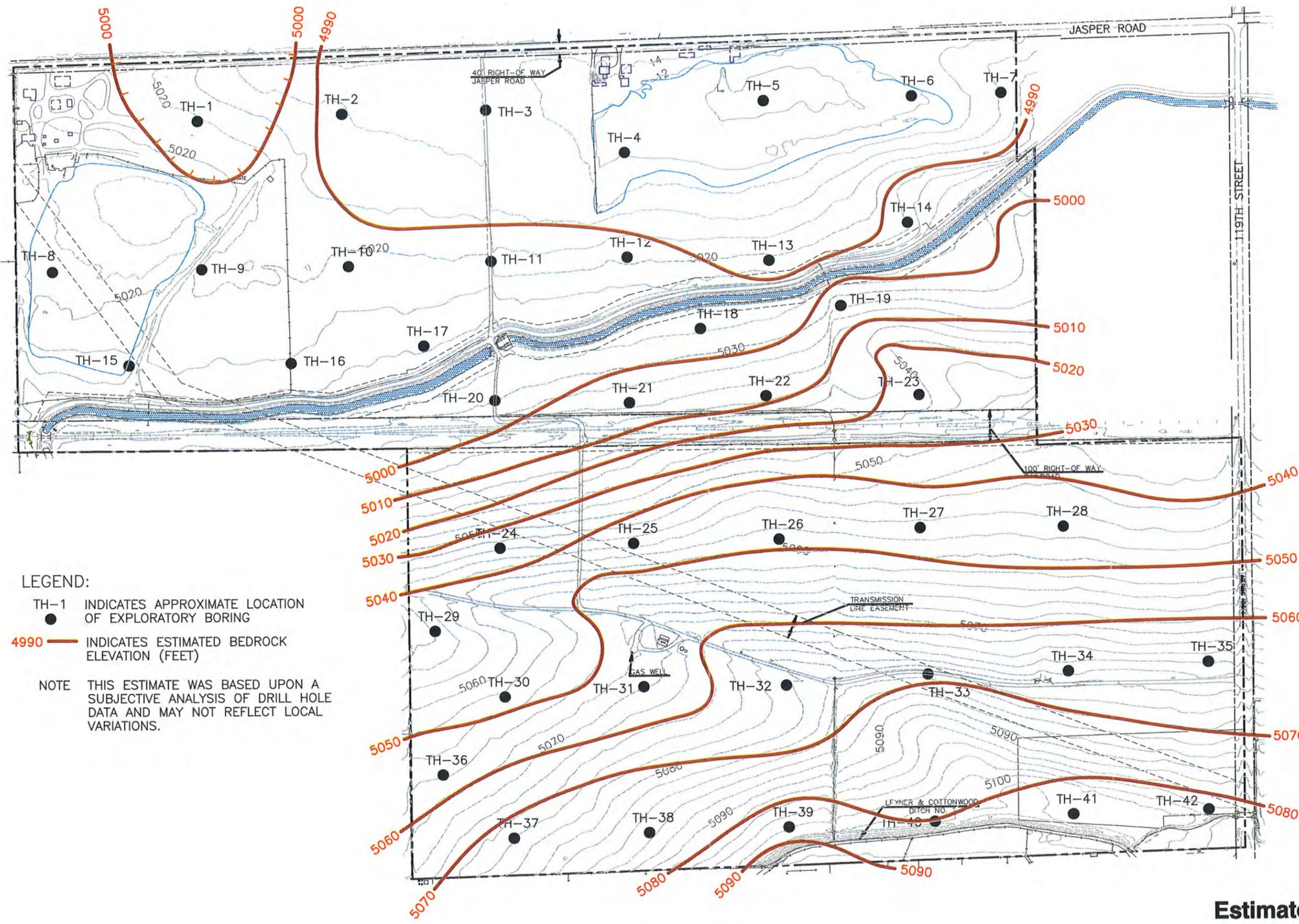

N
 SCALE: 1" = 300'

Estimated Depth to Ground Water
Fig. 4



Estimated Depth to Bedrock Fig. 2

1199-1-199-115 /UC



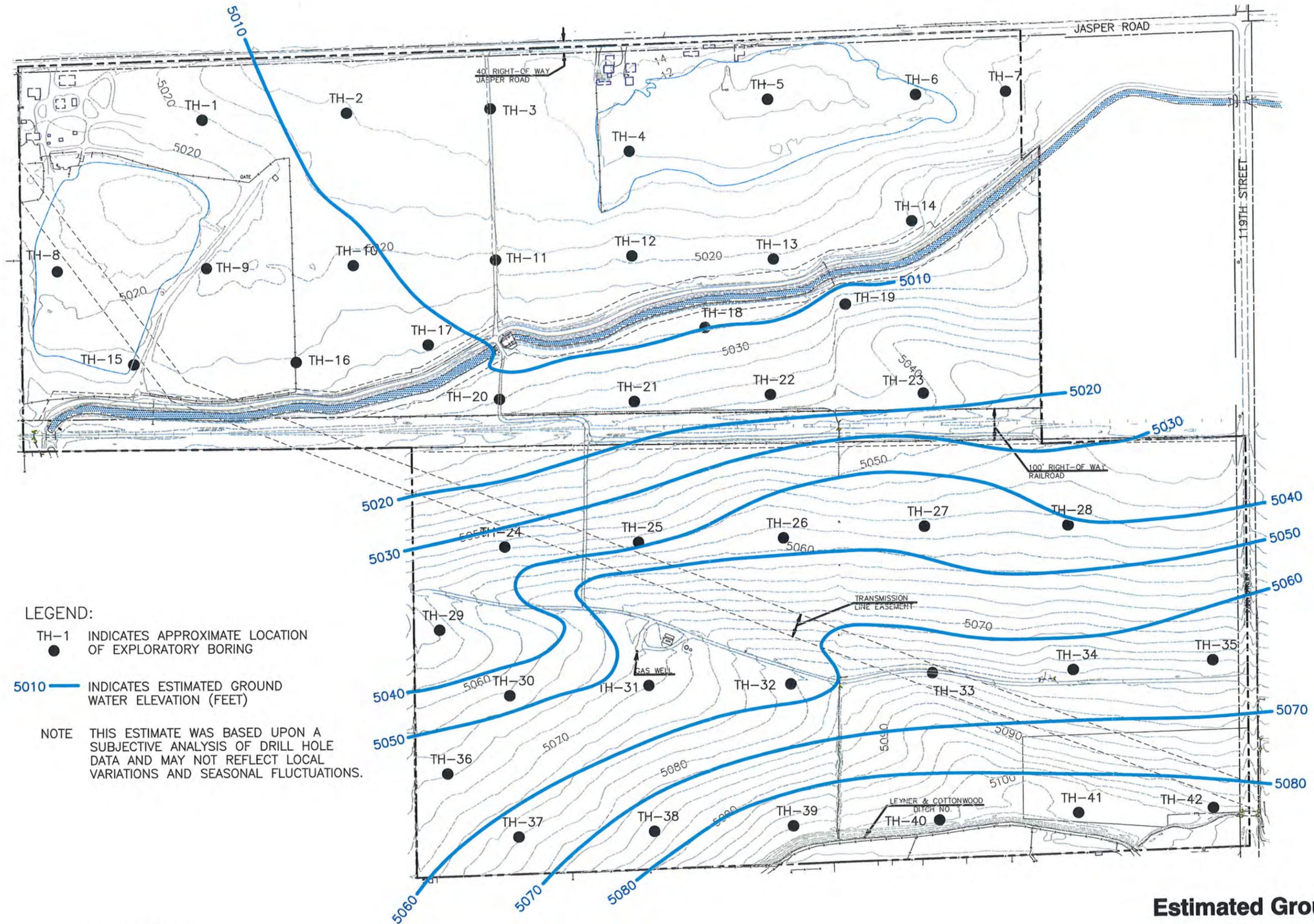
LEGEND:

- TH-1 INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING
- 4990 INDICATES ESTIMATED BEDROCK ELEVATION (FEET)

NOTE THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS.



Estimated Bedrock Elevation
 Fig. 3



LEGEND:

● TH-1 INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING

5010 — INDICATES ESTIMATED GROUND WATER ELEVATION (FEET)

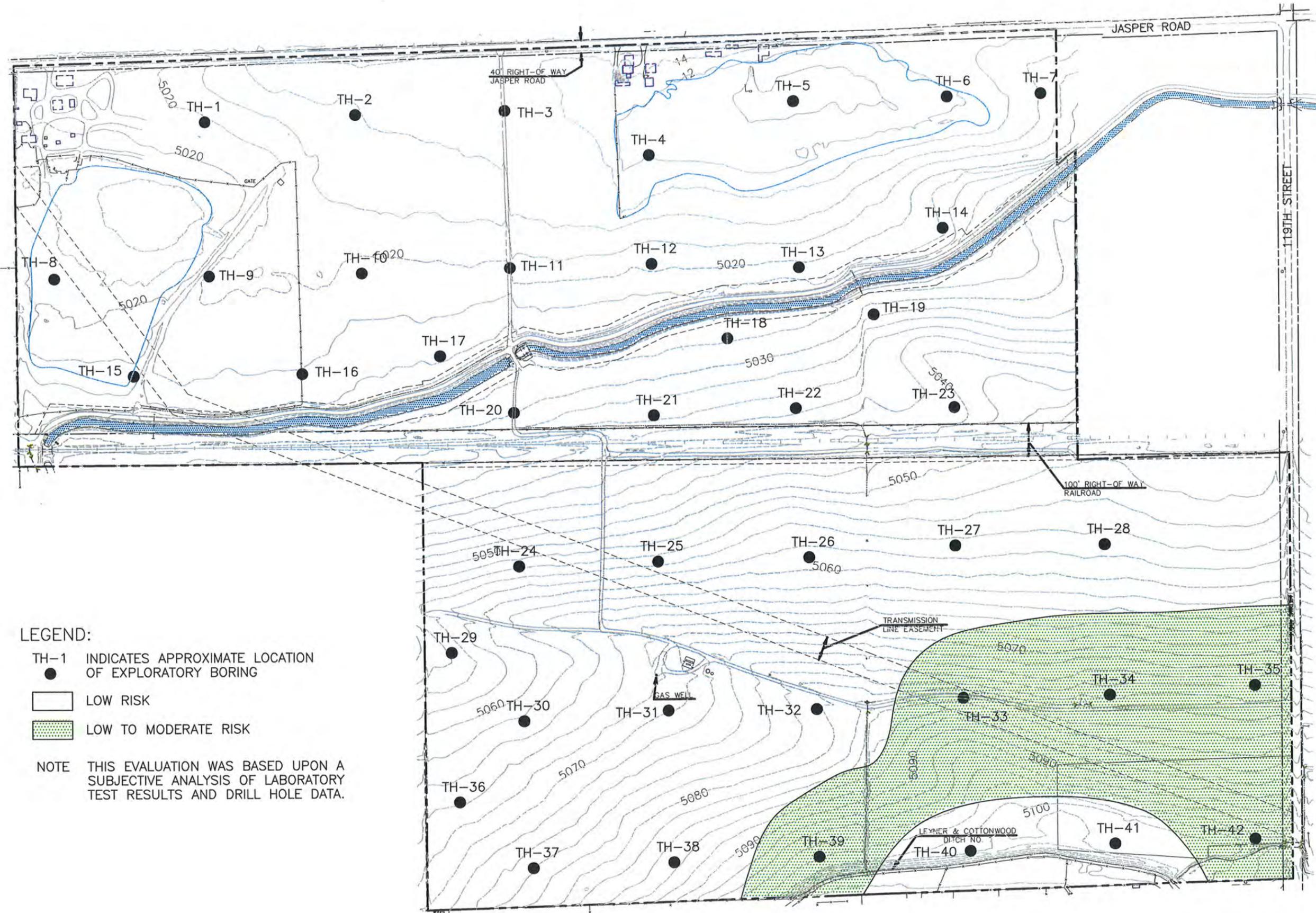
NOTE THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF DRILL HOLE DATA AND MAY NOT REFLECT LOCAL VARIATIONS AND SEASONAL FLUCTUATIONS.



SCALE: 1" = 300'

Estimated Ground Water Elevation

DN41199-115, F5-R1-0 12/17/05 /JC



LEGEND:

- TH-1 INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING
- LOW RISK
- ▨ LOW TO MODERATE RISK

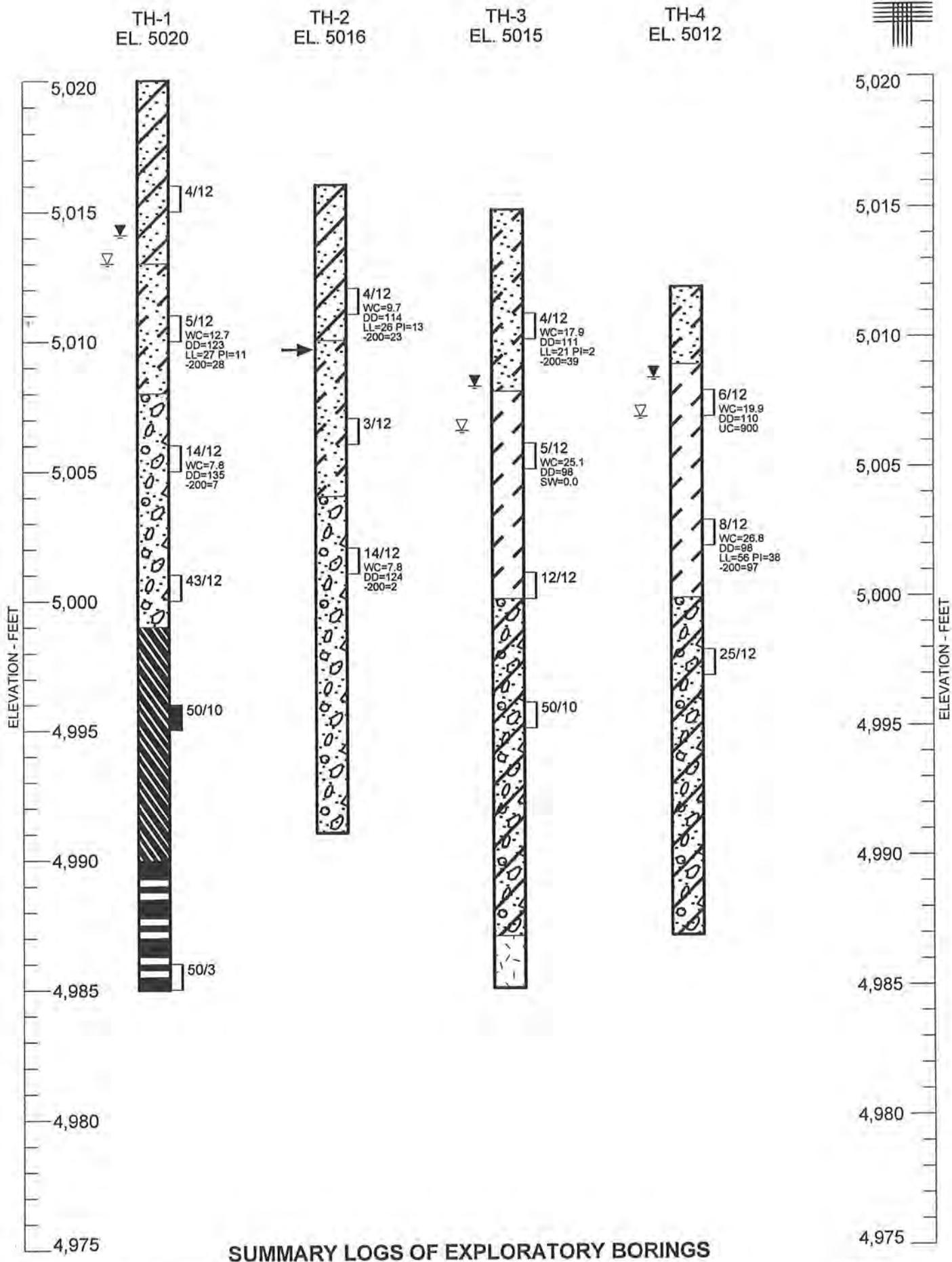
NOTE THIS EVALUATION WAS BASED UPON A SUBJECTIVE ANALYSIS OF LABORATORY TEST RESULTS AND DRILL HOLE DATA.



SCALE: 1" = 300'



APPENDIX A
LOGS OF EXPLORATORY BORINGS



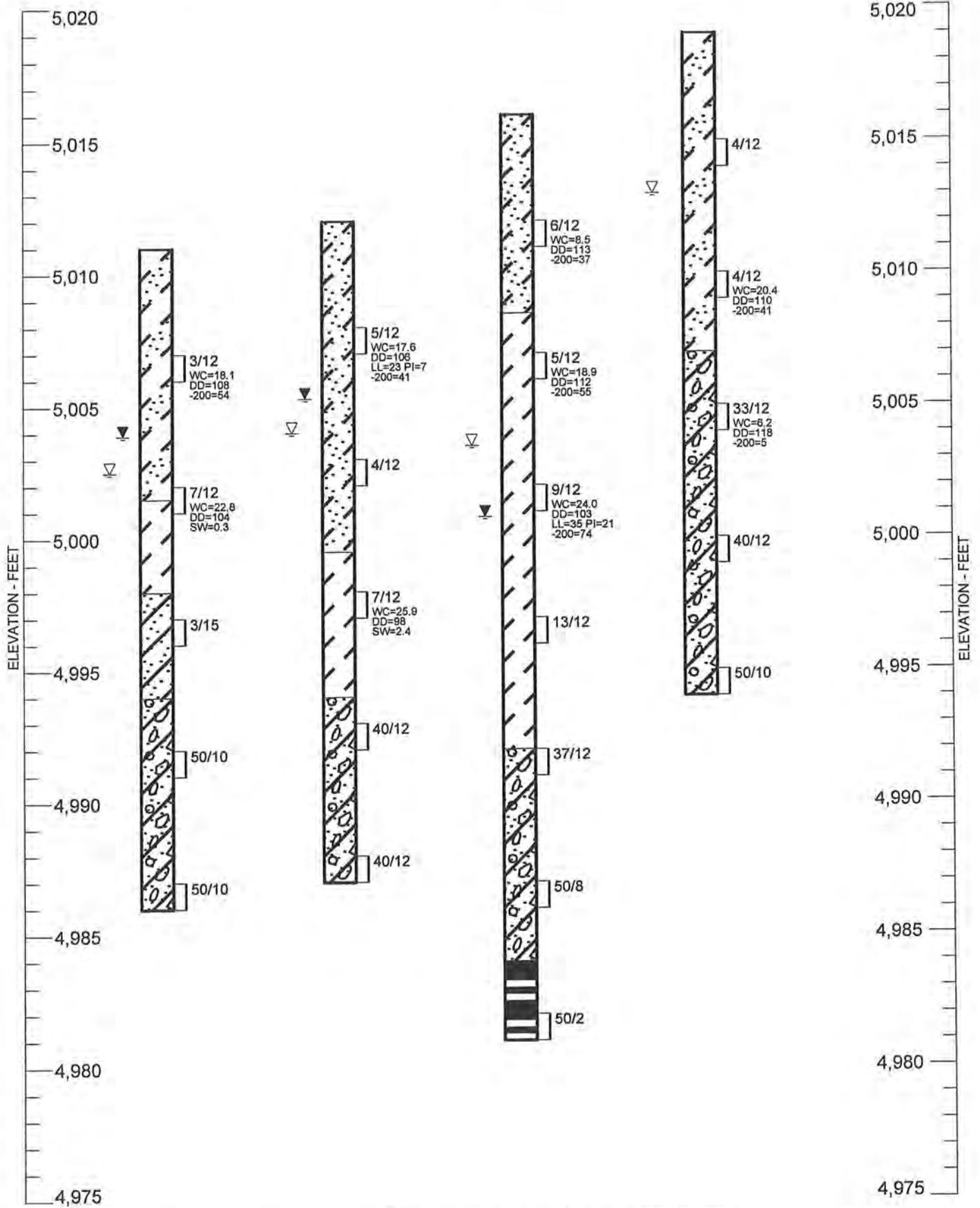
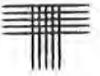
SUMMARY LOGS OF EXPLORATORY BORINGS

TH-5
EL. 5011

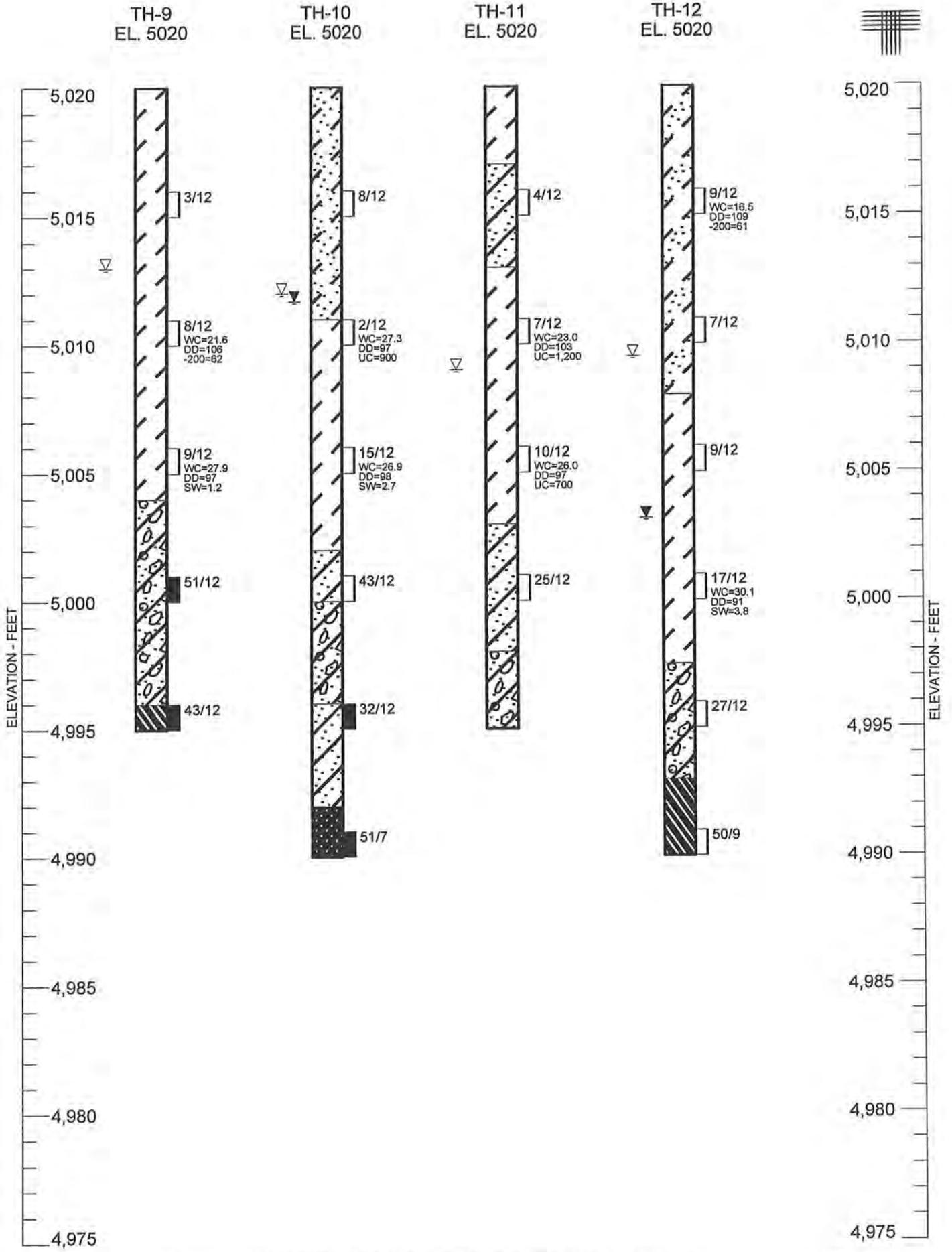
TH-6
EL. 5012

TH-7
EL. 5016

TH-8
EL. 5019



LOGS BY ELEVATION - LONG DN41199-115-01.GPJ C:\LMAIN.GD1 11/25/05



LOGS BY ELEVATION - LONG DN41199-115-GT.GPJ C:\MAIN.GUJ 11/25/05

SUMMARY LOGS OF EXPLORATORY BORINGS

FIG. A- 3

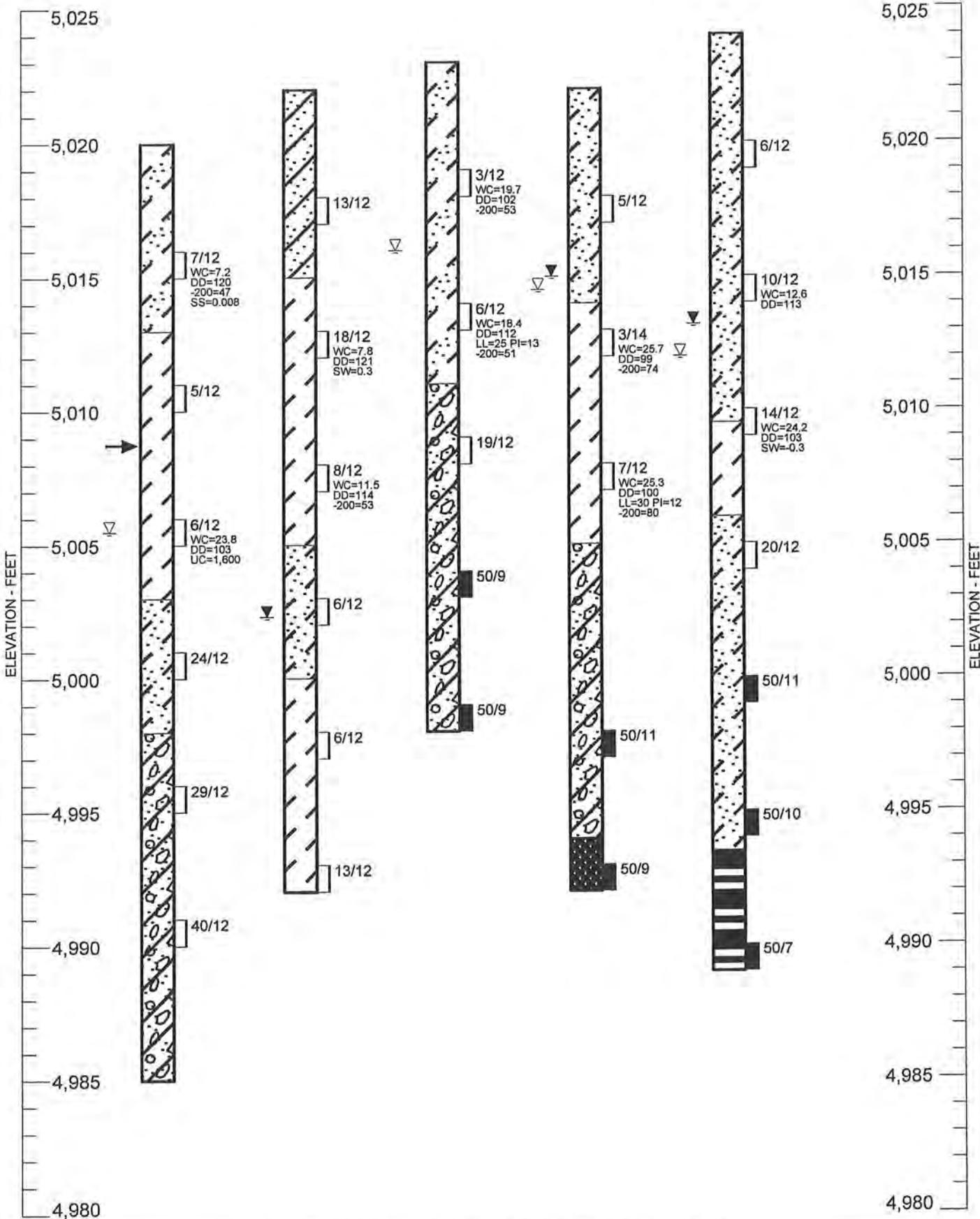
TH-13
EL. 5020

TH-14
EL. 5022

TH-15
EL. 5023

TH-16
EL. 5022

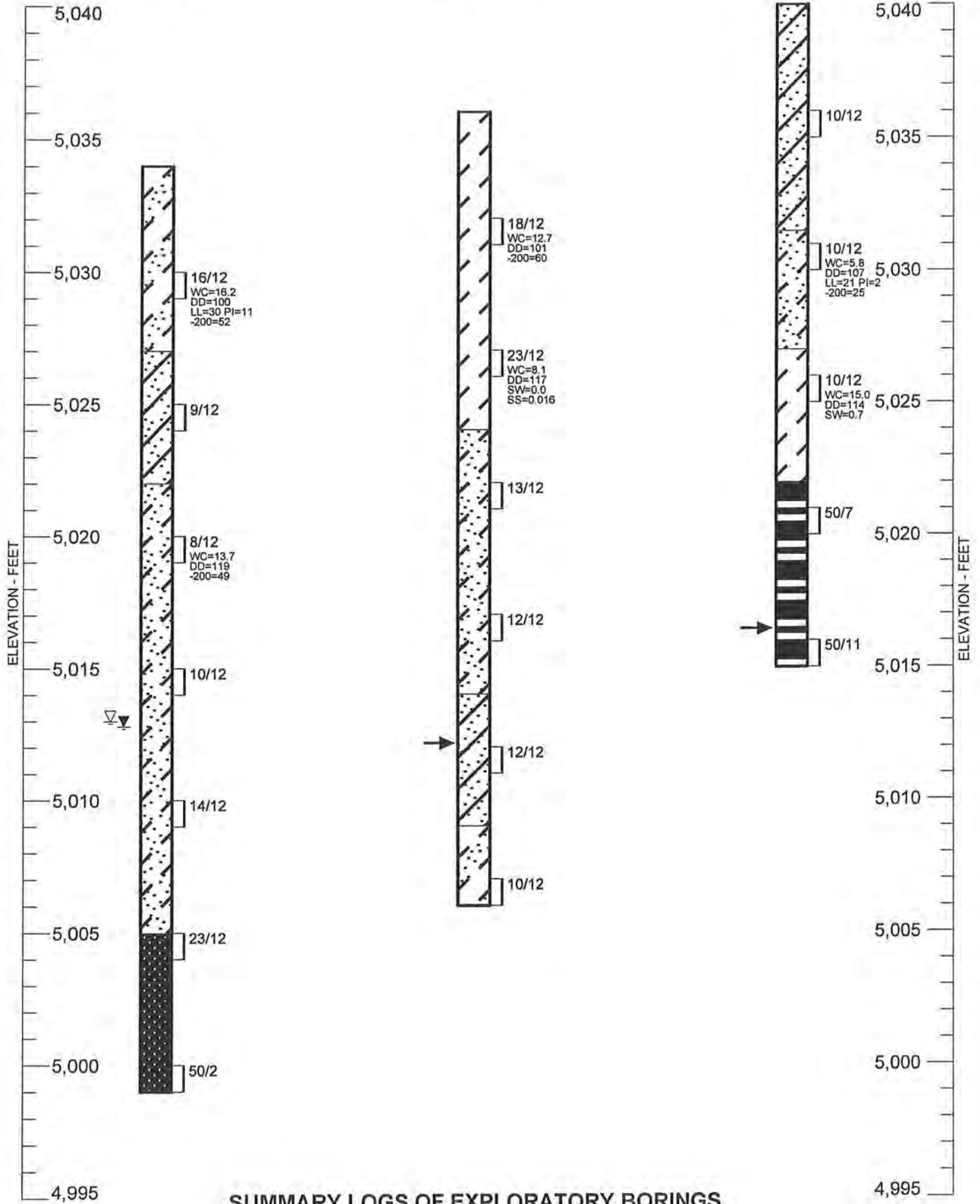
TH-17
EL. 5024



TH-21
EL. 5034

TH-22
EL. 5036

TH-23
EL. 5040



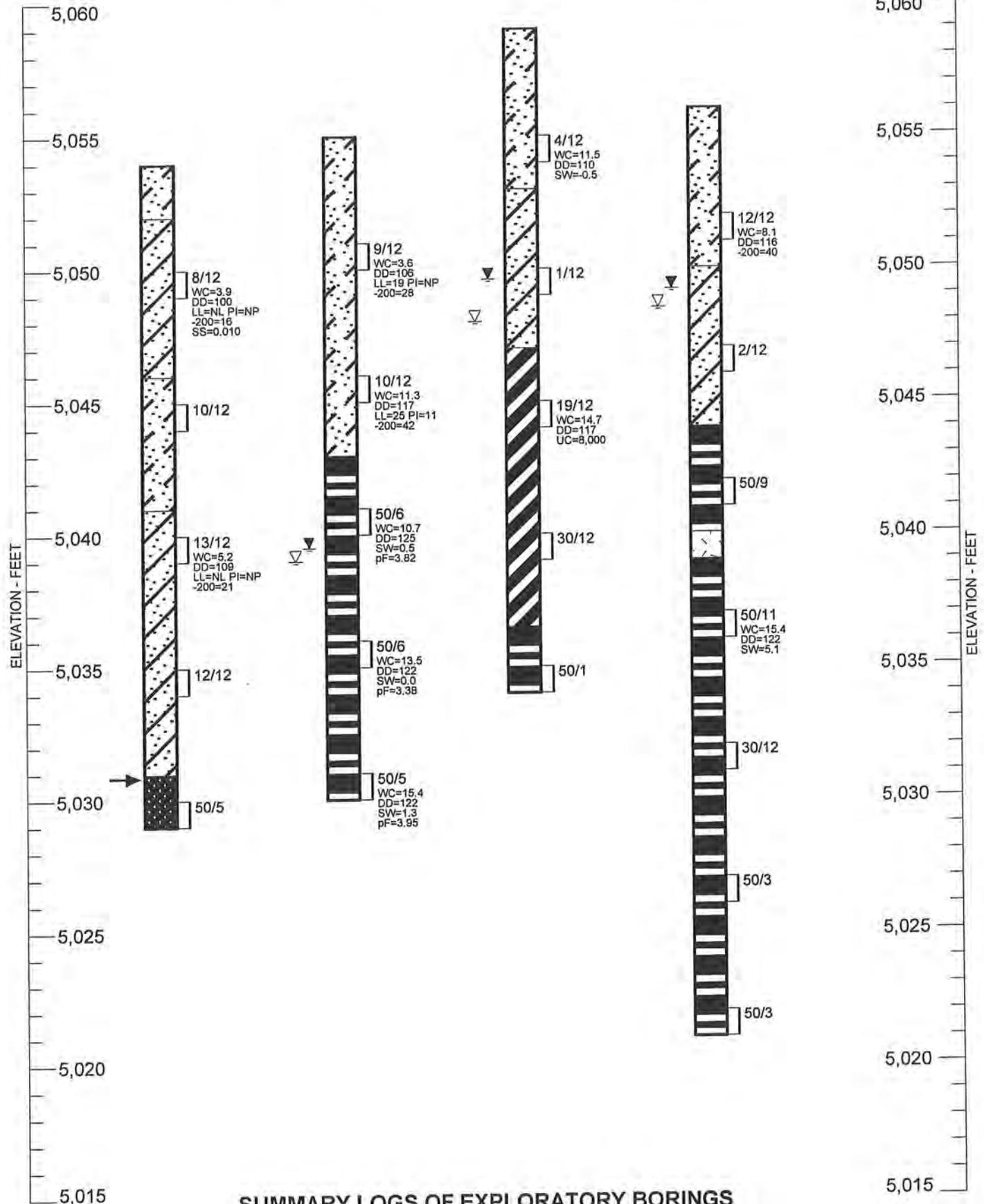
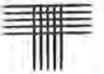
SUMMARY LOGS OF EXPLORATORY BORINGS

TH-24
EL. 5054

TH-25
EL. 5055

TH-26
EL. 5059

TH-27
EL. 5056

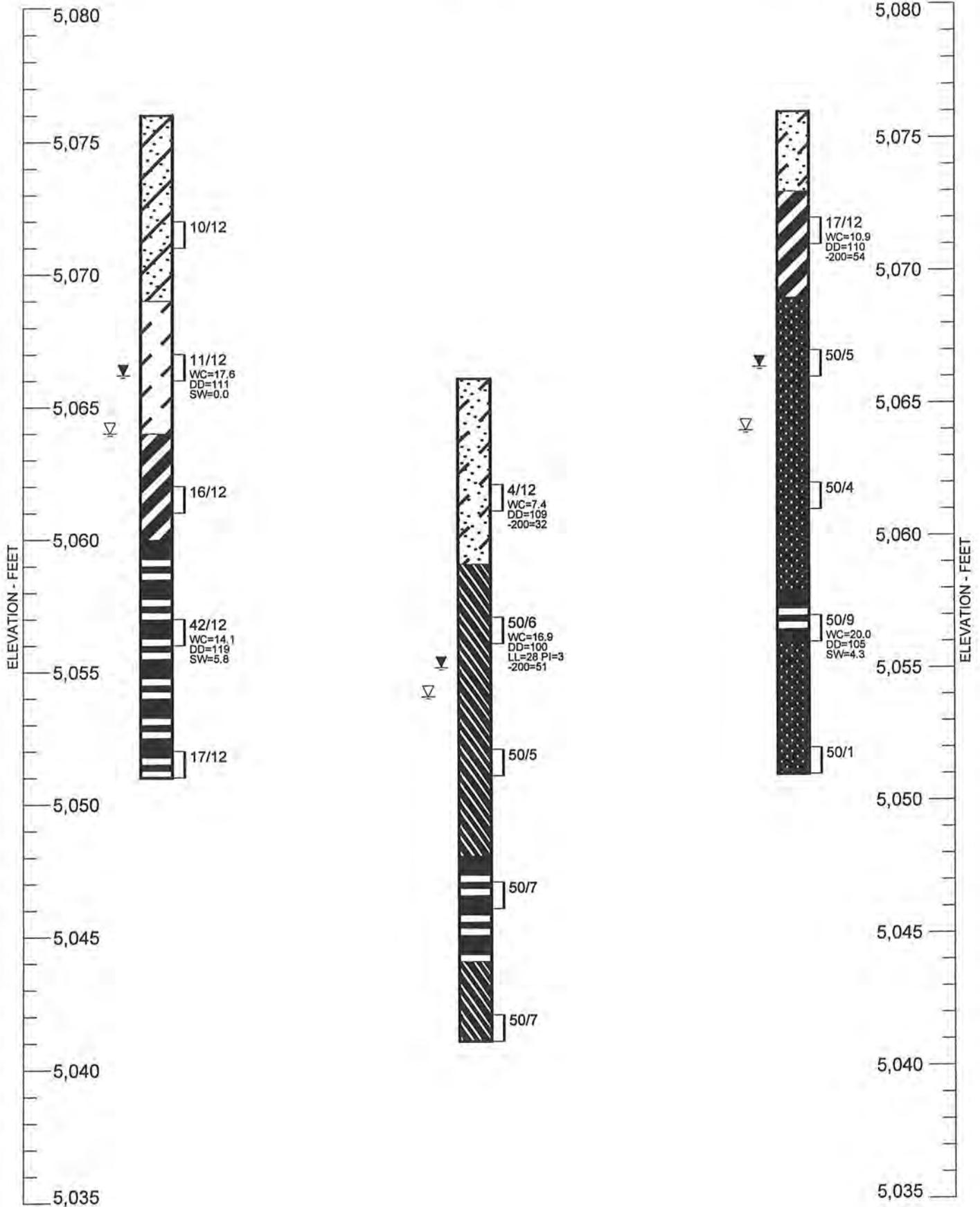
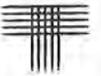


SUMMARY LOGS OF EXPLORATORY BORINGS

TH-35
EL. 5076

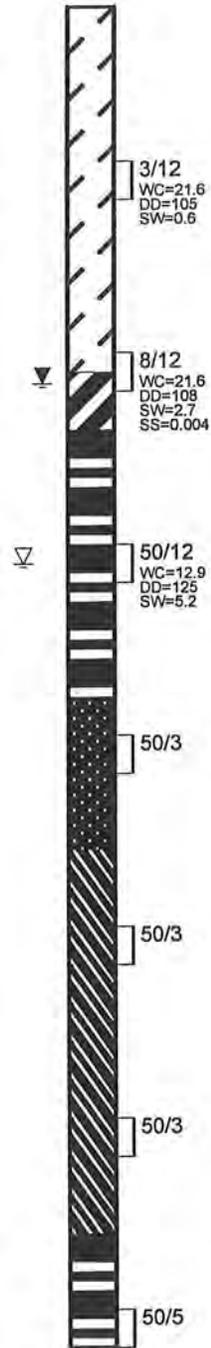
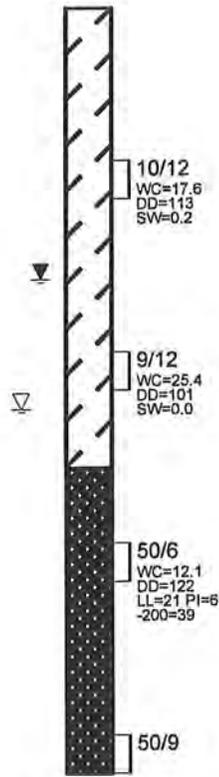
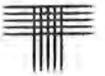
TH-36
EL. 5066

TH-37
EL. 5076



TH-38
EL. 5085

TH-39
EL. 5098



SUMMARY LOGS OF EXPLORATORY BORINGS



LEGEND:

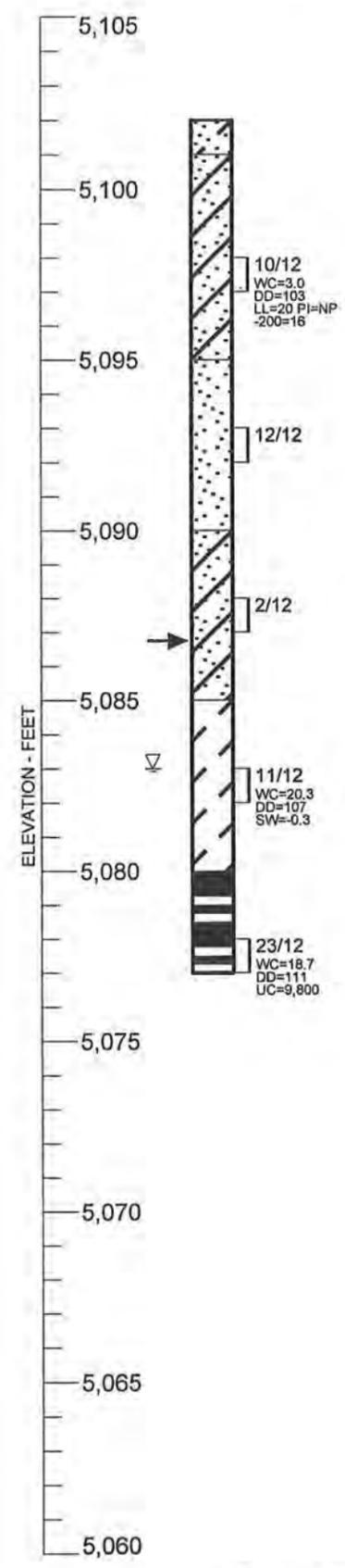
- CLAY, SANDY, SOFT TO VERY STIFF, MOIST TO VERY MOIST, BROWN, YELLOW-BROWN, BLACK CALCAREOUS (CL).
- SAND, CLAYEY, VERY LOOSE TO VERY DENSE, SLIGHTLY MOIST TO WET, BROWN, YELLOW-BROWN (SC).
- SAND, SILTY, VERY LOOSE TO MEDIUM DENSE, SLIGHTLY MOIST TO WET, BROWN, YELLOW-BROWN, RUST, BLACK (SM, SW-SM).
- GRAVEL, SANDY, CLEAN TO SLIGHTLY SILTY, MEDIUM DENSE TO DENSE, WET, YELLOW-BROWN, RUST (GP).
- GRAVEL, SANDY, SILTY, MEDIUM DENSE TO VERY DENSE, VERY MOIST TO WET, BROWN, YELLOW-BROWN (GM).
- INTERLAYERED CLAY/SAND, SOFT TO STIFF OR VERY LOOSE TO LOOSE, DRY TO WET, BROWN, YELLOW-BROWN, WHITE (CL OR SC).
- WEATHERED CLAYSTONE OR SANDSTONE, SLIGHTLY MOIST TO MOIST, BROWN, RUST, GRAY, OLIVE, YELLOW, BLACK-LIGNITE.
- BEDROCK, CLAYSTONE, MEDIUM HARD TO VERY HARD, SLIGHTLY MOIST TO WET, BROWN, GRAY, BLUE, RUST, WHITE, BLACK-LIGNITE.
- BEDROCK, SANDSTONE, MEDIUM HARD TO VERY HARD, SLIGHTLY MOIST TO VERY MOIST, BROWN, YELLOW, YELLOW-BROWN, RUST.
- BEDROCK, INTERBEDDED CLAYSTONE/SANDSTONE, MEDIUM HARD TO VERY HARD, DRY TO MOIST, BROWN, GRAY, YELLOW, RUST.
- CEMENTED SANDSTONE, VERY HARD.

- DRIVE SAMPLE. THE SYMBOL 4/12 INDICATES 4 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.
- DRIVE SAMPLE. THE SYMBOL 50/10 INDICATES 50 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.0-INCH O.D. SAMPLER 10 INCHES.
- WATER LEVEL MEASURED AT TIME OF DRILLING.
- WATER LEVEL MEASURED SEVERAL DAYS AFTER DRILLING.
- INDICATES DEPTH WHERE TEST HOLE CAVED AFTER DRILLING.

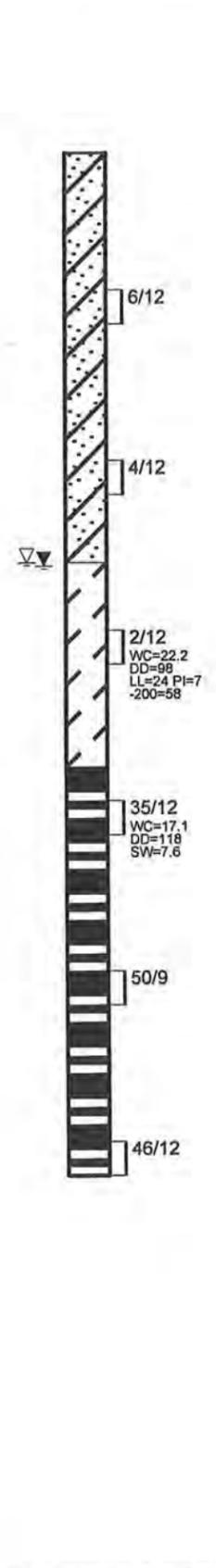
NOTES:

1. THE BORINGS WERE DRILLED ON NOVEMBER 7 THROUGH NOVEMBER 11, 2005 USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT AUGER AND A TRUCK-MOUNTED DRILL RIG.
2. BORING LOCATIONS ARE APPROXIMATE AND WERE SURVEYED BY A REPRESENTATIVE OF OUR FIRM USING A HAND HELD GPS UNIT. ELEVATIONS WERE APPROXIMATE FROM TOPOGRAPHY ON A PLAN PROVIDED BY CHARLESKEIM & ASSOICATES, INC.
3. WC - INDICATES MOISTURE CONTENT (%).
 DD - INDICATES DRY DENSITY (pcf).
 SW - INDICATES SWELL WHEN WETTED UNDER APPLIED PRESSURE (%).
 LL - INDICATES LIQUID LIMIT (%).
 PI - INDICATES PLASTICITY INDEX (%).
 -200 - INDICATES PERCENT PASSING NO. 200 SIEVE (%).
 UC - INDICATES UNCONFINED COMPRESSIVE STRENGTH (psf).
 SS - INDICATES WATER-SOLUBLE SULFATE CONCENTRATION (%).
 pF - INDICATES SOIL SUCTION VALUE (pF).
4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

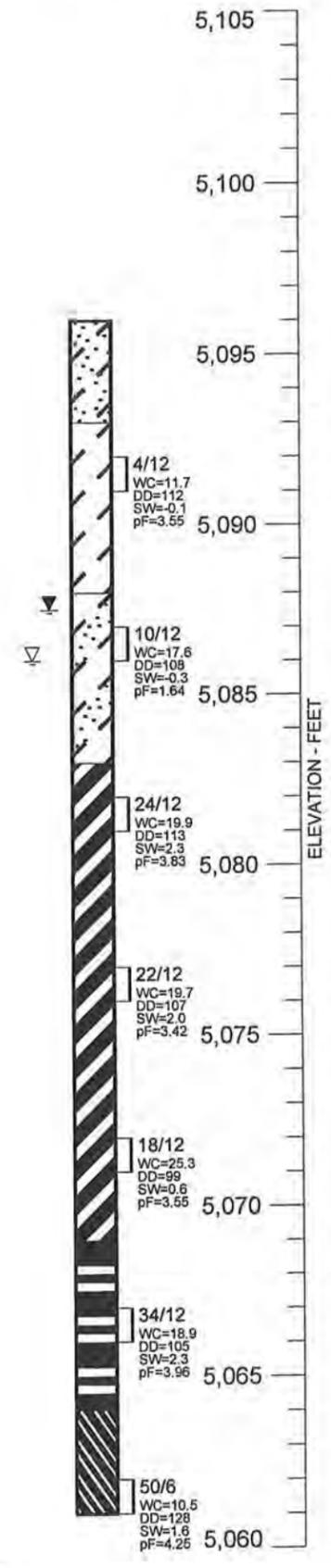
TH-40
EL. 5102



TH-41
EL. 5101



TH-42
EL. 5096

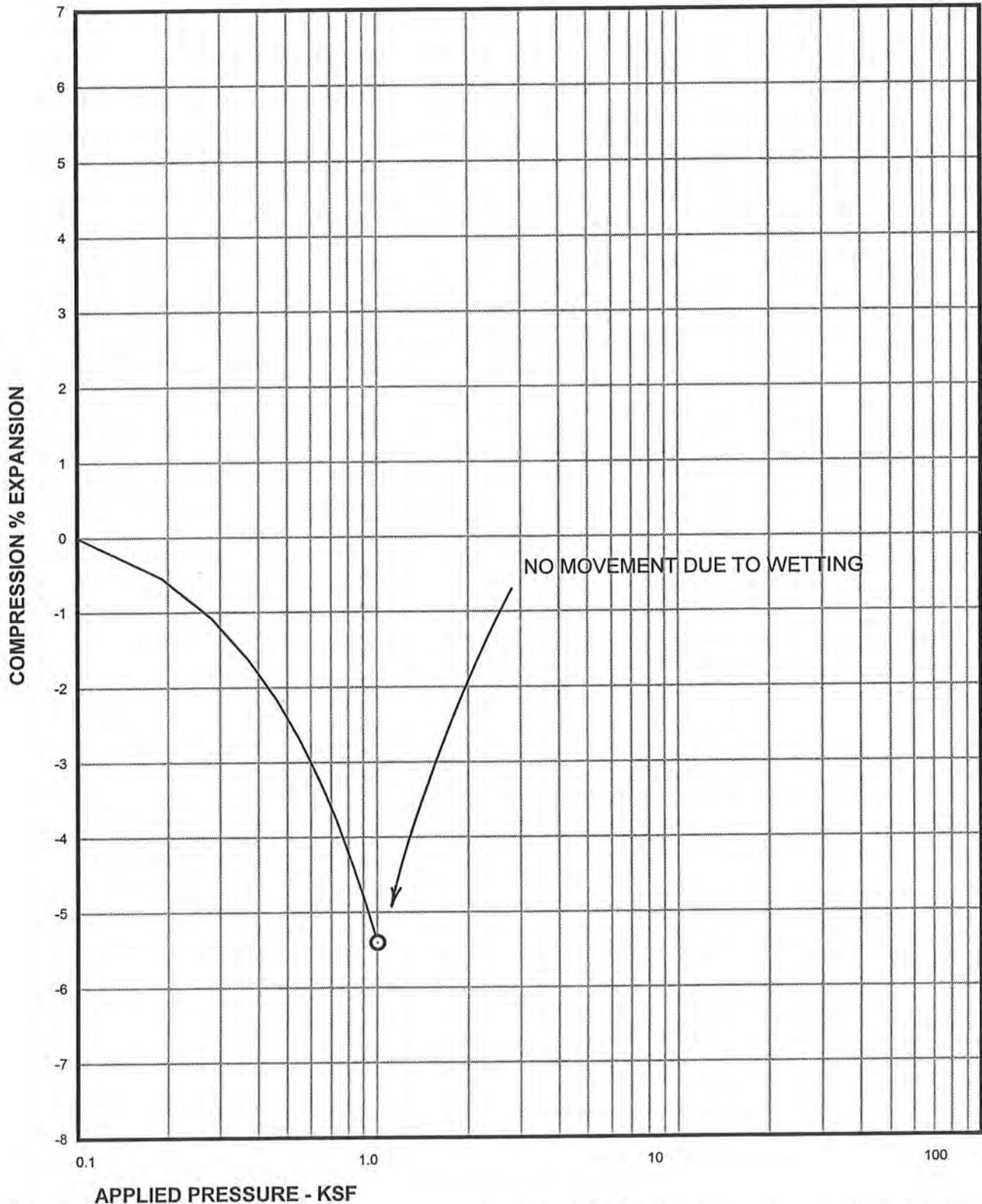
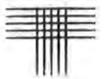


SUMMARY LOGS OF EXPLORATORY BORINGS

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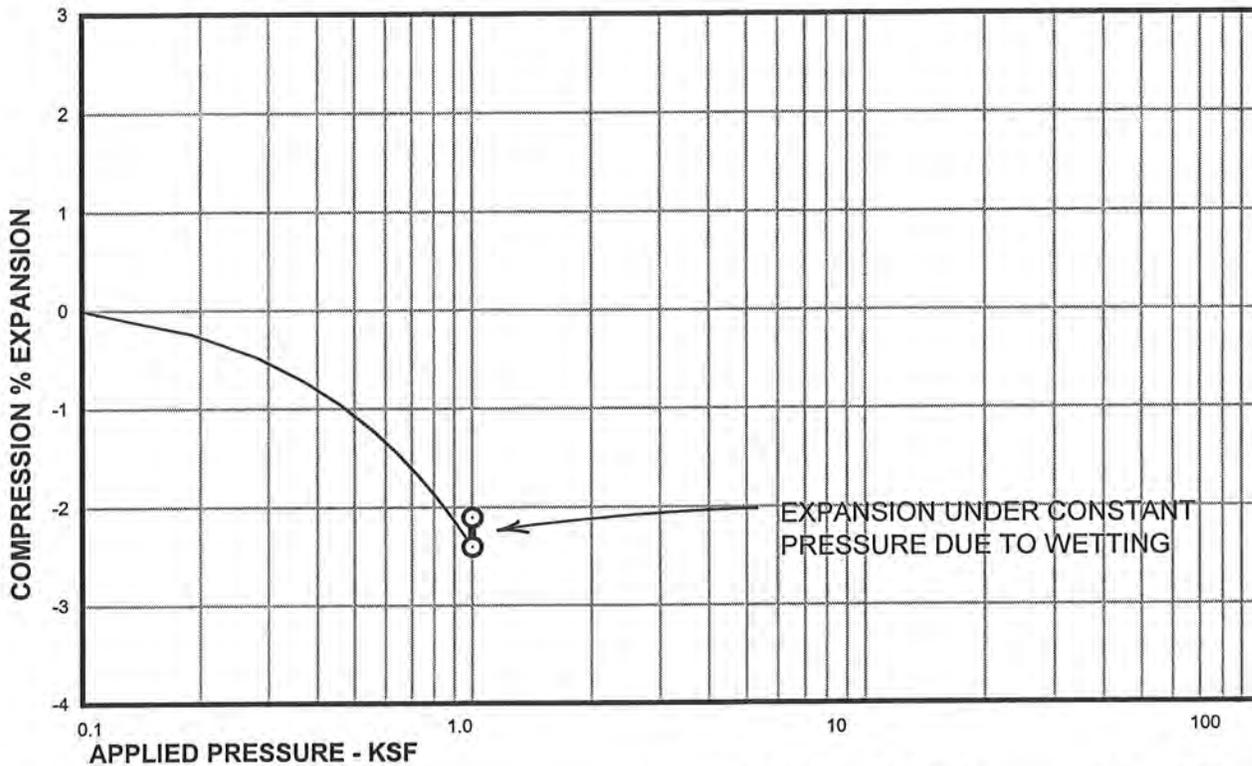


APPENDIX B
LABORATORY TEST RESULTS



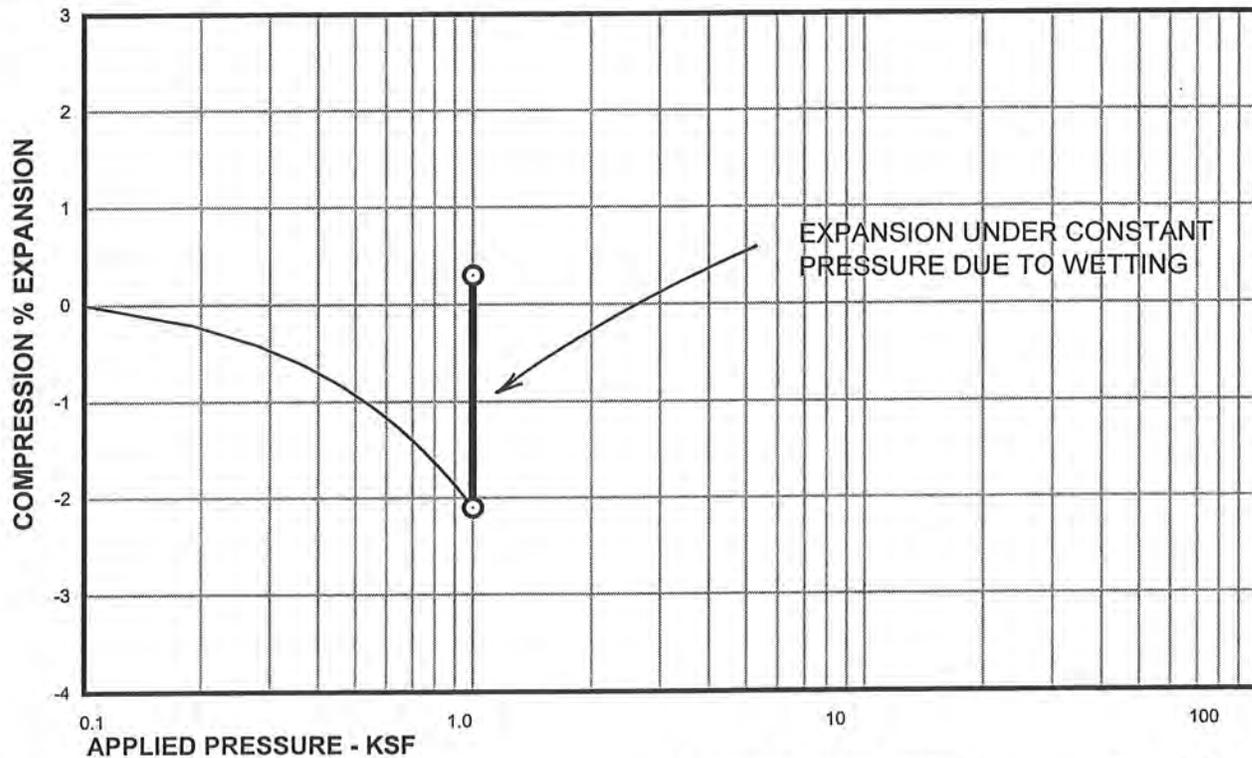
Sample of CLAY, SANDY (CL)
From TH-3 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 98 PCF
SAMPLE MOISTURE CONTENT= 25.1 %



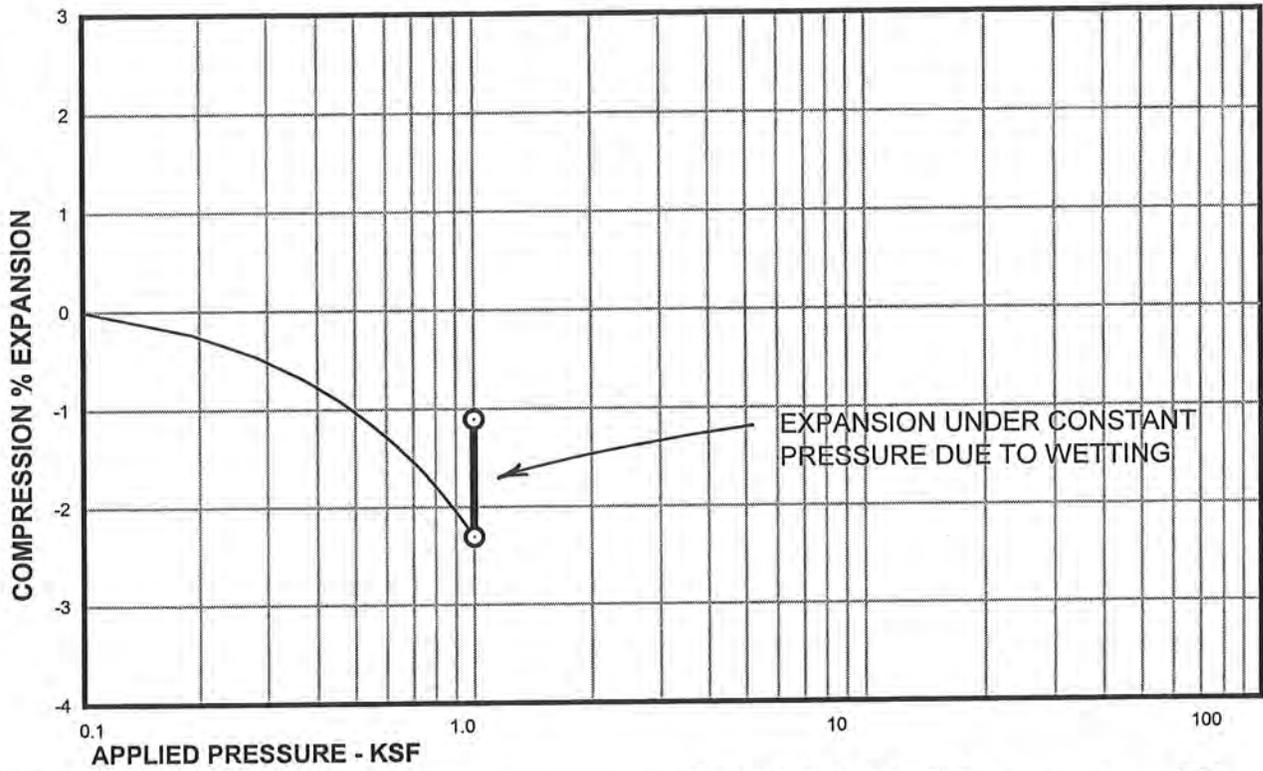
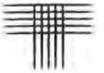
Sample of CLAY, SANDY (CL)
From TH-5 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 104 PCF
SAMPLE MOISTURE CONTENT= 22.8 %



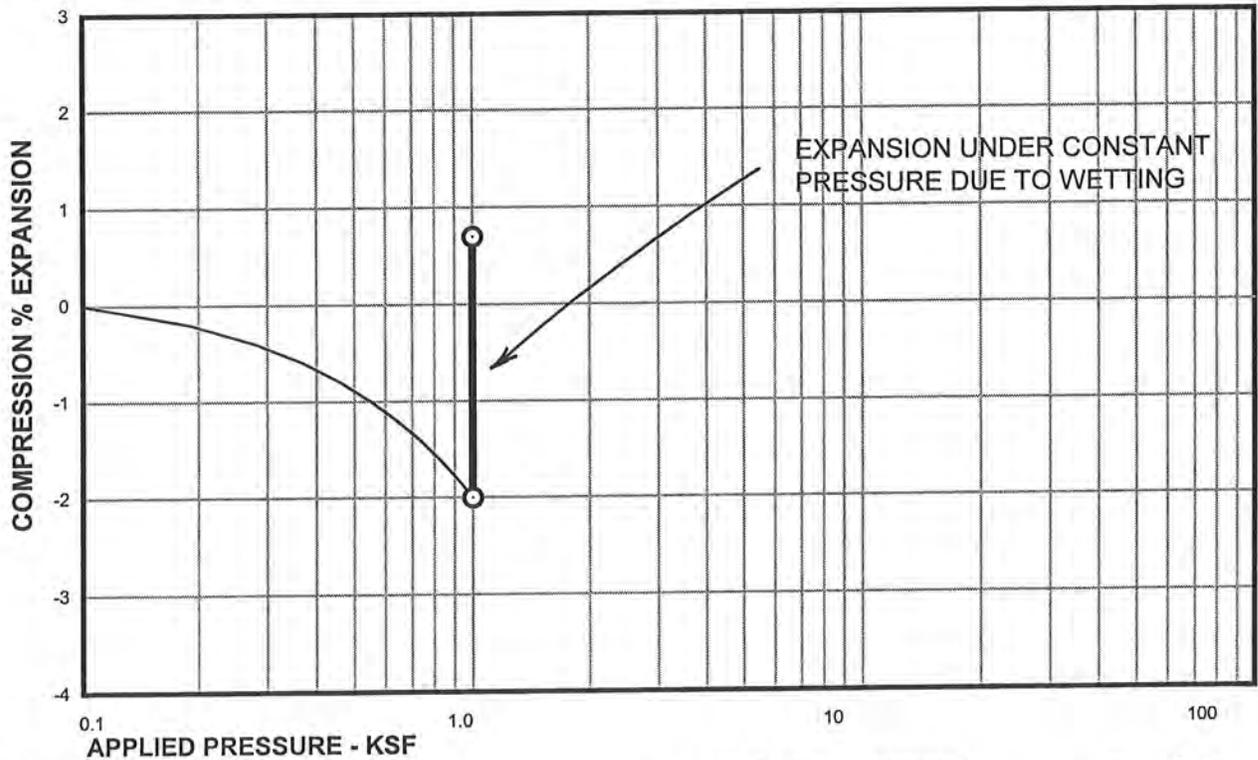
Sample of CLAY, SANDY (CL)
From TH-6 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 98 PCF
SAMPLE MOISTURE CONTENT= 25.9 %



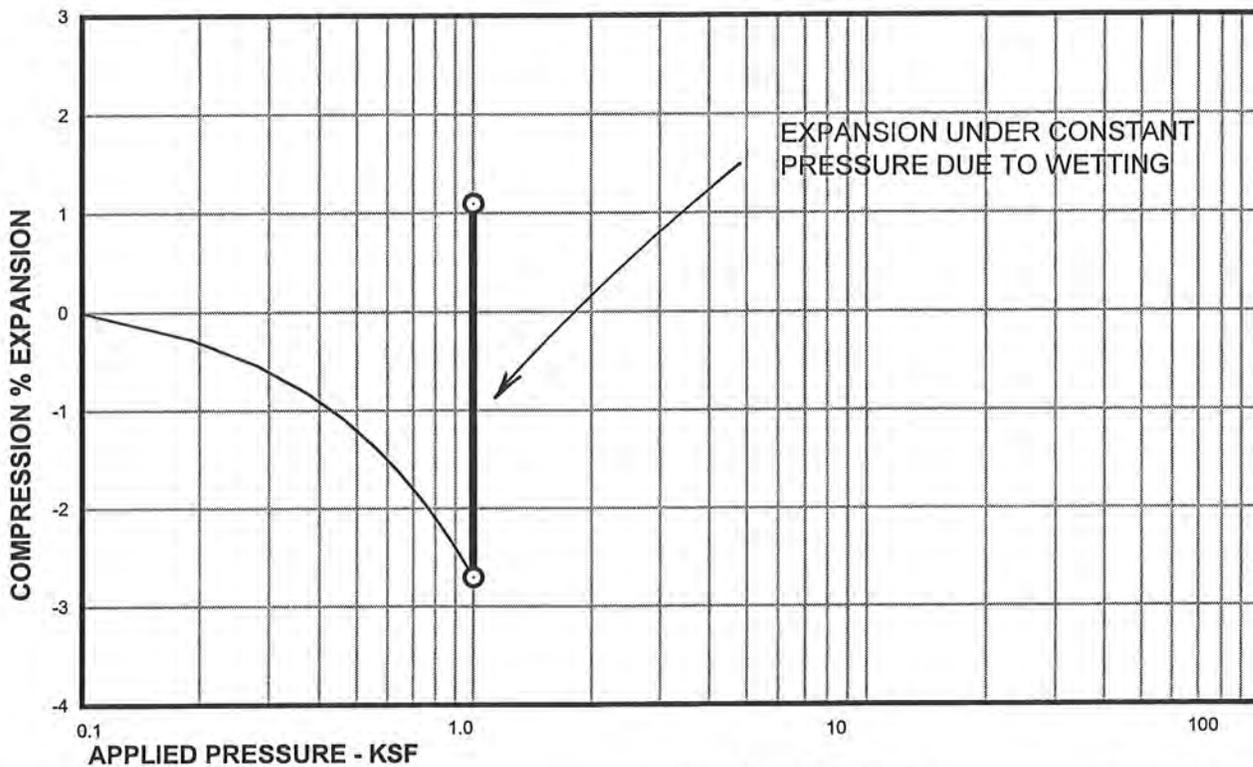
Sample of CLAY, SANDY (CL)
From TH-9 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 97 PCF
SAMPLE MOISTURE CONTENT= 27.9 %



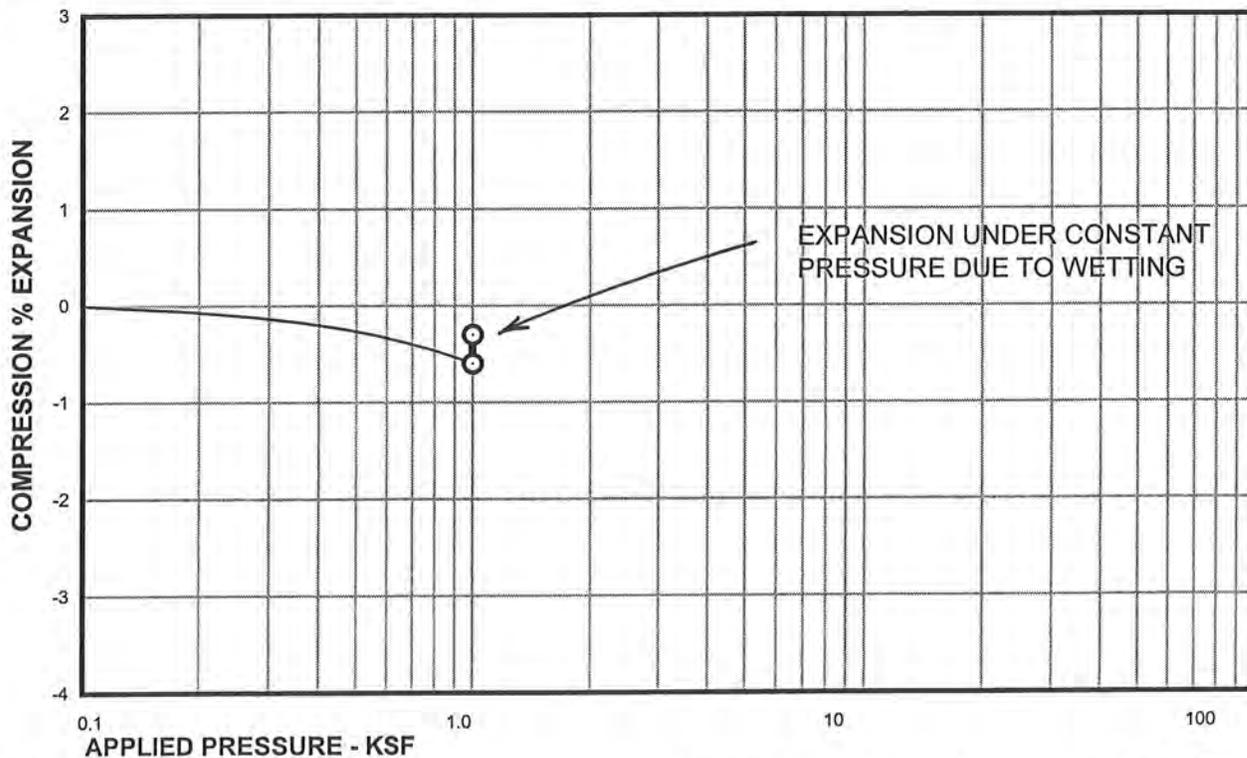
Sample of CLAY, SANDY (CL)
From TH-10 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 98 PCF
SAMPLE MOISTURE CONTENT= 26.9 %



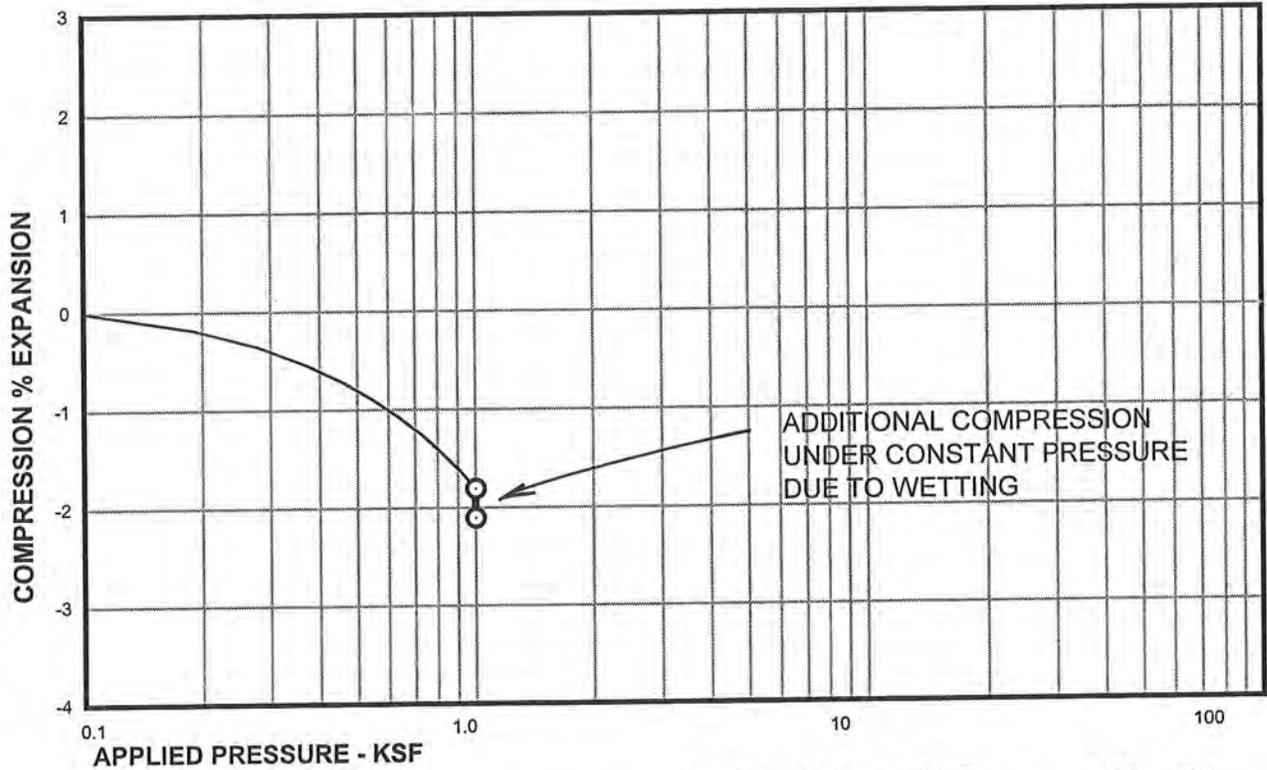
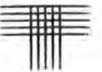
Sample of CLAY, SANDY (CL)
From TH-12 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 91 PCF
SAMPLE MOISTURE CONTENT= 30.1 %



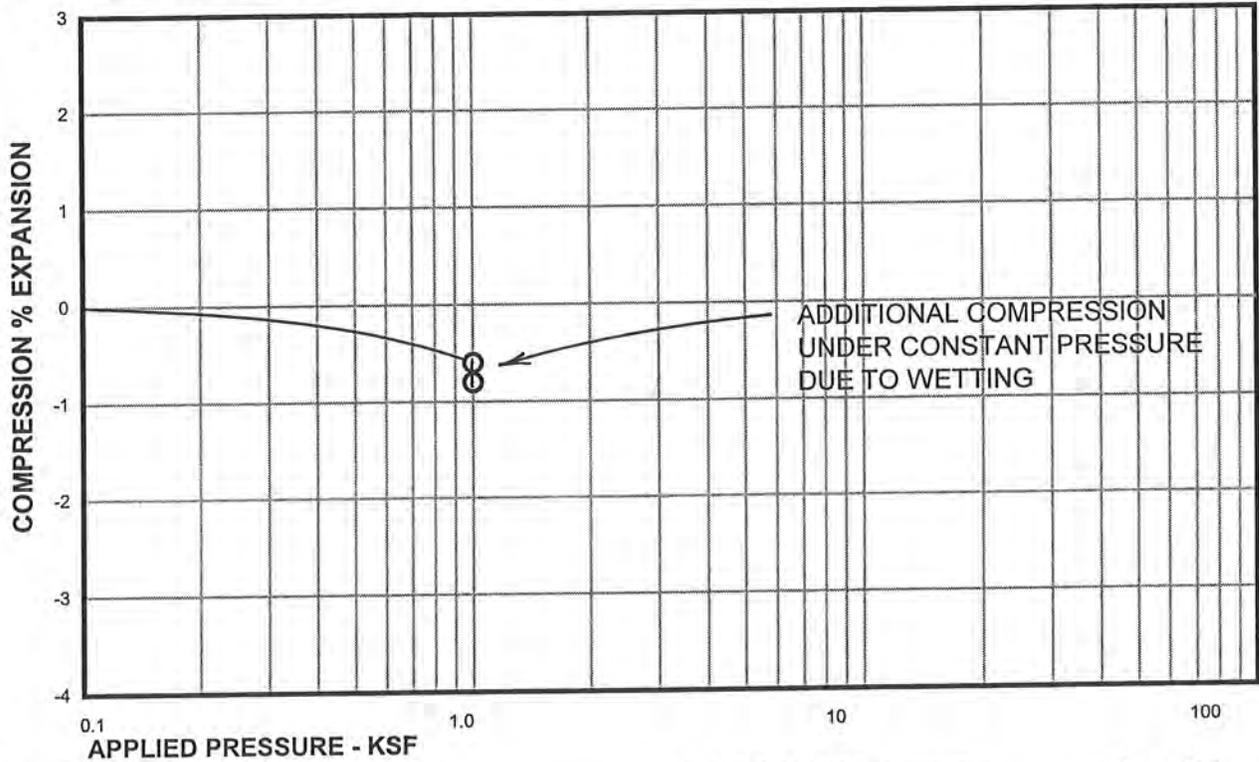
Sample of CLAY, SANDY (CL)
From TH-14 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 121 PCF
SAMPLE MOISTURE CONTENT= 7.8 %



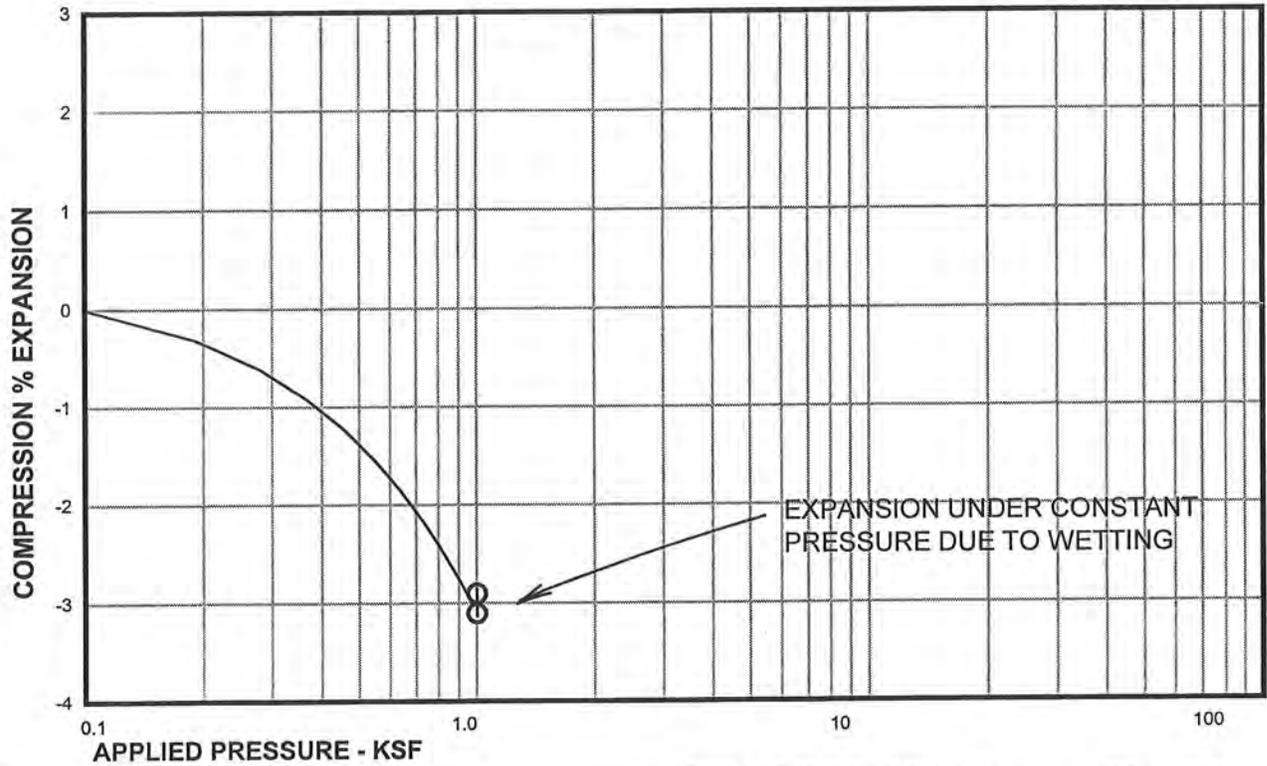
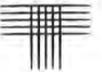
Sample of CLAY, SANDY (CL)
From TH-17 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 103 PCF
SAMPLE MOISTURE CONTENT= 24.2 %



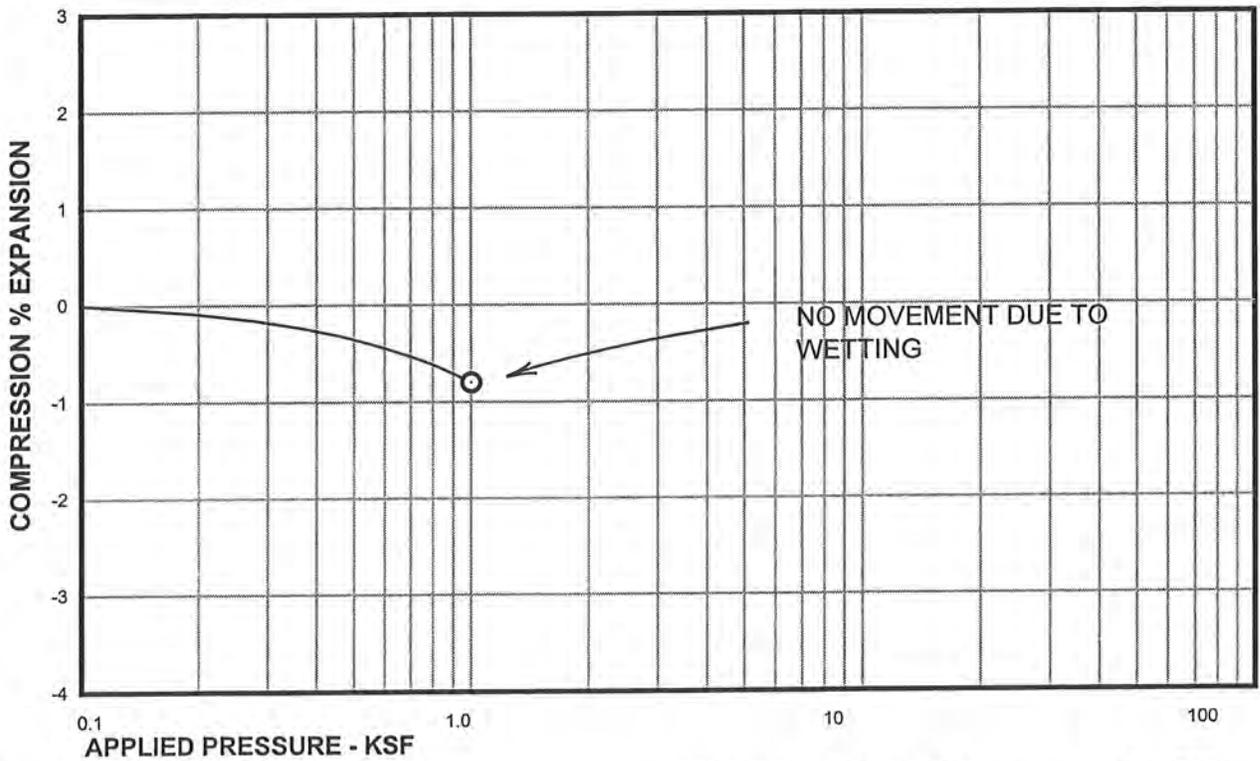
Sample of CLAY, SANDY (CL)
From TH-19 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 122 PCF
SAMPLE MOISTURE CONTENT= 11.9 %



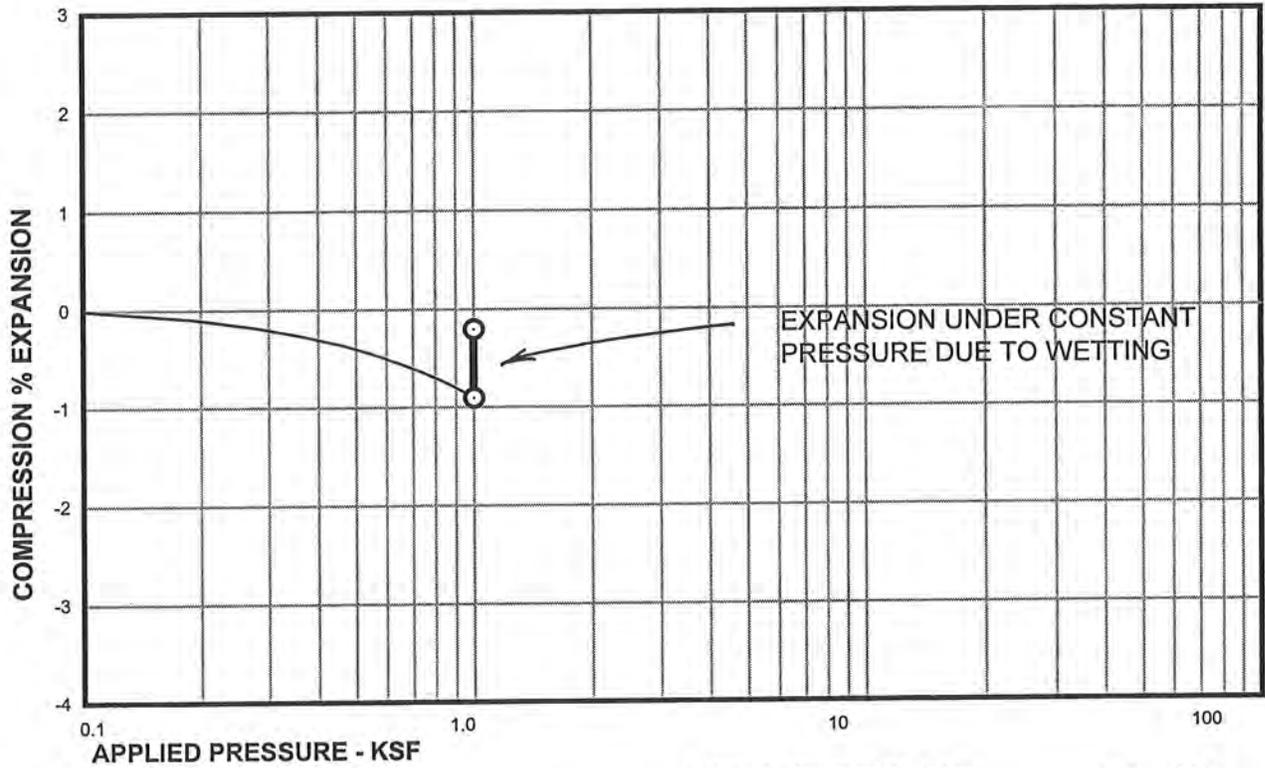
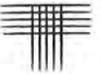
Sample of CLAY, SANDY (CL)
From TH-20 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 106 PCF
SAMPLE MOISTURE CONTENT= 23.9 %



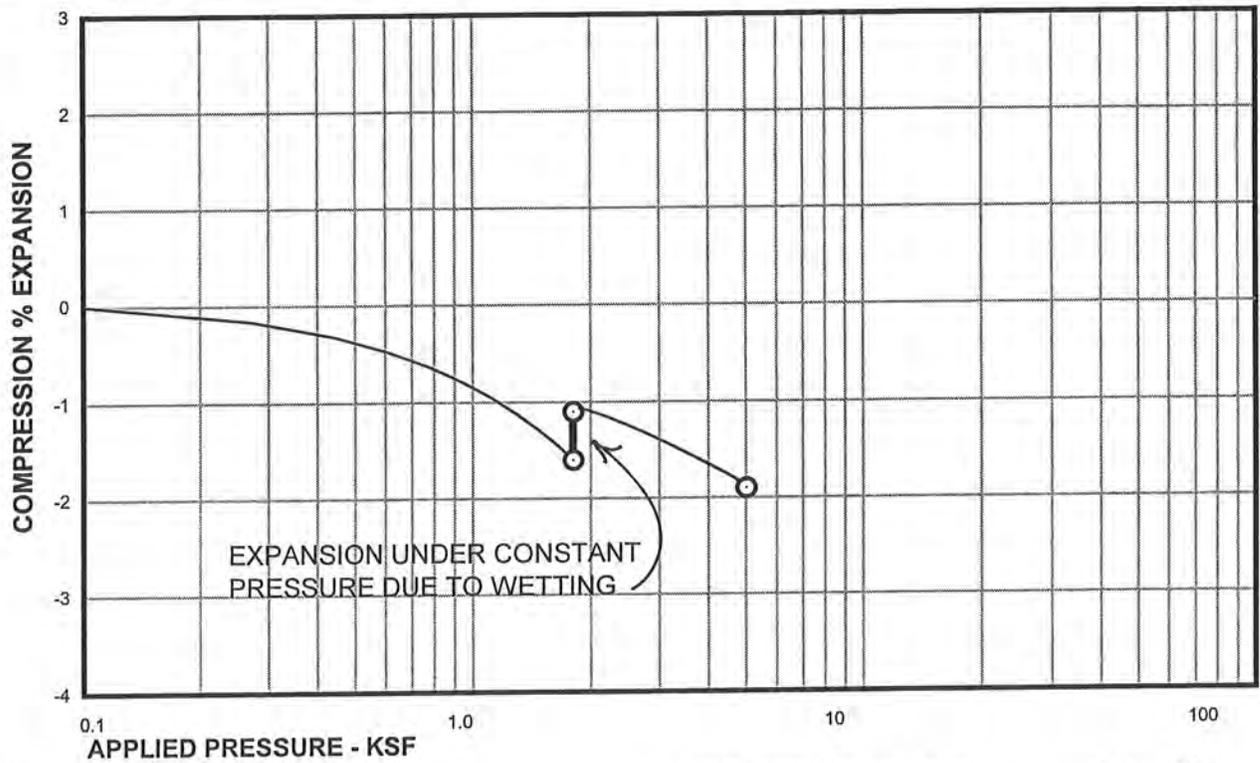
Sample of CLAY, SANDY (CL)
From TH-22 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 117 PCF
SAMPLE MOISTURE CONTENT= 8.1 %



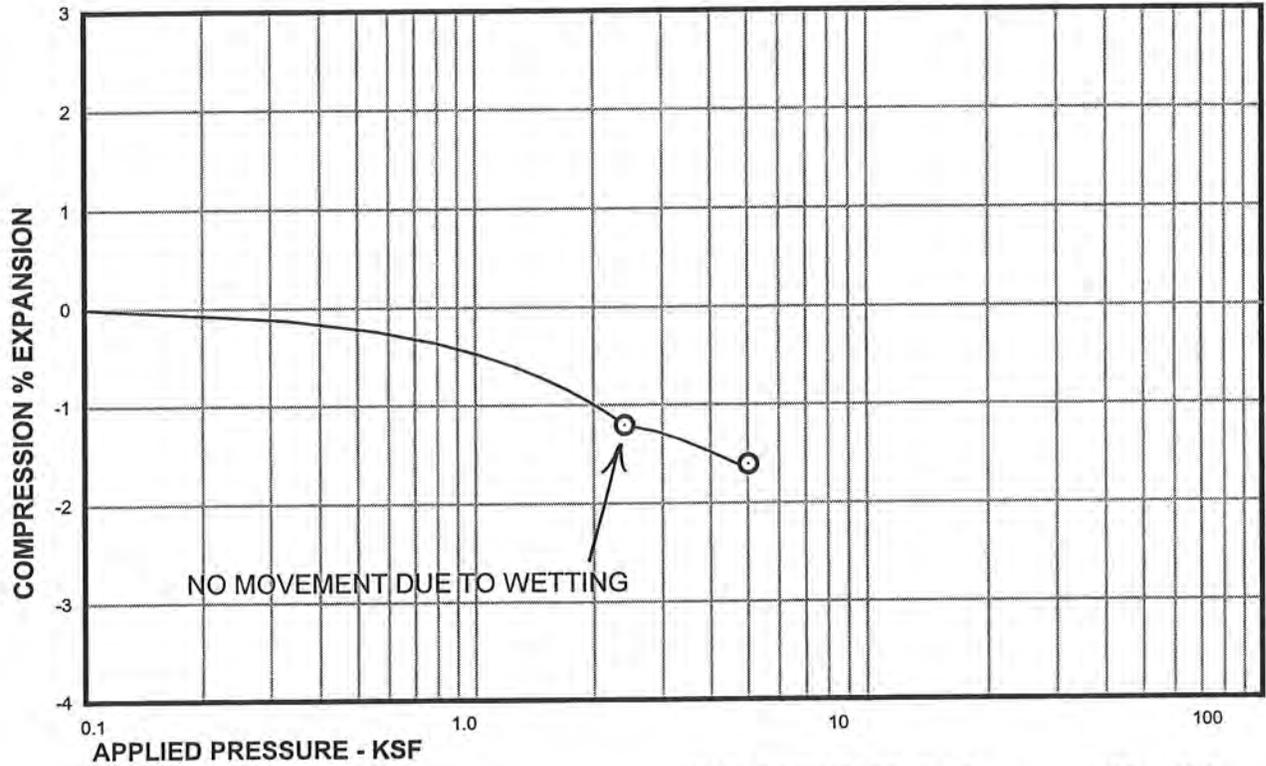
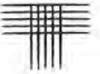
Sample of CLAY, SANDY (CL)
From TH-23 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 114 PCF
SAMPLE MOISTURE CONTENT= 15.0 %



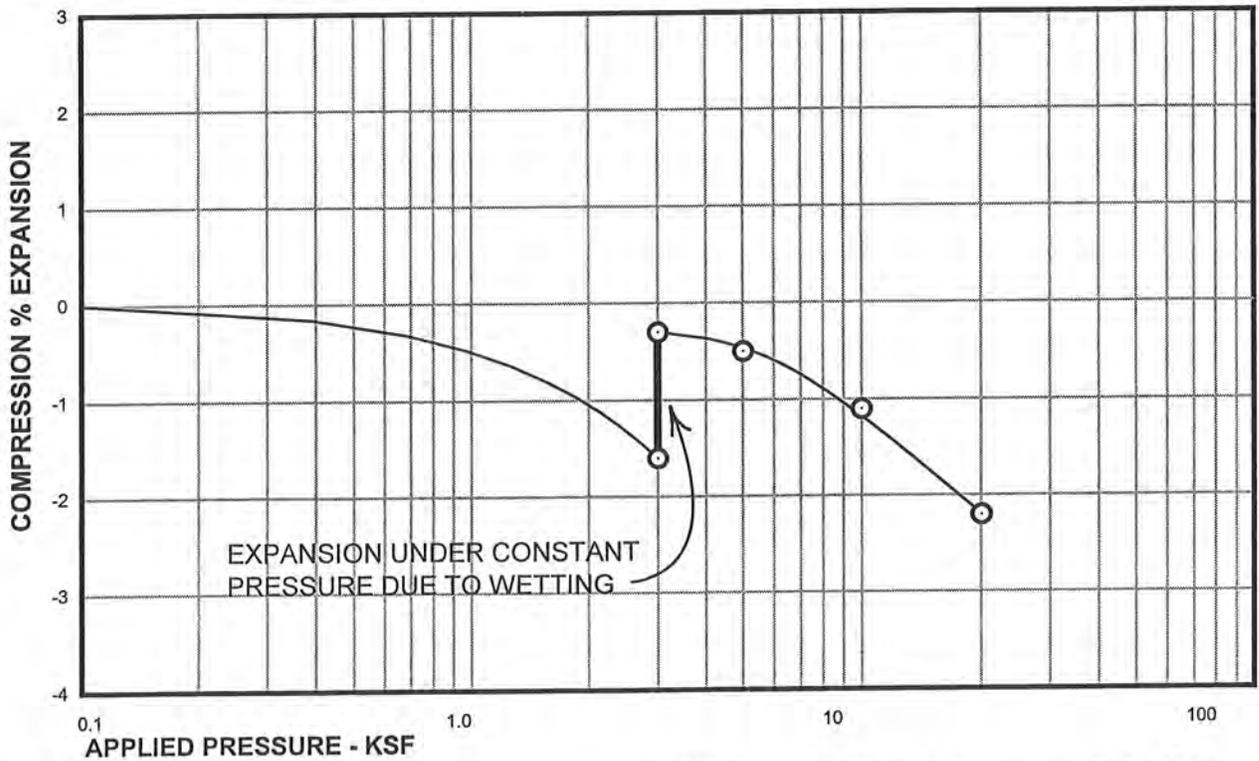
Sample of CLAYSTONE
From TH-25 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 125 PCF
SAMPLE MOISTURE CONTENT= 10.7 %



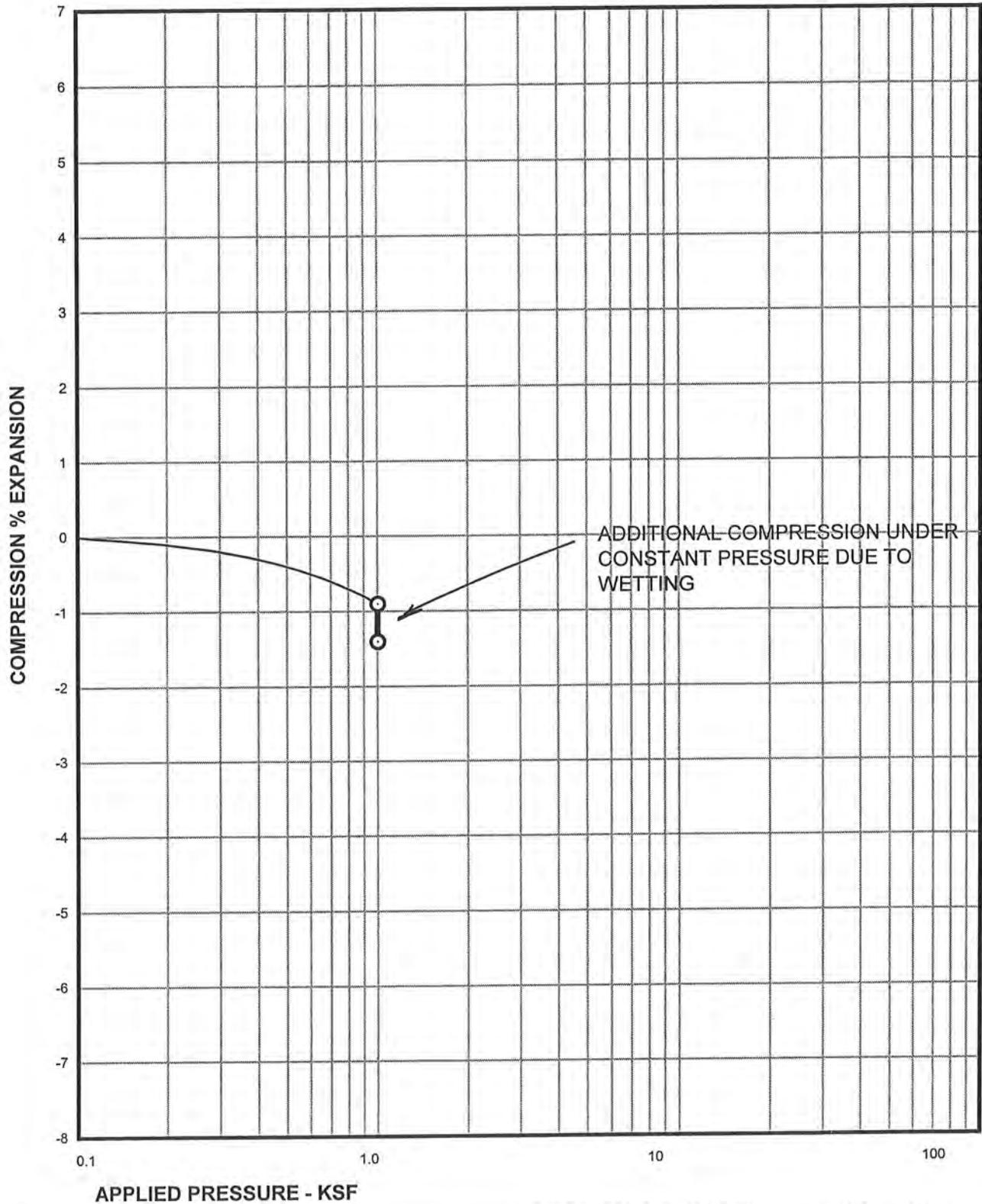
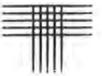
Sample of CLAYSTONE
From TH-25 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 122 PCF
SAMPLE MOISTURE CONTENT= 13.5 %



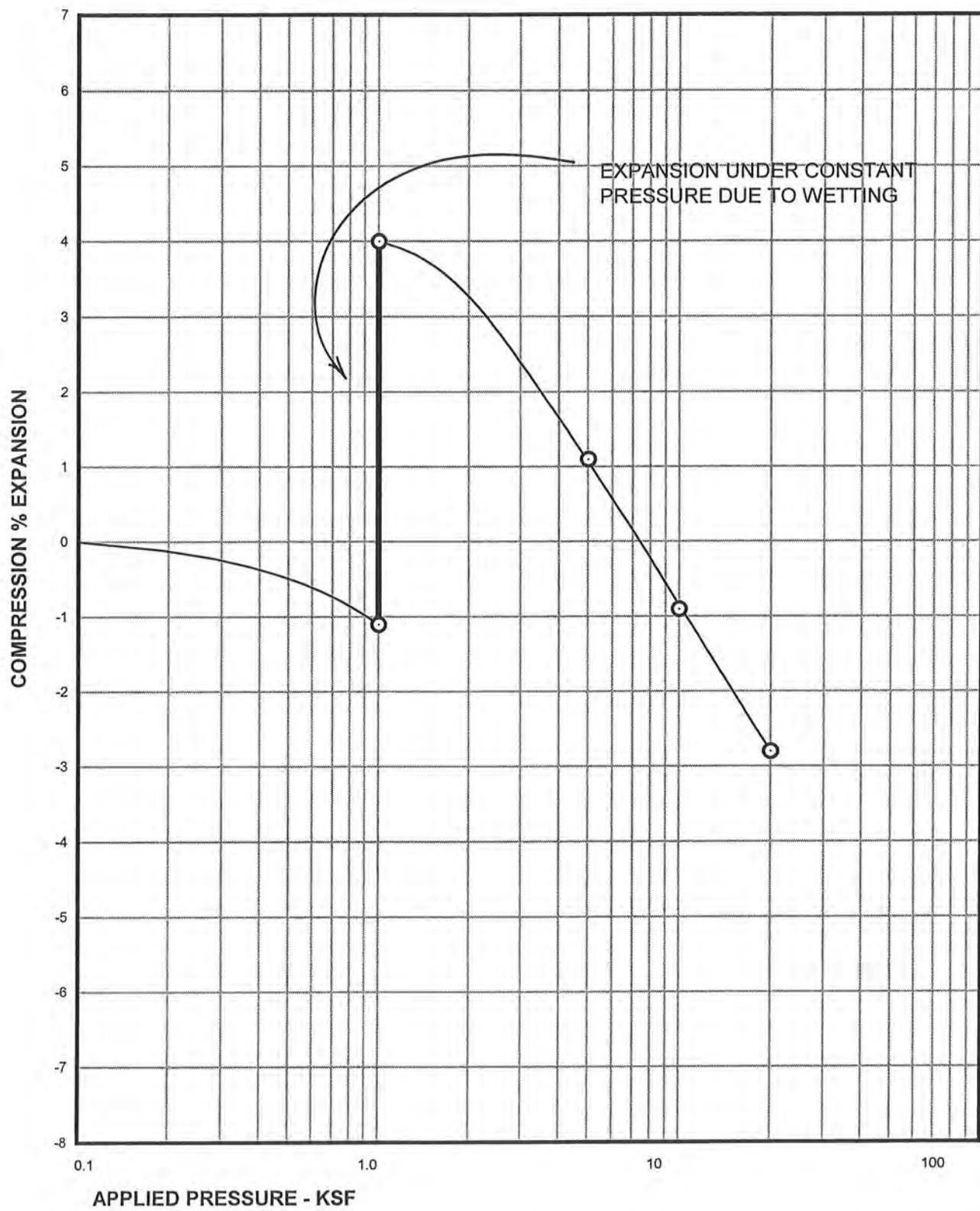
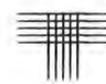
Sample of CLAYSTONE
From TH-25 AT 24 FEET

SAMPLE DRY UNIT WEIGHT= 122 PCF
SAMPLE MOISTURE CONTENT= 15.4 %



Sample of SAND, CLAYEY (SC)
From TH-26 AT 4 FEET

SAMPLE DRY UNIT WEIGHT= 110 PCF
SAMPLE MOISTURE CONTENT= 11.5 %



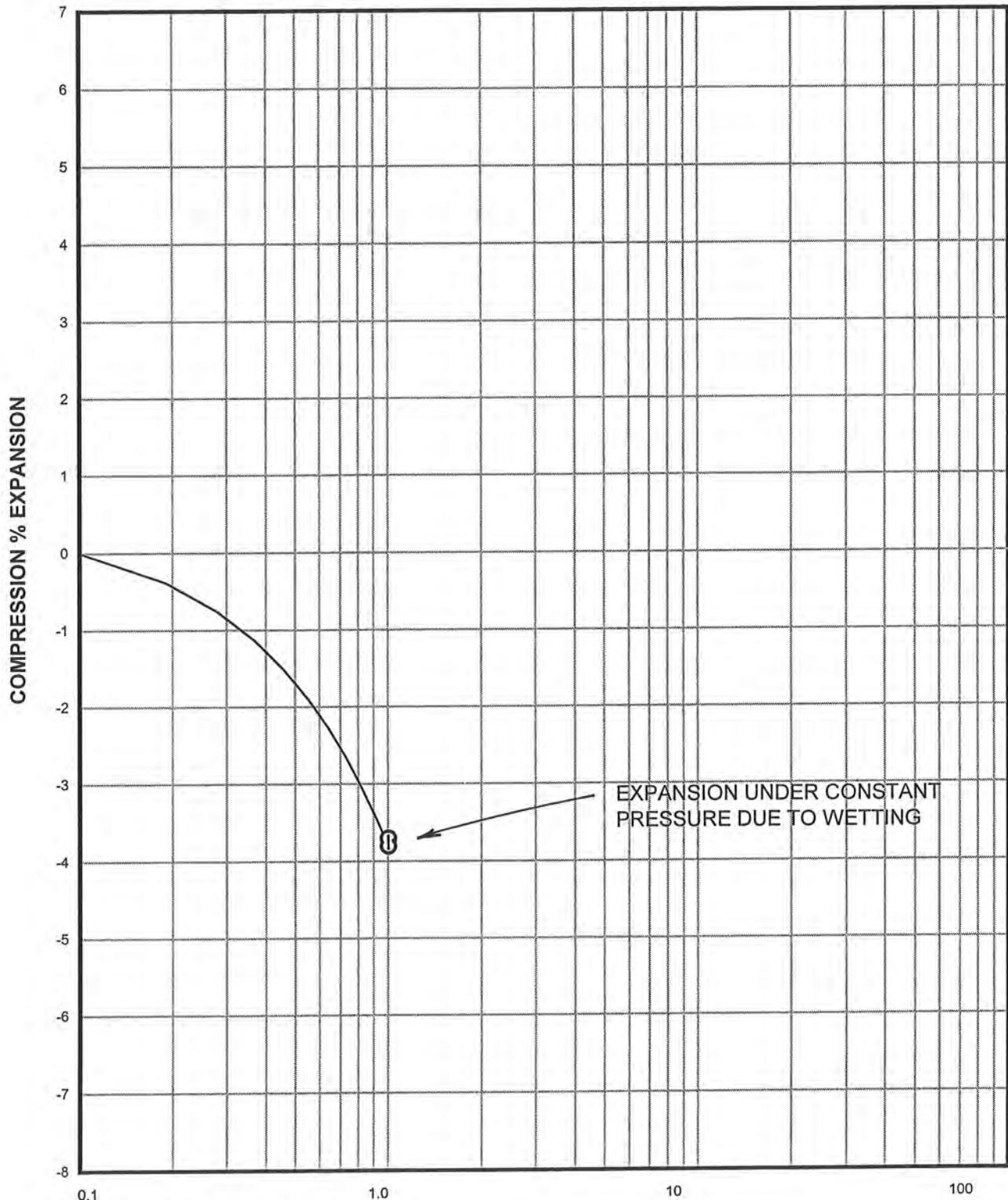
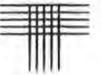
Sample of CLAYSTONE
From TH-27 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 122 PCF
SAMPLE MOISTURE CONTENT= 15.4 %

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Swell Consolidation Test Results

FIG. B-10



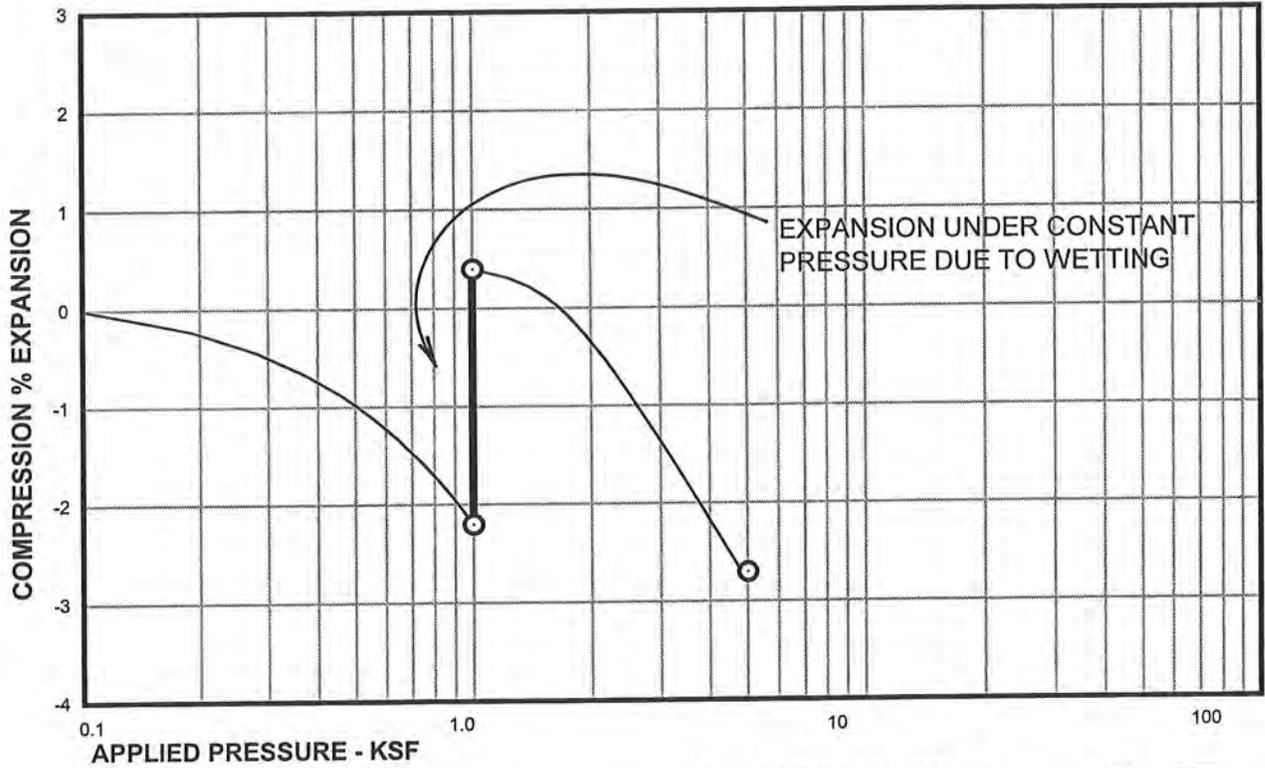
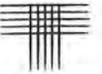
APPLIED PRESSURE - KSF
Sample of CLAY, SANDY (CL)
From TH-28 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 110 PCF
SAMPLE MOISTURE CONTENT= 18.3 %

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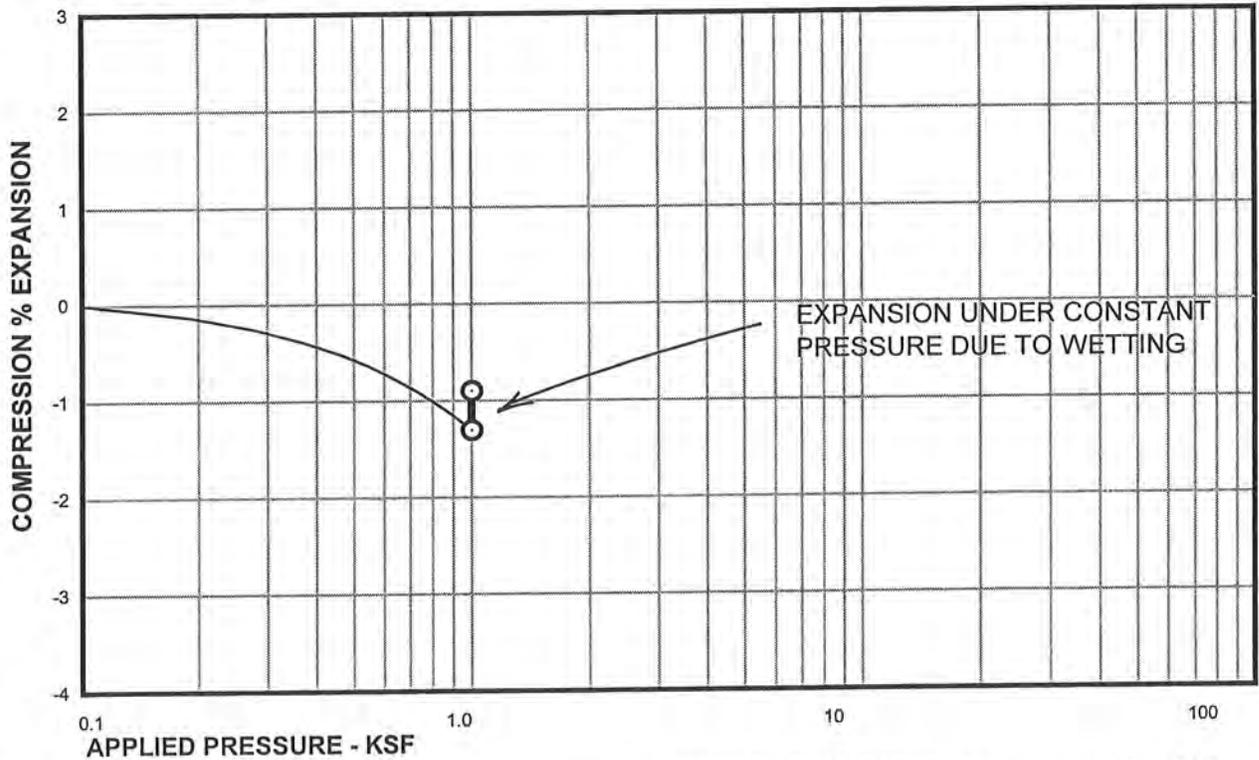
Swell Consolidation Test Results

FIG. B-11



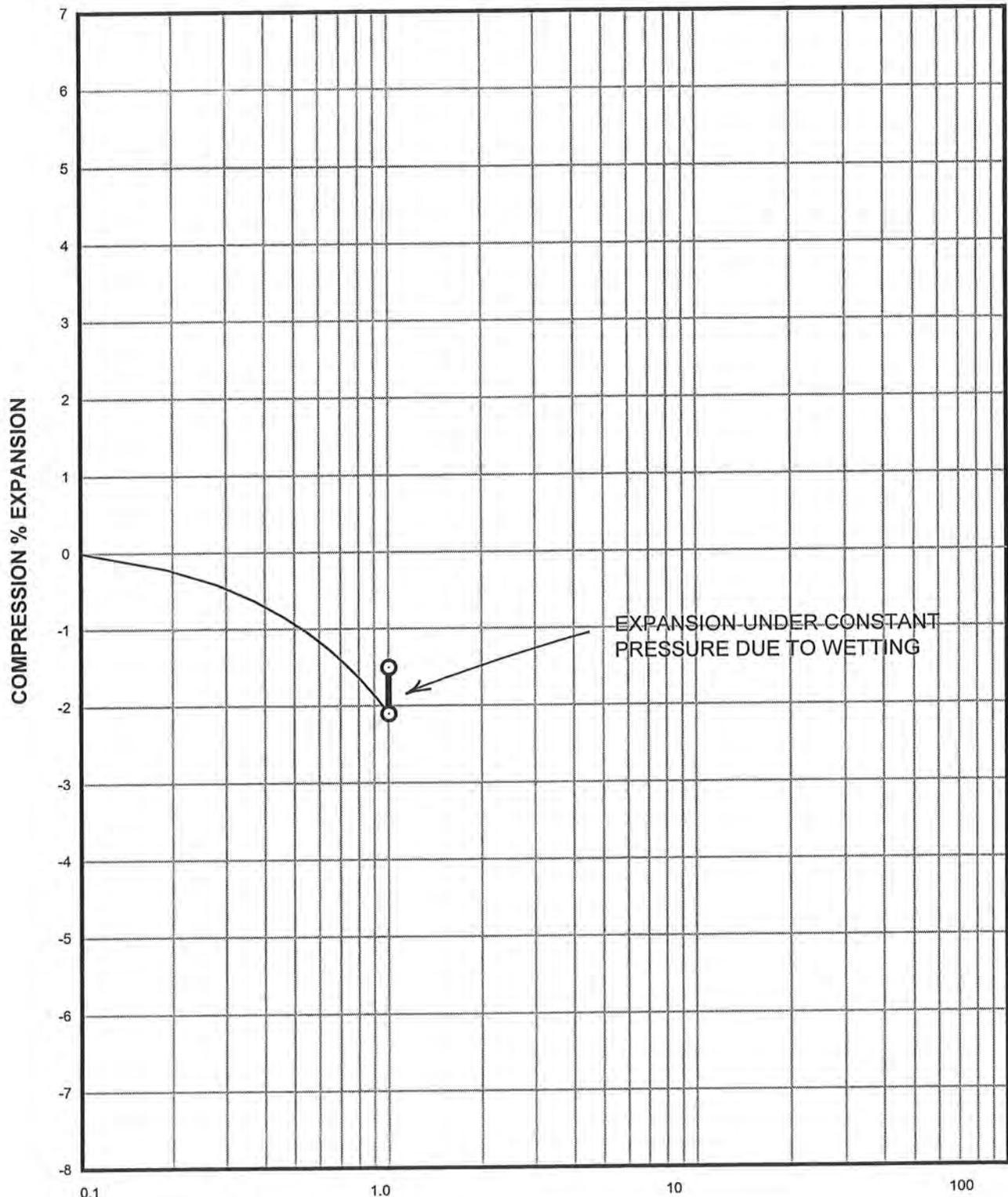
Sample of WEATHERED CLAYSTONE
From TH-28 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 122 PCF
SAMPLE MOISTURE CONTENT= 12.3 %



Sample of WEATHERED CLAYSTONE
From TH-29 AT 14 FEET

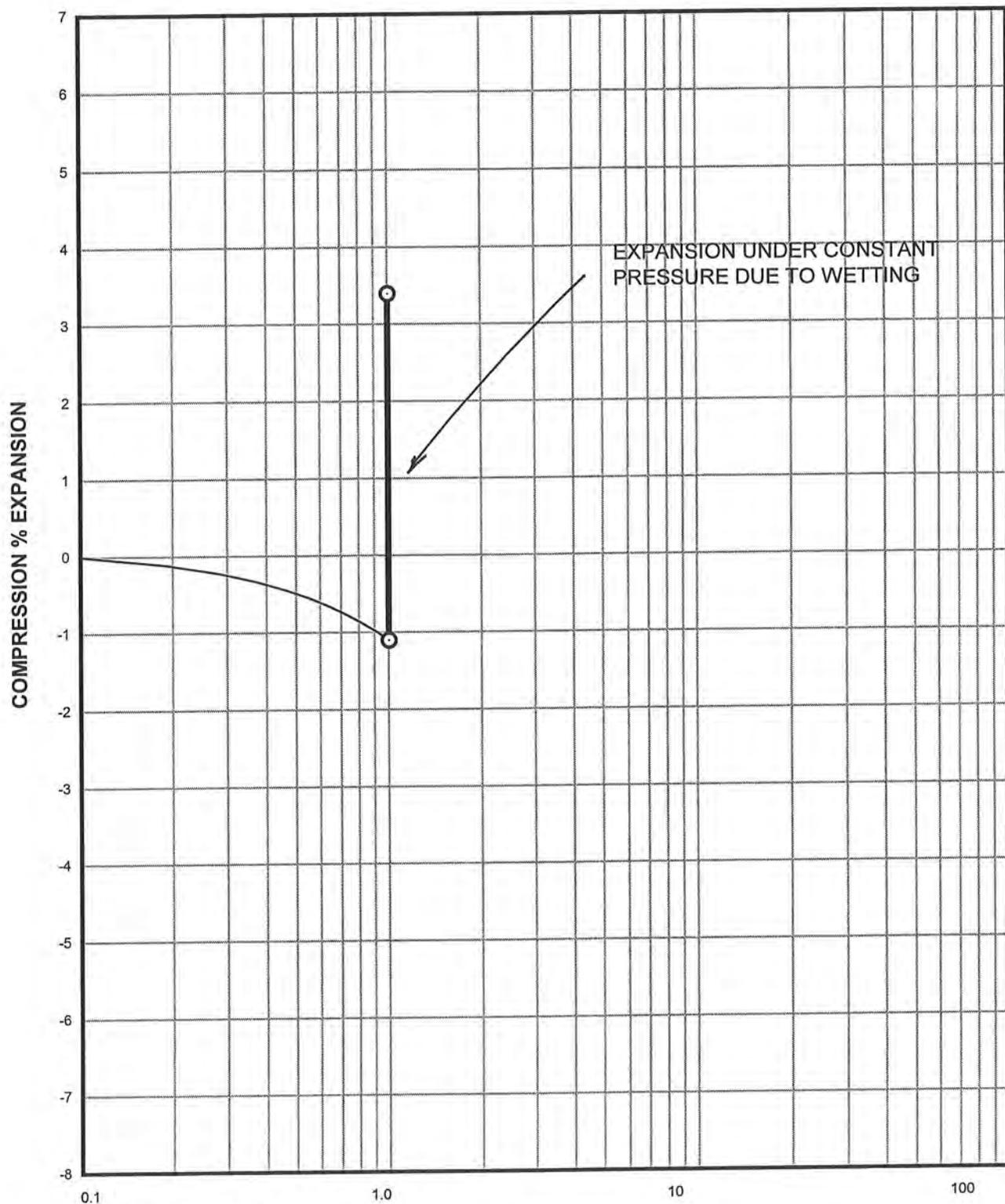
SAMPLE DRY UNIT WEIGHT= 110 PCF
SAMPLE MOISTURE CONTENT= 18.4 %



APPLIED PRESSURE - KSF

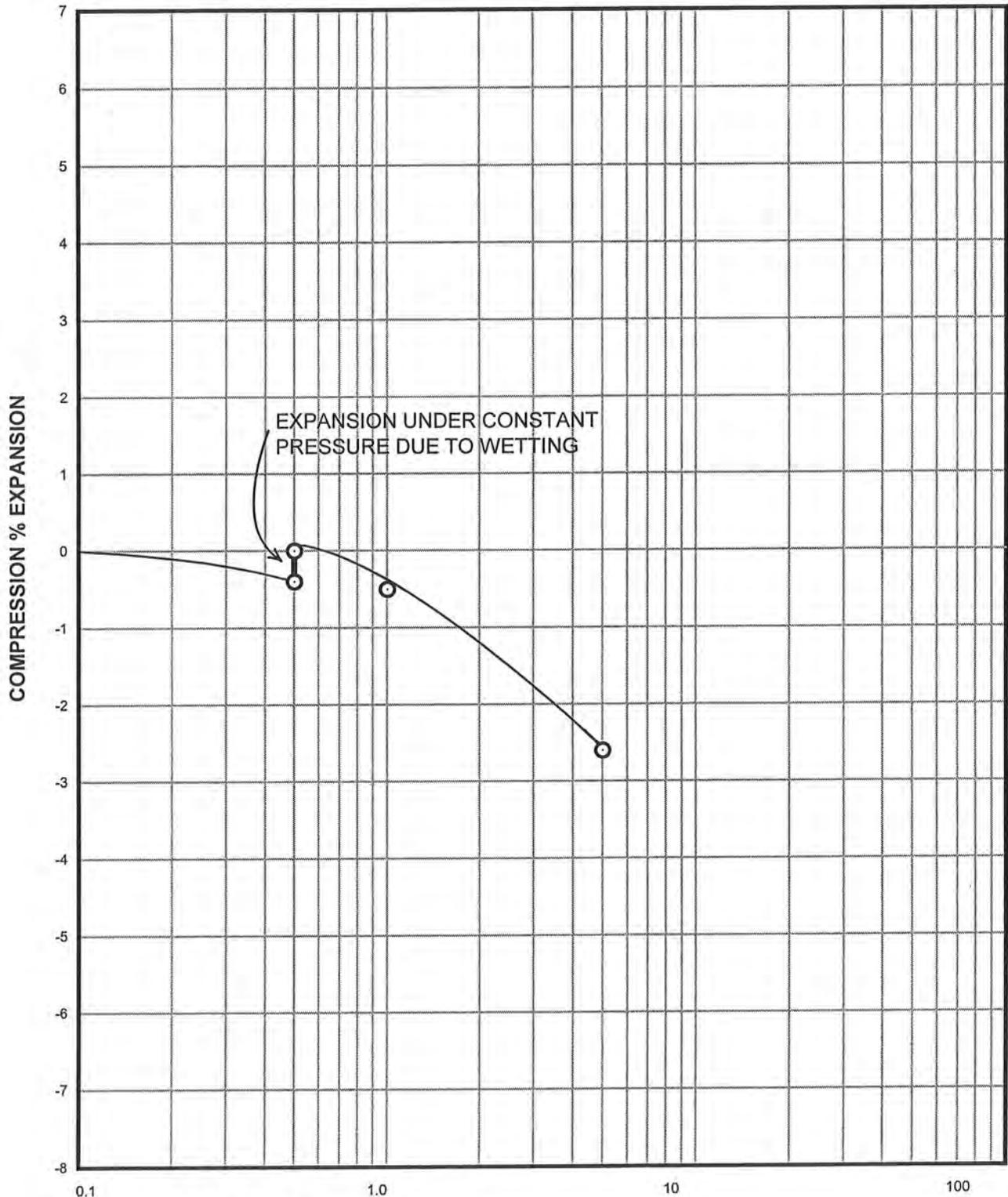
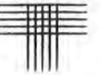
Sample of WEATHERED CLAYSTONE
From TH-31 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 117 PCF
SAMPLE MOISTURE CONTENT= 15.0 %



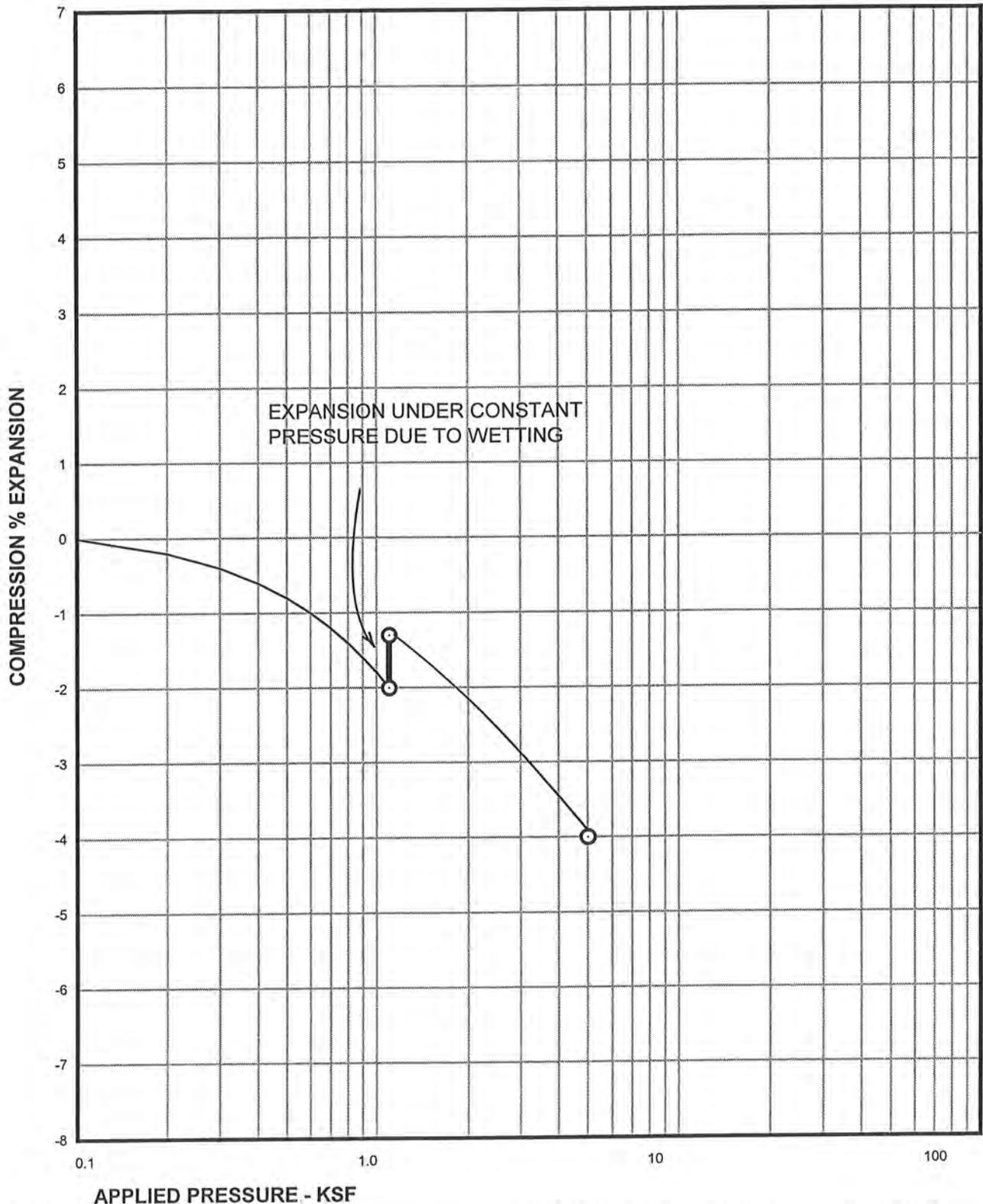
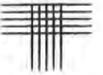
Sample of WEATHERED CLAYSTONE
From TH-32 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 119 PCF
SAMPLE MOISTURE CONTENT= 15.3 %



APPLIED PRESSURE - KSF
Sample of SAND, SILTY (SM)
From TH-33 AT 4 FEET

SAMPLE DRY UNIT WEIGHT= 113 PCF
SAMPLE MOISTURE CONTENT= 7.6 %



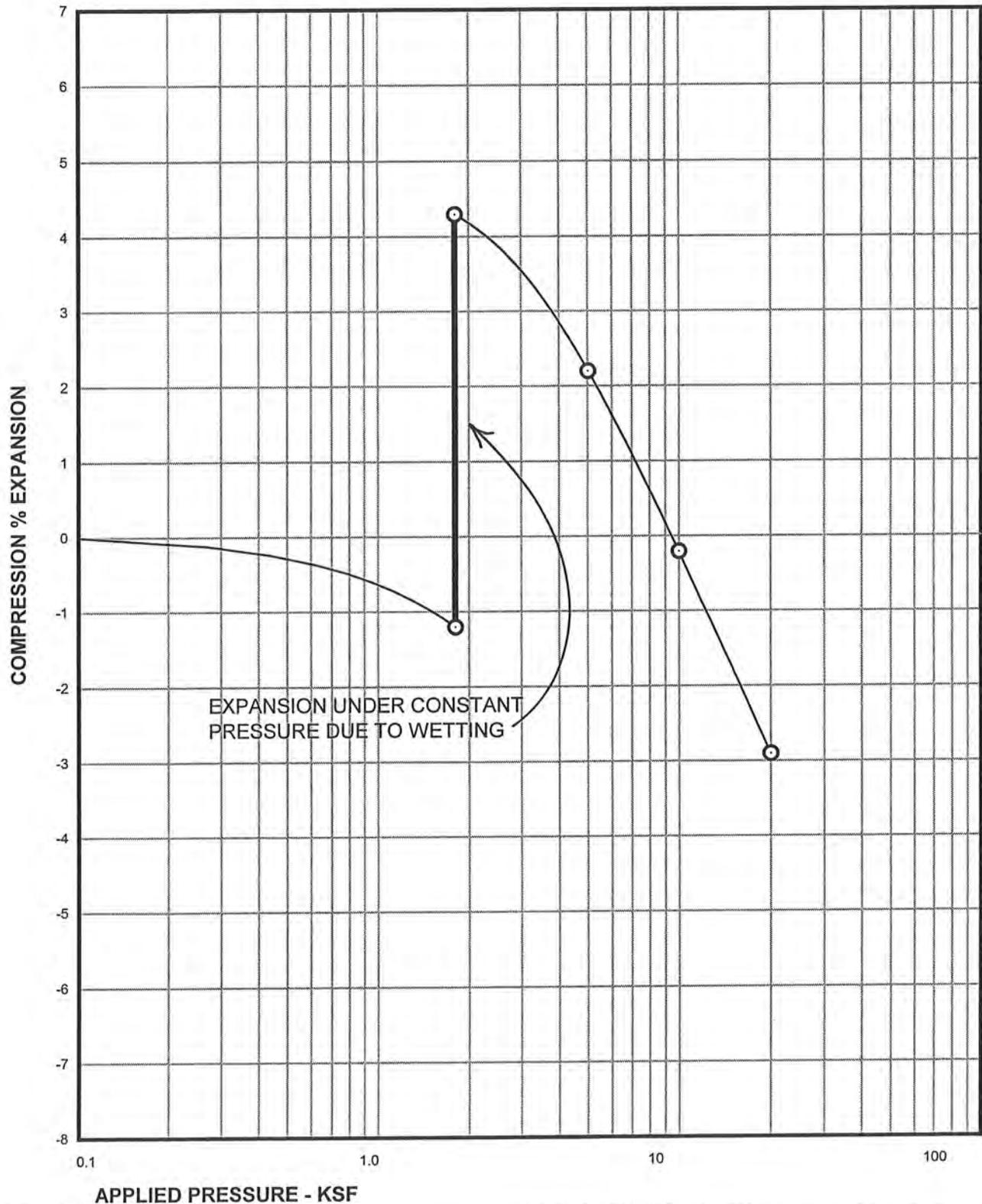
Sample of CLAY, SANDY (CL)
From TH-33 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 93 PCF
SAMPLE MOISTURE CONTENT= 26.0 %

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PROJECT NO. DN41,199-115

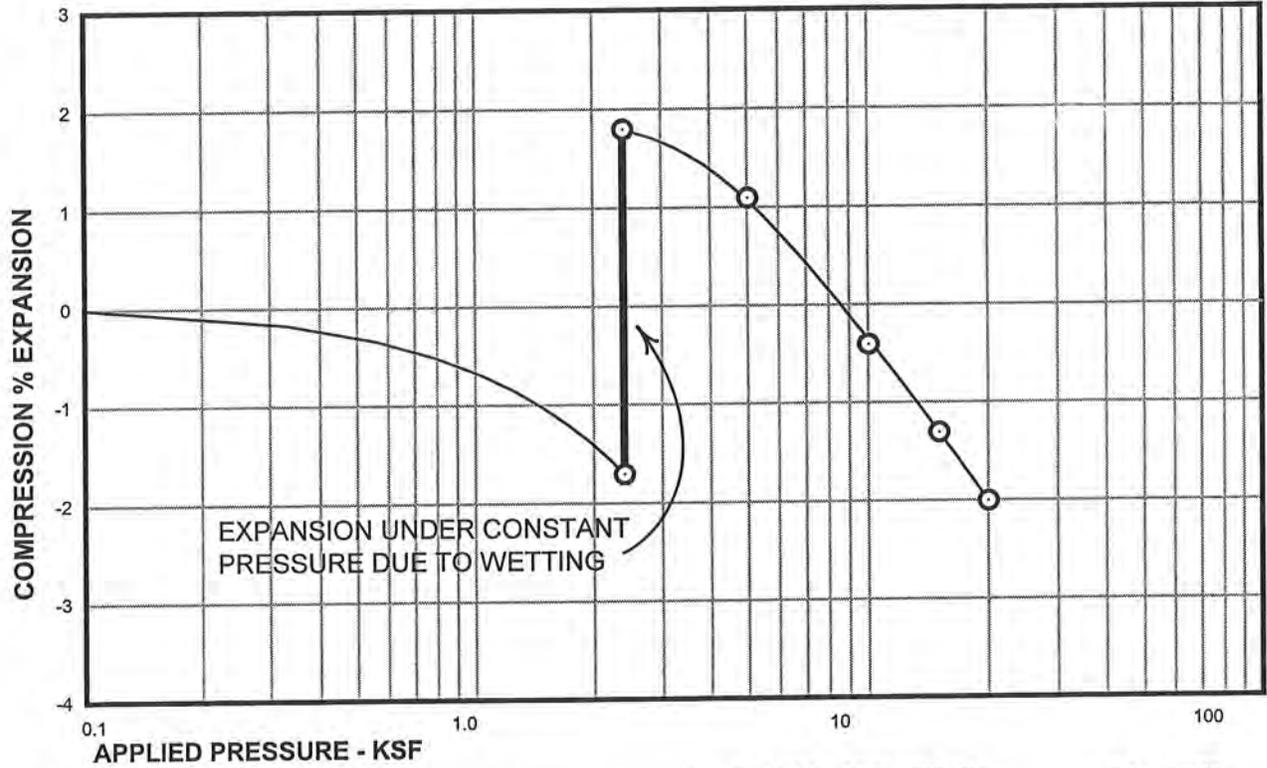
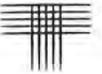
Swell Consolidation Test Results

FIG. B-16



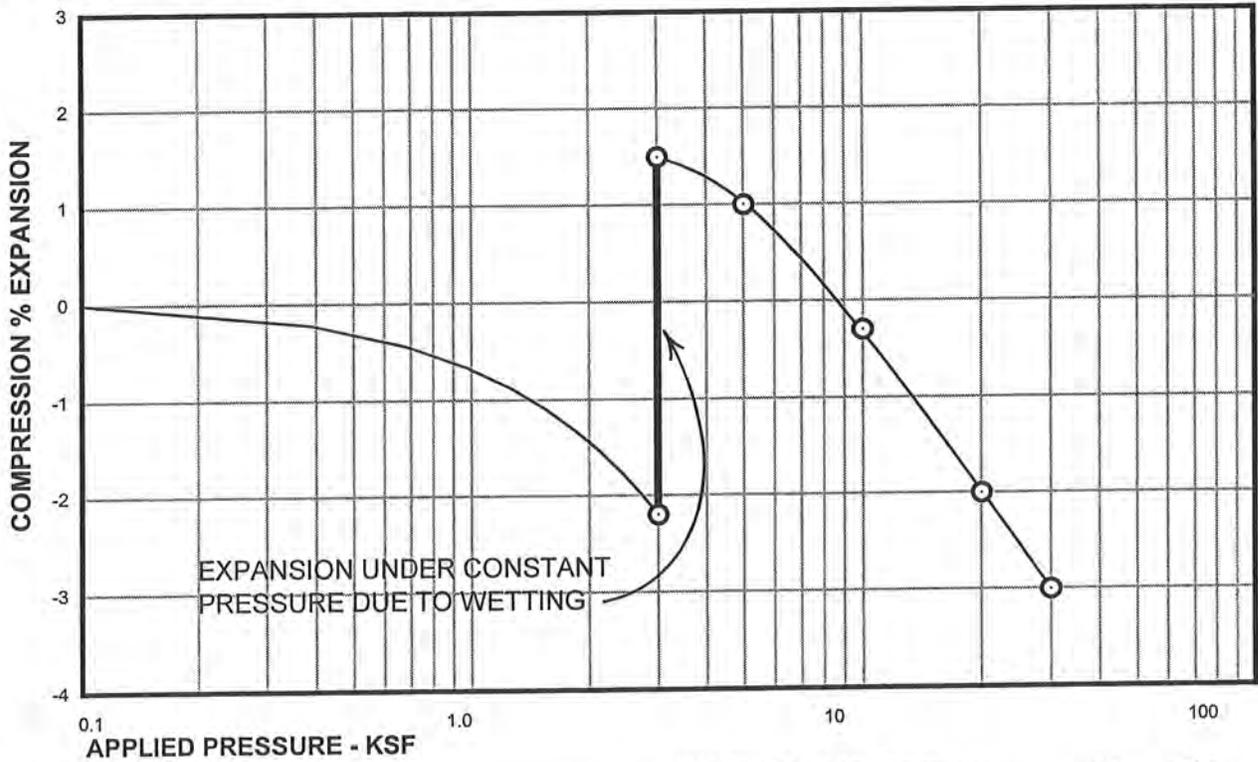
Sample of CLAYSTONE
From TH-33 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 127 PCF
SAMPLE MOISTURE CONTENT= 12.4 %



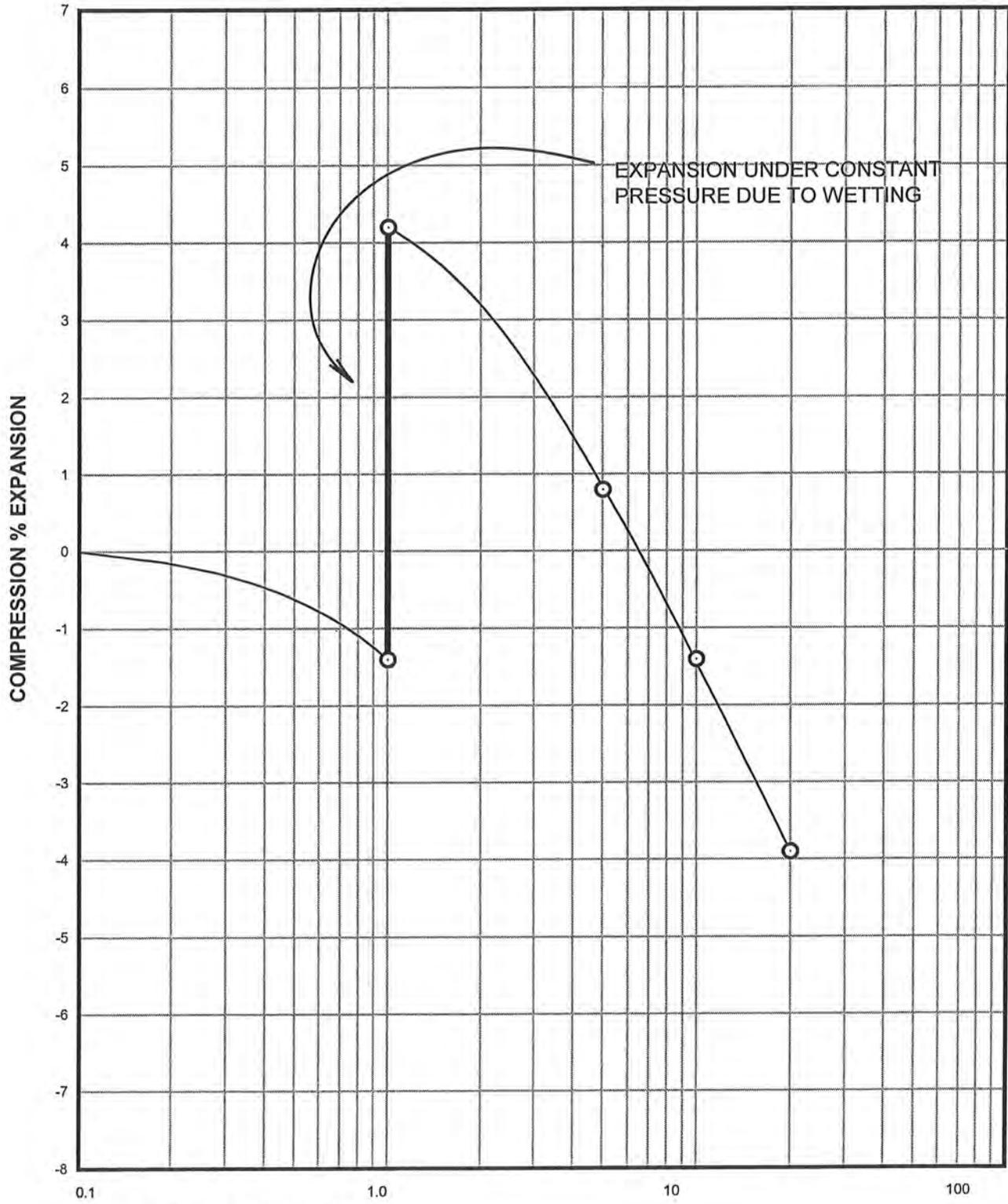
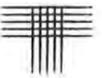
Sample of CLAYSTONE
From TH-33 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 125 PCF
SAMPLE MOISTURE CONTENT= 13.4 %



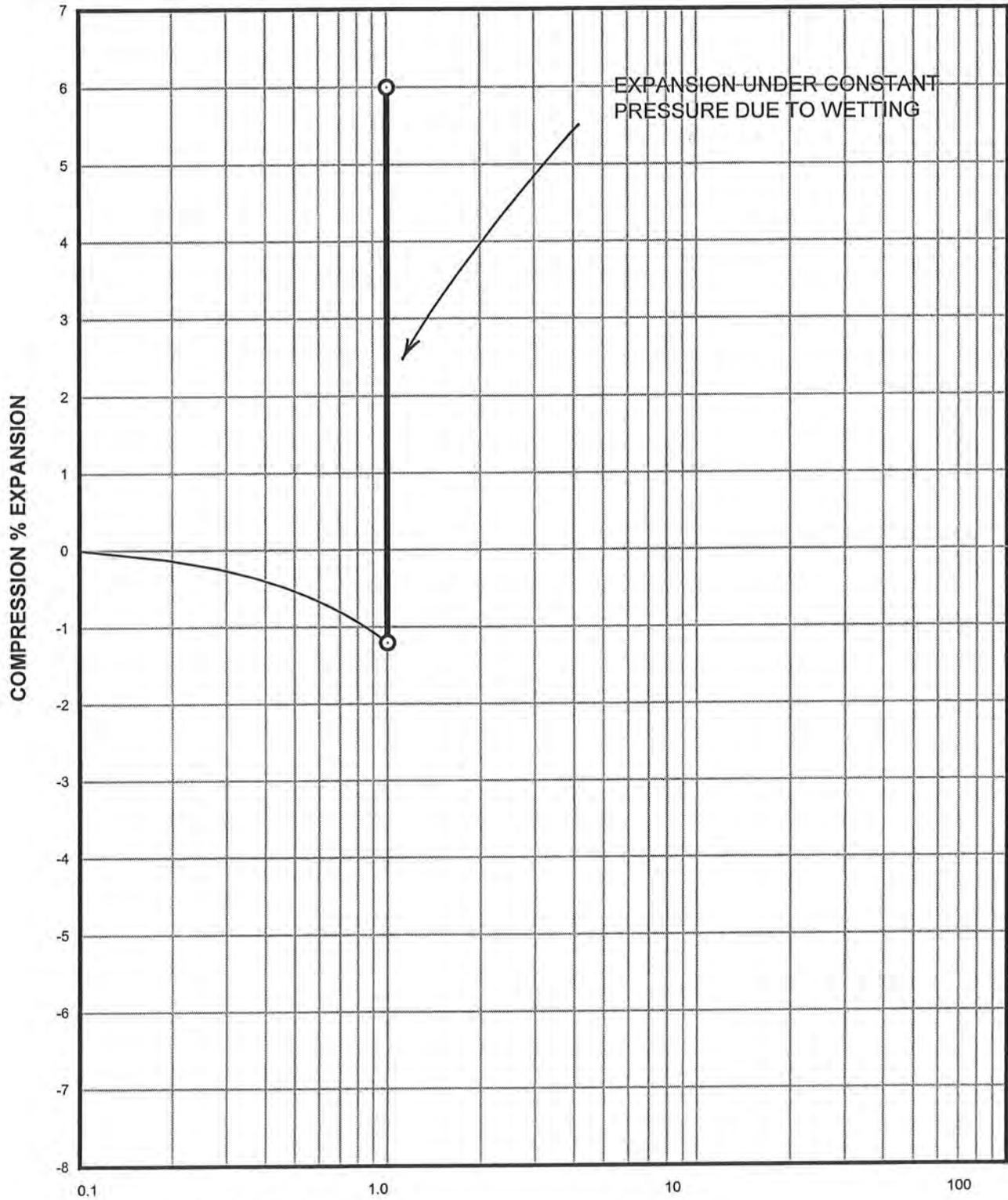
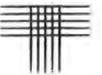
Sample of CLAYSTONE
From TH-33 AT 24 FEET

SAMPLE DRY UNIT WEIGHT= 125 PCF
SAMPLE MOISTURE CONTENT= 13.1 %



Sample of WEATHERED CLAYSTONE
From TH-34 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 101 PCF
SAMPLE MOISTURE CONTENT= 23.8 %



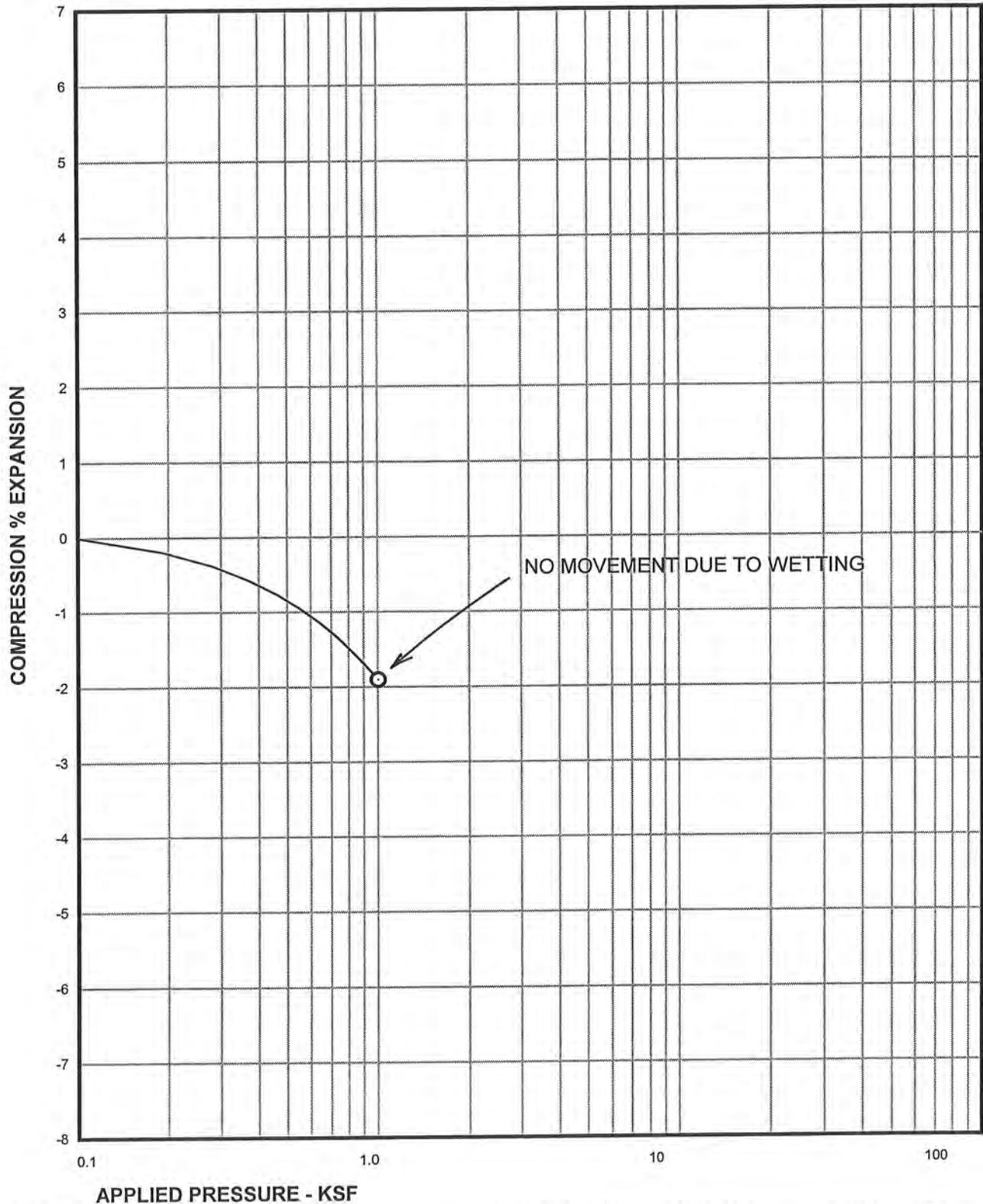
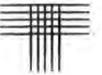
APPLIED PRESSURE - KSF
Sample of WEATHERED CLAYSTONE
From TH-34 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 125 PCF
SAMPLE MOISTURE CONTENT= 11.2 %

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Swell Consolidation Test Results

FIG. B-20



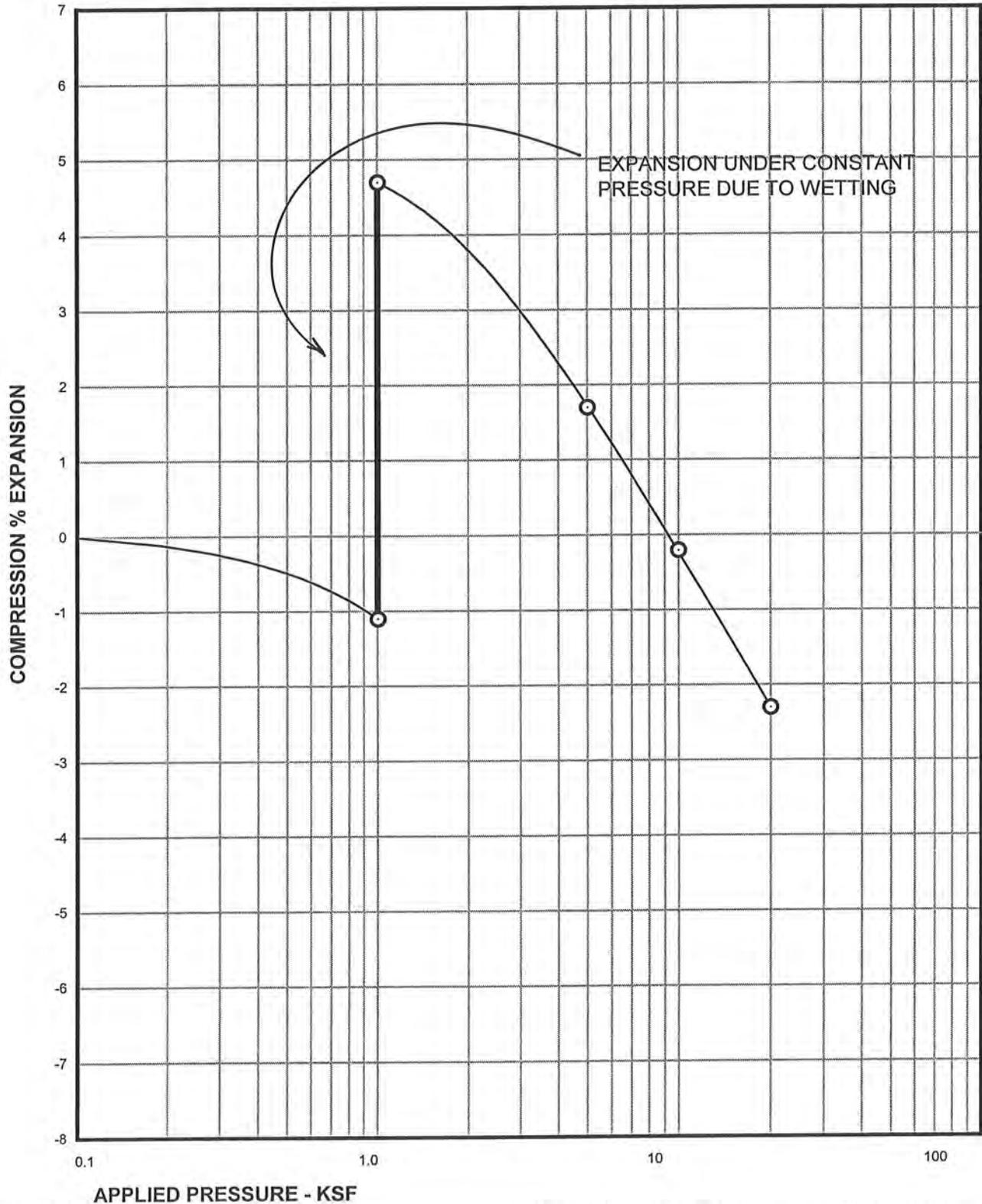
Sample of CLAY, SANDY (CL)
From TH-35 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 111 PCF
SAMPLE MOISTURE CONTENT= 17.6 %

177 JASPER INVESTMENTS, LLC
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PROJECT NO. DN41,199-115

Swell Consolidation Test Results

FIG. B-21



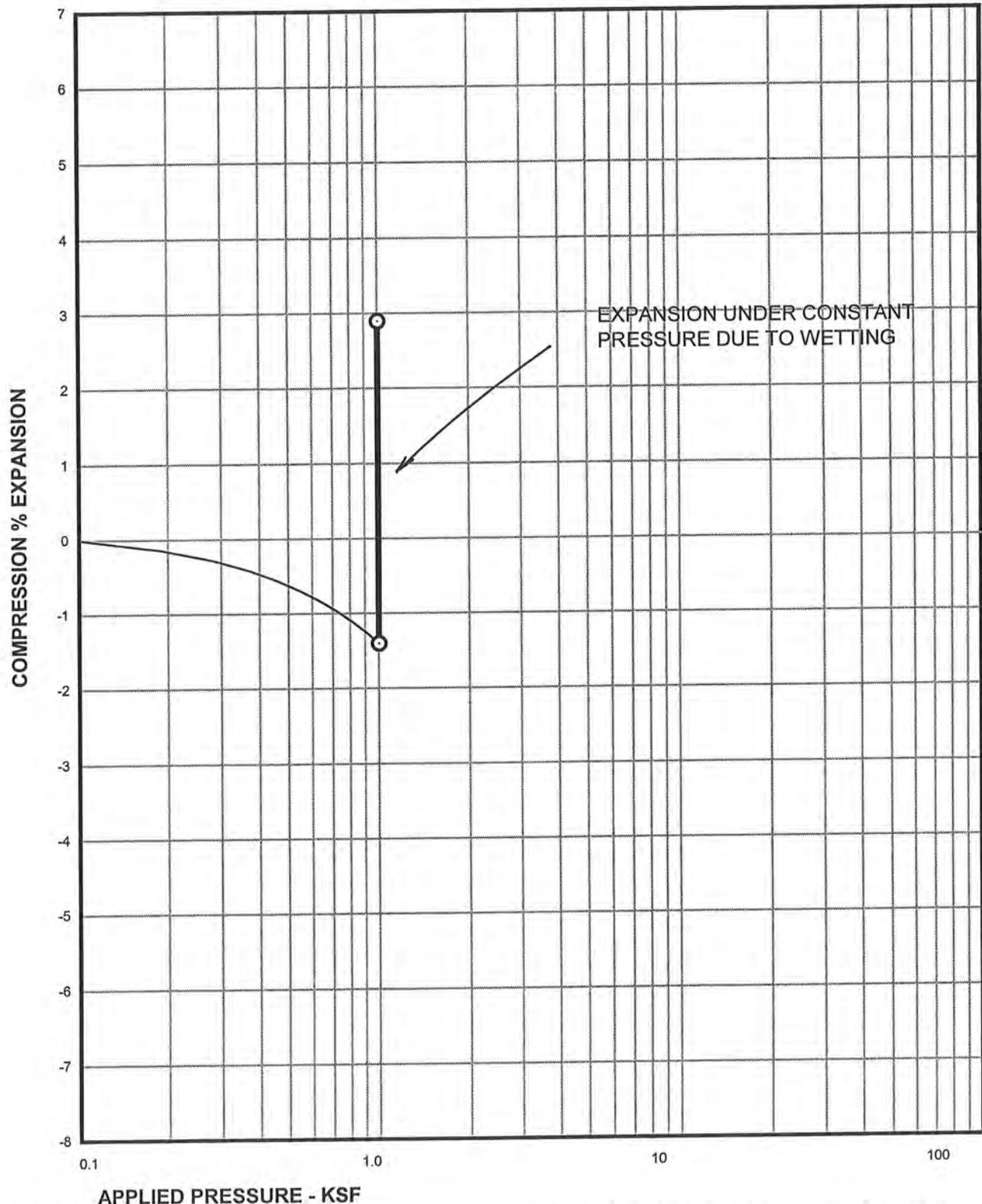
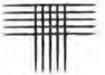
Sample of CLAYSTONE
From TH-35 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 119 PCF
SAMPLE MOISTURE CONTENT= 14.1 %

177 JASPER INVESTMENTS, LLC
WISE FARMS
PROJECT NO. DN41,199-115

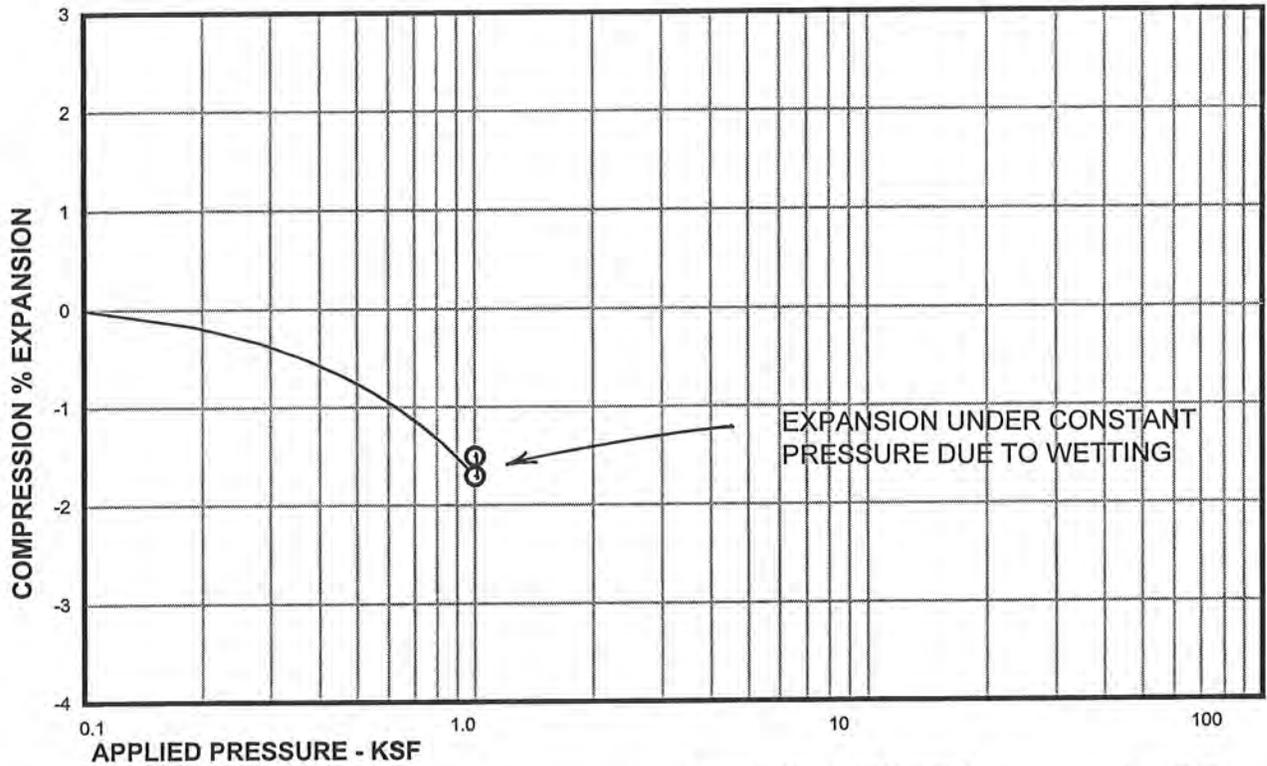
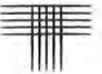
Swell Consolidation Test Results

FIG. B-22



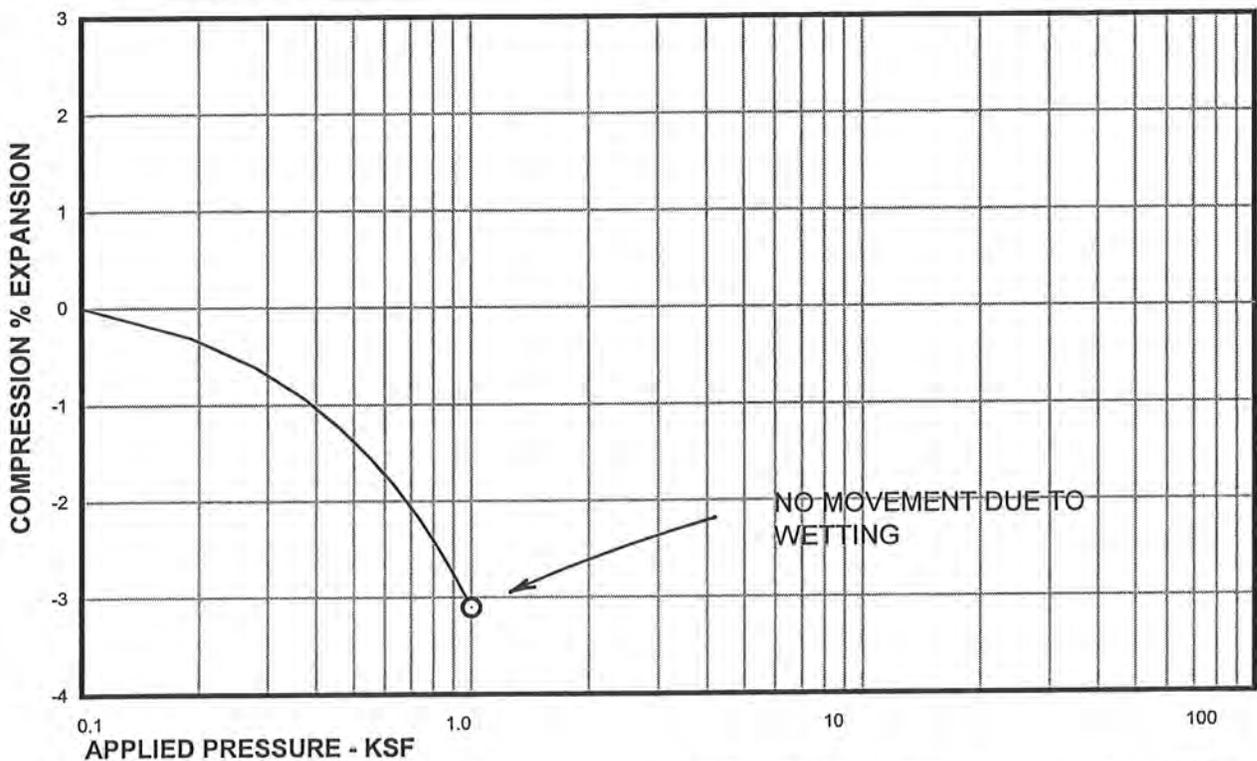
Sample of CLAYSTONE
From TH-37 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 105 PCF
SAMPLE MOISTURE CONTENT= 20.0 %



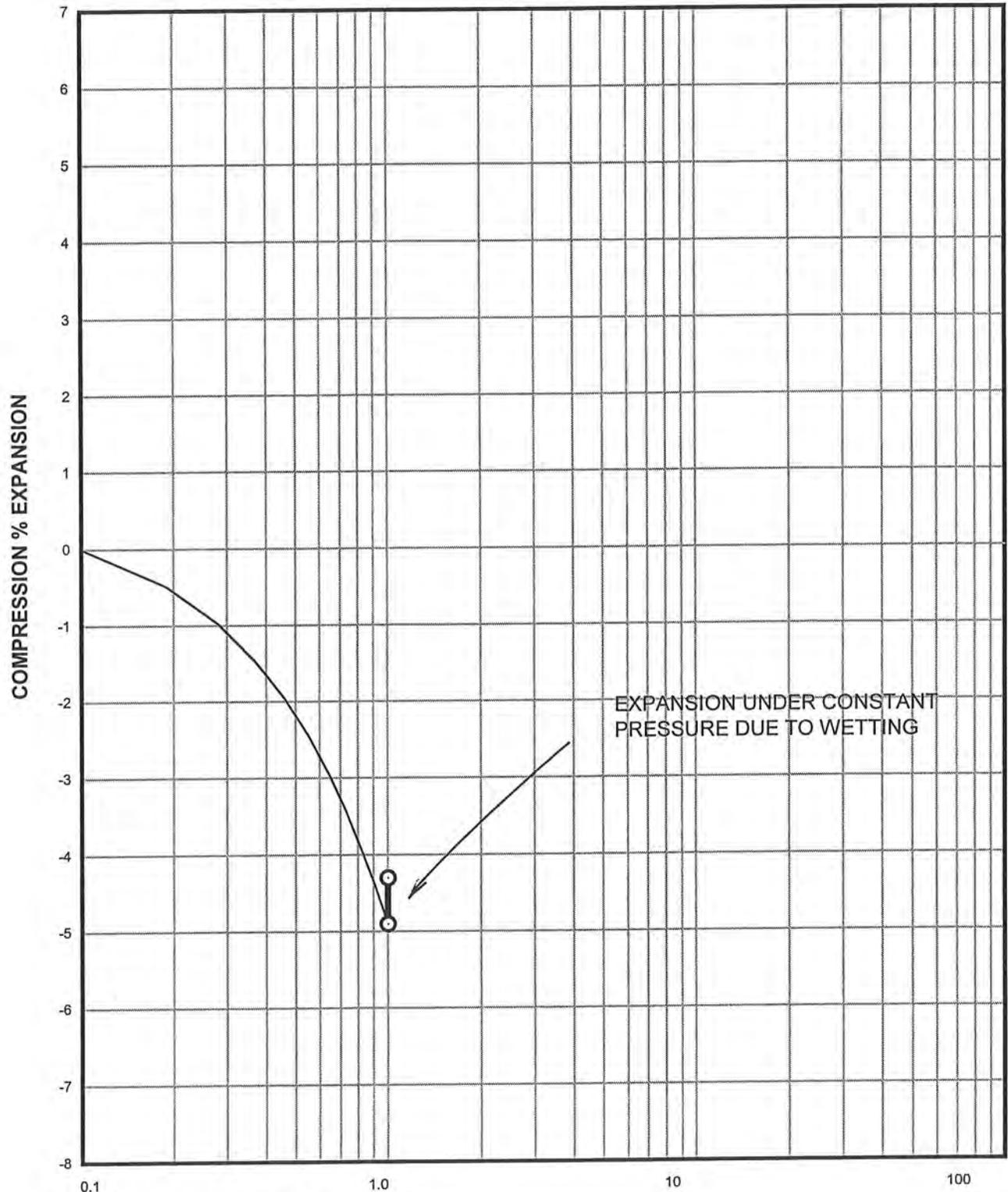
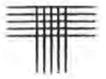
Sample of CLAY, SANDY (CL)
From TH-38 AT 4 FEET

SAMPLE DRY UNIT WEIGHT= 113 PCF
SAMPLE MOISTURE CONTENT= 17.6 %



Sample of CLAY, SANDY (CL)
From TH-38 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 101 PCF
SAMPLE MOISTURE CONTENT= 25.4 %



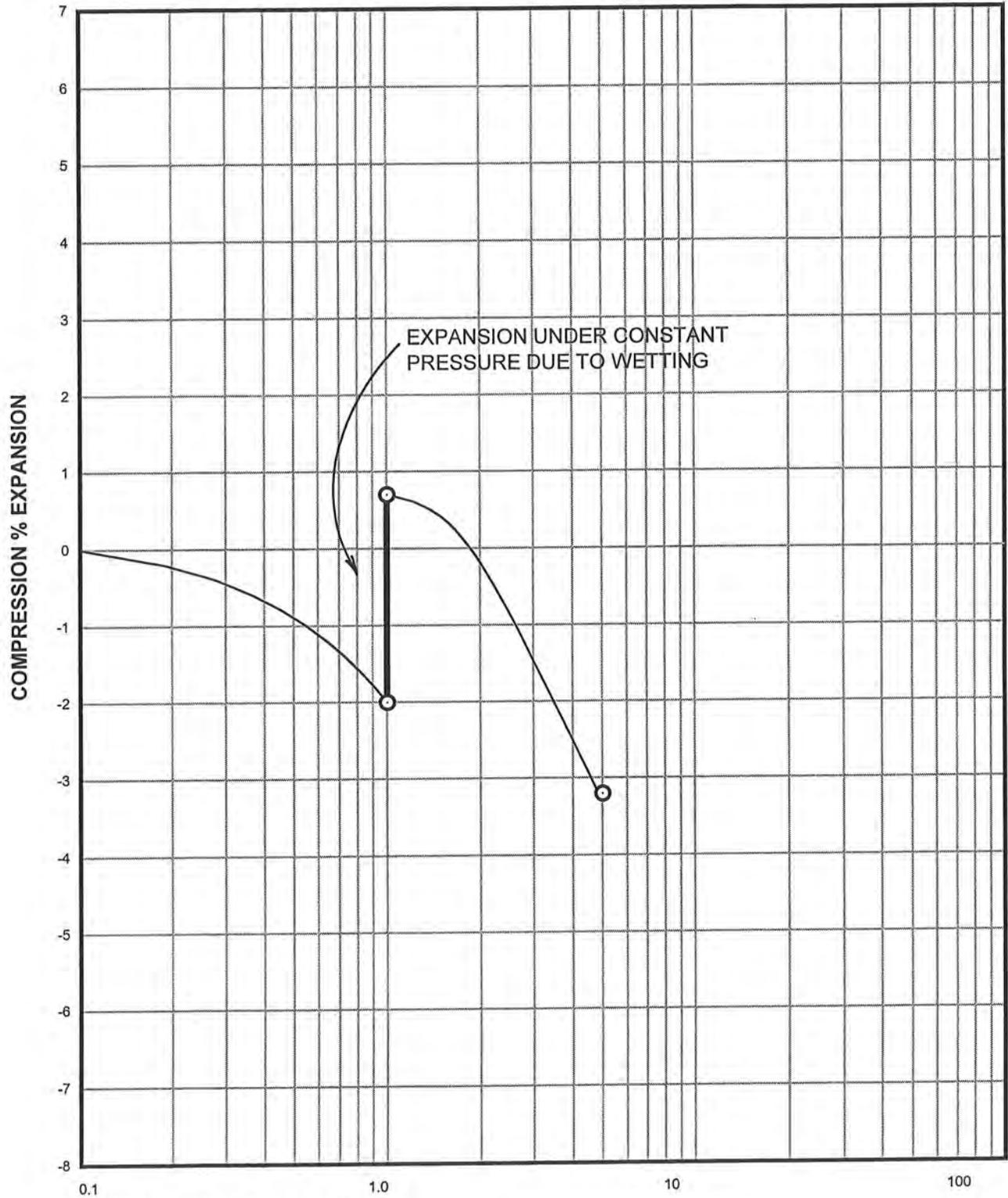
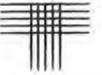
APPLIED PRESSURE - KSF
Sample of CLAY, SANDY (CL)
From TH-39 AT 4 FEET

SAMPLE DRY UNIT WEIGHT= 105 PCF
SAMPLE MOISTURE CONTENT= 21.6 %

177 JASPER INVESTMENTS, LLC
WISE FARMS
PROJECT NO. DN41,199-115

Swell Consolidation Test Results

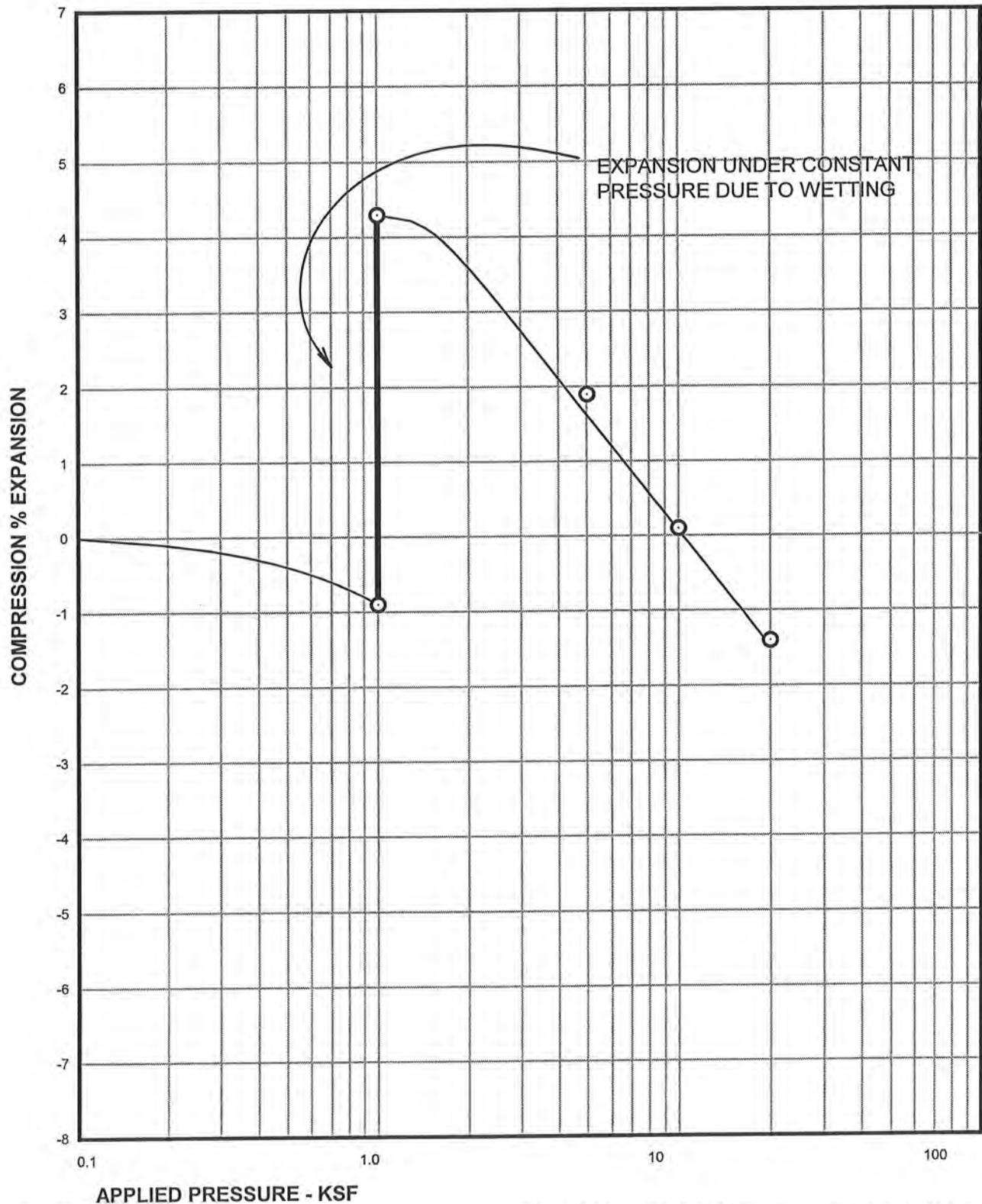
FIG. B-25



APPLIED PRESSURE - KSF

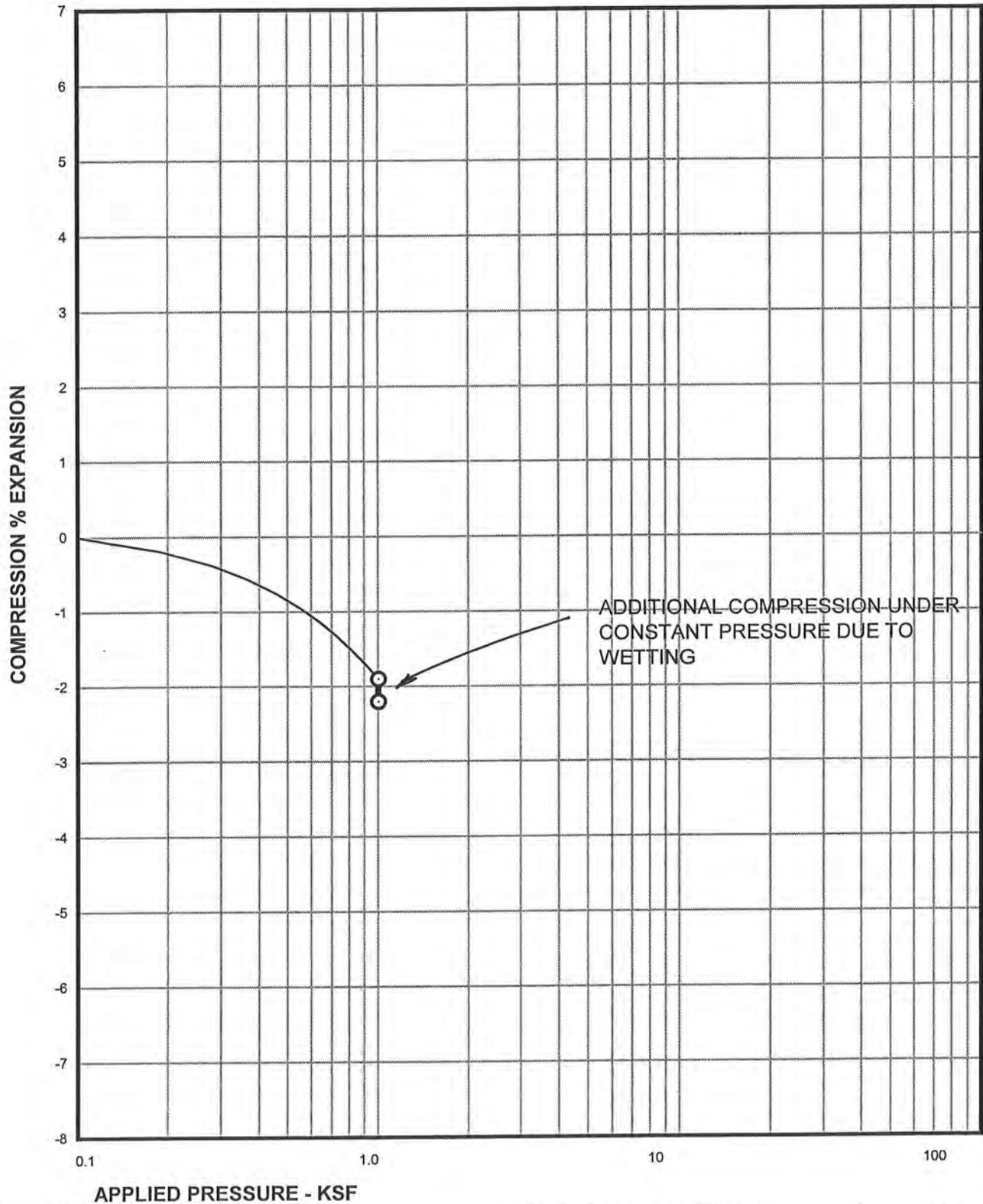
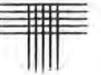
Sample of WEATHERED CLAYSTONE
From TH-39 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 108 PCF
SAMPLE MOISTURE CONTENT= 21.6 %



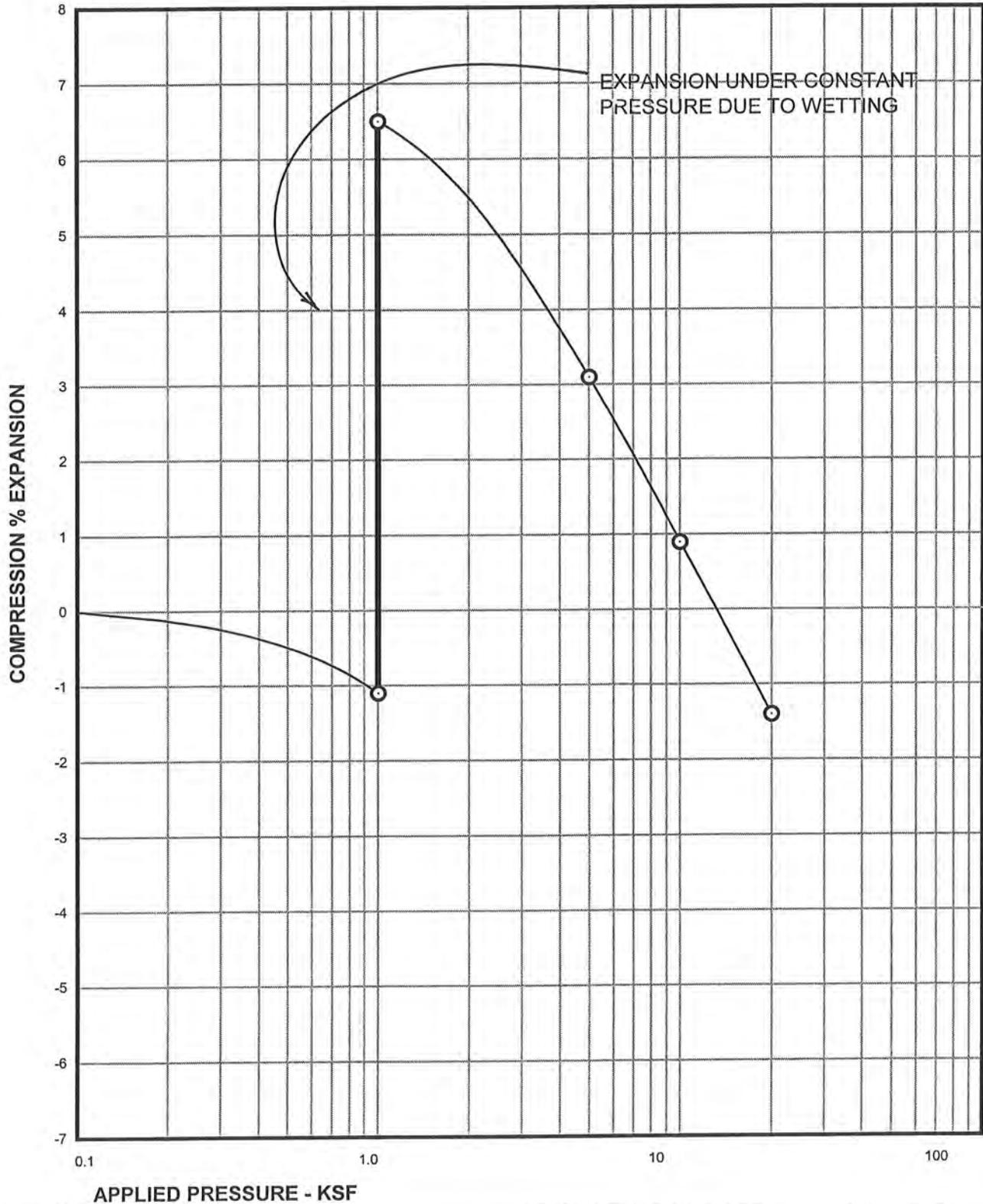
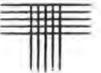
Sample of CLAYSTONE
From TH-39 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 125 PCF
SAMPLE MOISTURE CONTENT= 12.9 %



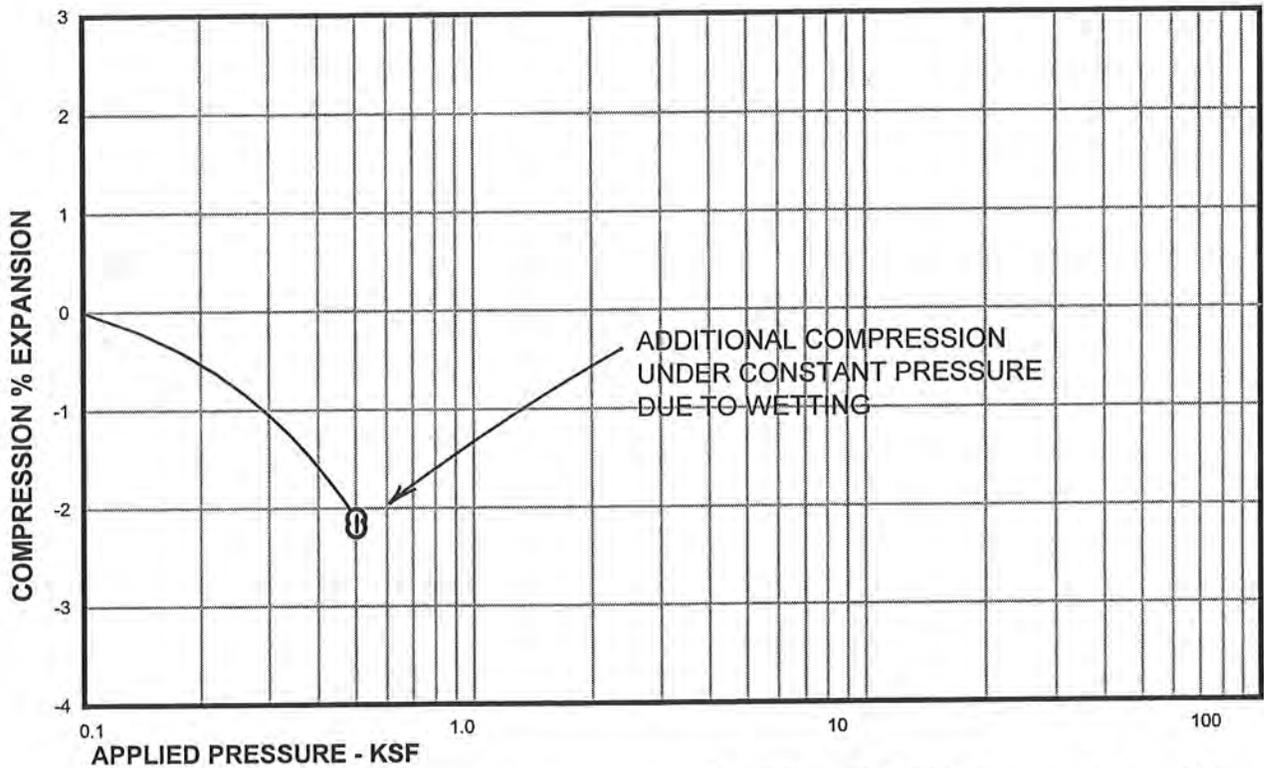
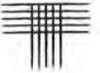
Sample of CLAY, SANDY (CL)
From TH-40 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 107 PCF
SAMPLE MOISTURE CONTENT= 20.3 %



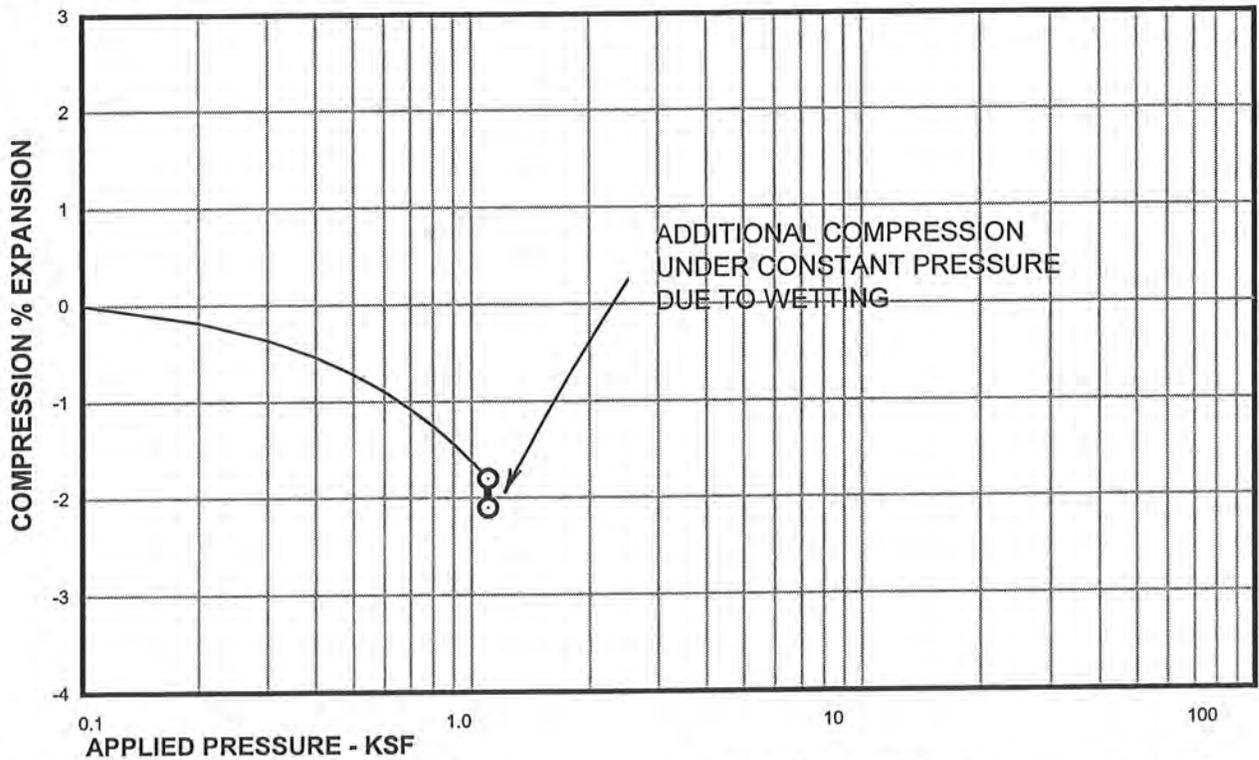
Sample of CLAYSTONE
From TH-41 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 118 PCF
SAMPLE MOISTURE CONTENT= 17.1 %



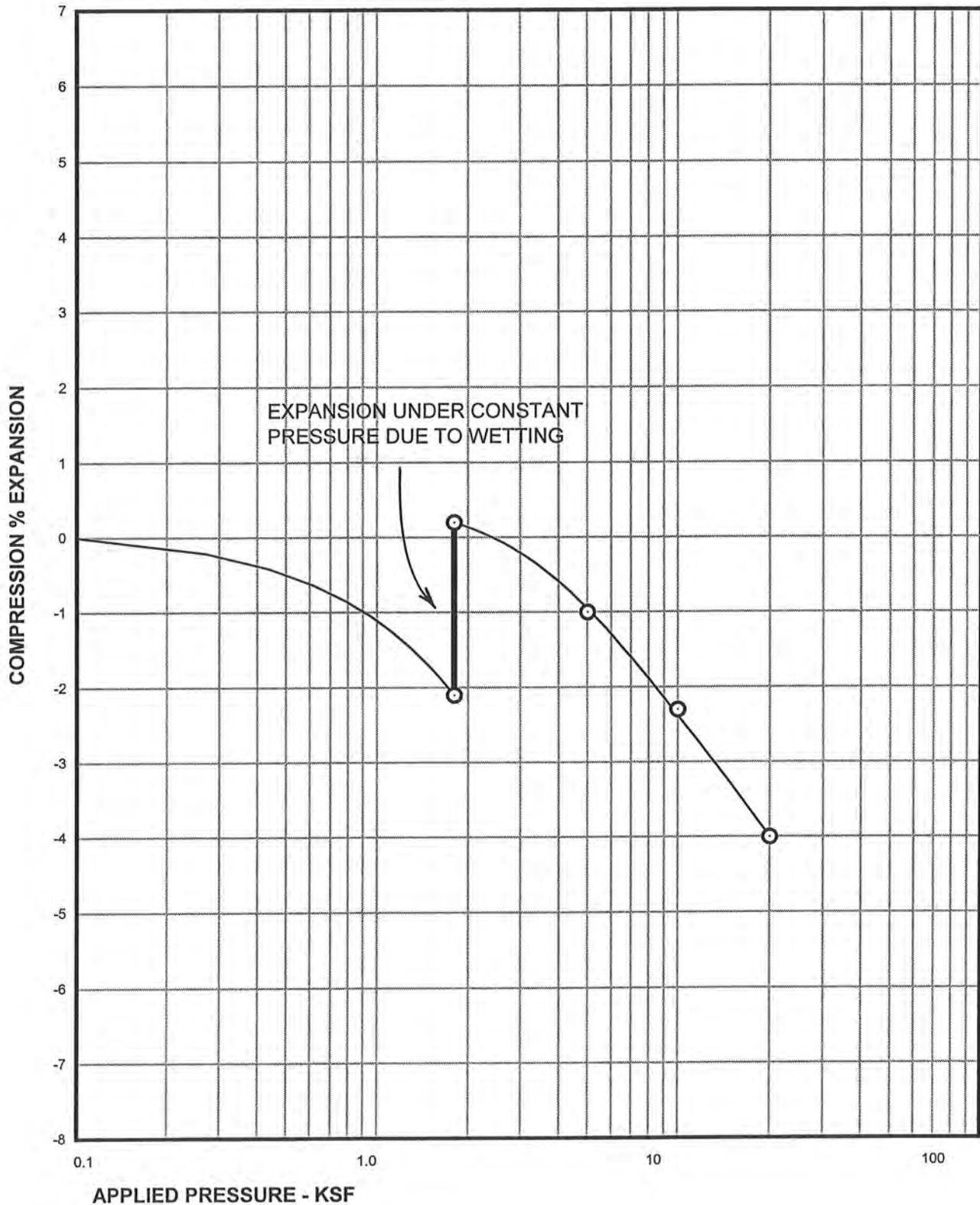
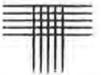
Sample of CLAY, SANDY (CL)
From TH-42 AT 4 FEET

SAMPLE DRY UNIT WEIGHT= 112 PCF
SAMPLE MOISTURE CONTENT= 11.7 %



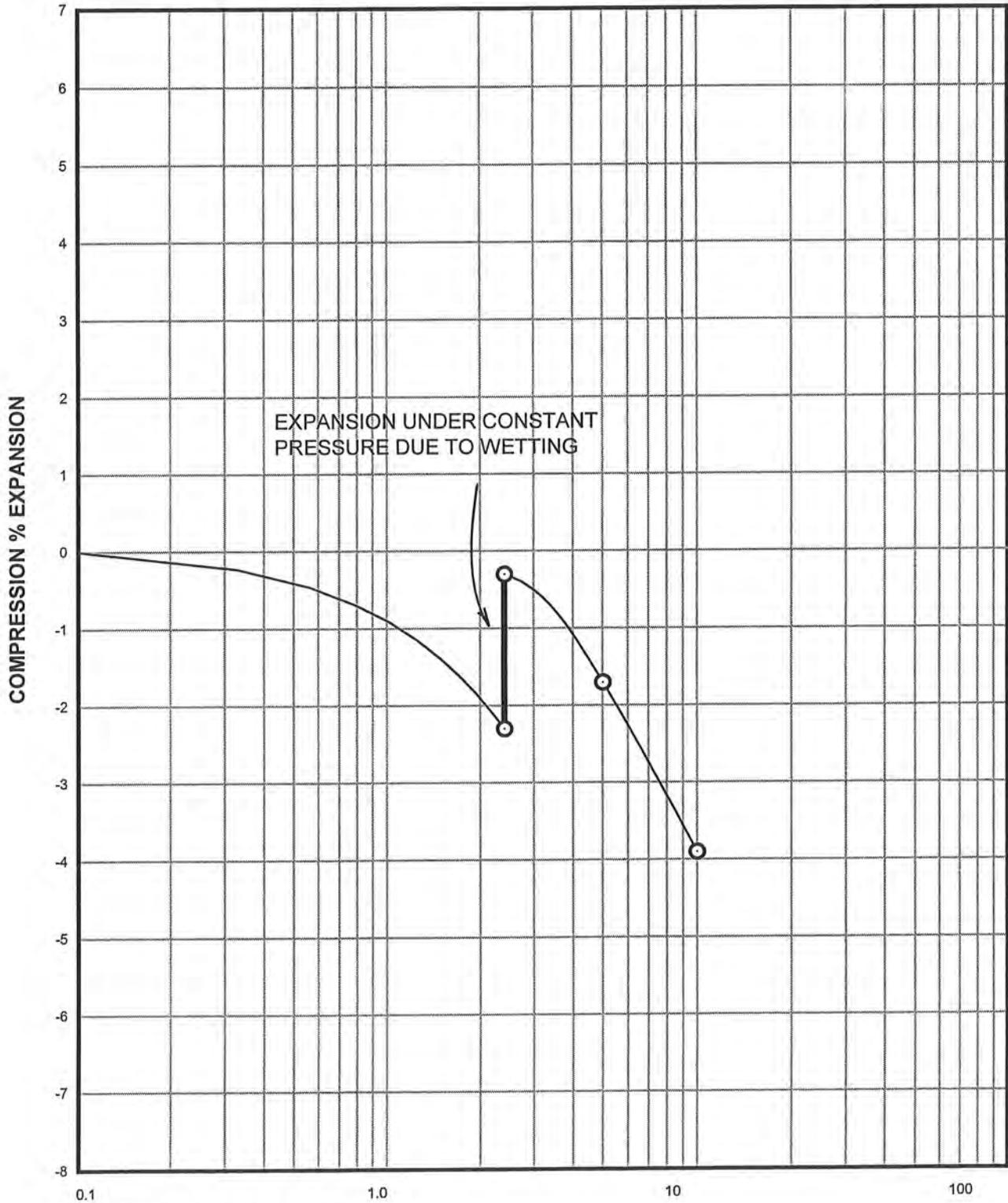
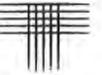
Sample of INTERLAYERED CLAY/SAND
From TH-42 AT 9 FEET

SAMPLE DRY UNIT WEIGHT= 108 PCF
SAMPLE MOISTURE CONTENT= 17.6 %



Sample of WEATHERED CLAYSTONE
From TH-42 AT 14 FEET

SAMPLE DRY UNIT WEIGHT= 113 PCF
SAMPLE MOISTURE CONTENT= 19.9 %



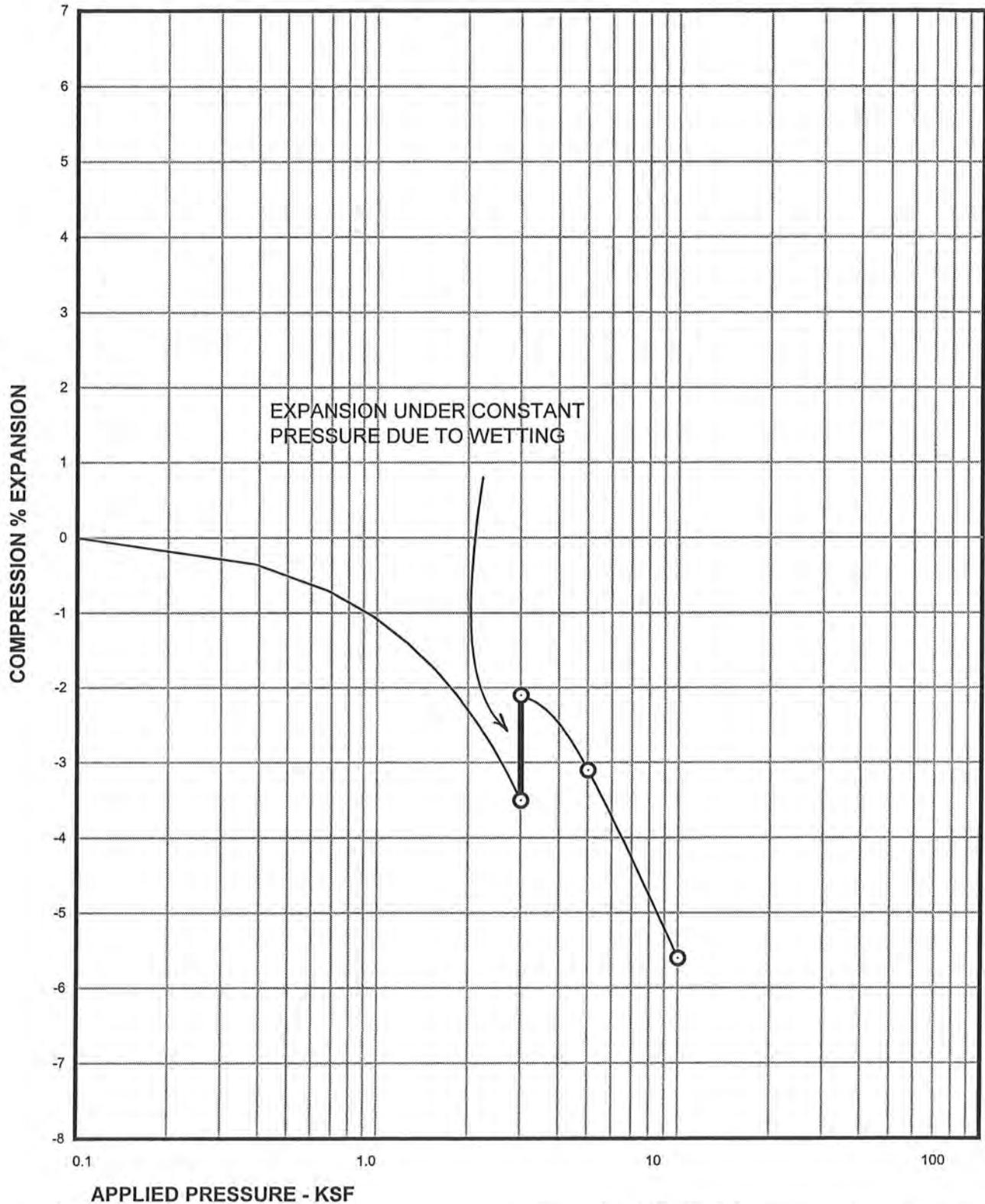
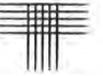
APPLIED PRESSURE - KSF
Sample of WEATHERED CLAYSTONE
From TH-42 AT 19 FEET

SAMPLE DRY UNIT WEIGHT= 107 PCF
SAMPLE MOISTURE CONTENT= 19.7 %

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PROJECT NO. DN41,199-115

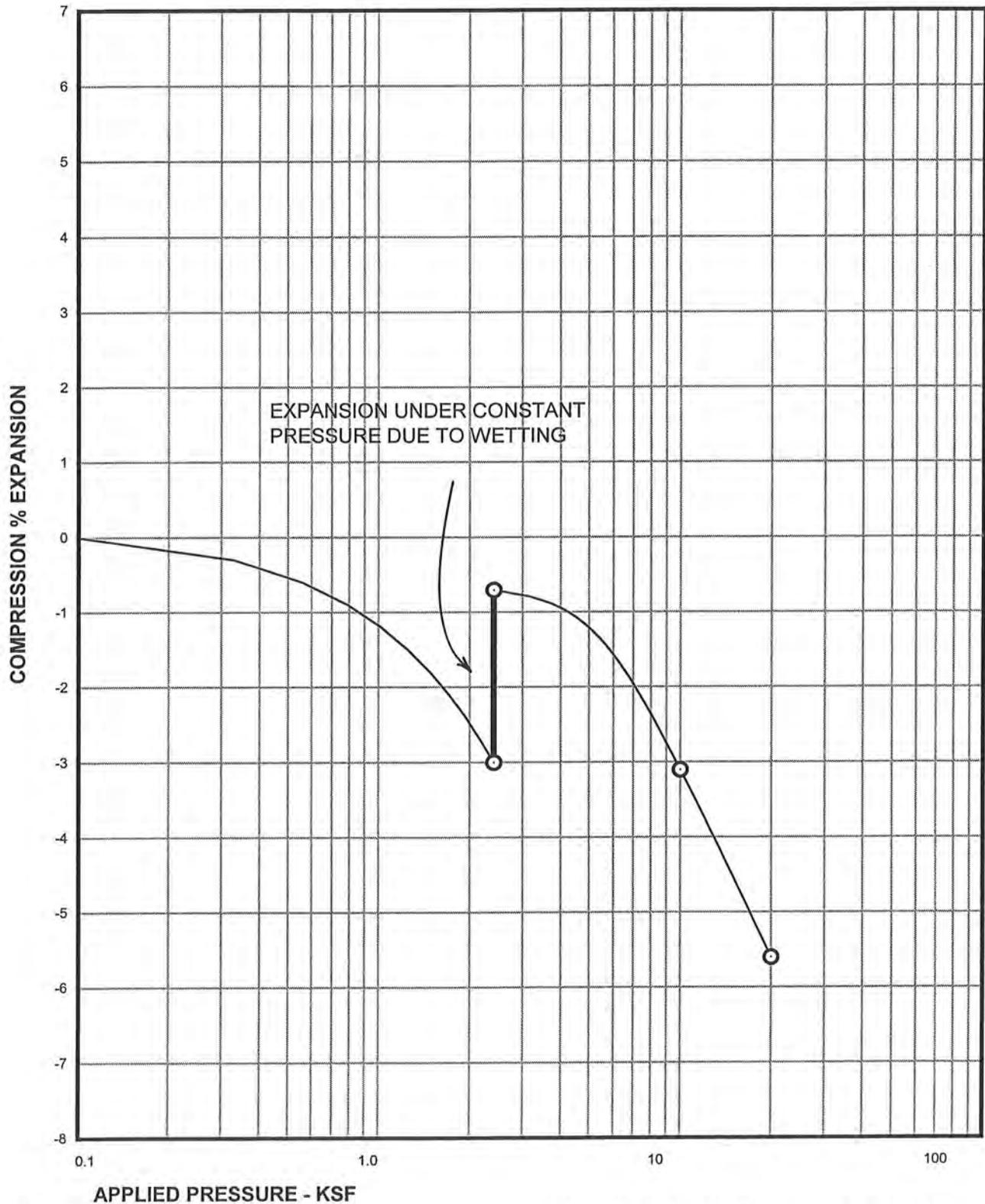
Swell Consolidation Test Results

FIG. B-32



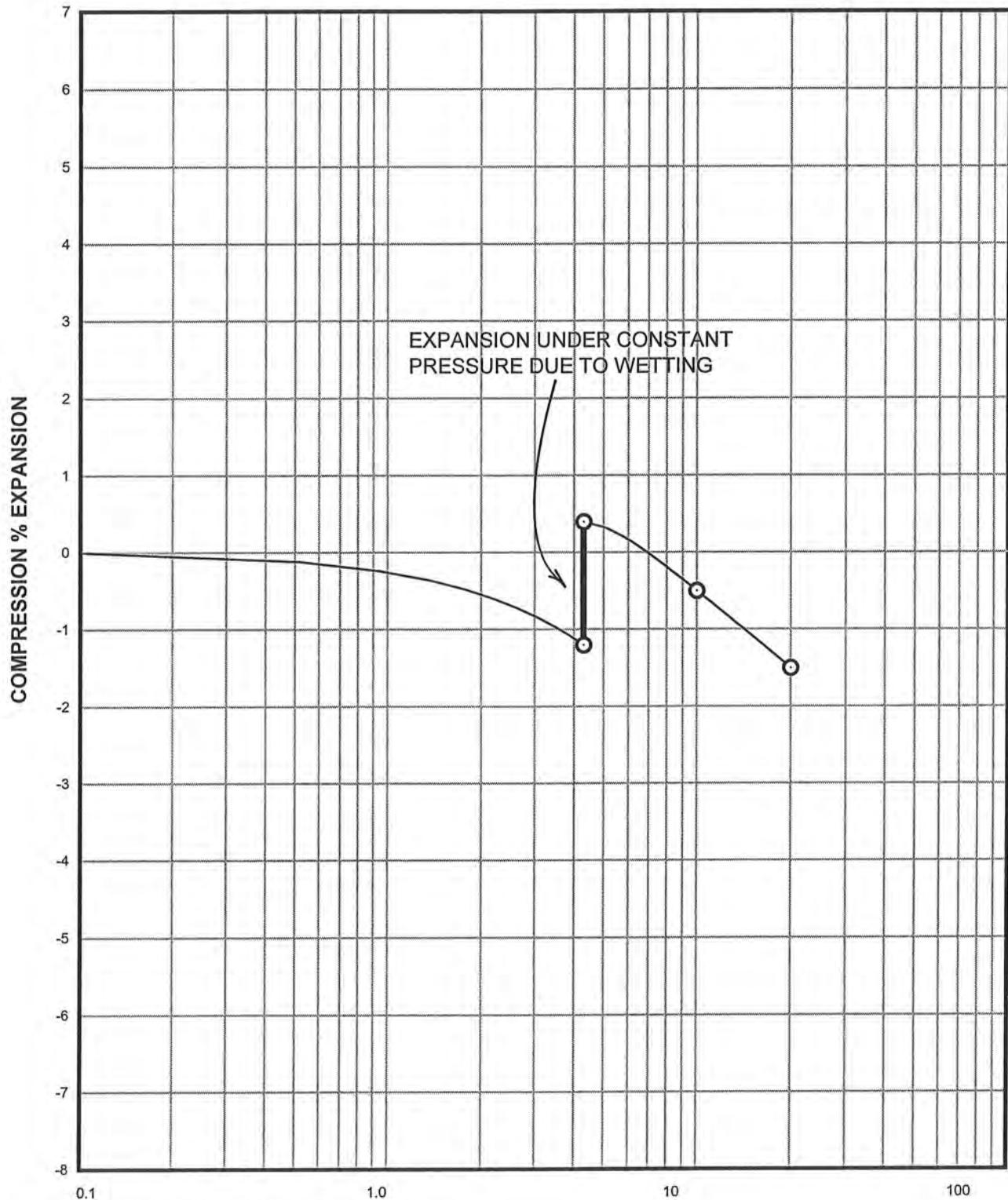
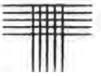
Sample of WEATHERED CLAYSTONE
From TH-42 AT 24 FEET

SAMPLE DRY UNIT WEIGHT= 99 PCF
SAMPLE MOISTURE CONTENT= 25.3 %



Sample of CLAYSTONE
From TH-42 AT 29 FEET

SAMPLE DRY UNIT WEIGHT= 105 PCF
SAMPLE MOISTURE CONTENT= 18.9 %

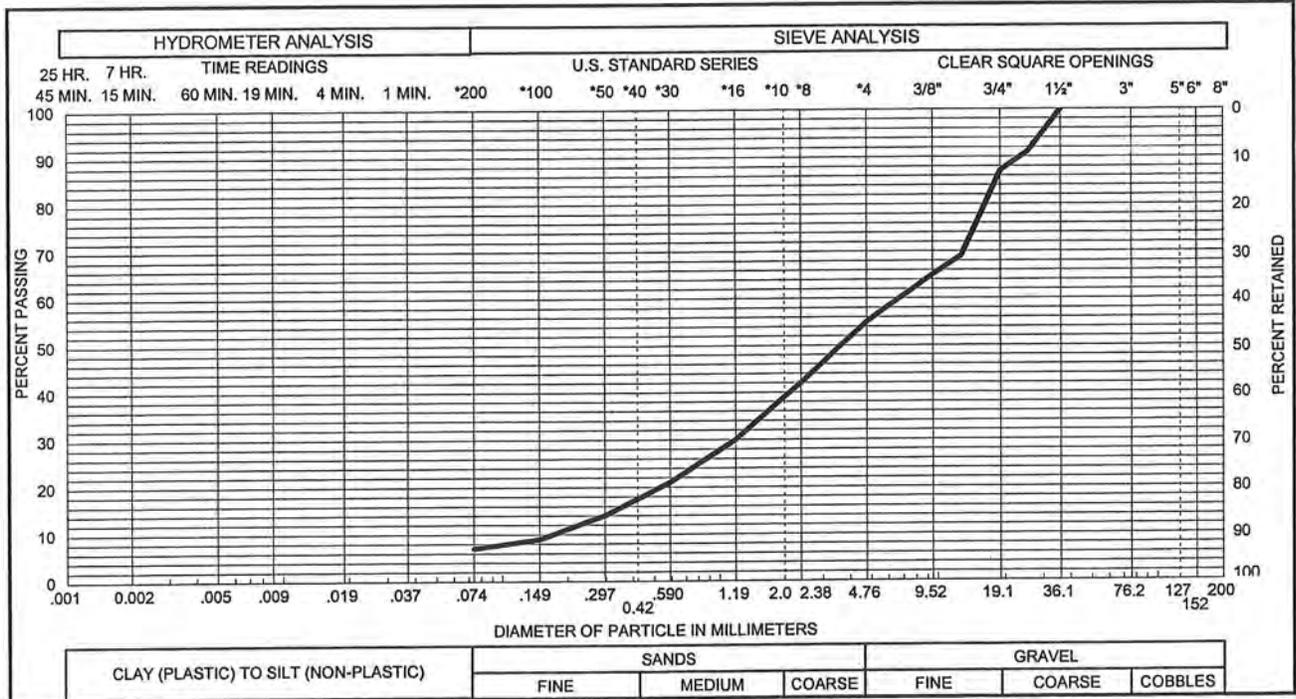


APPLIED PRESSURE - KSF
Sample of INTERBEDDED CLAYSTONE/SANDSTONE
From TH-42 AT 34 FEET

SAMPLE DRY UNIT WEIGHT= 128 PCF
SAMPLE MOISTURE CONTENT= 10.5 %

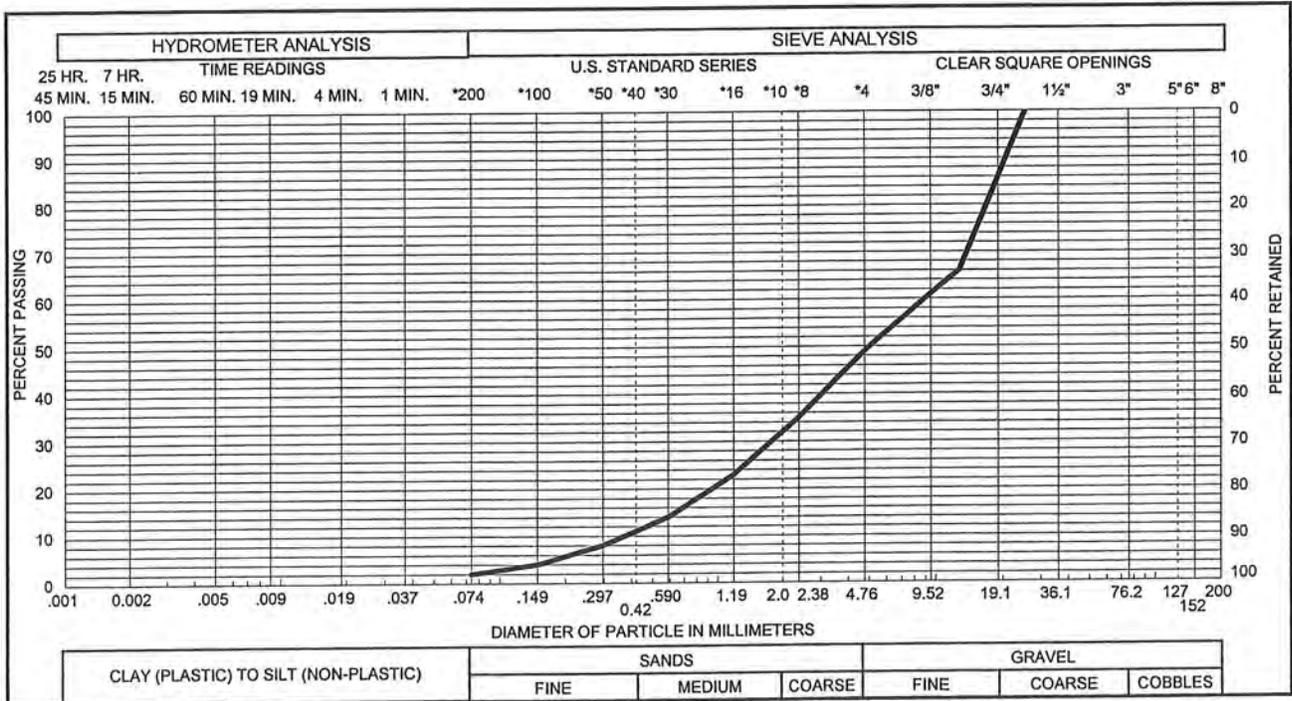
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WISE FARMS
PROJECT NO. DN41,199-115

**Swell Consolidation
Test Results** FIG. B-35



Sample of SAND, SILTY (SW-SM)
 From TH - 1 AT 14 FEET

GRAVEL 45 % SAND 48 %
 SILT & CLAY 7 % LIQUID LIMIT - %
 PLASTICITY INDEX - %

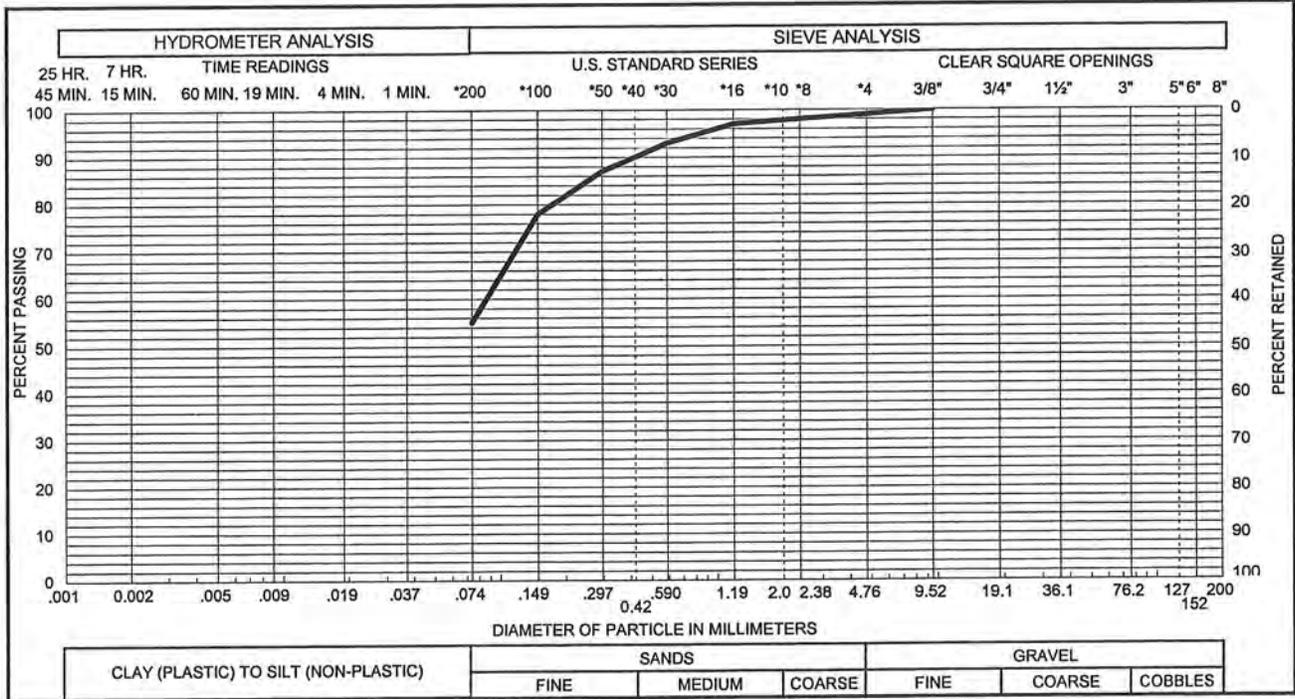


Sample of GRAVEL, SANDY (GW)
 From TH - 2 AT 14 FEET

GRAVEL 51 % SAND 47 %
 SILT & CLAY 2 % LIQUID LIMIT - %
 PLASTICITY INDEX - %

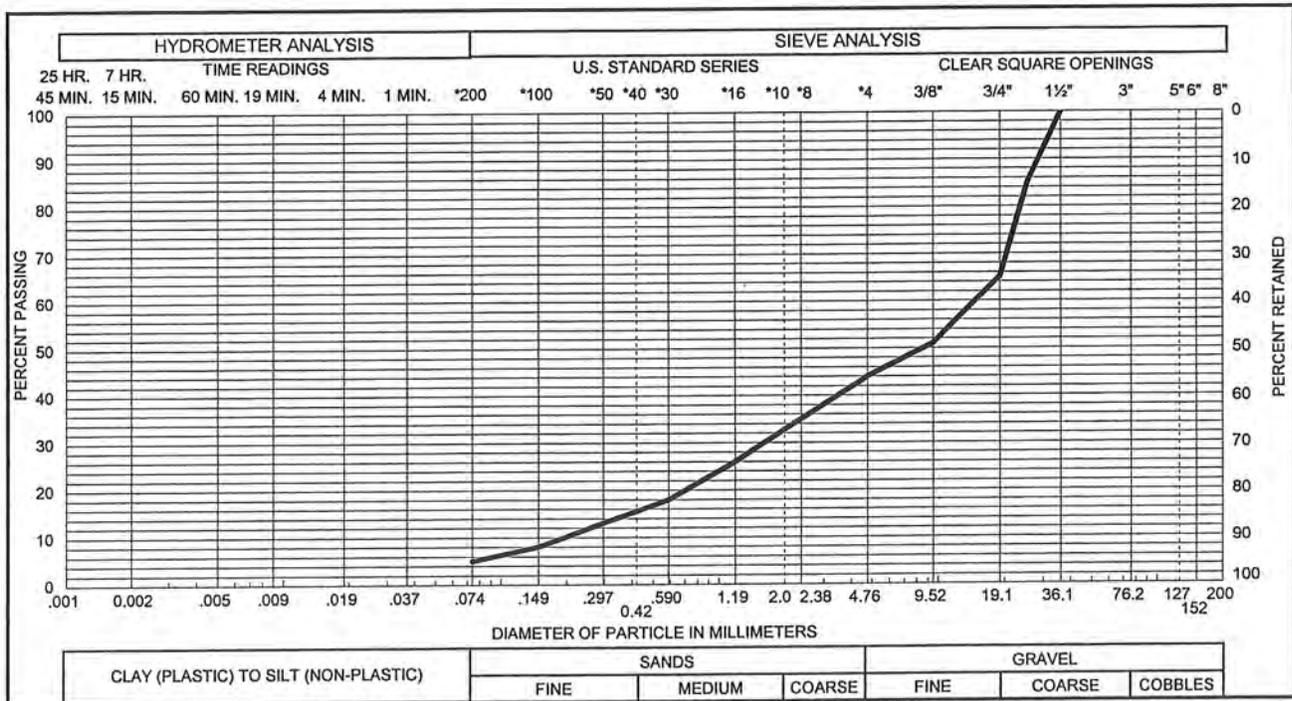
177 JASPER INVESTMENTS,
 WISE FARMS
 PROJECT NO. DN41,199-115

Gradation Test Results



Sample of CLAY, SANDY (CL)
 From TH - 7 AT 9 FEET

GRAVEL 1 % SAND 44 %
 SILT & CLAY 55 % LIQUID LIMIT - %
 PLASTICITY INDEX - %

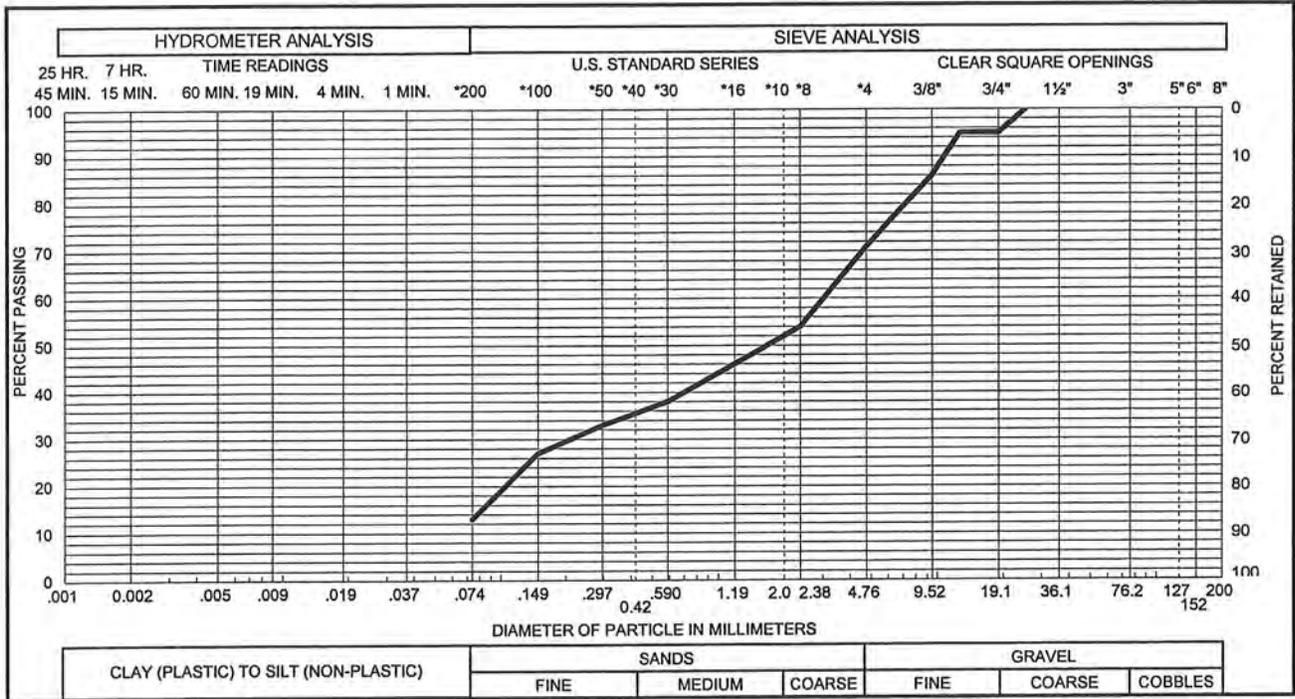


Sample of GRAVEL, SILTY (GP-GM)
 From TH - 8 AT 14 FEET

GRAVEL 56 % SAND 39 %
 SILT & CLAY 5 % LIQUID LIMIT - %
 PLASTICITY INDEX - %

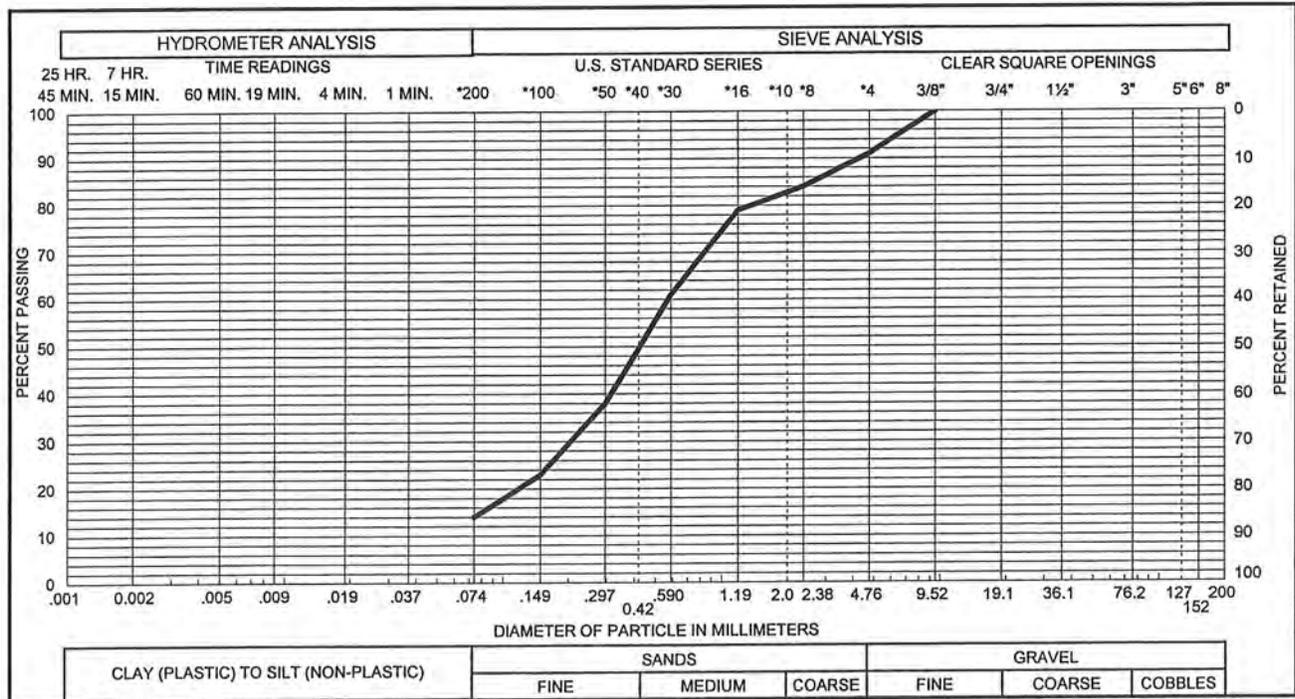
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 WISE FARMS
 PROJECT NO. DN41,199-115

Gradation Test Results



Sample of SAND, SILTY (SM)
 From TH - 17 AT 9 FEET

GRAVEL 29 % SAND 58 %
 SILT & CLAY 13 % LIQUID LIMIT - %
 PLASTICITY INDEX - %



Sample of SAND, SILTY (SM)
 From TH - 18 AT 9 FEET

GRAVEL 9 % SAND 77 %
 SILT & CLAY 14 % LIQUID LIMIT - %
 PLASTICITY INDEX - %

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 WISE FARMS
 PROJECT NO. DN41,199-115

Gradation Test Results

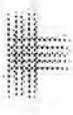


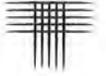
TABLE B - I
SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA			SOIL SUCTION VALUE (pF)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (psf)	SOLUBLE SULFATE CONTENT (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
				SWELL (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)		LIQUID LIMIT (%)	PLASTICITY INDEX (%)				
TH-1	9	12.7	123					27	11			28	SAND, CLAYEY (SC)
TH-1	14	7.8	135									7	SAND, SILTY (SW-SM)
TH-2	4	9.7	114					26	13			23	SAND, SILTY (SM)
TH-2	14	7.8	124									2	GRAVEL, SANDY (GW)
TH-3	4	17.9	111					21	2			39	SAND, CLAYEY (SC)
TH-3	9	25.1	98	0.0	1,000								CLAY, SANDY (CL)
TH-4	4	19.9	110					56	38	900		97	CLAY, SANDY (CL)
TH-4	9	26.8	98									54	CLAY, SANDY (CL)
TH-5	4	18.1	108										INTERLAYERED CLAY/SAND
TH-5	9	22.8	104	0.3	1,000			23	7			41	CLAY, SANDY (CL)
TH-6	4	17.6	106										SAND, CLAYEY (SC)
TH-6	14	25.9	98	2.4	1,000							37	CLAY, SANDY (CL)
TH-7	4	8.5	113									55	SAND, CLAYEY (SC)
TH-7	9	18.9	112									74	CLAY, SANDY (CL)
TH-7	14	24.0	103					35	21			41	CLAY, SANDY (CL)
TH-8	9	20.4	110									5	INTERLAYERED CLAY/SAND
TH-8	14	6.2	118									62	GRAVEL, SILTY (GP-GM)
TH-9	9	21.6	106										CLAY, SANDY (CL)
TH-9	14	27.9	97	1.2	1,000								CLAY, SANDY (CL)
TH-10	9	27.3	97							900			CLAY, SANDY (CL)
TH-10	14	26.9	98	2.7	1,000								CLAY, SANDY (CL)
TH-11	9	23.0	103							1,200			CLAY, SANDY (CL)
TH-11	14	26.0	97							700			CLAY, SANDY (CL)
TH-12	4	16.5	109									61	INTERLAYERED CLAY/SAND
TH-12	19	30.1	91	3.8	1,000								CLAY, SANDY (CL)
TH-13	4	7.2	120									47	INTERLAYERED CLAY/SAND
TH-13	14	23.8	103							1,600			CLAY, SANDY (CL)
TH-14	9	7.8	121	0.3	1,000								CLAY, SANDY (CL)
TH-14	14	11.5	114										CLAY, SANDY (CL)
TH-15	4	19.7	102									53	CLAY, SANDY (CL)
TH-15	9	18.4	112					25	13			53	INTERLAYERED CLAY/SAND
TH-16	9	25.7	99									51	INTERLAYERED CLAY/SAND
TH-16	14	25.3	100					30	12			74	CLAY, SANDY (CL)
TH-17	9	12.6	113									80	CLAY, SANDY (CL)
TH-17	14	24.2	103	-0.3	1,000								SAND, SILTY (SM)
TH-18	4	11.5	112										CLAY, SANDY (CL)
TH-18	9	5.3	124								0.004		GRAVEL/CLAYEY (GC)
TH-18	14	24.1	97					26	11			14	SAND, SILTY (SM)
TH-19	4	3.4	109									45	SAND, CLAYEY (SC)
TH-19	14	11.9	122	-0.2	1,000							31	SAND, CLAYEY (SC)
TH-20	4	5.0	104								0.016	62	CLAY, SANDY (CL)
TH-20	19	23.9	106	0.2	1,000								SAND, CLAYEY (SC)
TH-21	4	16.2	100									52	INTERLAYERED CLAY/SAND
TH-21	14	13.7	119					30	11			49	SAND, CLAYEY (SC)
TH-22	4	12.7	101									60	CLAY, SANDY (CL)

TABLE B - 1

SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA			SOIL SUCTION VALUE (pF)	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (psf)	SOLUBLE SULFATE CONTENT (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
				SWELL (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)		LIQUID LIMIT (%)	PLASTICITY INDEX (%)				
TH-22	9	8.1	117	0.0	1,000			21	2		0.016	25	CLAY, SANDY (CL)
TH-23	9	5.8	107										SAND, CLAYEY (SC)
TH-23	14	15.0	114	0.7	1,000								CLAY, SANDY (CL)
TH-24	4	3.9	100					NL	NP		0.01	16	SAND, SILTY (SM)
TH-24	14	5.2	109					NL	NP			21	SAND, SILTY (SM)
TH-25	4	3.6	106					19	NP			28	SAND, CLAYEY (SC)
TH-25	9	11.3	117					25	11			42	SAND, CLAYEY (SC)
TH-25	14	10.7	125	0.5	1,800	3,900	3.82						CLAYSTONE
TH-25	19	13.5	122	0.0	2,400	13,000	3.38						CLAYSTONE
TH-25	24	15.4	122	1.3	3,000		3.95						CLAYSTONE
TH-26	4	11.5	110	-0.5	1,000					8,000			SAND, CLAYEY (SC)
TH-26	14	14.7	117										WEATHERED CLAYSTONE
TH-27	4	8.1	116									40	SAND, CLAYEY (SC)
TH-27	19	15.4	122	5.1	1,000	11,000							CLAYSTONE
TH-28	4	5.7	111					22	4			42	SAND, CLAYEY (SC)
TH-28	9	18.3	110	0.1	1,000	4,000							CLAY, SANDY (CL)
TH-28	14	12.3	122	2.6	1,000								WEATHERED CLAYSTONE
TH-29	4	2.9	104										SAND, CLAYEY (SC)
TH-29	14	18.4	110	0.4	1,000								WEATHERED CLAYSTONE
TH-30	4	3.5	110										WEATHERED CLAYSTONE
TH-30	9	11.1	98					NL	NP			16	SAND, SILTY (SM)
TH-30	14	15.7	102									20	SAND, SILTY (SM)
TH-31	9	12.9	112					27	4			37	SANDSTONE
TH-31	14	15.0	117	0.6	1,000							50	CLAY, SANDY (CL)
TH-32	9	9.0	102										WEATHERED CLAYSTONE
TH-32	19	15.3	119	4.5	1,000							26	SAND, CLAYEY (SC)
TH-33	4	7.6	113	0.4	500	1,000	4.01						WEATHERED CLAYSTONE
TH-33	9	26.0	93	0.7	1,100	1,800	3.00						SAND, SILTY (SM)
TH-33	14	12.4	127	5.5	1,800	13,000	4.17						CLAY, SANDY (CL)
TH-33	19	13.4	125	3.5	2,400	17,000	4.07						CLAYSTONE
TH-33	24	13.1	125	3.7	3,000	22,000	4.08						CLAYSTONE
TH-34	9	11.6	106									27	SAND, CLAYEY (SC)
TH-34	14	23.8	101	5.6	1,000	10,000							WEATHERED CLAYSTONE
TH-34	19	11.2	125	7.2	1,000								WEATHERED CLAYSTONE
TH-35	9	17.6	111	0.0	1,000								WEATHERED CLAYSTONE
TH-35	19	14.1	119	5.8	1,000	13,000							CLAY, SANDY (CL)
TH-36	4	7.4	109										CLAYSTONE
TH-36	9	16.9	100					28	3			32	SAND, CLAYEY (SC)
TH-37	4	10.9	110									51	CLAYSTONE/SANDSTONE
TH-37	19	20.0	105	4.3	1,000							54	WEATHERED CLAYSTONE
TH-38	4	17.6	113	0.2	1,000								CLAYSTONE
TH-38	9	25.4	101	0.0	1,000								CLAY, SANDY (CL)
TH-38	14	12.1	122					21	6			39	SANDSTONE
TH-39	4	21.6	105	0.6	1,000	3,400					0.004		CLAY, SANDY (CL)
TH-39	9	21.6	108	2.7	1,000								WEATHERED CLAYSTONE



APPENDIX C
GUIDELINE SITE GRADING SPECIFICATIONS
Wise Farms
Erie, Colorado



GUIDELINE SITE GRADING SPECIFICATIONS

Wise Farms
Erie, Colorado

1. DESCRIPTION

This item shall consist of the excavation, transportation, placement and compaction of materials from locations indicated on the plans, or staked by the Engineer, as necessary to achieve preliminary street and overlot elevations. These specifications shall also apply to compaction of excess cut materials that may be placed outside of the development boundaries.

2. GENERAL

The Soils Representative shall be the Owner's representative. The Soils Representative shall approve fill materials, method of placement, moisture contents and percent compaction, and shall give written approval of the completed fill.

3. CLEARING JOB SITE

The Contractor shall remove all vegetation and debris before excavation or fill placement is begun. The Contractor shall dispose of the cleared material to provide the Owner with a clean, neat appearing job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures of any kind.

4. AREA TO BE FILLED

All topsoil and vegetable matter shall be removed from the ground surface upon which fill is to be placed. The surface shall then be plowed or scarified until the surface is free from ruts, hummocks or other uneven features, which would prevent uniform compaction.

After the foundation for the fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, brought to the proper moisture content (0 to 3 percent above optimum moisture content for clays and within 2 percent of optimum moisture content for sands) and compacted to not less than 95 percent of maximum dry density as determined in accordance with ASTM D698.

5. FILL MATERIALS

Fill soils shall be free from organics, debris or other deleterious substances, and shall not contain rocks or lumps having a diameter greater than six (6) inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer.



On-site materials classifying as CL, CH, SC, SM, SW, SP, GP, GC and GM are acceptable. Concrete, asphalt, organic matter and other deleterious materials or debris shall not be used as fill.

6. MOISTURE CONTENT

Fill material classifying as CH and CL shall be moisture conditioned to between optimum and 3 percent above optimum moisture content. Granular soils classifying as SC, SM, SW, SP, GP, GC and GM shall be moisture conditioned to within 2 percent of optimum moisture content as determined from Proctor compaction tests. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Representative, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor may be required to rake or disc the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with any type of watering equipment approved by the Soils Representative, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are washed out.

Should too much water be added to any part of the fill, such that the material is too wet to permit the desired compaction from being obtained, rolling and all work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework wet material in an approved manner to hasten its drying.

7. COMPACTION OF FILL AREAS

Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill shall be compacted to at least 95 percent of the maximum density as determined in accordance with ASTM D 698. At the option of the Soils Representative, soils classifying as SW, GP, GC, or GM may be compacted to 95 percent of maximum density as determined in accordance with ASTM D 1557 or 70 percent relative density for cohesionless sand soils. Fill materials shall be placed such that the thickness of loose materials does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches.



Compaction as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment for soils classifying as CL, CH, or SC. Granular fill shall be compacted using vibratory equipment or other approved equipment. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area. Compaction equipment shall make sufficient trips to ensure that the required density is obtained.

8. **COMPACTION OF SLOPES**

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and there is not appreciable amount of loose soils on the slopes. Compaction of slopes may be done progressively in increments of three to five feet (3' to 5') in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

9. **PLACEMENT OF FILL ON NATURAL SLOPES**

Where natural slopes are steeper than 20 percent in grade and the placement of fill is required, benches shall be cut at the rate of one bench for each 5 feet in height (minimum of two benches). Benches shall be at least 10 feet in width. Larger bench widths may be required by the Engineer. Fill shall be placed on completed benches as outlined within this specification.

10. **DENSITY TESTS**

Field density tests shall be made by the Soils Representative at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate that the density or moisture content of any layer of fill or portion thereof is not within specification, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

11. **SEASONAL LIMITS**

No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Soils Representative indicates that the moisture content and density of previously placed materials are as specified.



12. NOTICE REGARDING START OF GRADING

The Contractor shall submit notification to the Soils Representative and Owner advising them of the start of grading operations at least three (3) days in advance of the starting date. Notification shall also be submitted at least 3 days in advance of any resumption dates when grading operations have been stopped for any reason other than adverse weather conditions.

13. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Representative, as specified under "Density Tests" above, shall be submitted progressively to the Owner. Dry density, moisture content, and percentage compaction shall be reported for each test taken.

14. DECLARATION REGARDING COMPLETED FILL

The Soils Engineer shall provide a written declaration stating that the site was filled with acceptable materials, and was placed in general accordance with the specifications.

December 5, 2012

Jasper Land Investments, LLC
9162 South Kenwood Court
Highlands Ranch, Colorado 80126

Attention: Jim Dullea

Subject: Preliminary Geotechnical Investigation
Wise Farms
Erie, Colorado
Project No. DN41,199-115

At your request, we reviewed the recent development schematic plan you provided to us. We are of the opinion that the study we completed for you, "Preliminary Geotechnical Investigation, Wise Farms" Project No. DN41,199-115, report dated December 9, 2005 remains valid for your use in planning the property. As stated in our report, the primary geotechnical concern for development is shallow ground water.

Please call if there are any questions about this letter. We appreciate the opportunity to assist you with this planned development.

Respectfully Submitted,

CTL|Thompson, Inc.



DAVID A. GLATER
2/5/12
20204
PROFESSIONAL ENGINEER

David A. Glater, P.E., C.P.G.
Principal Geotechnical Engineer

DAG/nt

Via e-mail: john@pcsgroupco.com



LSC TRANSPORTATION CONSULTANTS, INC.

1889 York Street
Denver, CO 80206
(303) 333-1105
FAX (303) 333-1107
E-mail: lsc@lscdenver.com

May 31, 2016

Mr. James Dullea
Jasper Land Investments, LLC
9162 S. Kenwood Court
Highlands Ranch, CO 80126

Re: Wise Farms Update
Trip Generation Comparison
(LSC #120761)

Dear Mr. Dullea:

Per your request, we have completed this trip generation comparison letter for the proposed Wise Farms development in Erie, Colorado. The purpose of this letter is to compare the trip generation potential from the previously proposed land use (July 31, 2014 *Wise Farms TIA* by LSC) with the trip generation potential from the currently proposed land use. Table 2 from the 2014 TIA is attached.

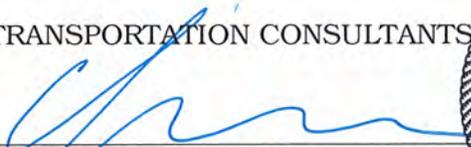
Table 1 shows the estimated trip generation potential for previously proposed land uses (2014 TIA) as well as for the currently proposed land uses based on the trip generation rates from the 9th edition of the ITE *Trip Generation Manual*, 2012. Table 1 shows the proposed change in land use is expected to generate about 628 fewer weekday vehicle-trips, about 49 fewer weekday morning peak-hour trips, and about 66 fewer weekday afternoon peak-hour trips.

* * * * *

We trust this information will assist you in gaining approval of the Wise Farms development. Please contact me if you have any questions or need further assistance.

Sincerely,

LSC TRANSPORTATION CONSULTANTS, INC.

By 
Christopher S. McGranahan, P.E., P.T.D.
Principal



CSM/wc

Enclosures: Table 1
Table 2 (July 31, 2014 *Wise Farms TIA* by LSC)

Table 1
ESTIMATED TRAFFIC GENERATION
Wise Farms Update
Erie, CO
(LSC #120761; May, 2016)

Trip Generating Category	Quantity	Trip Generation Rates ⁽¹⁾					Total Trips				
		Average Weekday	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour In	PM Peak Hour Out	Average Weekday	AM Peak Hour In	AM Peak Hour Out	PM Peak - Hour In	PM Peak - Hour Out
PREVIOUSLY PROPOSED LAND USE (July 31, 2014 <i>Wise Farms Traffic Impact Analysis</i> by LSC)											
North Half											
Single-Family Homes ⁽²⁾	127 DU ⁽³⁾	9.52	0.188	0.563	0.630	0.370	1,209	24	71	80	47
South Half											
Single-Family Homes	39 DU	9.52	0.188	0.563	0.630	0.370	371	7	22	25	14
Site Total =							1,580	31	93	105	61
CURRENTLY PROPOSED LAND USE											
North Half											
Single-Family Homes ⁽²⁾	43 DU ⁽³⁾	9.52	0.188	0.563	0.630	0.370	409	8	24	27	16
South Half											
Single-Family Homes	57 DU	9.52	0.188	0.563	0.630	0.370	543	11	32	36	21
Site Total =							952	19	56	63	37
Difference =							-628	-12	-37	-42	-24
								-49		-66	

Notes:

(1) Source: *Trip Generation*, Institute of Transportation Engineers, 9th Edition, 2012.

(2) ITE Land Use #210 - Single-Family Detached Housing

(3) DU = Dwelling Unit

Table 2
ESTIMATED TRAFFIC GENERATION
Wise Farms
Erie, CO
(LSC #120761; July, 2014)

Trip Generating Category	Quantity	Trip Generation Rates ⁽¹⁾				Total Trips					
		Average Weekday	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour In	PM Peak Hour Out	Average Weekday	AM Peak Hour In	AM Peak Hour Out	PM Peak - Hour In	PM Peak - Hour Out
North Half											
Single-Family Homes ⁽²⁾	127 DU ⁽³⁾	9.52	0.188	0.563	0.630	0.370	1,209	24	71	80	47
South Half											
Single-Family Homes	39 DU	9.52	0.188	0.563	0.630	0.370	371	7	22	25	14
Site Total =							1,580	31	93	105	61

Notes:

- (1) Source: *Trip Generation*, Institute of Transportation Engineers, 9th Edition, 2012.
- (2) ITE Land Use #210 - Single-Family Detached Housing
- (3) DU = Dwelling Unit

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July 31, 2014

Mr. James Dullea
Jasper Land Investments, LLC
9162 S. Kenwood Court
Highlands Ranch, CO 80126

Re: Wise Farms
Traffic Analysis
(LSC #120761)

Dear Mr. Dullea:

In response to your request, LSC Transportation Consultants, Inc. has prepared this traffic analysis for the Wise Farms development. As shown on Figure 1, the site is located south of Jasper Road and west of N. 119th Street in Erie, Colorado.

REPORT CONTENTS

The report contains the following: the existing roadway and traffic conditions in the vicinity of the site; the existing traffic volumes; the site-generated traffic volumes; the assignment of the site-generated traffic volumes; the resulting short and long-term total traffic volumes; the site's projected traffic impacts; and any recommended roadway improvements to mitigate the site's traffic impacts.

LAND USE AND ACCESS

Figure 2 shows the conceptual site plan. The site is proposed as a residential development with up to 127 single-family detached dwelling units on the north half and 39 single-family detached dwelling units on the south half.

The site is proposed to have two full movement access points on Jasper Road, one full movement and one emergency access point on N. 119th Street, with a potential future connection between the north and south halves of the site across existing RTD right-of-way. The analysis and trip assignment assumes no connection across the RTD right-of-way.

ROADWAY AND TRAFFIC CONDITIONS

Area Roadways

The major roadways in the site's vicinity are shown on Figure 1 and are described below.

- **Jasper Road** is a two-lane east/west collector street north of the site. The posted speed limit is 50 mph at the western access and 35 mph at the eastern access. The intersection with N. 119th Street is all-way stop controlled. The approach to US 287 is stop sign controlled.
- **N. 119th Street** is a two-lane north-south minor arterial east of the site. The posted speed limit in the vicinity of the site is 30 mph. The intersection with Jasper Road is all-way stop controlled. The intersection with Erie Parkway is a single-lane roundabout.
- **US 287** is a four-lane north-south highway west of the site. The posted speed limit in the vicinity of the site is 60 mph. It is classified by CDOT as a Principal Highway (NR-A) south of Jasper Road and a Regional Highway (R-A) north of Jasper Road.
- **Erie Parkway** is a two-lane east-west principal arterial south of the site. The posted speed limit is 30 mph west of N. 119th Street and 35 mph east of N. 119th Street. The intersection with N. 119th Street is a single-lane roundabout. The intersection with US 287 is signalized.
- **N. 109th Street** is a two-lane north-south county road connecting Jasper Road and Erie Parkway between the site and US 287. The posted speed limit is 40 mph and the approaches to Jasper Road and Erie Parkway are stop-sign controlled.

Existing Traffic Conditions

Figure 3 shows the existing traffic volumes and the existing lane geometry and traffic control at the major intersections in the vicinity of the site. The weekday peak-hour traffic volumes are from the attached traffic counts conducted by Counter Measures in January, 2013. Daily traffic counts are from the attached traffic counts from the Town of Erie. The intersection of Jasper Road and N. 109th Street was counted by Counter Measures in February, 2014 per a comment from Boulder County. The turning movements at the US 287/Jasper Road and Jasper Road/N. 119th Street were adjusted to be consistent with the more recent traffic counts.

Existing Accident History

Accident data at the intersection of Jasper Road/N. 119th Street was reviewed. The Erie Police Department provided accident history dating back to 2006. Since that time there have been three accidents, two with only property damage and one with both an injury and property damage. From 1997 to 2006, the Police Department has documentation for 19 additional accidents with one particularly bad accident occurring in July of 2005. Shortly thereafter the current all-way stop sign control was implemented. Previously Jasper Road had operate freely with stop signs on N. 119th Street.

2017 and 2035 Background Traffic

Figure 4 shows the estimated 2017 background traffic, lane geometry, and traffic control. It is expected that the homes will be completed by 2017. Figure 5 shows the estimated 2035

background traffic, lane geometry, and traffic control. The through volumes on US 287 were grown based on CDOT's 20-year factor of 1.54 and the growth on Erie Parkway was based on the *Town of Erie Transportation Master Plan*. Year 2017 volumes were prorated between the existing volumes and the projected 2035 background traffic.

Existing, 2017, and 2035 Background Levels of Service

Level of service (LOS) is a quantitative measure of the level of congestion or delay at an intersection. Level of service is indicated on a scale from "A" to "F". LOS A is indicative of little congestion or delay and LOS F is indicative of a high level of congestion or delay. Attached are specific level of service definitions for both signalized and unsignalized intersections.

The intersections of Jasper Road/N. 119th Street, Jasper Road/N. 109th Street, Erie Parkway/N. 119th Street, and US 287/ Jasper Road were analyzed to determine the existing levels of service based on the unsignalized and roundabout intersection analysis procedures from the 2010 version of the *Highway Capacity Manual*. Table 1 shows the level of service analysis results. The level of service reports are attached.

- **Jasper Road/N. 119th Street:** All movements of this all-way stop controlled intersection currently operate at Level of Service "A" and will be expected to operate at LOS "B" or better through 2035.
- **Jasper Road/N. 109th Street:** All movements of this two-way stop controlled intersection currently operate at Level of Service "B" or better and will continue to do so through 2035.
- **US 287/Jasper Road:** The eastbound approach and westbound left/through lane currently operate at LOS "F" and are expected to do so through 2035 with stop-sign control. A vehicular-based signal warrant is not expected to be met. By 2035, the westbound right-turn movement is expected to operate at LOS "F" in the morning peak. There is an existing acceleration lane for this movement. The southbound left-turn movement could operate at LOS "F" in the afternoon peak-hour. The actual level of service is expected to be better due to gaps created by the existing traffic signal at US 287/Erie Parkway.
- **Erie Parkway/N. 119th Street:** All approaches of this roundabout are expected to operate at Level of Service "D" or better with an overall Level of Service "C" or better through 2035.

TRIP GENERATION

Table 2 shows the estimated typical weekday, morning peak-hour, and afternoon peak-hour trip generation for the site based on the rates from *Trip Generation, 9th Edition*, 2012, by the Institute of Transportation Engineers (ITE).

The site is projected to generate about 1,580 vehicle-trips on the average weekday, with about half entering and half exiting the site during a 24-hour period. During the morning peak-hour, which generally occurs for one hour between 6:30 and 8:30 a.m., about 31 vehicles would enter and about 93 vehicles would exit the site. During the afternoon peak-hour, which

generally occurs for one hour between 4:00 and 6:30 p.m., about 105 vehicles would enter and about 61 vehicles would exit the site.

TRIP DISTRIBUTION AND ASSIGNMENT

Figure 6 shows the directional distribution of site-generated trips. The percentages are based on the proposed land use, the population and employment centers in the area, and the distribution of existing turning traffic documented in the traffic counts. Figure 7 shows the assignment of site-generated trips which are the trips shown in Table 2 distributed based on the assumptions in Figure 6. The intersection of US 287/Jasper Road has poor existing levels of service and is not expected to meet a traffic signal warrant so the majority of trips exiting the site to head south on US 287 are expected to head west on Jasper Road and turn south on N. 109th Street to access the existing traffic signal at US 287/Erie Parkway.

2017 TOTAL TRAFFIC

Figure 8 shows the 2017 total traffic which is the sum of 2017 background traffic (Figure 4) and the site-generated traffic (Figure 7).

2035 TOTAL TRAFFIC

Figure 9 shows the typical weekday 2035 total traffic which is the sum of 2035 background traffic (Figure 5) and the site-generated traffic (Figure 7).

PROJECTED LEVELS OF SERVICE

The intersections of Jasper Road/N. 119th Street, Jasper Road/N. 109th Street, US 287/Jasper Road, and Erie Parkway/ N. 119th Street, and as well as the site access intersections with Jasper Road and N. 119th Street were analyzed to determine the levels of service with the addition of site traffic, based on the unsignalized and roundabout intersection analysis procedures from the *Highway Capacity Manual*. Table 1 shows the level of service analysis results. The level of service reports are attached.

- **Jasper Road/N. 119th Street:** All movements of this unsignalized intersection are expected to operate at Level of Service “B” or better through 2035 with or without the addition of site traffic.
- **Jasper Road/N. 109th Street:** All movements of this unsignalized intersection are expected to operate at Level of Service “B” or better through 2035 with or without the addition of site traffic.
- **US 287/Jasper Road:** The eastbound approach and westbound left/through lane are expected to operate at LOS “F” through 2035 in the morning peak-hour with or without the addition of site traffic as an unsignalized intersection. A vehicular-based traffic signal warrant is not expected to be met. By 2035, the westbound right-turn movement could operate at LOS “F” in the morning peak-hour with or without the addition of site traffic. There is an existing acceleration lane for this movement. The southbound left-turn move-

ment could operate at LOS “F” by 2035 with or without the addition of site traffic. The actual level of service is expected to be better due to gaps created by the existing traffic signal at US 287/Erie Parkway.

- **Erie Parkway/N. 119th Street:** All approaches of this roundabout are expected to operate at Level of Service “D” or better with an overall Level of Service “C” or better through 2035 with or without the addition of site traffic.
- **Jasper Road/East Site Access:** All movements of this unsignalized intersection are expected to operate at Level of Service “B” or better through 2035.
- **Jasper Road/West Site Access:** All movements of this unsignalized intersection are expected to operate at Level of Service “B” or better through 2035.
- **N. 119th Street/Site Access:** All movements of this unsignalized intersection are expected to operate at LOS “A” through 2035.

CONCLUSIONS AND RECOMMENDATIONS

Proposed Land Use

1. The site is proposed as a residential development with up to 166 single-family detached homes. Of these, 127 are proposed on the north half of the site and 39 are proposed on the south half of the site.

Proposed Access Plan

2. The site is proposed to have two full movement access points on Jasper Road, one full movement access point and one emergency access point on N. 119th Street, and a potential future connection across RTD right-of-way between the north and south halves of the site. This connection was not assumed in the analyses.

Trip Generation

3. The site is projected to generate about 1,580 external vehicle-trips on the average week-day, with about half entering and half exiting the site during a 24-hour period. During the morning peak-hour about 31 vehicles would enter and about 93 vehicles would exit the site. During the afternoon peak-hour about 105 vehicles would enter and about 61 vehicles would exit the site.

Levels of Service

4. All movements at the intersections analyzed are expected to operate at acceptable levels of service through 2035 with or without the addition of site traffic with the following exceptions: The eastbound approach and westbound left/through movements at the US 287/Jasper Road intersection currently operate at LOS “F” in the morning peak-hour with stop sign control and are expected to continue to do so through 2035 with stop sign

control. A vehicular volume based traffic signal warrant is not expected to be met in the foreseeable future. The eastbound approach and westbound left/through lane are expected to operate at LOS "F" through 2035 with or without the addition of site traffic as an unsignalized intersection. A vehicular-based traffic signal warrant is not expected to be met. By 2035, the westbound right-turn movement could operate at LOS "F" in the morning peak-hour with or without the addition of site traffic. There is an existing acceleration lane for this movement. The southbound left-turn movement could operate at LOS "F" by 2035 with or without the addition of site traffic. The actual level of service is expected to be better due to gaps created by the existing traffic signal at US 287/Erie Parkway.

Recommended Improvements

5. An eastbound right-turn deceleration lane is recommended on Jasper Road at the western site access. The lane would be 320 feet long with a 180-foot transition taper based on the requirements of the *State Highway Access Code* (SHAC) and the posted speed of 50 mph. This lane would not be recommended if the posted speed was dropped to 40 mph or less.
6. A northbound left-turn deceleration lane on N. 119th Street at the full movement site access is being required by the Town. The projected turning volume is expected to peak at about 17 vph and the trigger threshold is greater than 10 vph for higher posted speeds and greater than 25 vph for lower posted speeds. The lane would be 175 feet long (155 feet for deceleration and 20 feet for vehicle storage) with a 95-foot transition taper based on the SHAC and a posted speed limit of 30 mph. The appropriate redirect taper would be 15:1.
7. A westbound left-turn lane is recommended on Jasper Road at N. 109th Street. The lane would be 370 feet long (320 feet for deceleration and 50 feet for vehicle storage) with an 180-foot transition taper based on the SHAC and the posted speed limit of 50 mph. These lengths would be less if the posted speed is lowered with development. The appropriate redirect taper would be 50:1.

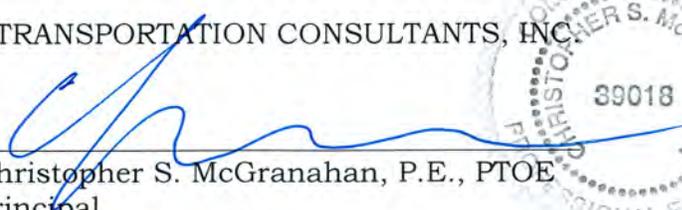
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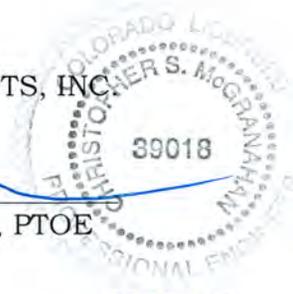
We trust this traffic analysis will assist you in gaining approval of the Wise Farms development. Please contact me if you have any questions or need further assistance.

Sincerely,

LSC TRANSPORTATION CONSULTANTS, INC

By


Christopher S. McGranahan, P.E., PTOE
Principal



CSM/wc

7-31-14

Enclosures: Tables 1 and 2
Figures 1 - 9
Traffic Count Reports
Accident History at Jasper Road/N. 119th Street
Level of Service Definitions
Level of Service Reports

**Table 1
Intersection Levels of Service Analysis
Wise Farms
Erie, CO
(LSC #120761; July, 2014)**

Intersection Location	Traffic Control	Existing Traffic		2017 Background Traffic		2017 Total Traffic		2035 Background Traffic		2035 Total Traffic	
		Level of Service	Level of Service	Level of Service	Level of Service	Level of Service	Level of Service	Level of Service	Level of Service	Level of Service	Level of Service
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
<u>Jasper Road/N. 119th Street</u>	AWSC										
NB Approach		A	A	A	A	A	A	B	A	B	A
EB Approach		A	A	A	A	A	A	A	A	A	B
WB Approach		A	A	A	A	A	A	A	A	A	A
SB Approach		A	A	A	A	A	A	A	A	A	A
Critical Movement Delay		9.4	8.7	9.4	8.9	9.5	9.3	10.5	9.9	11.0	10.5
<u>Jasper Road/N. 109th Street</u>	TWSC										
NB Approach		B	B	B	B	B	B	B	B	C	B
EB Approach		A	A	A	A	A	A	A	A	A	A
WB Approach		A	A	A	A	A	A	A	A	A	A
SB Approach		B	B	B	B	B	B	B	B	B	B
Critical Movement Delay		12.4	11.1	12.8	10.8	13.1	11.3	13.6	11.2	15.1	12.2
<u>US 287/Jasper Road</u>	TWSC										
NB Left		B	B	B	B	B	B	C	C	C	C
EB Approach		E	F	F	F	F	F	F	D	F	D
WB Left/Through		F	F	F	F	F	F	F	D	F	E
WB Right		C	C	D	C	D	C	F ⁽¹⁾	D	F ⁽¹⁾	D
SB Left		B	C	B	C	B	C	C	F	C	F ⁽²⁾
Critical Movement Delay		>240	>240	>240	>240	>240	>240	>240	78.8	>240	98.7
<u>Erie Parkway/N. 119th Street</u>	Roundabout										
EB Approach		A	A	A	A	A	A	A	C	A	C
WB Approach		B	A	B	A	B	A	D	A	D	A
NB Approach		A	A	A	A	A	A	A	B	A	B
SB Approach		A	A	A	A	A	A	B	A	B	A
Entire Intersection Delay (sec /veh)		9.0	6.7	9.3	7.4	9.5	7.6	18.1	13.4	19.0	14.2
Entire Intersection LOS		A	A	A	A	A	A	C	B	C	B
<u>Jasper Road/East Site Access</u>	TWSC										
NB Approach		--	--	--	--	A	B	--	--	B	B
WB Approach		--	--	--	--	A	A	--	--	A	A
Critical Movement Delay		--	--	--	--	9.8	10.3	--	--	10.2	10.8
<u>Jasper Road/West Site Access</u>	TWSC										
NB Approach		--	--	--	--	B	B	--	--	B	B
WB Approach		--	--	--	--	A	A	--	--	A	A
Critical Movement Delay		--	--	--	--	10.7	10.9	--	--	11.5	11.7
<u>N. 119th Street/Site Access</u>	TWSC										
NB Left/Through		--	--	--	--	A	A	--	--	A	A
EB Approach		--	--	--	--	A	A	--	--	A	A
Critical Movement Delay		--	--	--	--	9.4	9.3	--	--	9.7	9.5

(1) There is a long acceleration lane for this movement .

(2) The actual level of service is expected to be better than LOS "F" due to gaps created by the existing traffic signal at US 287/Erie Parkway.

Table 2
ESTIMATED TRAFFIC GENERATION
Wise Farms
Erie, CO
(LSC #120761; July, 2014)

Trip Generating Category	Quantity	Trip Generation Rates ⁽¹⁾				Total Trips					
		Average Weekday	AM Peak Hour In	AM Peak Hour Out	PM Peak Hour In	PM Peak Hour Out	Average Weekday	AM Peak Hour In	AM Peak Hour Out	PM Peak - Hour In	PM Peak - Hour Out
North Half											
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Notes:

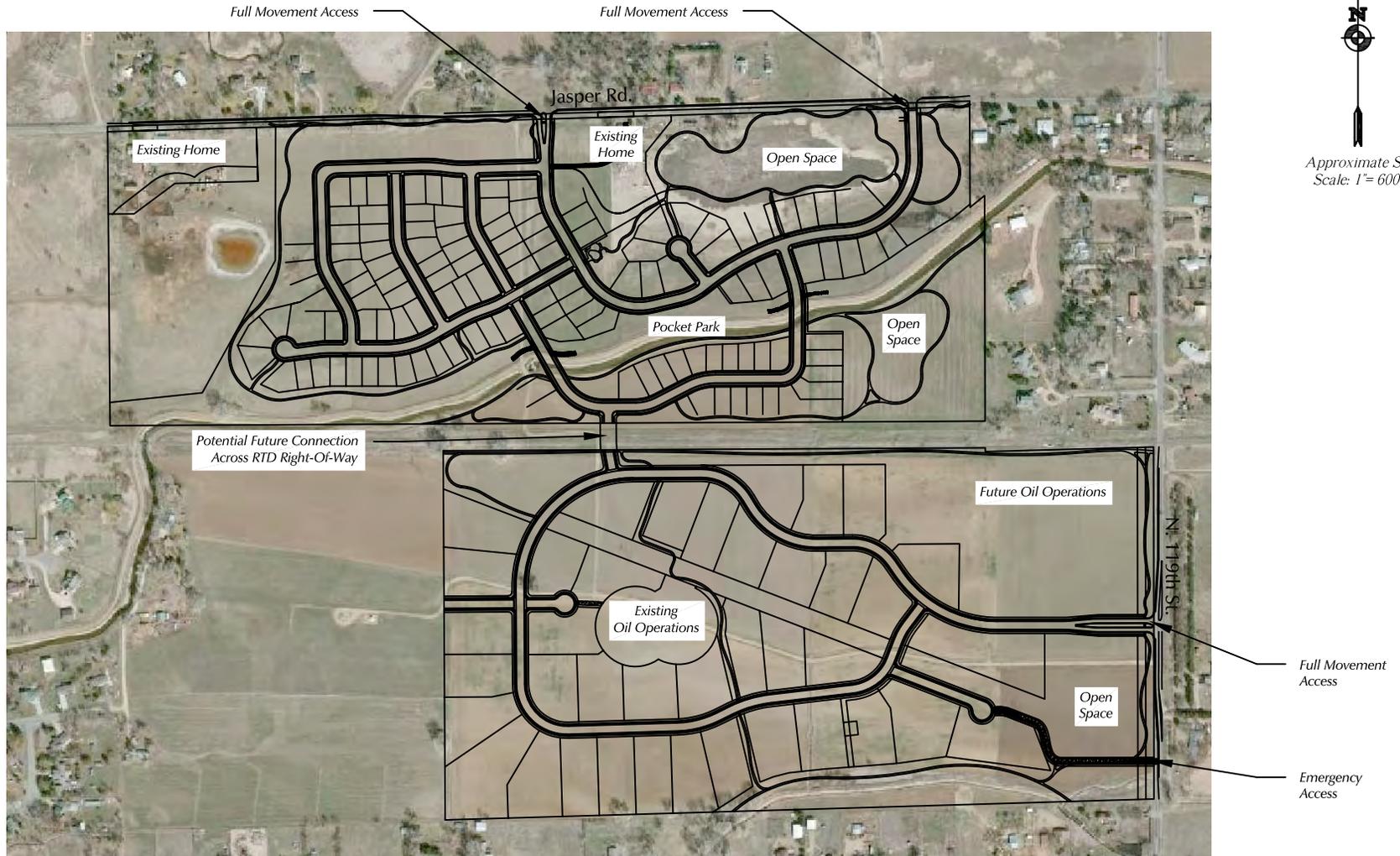
- (1) Source: *Trip Generation*, Institute of Transportation Engineers, 9th Edition, 2012.
- (2) ITE Land Use #210 - Single-Family Detached Housing
- (3) DU = Dwelling Unit



Approximate Scale
Scale: 1" = 2,500'

Figure 1
**Vicinity
Map**

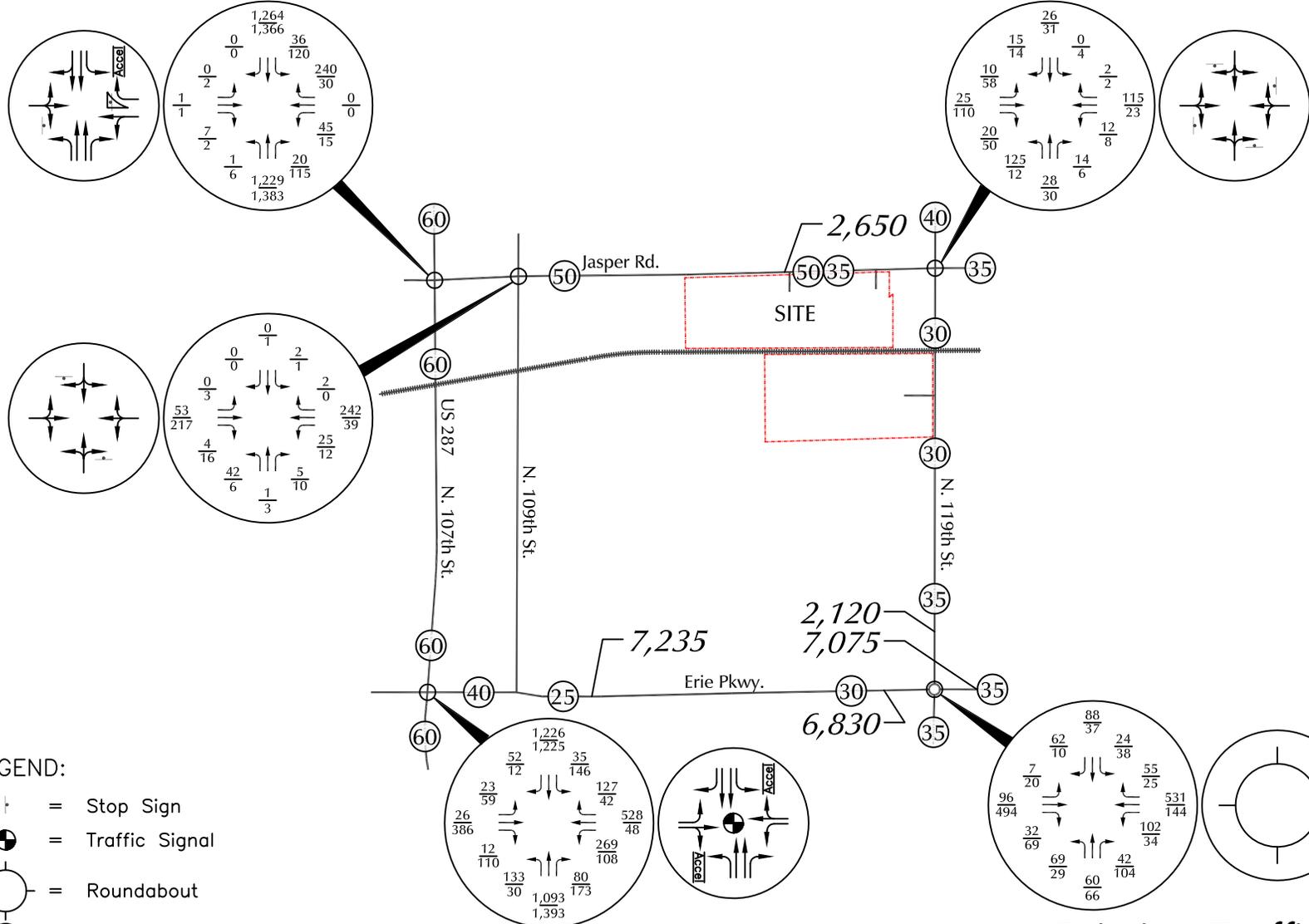
Wise Farms (LSC #120761)



North arrow pointing up with 'N' and 'S' markers.
Approximate Scale
Scale: 1" = 600'

Figure 2
Site Plan

Wise Farms (LSC #120761)

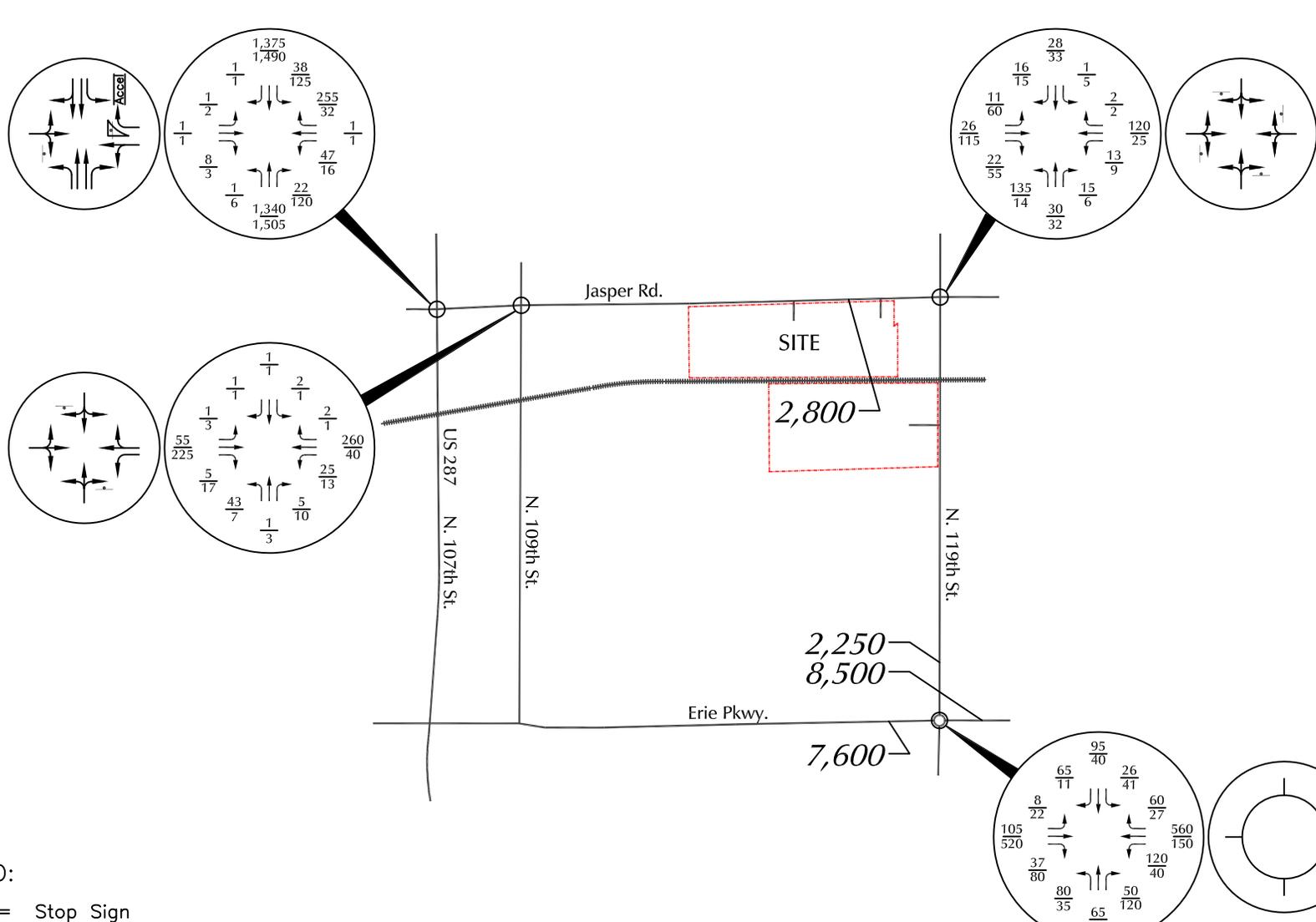


LEGEND:

-  = Stop Sign
-  = Traffic Signal
-  = Roundabout
-  = Speed Limit

$\frac{45}{65}$ = $\frac{\text{AM Peak-Hour Traffic}}{\text{PM Peak-Hour Traffic}}$
 50 = Average Weekday Traffic

Figure 3
**Existing Traffic, Lane
Geometry and Traffic Control**

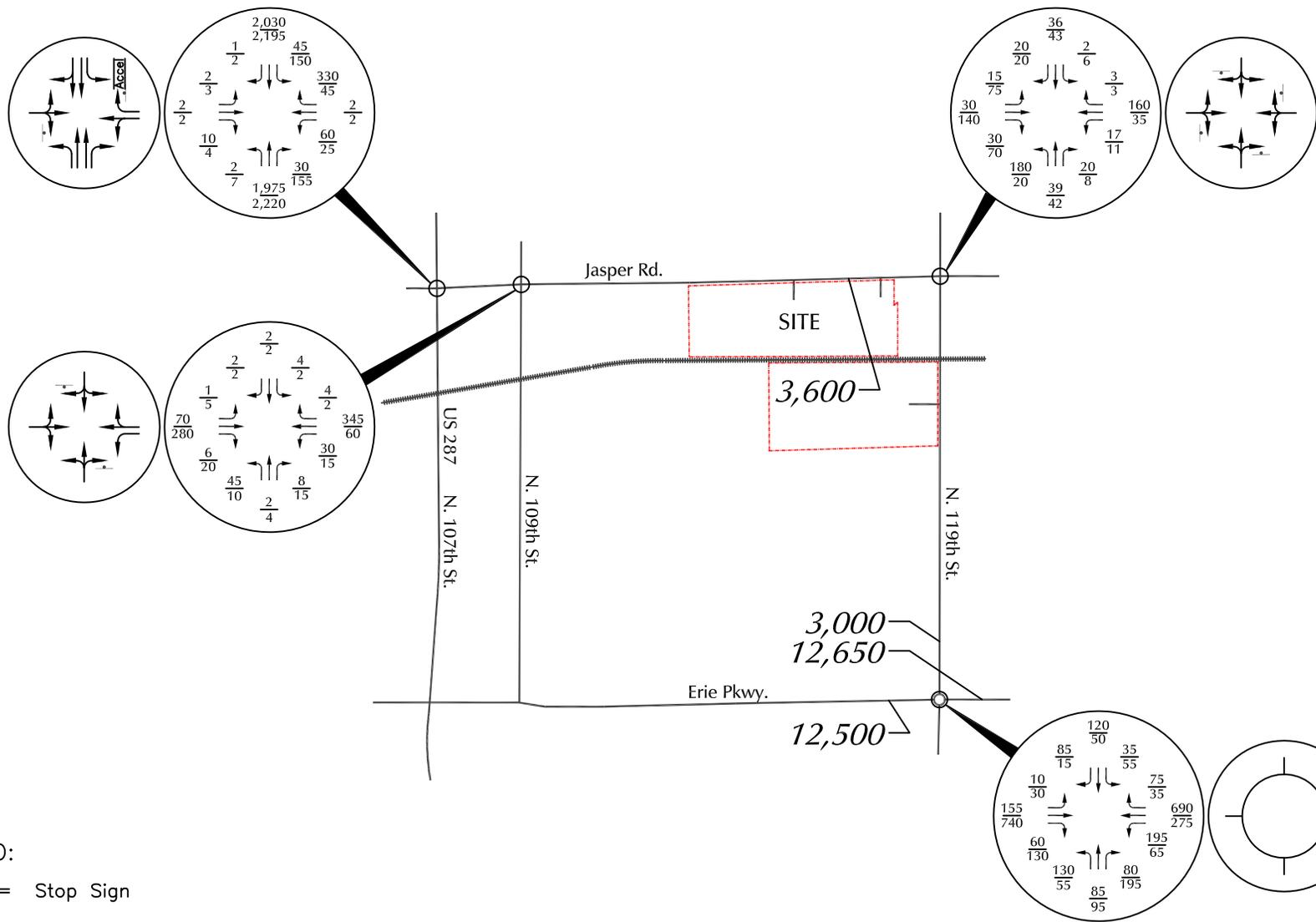


Approximate Scale
Scale: 1" = 2,500'

LEGEND:

-  = Stop Sign
-  = Roundabout
- $\frac{45}{65}$ = $\frac{\text{AM Peak-Hour Traffic}}{\text{PM Peak-Hour Traffic}}$
- 50 = Average Weekday Traffic

Figure 4
**Year 2017 Background Traffic,
Lane Geometry and Traffic Control**



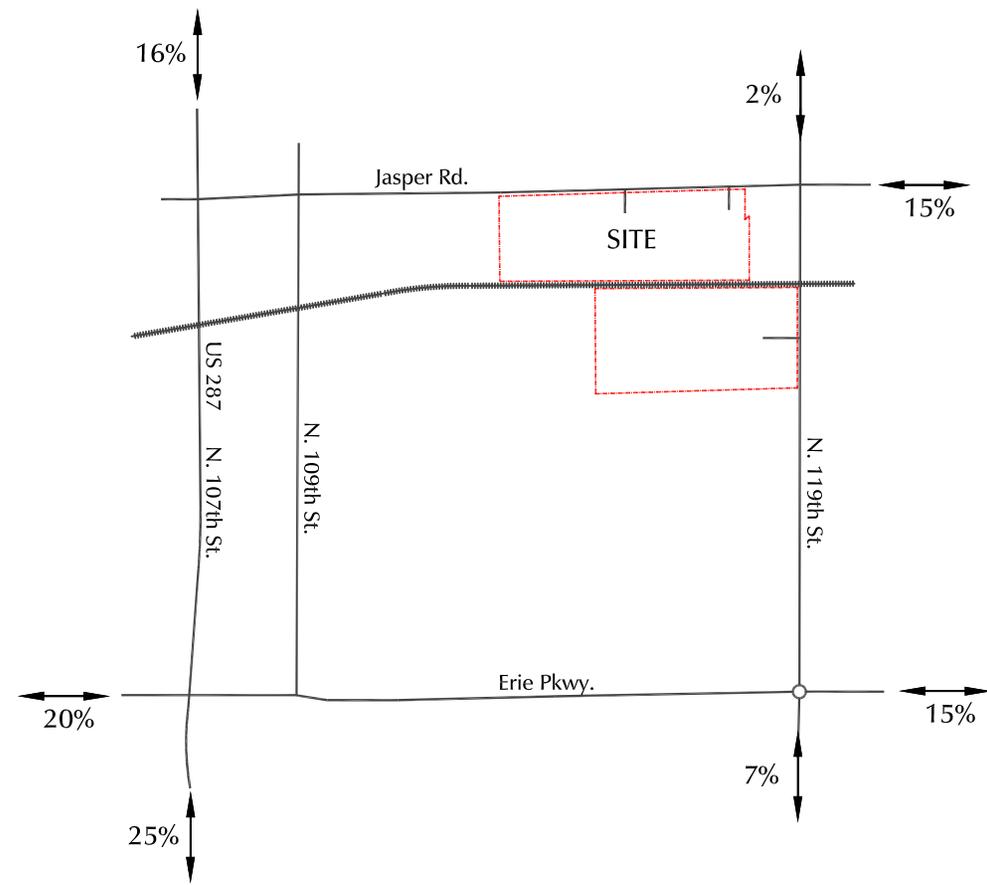
Approximate Scale
Scale: 1" = 2,500'

- LEGEND:**
- = Stop Sign
 - = Roundabout
 - $\frac{45}{65}$ = $\frac{\text{AM Peak-Hour Traffic}}{\text{PM Peak-Hour Traffic}}$
 - 50 = Average Weekday Traffic

Figure 5
**Year 2035 Background Traffic,
Lane Geometry and Traffic Control**
Wise Farms (LSC #120761)



Approximate Scale
Scale: 1" = 2,500'

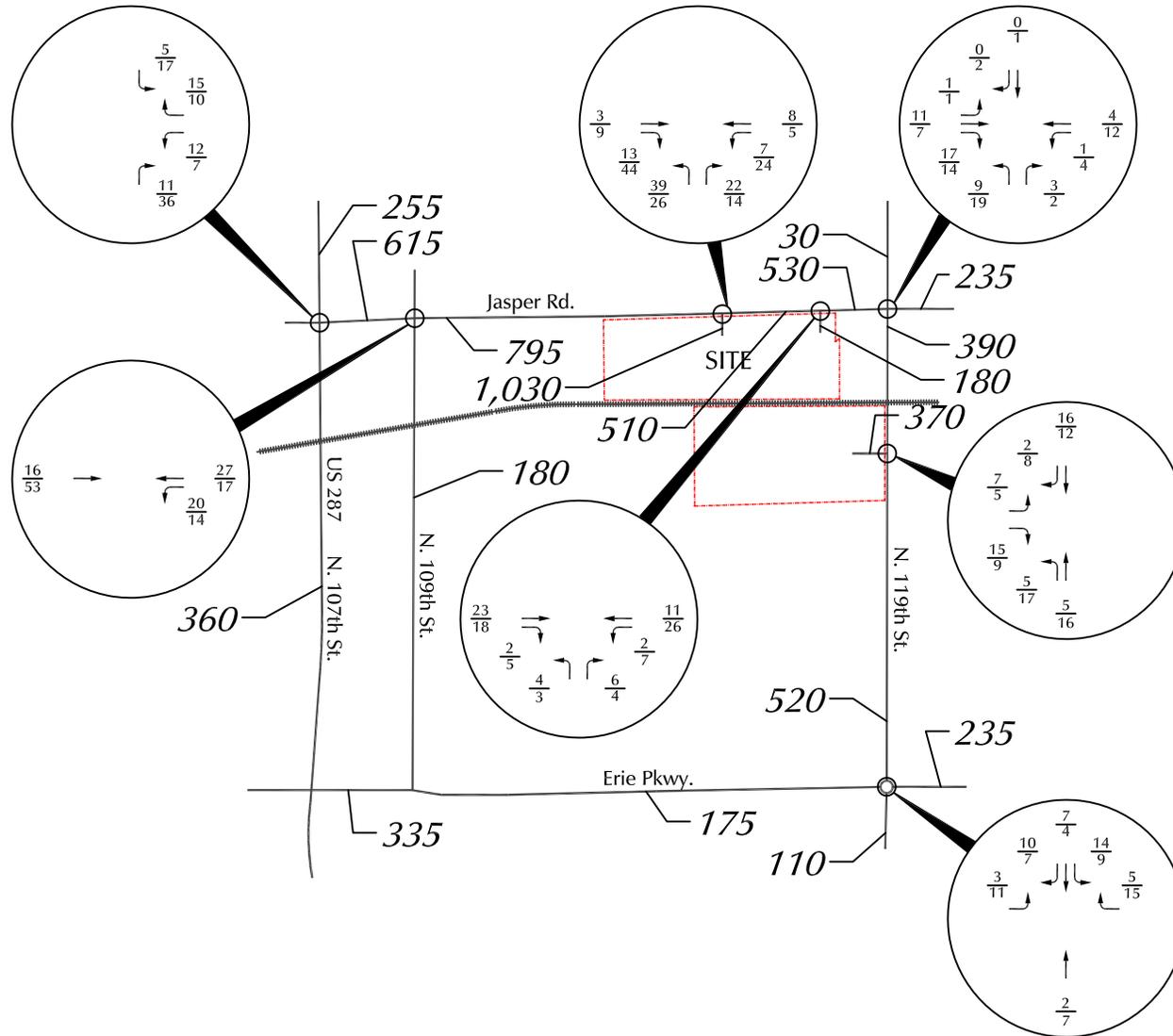


LEGEND:

← 20% = Percent of Directional Distribution →

Figure 6
*Directional Distribution
of Trips*

Wise Farms (LSC #120761)



Approximate Scale
Scale: 1" = 2,500'

Figure 7

Assignment of Site-Generated Traffic

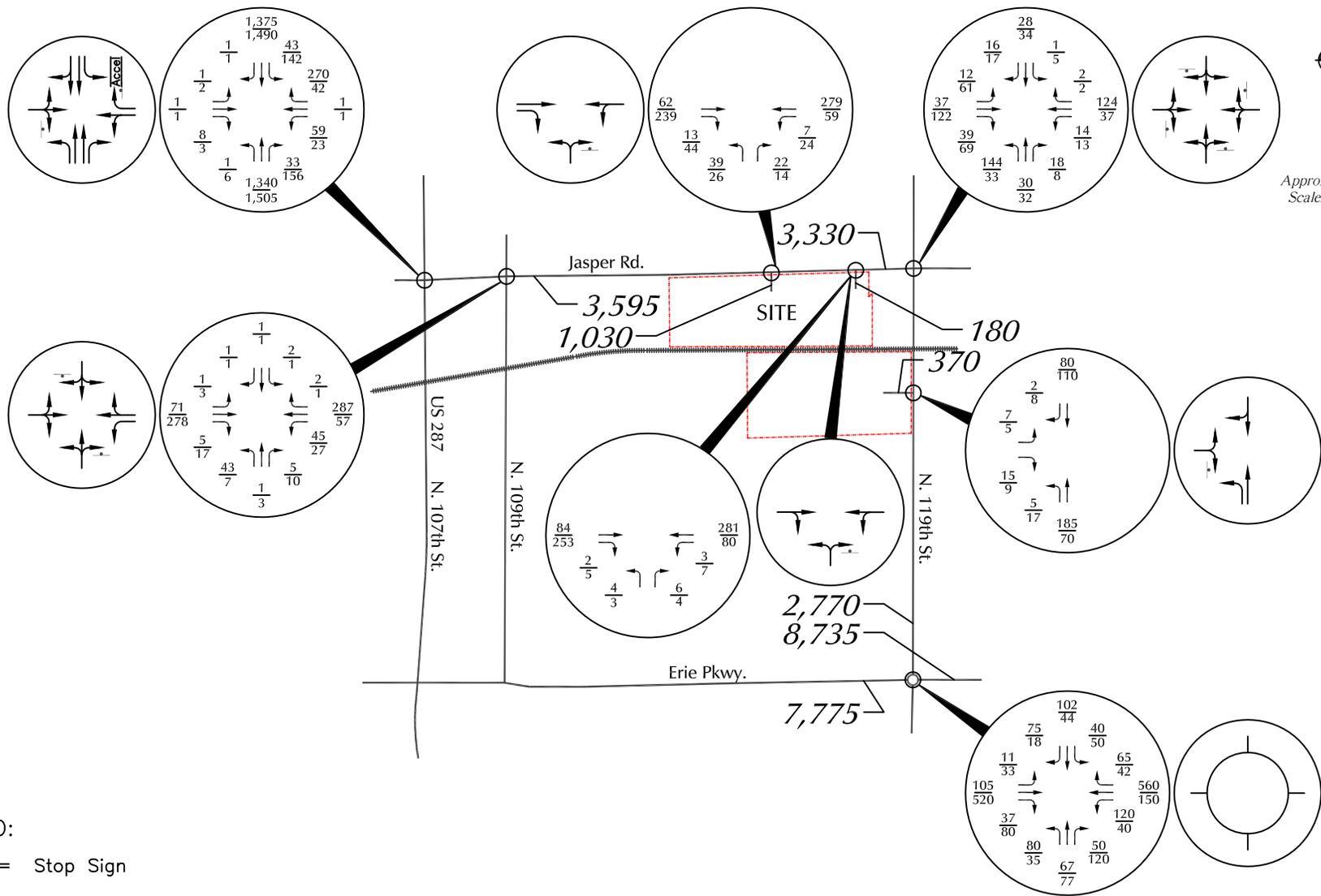
Wise Farms (LSC #120761)

LEGEND:

- $\frac{45}{65}$ = AM Peak-Hour Traffic / PM Peak-Hour Traffic
- 50 = Average Weekday Traffic



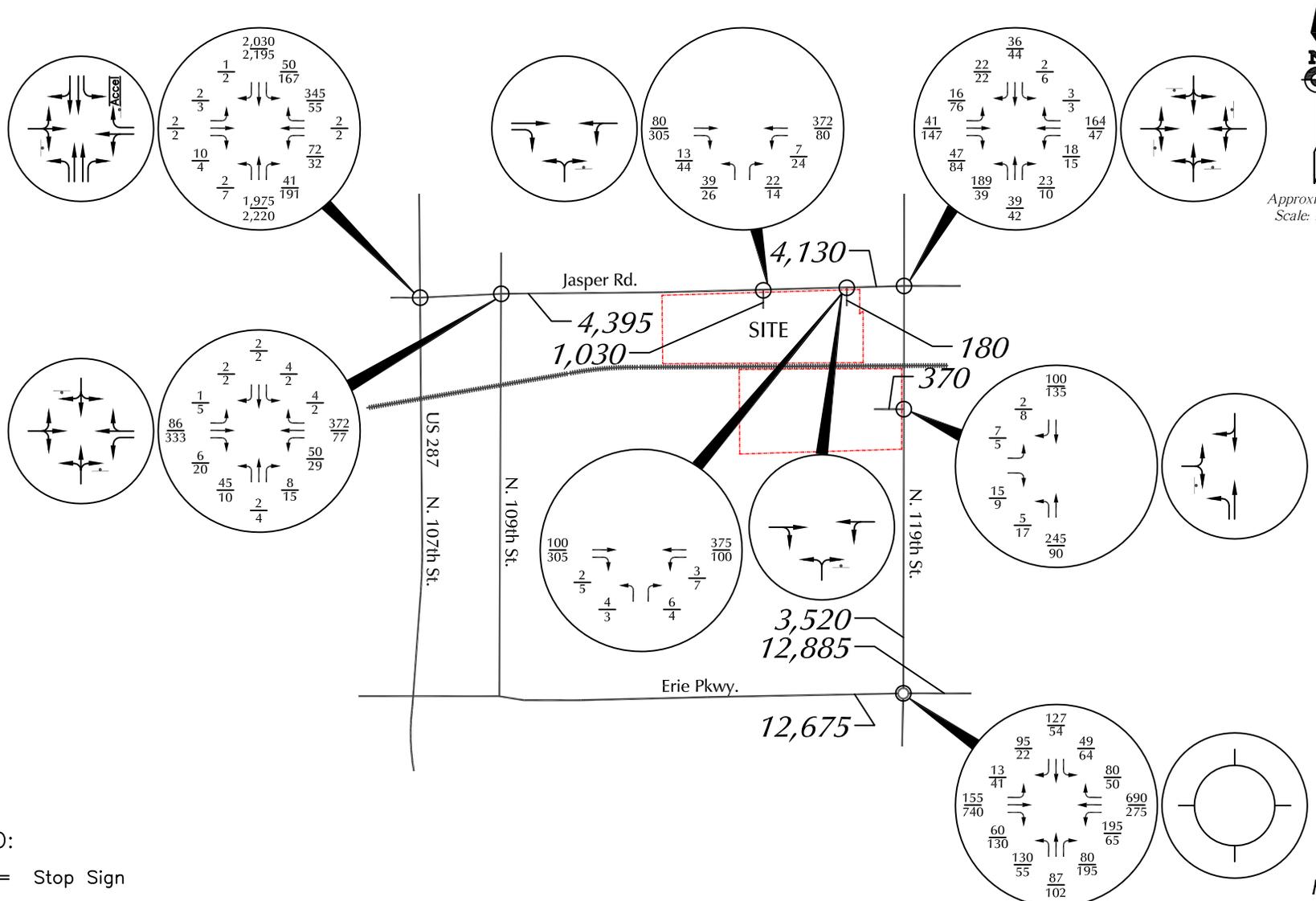
Approximate Scale
Scale: 1" = 2,500'



LEGEND:

-  = Stop Sign
-  = Roundabout
- $\frac{45}{65}$ = $\frac{\text{AM Peak-Hour Traffic}}{\text{PM Peak-Hour Traffic}}$
- 50 = Average Weekday Traffic

Figure 8
**Year 2017 Total Traffic,
Lane Geometry and Traffic Control**



LEGEND:

-  = Stop Sign
-  = Roundabout
- $\frac{45}{65}$ = $\frac{\text{AM Peak-Hour Traffic}}{\text{PM Peak-Hour Traffic}}$
- 50 = Average Weekday Traffic

Figure 9
**Year 2035 Total Traffic,
Lane Geometry and Traffic Control**

COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: US-287 (107TH ST)
E/W STREET: JASPER RD
CITY: ERIE
COUNTY: BOULDER

File Name : US28JASP
Site Code : 00000017
Start Date : 1/15/2013
Page No : 1

Groups Printed- VEHICLES

Start Time	US-287 (107TH ST) Southbound			JASPER RD Westbound			US-287 (107TH ST) Northbound			JASPER RD Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	2	266	0	10	0	15	0	200	2	0	0	1	496
06:45 AM	4	220	0	9	0	12	0	186	4	0	0	0	435
Total	6	486	0	19	0	27	0	386	6	0	0	1	931
07:00 AM	1	235	0	9	0	13	0	218	2	1	0	1	480
07:15 AM	2	302	0	11	0	26	0	265	3	0	1	3	613
07:30 AM	4	323	0	7	0	77	0	267	5	0	0	1	684
07:45 AM	12	352	0	4	0	52	0	347	5	0	0	3	775
Total	19	1212	0	31	0	168	0	1097	15	1	1	8	2552
08:00 AM	12	287	0	20	0	31	1	350	0	0	0	0	701
08:15 AM	5	290	0	6	0	21	0	270	6	0	0	0	598
Total	17	577	0	26	0	52	1	620	6	0	0	0	1299
04:00 PM	26	234	1	6	0	7	1	274	17	1	0	0	567
04:15 PM	21	225	0	2	0	7	0	311	19	0	0	1	586
04:30 PM	17	286	1	5	0	5	1	292	28	0	0	1	636
04:45 PM	23	351	0	3	0	9	1	353	23	0	1	1	765
Total	87	1096	2	16	0	28	3	1230	87	1	1	3	2554
05:00 PM	26	330	0	5	0	9	2	320	24	1	0	0	717
05:15 PM	29	351	0	3	0	8	2	370	28	1	0	0	792
05:30 PM	31	334	0	4	0	2	1	340	30	0	0	1	743
05:45 PM	21	299	0	0	0	12	0	240	18	0	0	0	590
Total	107	1314	0	12	0	31	5	1270	100	2	0	1	2842
Grand Total	236	4685	2	104	0	306	9	4603	214	4	2	13	10178
Apprch %	4.8	95.2	0.0	25.4	0.0	74.6	0.2	95.4	4.4	21.1	10.5	68.4	
Total %	2.3	46.0	0.0	1.0	0.0	3.0	0.1	45.2	2.1	0.0	0.0	0.1	

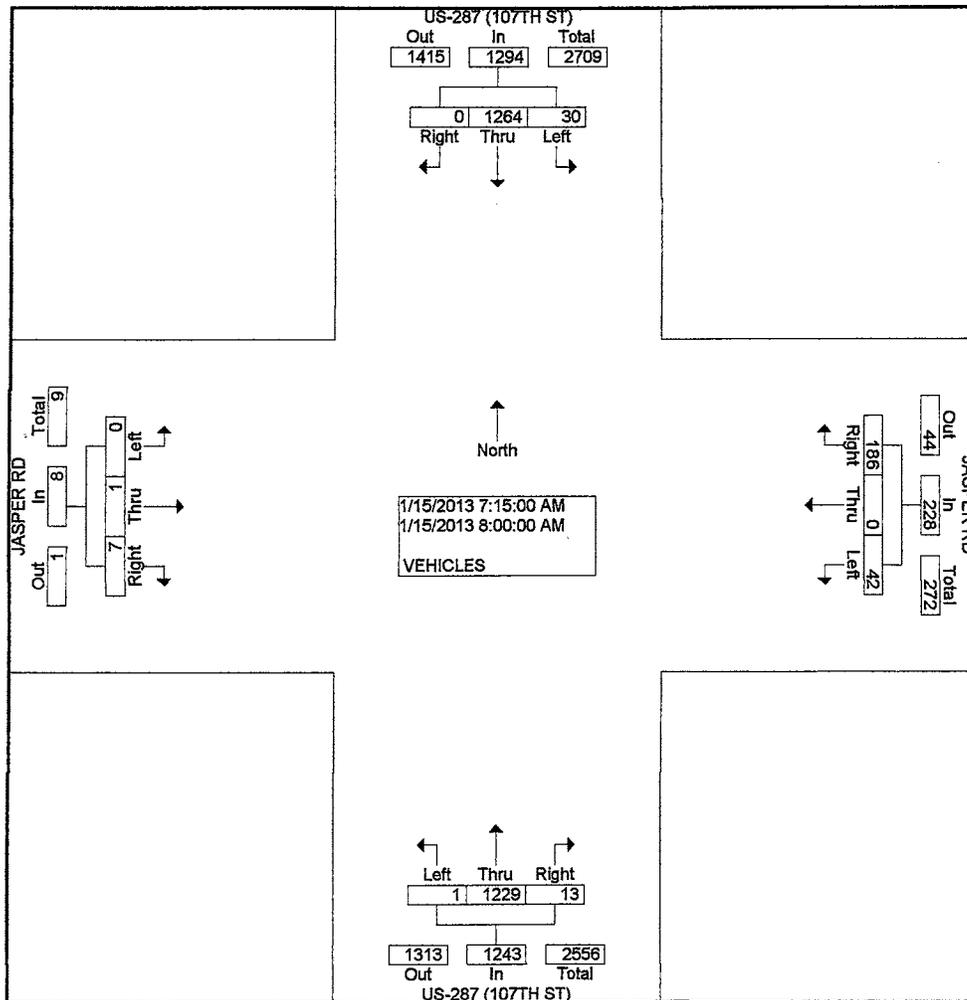
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: US-287 (107TH ST)
E/W STREET: JASPER RD
CITY: ERIE
COUNTY: BOULDER

File Name : US28JASP
Site Code : 00000017
Start Date : 1/15/2013
Page No : 2

Start Time	US-287 (107TH ST) Southbound				JASPER RD Westbound				US-287 (107TH ST) Northbound				JASPER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	30	1264	0	1294	42	0	186	228	1	1229	13	1243	0	1	7	8	2773
Percent	2.3	97.7	0.0		18.4	0.0	81.6		0.1	98.9	1.0		0.0	12.5	87.5		
07:45																	
Volume	12	352	0	364	4	0	52	56	0	347	5	352	0	0	3	3	775
Peak Factor	0.895																
High Int.	07:45 AM																
Volume	12	352	0	364	7	0	77	84	0	347	5	352	0	1	3	4	
Peak Factor	0.889				0.679				0.883				0.500				



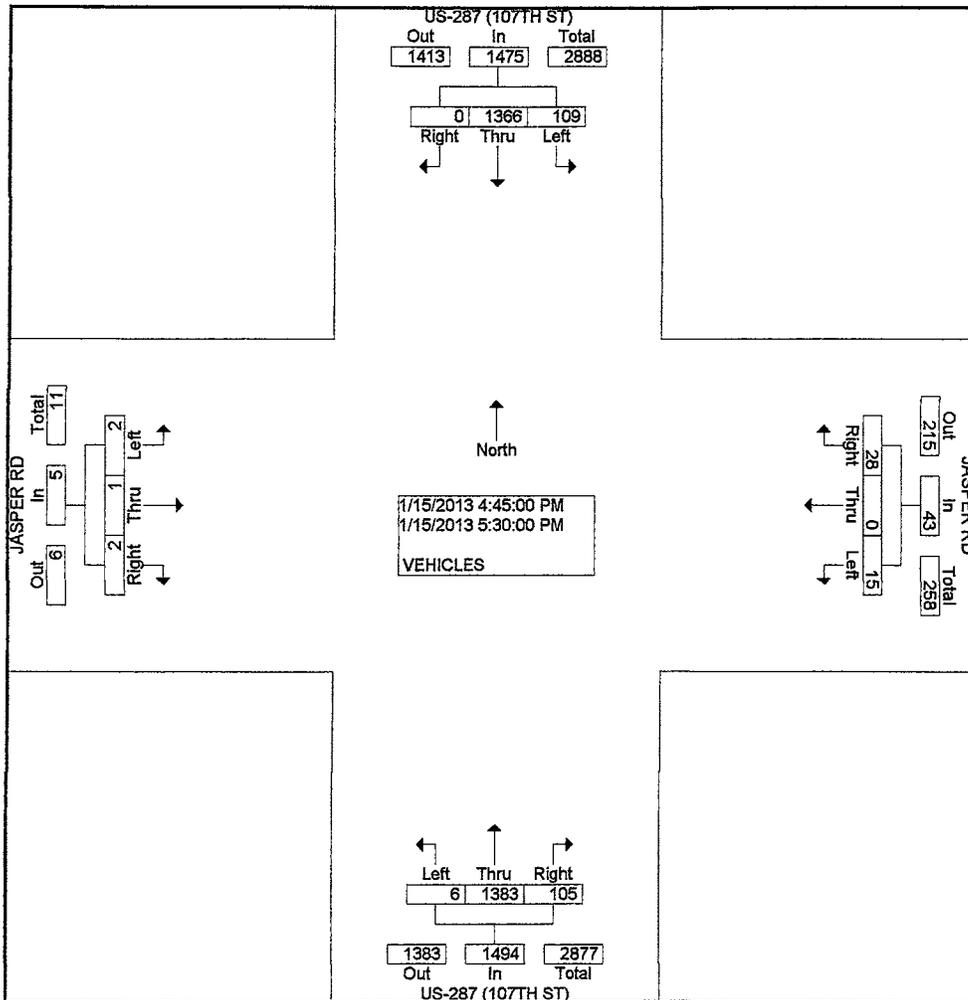
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: US-287 (107TH ST)
E/W STREET: JASPER RD
CITY: ERIE
COUNTY: BOULDER

File Name : US28JASP
Site Code : 00000017
Start Date : 1/15/2013
Page No : 2

Start Time	US-287 (107TH ST) Southbound				JASPER RD Westbound				US-287 (107TH ST) Northbound				JASPER RD Eastbound				Int. Total			
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total				
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																				
Intersection	04:45 PM																			
Volume	109	1366	0	1475	15	0	28	43	6	1383	105	1494	2	1	2	5	3017			
Percent	7.4	92.6	0.0		34.9	0.0	65.1		0.4	92.6	7.0		40.0	20.0	40.0					
05:15																				
Volume	29	351	0	380	3	0	8	11	2	370	28	400	1	0	0	1	792			
Peak Factor	0.952																			
High Int.	05:15 PM																			
Volume	29	351	0	380	5	0	9	14	2	370	28	400	0	1	1	2				
Peak Factor	0.970								0.768								0.625			



COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: US-287 (107TH ST)
E/W STREET: ERIE PKWY
CITY: ERIE
COUNTY: BOULDER

File Name : US28ERIE
Site Code : 00000016
Start Date : 1/15/2013
Page No : 1

Groups Printed- VEHICLES

Start Time	US-287 (107TH ST) Southbound			ERIE PKWY Westbound			US-287 (107TH ST) Northbound			ERIE PKWY Eastbound			Int. Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	14	259	4	37	54	23	19	179	6	0	5	5	605
06:45 AM	12	212	5	38	58	16	22	173	8	1	3	6	554
Total	26	471	9	75	112	39	41	352	14	1	8	11	1159
07:00 AM	7	228	10	82	105	31	27	187	8	2	3	1	691
07:15 AM	2	303	11	70	115	28	26	239	7	1	5	8	815
07:30 AM	8	314	9	53	153	35	32	226	43	11	5	2	891
07:45 AM	11	339	9	74	140	33	37	309	13	10	9	1	985
Total	28	1184	39	279	513	127	122	961	71	24	22	12	3382
08:00 AM	14	270	23	72	120	31	38	319	17	1	7	1	913
08:15 AM	13	274	9	62	75	27	38	245	5	4	4	0	756
Total	27	544	32	134	195	58	76	564	22	5	11	1	1669
04:00 PM	13	223	4	36	13	10	7	274	54	8	59	21	722
04:15 PM	16	205	7	23	10	14	17	307	39	9	71	28	746
04:30 PM	20	269	3	28	9	8	10	303	65	10	83	31	839
04:45 PM	30	319	6	35	15	17	6	336	40	24	95	25	948
Total	79	1016	20	122	47	49	40	1220	198	51	308	105	3255
05:00 PM	42	290	3	17	7	4	7	329	42	13	86	29	869
05:15 PM	43	310	1	24	9	11	7	379	41	10	97	27	959
05:30 PM	31	306	2	32	17	10	10	349	50	12	108	29	956
05:45 PM	29	269	1	24	8	7	5	241	47	10	96	32	769
Total	145	1175	7	97	41	32	29	1298	180	45	387	117	3553
Grand Total	305	4390	107	707	908	305	308	4395	485	126	736	246	13018
Apprch %	6.4	91.4	2.2	36.8	47.3	15.9	5.9	84.7	9.3	11.4	66.4	22.2	
Total %	2.3	33.7	0.8	5.4	7.0	2.3	2.4	33.8	3.7	1.0	5.7	1.9	

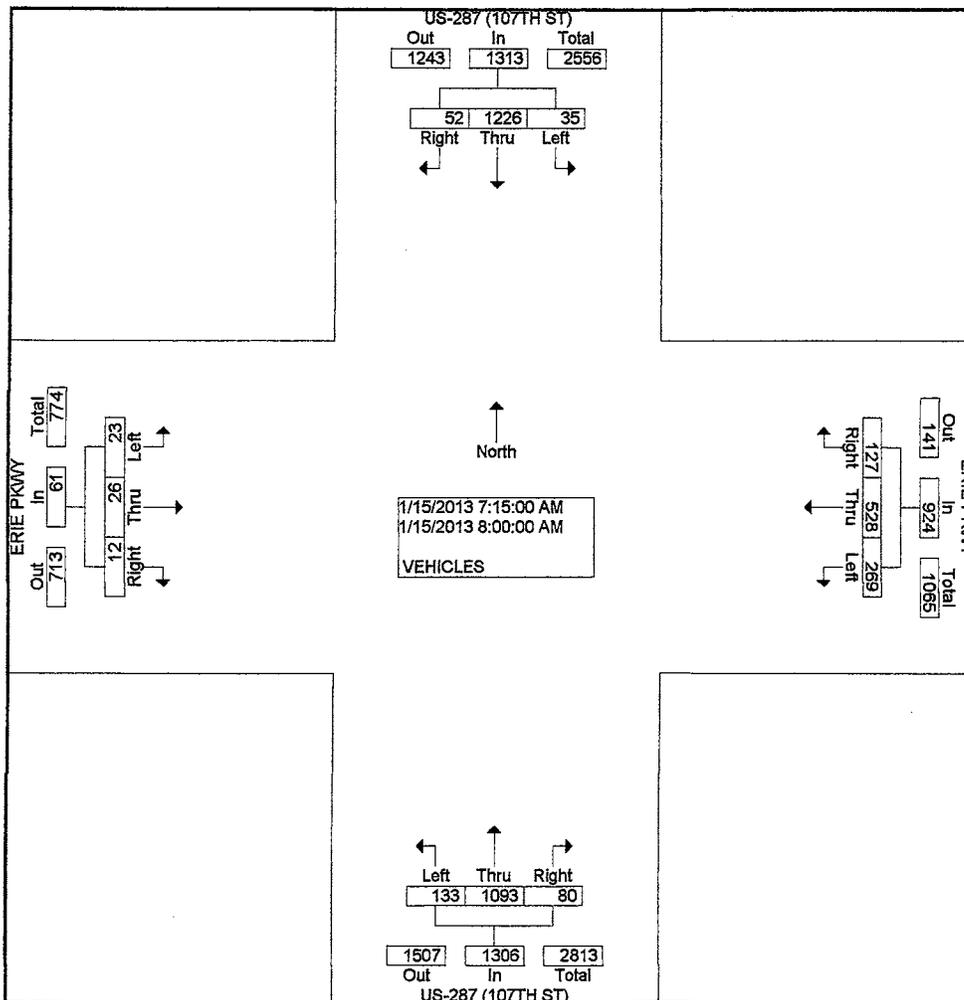
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: US-287 (107TH ST)
E/W STREET: ERIE PKWY
CITY: ERIE
COUNTY: BOULDER

File Name : US28ERIE
Site Code : 00000016
Start Date : 1/15/2013
Page No : 2

Start Time	US-287 (107TH ST) Southbound				ERIE PKWY Westbound				US-287 (107TH ST) Northbound				ERIE PKWY Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	35	1226	52	1313	269	528	127	924	133	1093	80	1306	23	26	12	61	3604
Percent	2.7	93.4	4.0		29.1	57.1	13.7		10.2	83.7	6.1		37.7	42.6	19.7		
07:45																	
Volume	11	339	9	359	74	140	33	247	37	309	13	359	10	9	1	20	985
Peak Factor																	
High Int.	07:45 AM																
Volume	11	339	9	359	74	140	33	247	38	319	17	374	10	9	1	20	0.915
Peak Factor	0.914								0.935				0.873				0.763



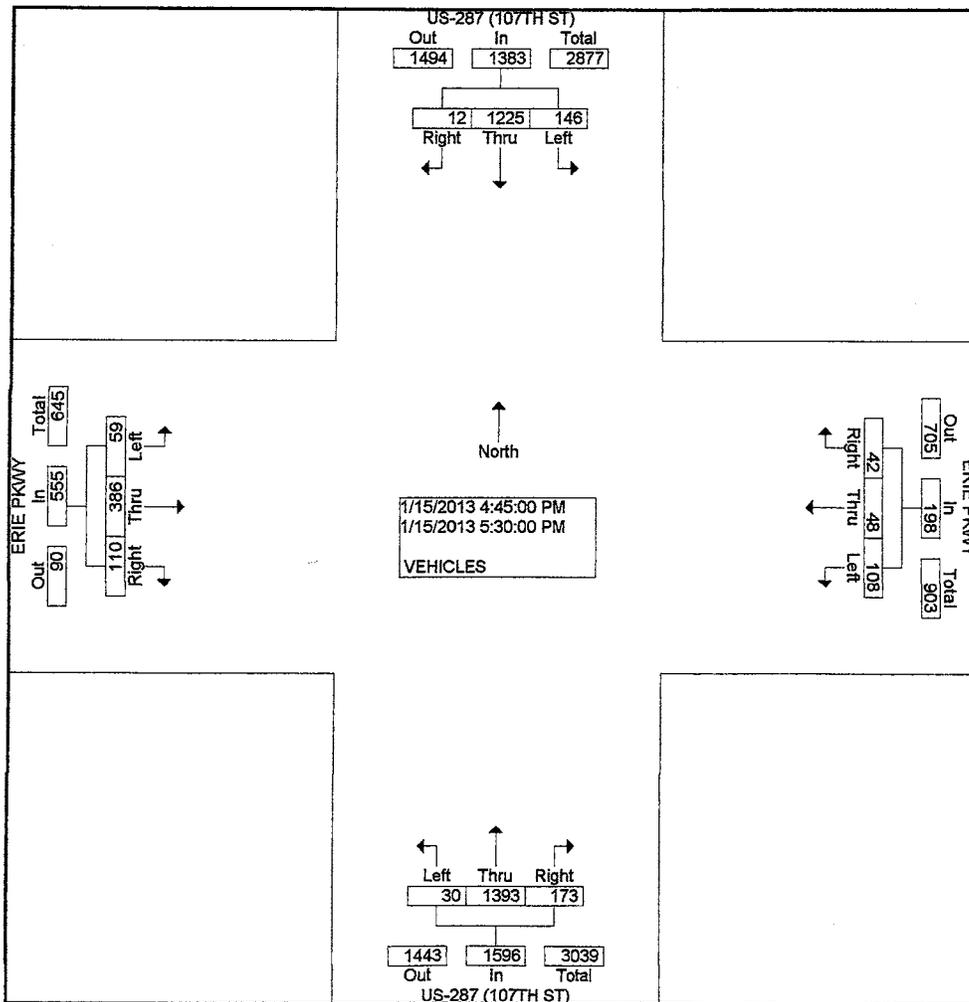
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: US-287 (107TH ST)
E/W STREET: ERIE PKWY
CITY: ERIE
COUNTY: BOULDER

File Name : US28ERIE
Site Code : 00000016
Start Date : 1/15/2013
Page No : 2

Start Time	US-287 (107TH ST) Southbound				ERIE PKWY Westbound				US-287 (107TH ST) Northbound				ERIE PKWY Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:45 PM																
Volume	146	1225	12	1383	108	48	42	198	30	1393	173	1596	59	386	110	555	3732
Percent	10.6	88.6	0.9		54.5	24.2	21.2		1.9	87.3	10.8		10.6	69.5	19.8		
05:15																	
Volume	43	310	1	354	24	9	11	44	7	379	41	427	10	97	27	134	959
Peak Factor	0.973																
High Int.	04:45 PM																
Volume	30	319	6	355	35	15	17	67	7	379	41	427	12	108	29	149	
Peak Factor	0.974				0.739				0.934				0.931				



COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: 119TH ST
E/W STREET: JASPER RD
CITY: ERIE
COUNTY: BOULDER

File Name : 119TJASP
Site Code : 00000020
Start Date : 1/15/2013
Page No : 1

Groups Printed- VEHICLES

Start Time	119TH ST Southbound			JASPER RD Westbound			119TH ST Northbound			JASPER RD Eastbound			Int. Total
	Left	Thru	Right										
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	0	0	3	0	9	1	5	2	0	2	1	0	23
06:45 AM	0	2	8	0	5	0	6	4	1	1	4	2	33
Total	0	2	11	0	14	1	11	6	1	3	5	2	56
07:00 AM	0	10	7	0	7	1	12	3	2	1	1	1	45
07:15 AM	0	7	3	1	14	1	14	6	1	4	1	2	54
07:30 AM	0	6	3	1	19	0	36	13	8	2	7	1	96
07:45 AM	0	6	1	6	24	0	25	3	3	1	7	5	81
Total	0	29	14	8	64	2	87	25	14	8	16	9	276
08:00 AM	0	7	3	4	21	1	16	6	2	0	3	9	72
08:15 AM	0	6	1	4	15	1	7	2	1	2	5	5	49
Total	0	13	4	8	36	2	23	8	3	2	8	14	121
04:00 PM	0	4	2	3	8	0	1	8	3	4	19	12	64
04:15 PM	0	5	4	3	3	1	4	7	6	6	19	9	67
04:30 PM	1	8	1	0	4	0	3	11	0	10	28	8	74
04:45 PM	0	7	2	1	9	1	4	10	1	13	21	8	77
Total	1	24	9	7	24	2	12	36	10	33	87	37	282
05:00 PM	3	6	3	2	7	0	5	8	0	11	24	9	78
05:15 PM	0	11	5	3	2	0	2	8	4	14	25	14	88
05:30 PM	1	7	4	2	5	1	1	4	1	10	21	12	69
05:45 PM	0	3	0	3	7	0	3	9	2	6	28	12	73
Total	4	27	12	10	21	1	11	29	7	41	98	47	308
Grand Total	5	95	50	33	159	8	144	104	35	87	214	109	1043
Apprch %	3.3	63.3	33.3	16.5	79.5	4.0	50.9	36.7	12.4	21.2	52.2	26.6	
Total %	0.5	9.1	4.8	3.2	15.2	0.8	13.8	10.0	3.4	8.3	20.5	10.5	

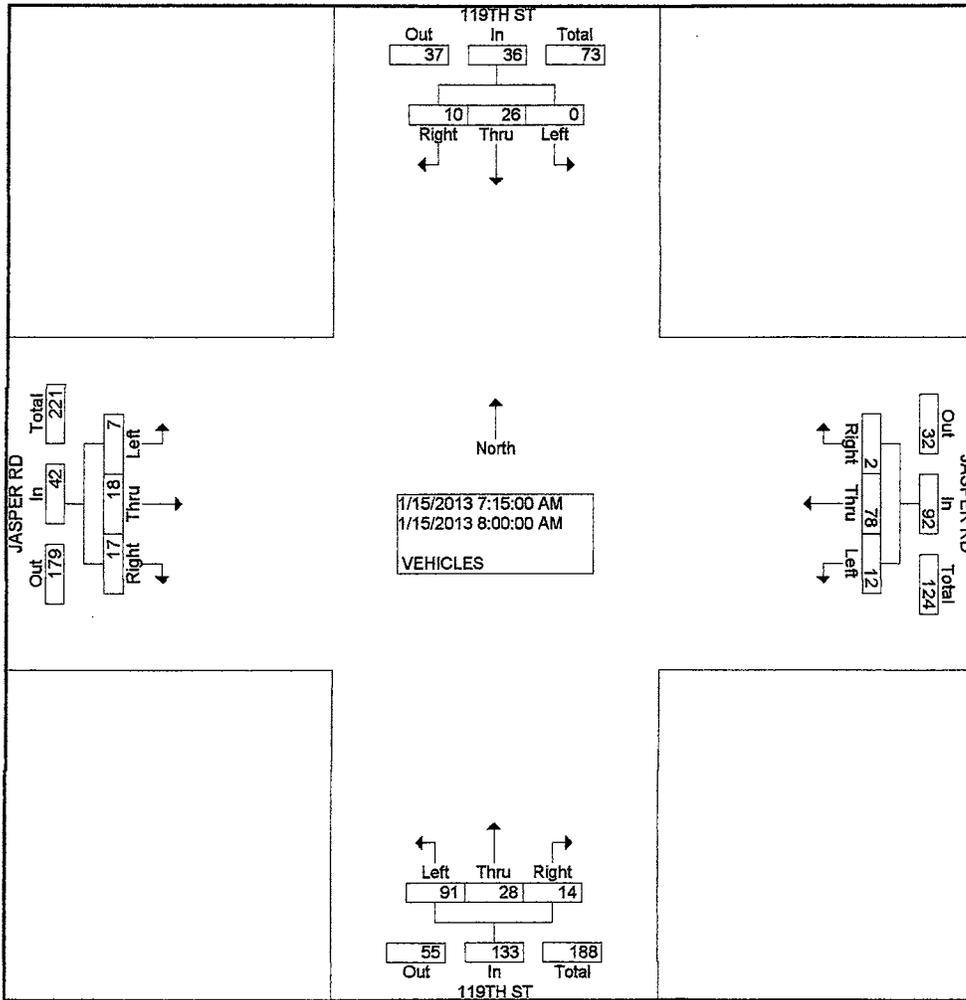
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: 119TH ST
E/W STREET: JASPER RD
CITY: ERIE
COUNTY: BOULDER

File Name : 119TJASP
Site Code : 00000020
Start Date : 1/15/2013
Page No : 2

Start Time	119TH ST Southbound				JASPER RD Westbound				119TH ST Northbound				JASPER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	0	26	10	36	12	78	2	92	91	28	14	133	7	18	17	42	303
Percent	0.0	72.2	27.8		13.0	84.8	2.2		68.4	21.1	10.5		16.7	42.9	40.5		
07:30																	
Volume	0	6	3	9	1	19	0	20	36	13	8	57	2	7	1	10	96
Peak Factor	0.789																
High Int.	07:15 AM				07:45 AM				07:30 AM				07:45 AM				
Volume	0	7	3	10	6	24	0	30	36	13	8	57	1	7	5	13	
Peak Factor	0.900				0.767				0.583				0.808				



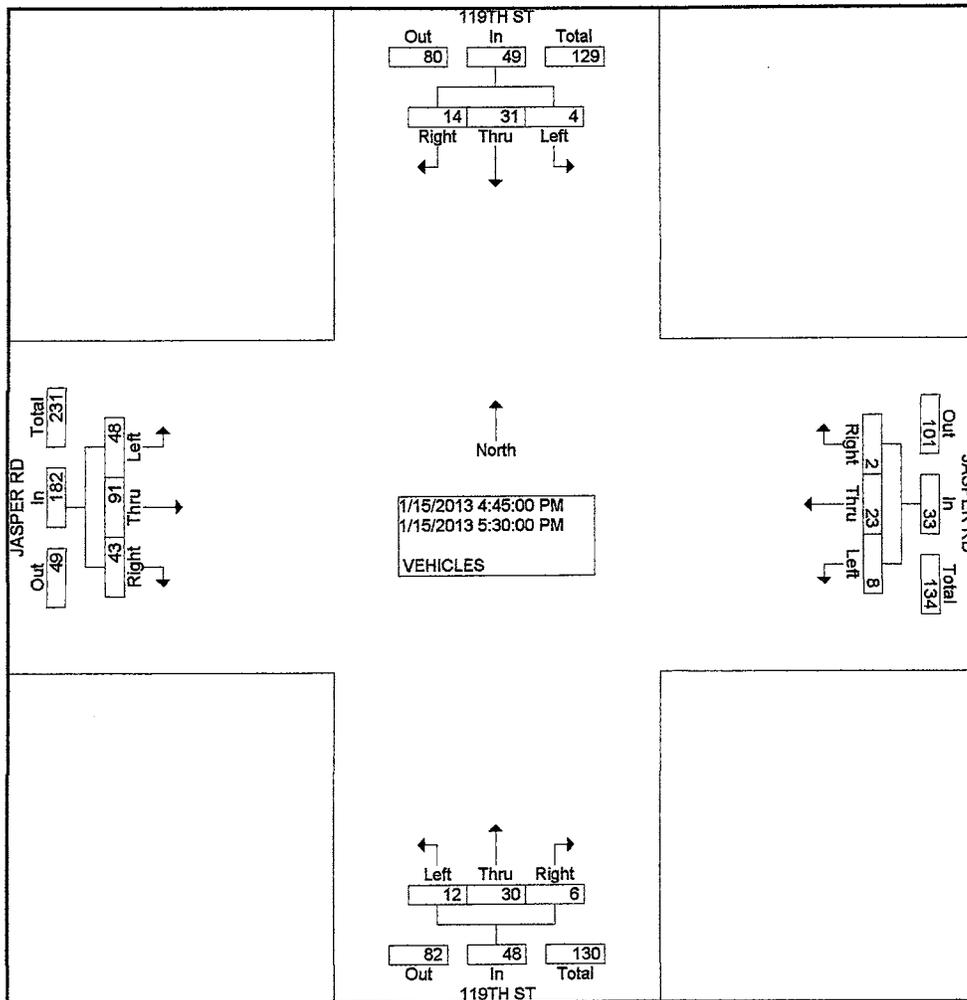
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: 119TH ST
E/W STREET: JASPER RD
CITY: ERIE
COUNTY: BOULDER

File Name : 119TJASP
Site Code : 0000020
Start Date : 1/15/2013
Page No : 2

Start Time	119TH ST Southbound				JASPER RD Westbound				119TH ST Northbound				JASPER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 04:45 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:45 PM																
Volume	4	31	14	49	8	23	2	33	12	30	6	48	48	91	43	182	312
Percent	8.2	63.3	28.6		24.2	69.7	6.1		25.0	62.5	12.5		26.4	50.0	23.6		
05:15																	
Volume	0	11	5	16	3	2	0	5	2	8	4	14	14	25	14	53	88
Peak Factor																	
High Int.	05:15 PM				04:45 PM				04:45 PM				05:15 PM				0.886
Volume	0	11	5	16	1	9	1	11	4	10	1	15	14	25	14	53	
Peak Factor	0.766				0.750				0.800				0.858				



COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: 119TH ST
E/W STREET: ERIE PKWY
CITY: ERIE
COUNTY: BOULDER

File Name : 119TERIE
Site Code : 00000016
Start Date : 1/16/2013
Page No : 1

Groups Printed- 1 - VEHICLES

Start Time	119TH ST Southbound			ERIE PKWY Westbound			119TH ST Northbound			ERIE PKWY Eastbound			Int. Total
	Left	Thru	Right										
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	1	4	3	8	61	1	9	2	3	0	12	3	107
06:45 AM	2	12	5	14	78	1	8	4	6	0	30	4	164
Total	3	16	8	22	139	2	17	6	9	0	42	7	271
07:00 AM	9	15	17	15	92	5	12	3	6	1	27	4	206
07:15 AM	6	17	20	29	135	13	18	6	9	1	13	5	272
07:30 AM	6	38	17	29	163	17	22	12	11	0	30	15	360
07:45 AM	9	19	11	30	119	16	9	19	15	2	29	5	283
Total	30	89	65	103	509	51	61	40	41	4	99	29	1121
08:00 AM	3	14	14	14	114	9	20	23	7	4	24	7	253
08:15 AM	8	6	10	12	110	6	12	6	11	1	27	6	215
Total	11	20	24	26	224	15	32	29	18	5	51	13	468
04:00 PM	4	7	2	17	30	13	6	14	17	6	84	16	216
04:15 PM	11	15	3	14	41	3	6	7	13	0	82	12	207
04:30 PM	10	10	2	16	29	4	4	9	20	10	82	12	208
04:45 PM	5	9	0	6	27	5	3	22	26	7	108	21	239
Total	30	41	7	53	127	25	19	52	76	23	356	61	870
05:00 PM	9	7	5	9	35	8	7	14	29	5	103	12	243
05:15 PM	8	12	3	6	41	5	9	14	26	4	153	13	294
05:30 PM	16	9	2	13	41	7	10	16	23	4	130	23	294
05:45 PM	7	11	5	10	30	5	5	14	26	6	129	10	258
Total	40	39	15	38	147	25	31	58	104	19	515	58	1089
Grand Total	114	205	119	242	1146	118	160	185	248	51	1063	168	3819
Apprch %	26.0	46.8	27.2	16.1	76.1	7.8	27.0	31.2	41.8	4.0	82.9	13.1	
Total %	3.0	5.4	3.1	6.3	30.0	3.1	4.2	4.8	6.5	1.3	27.8	4.4	

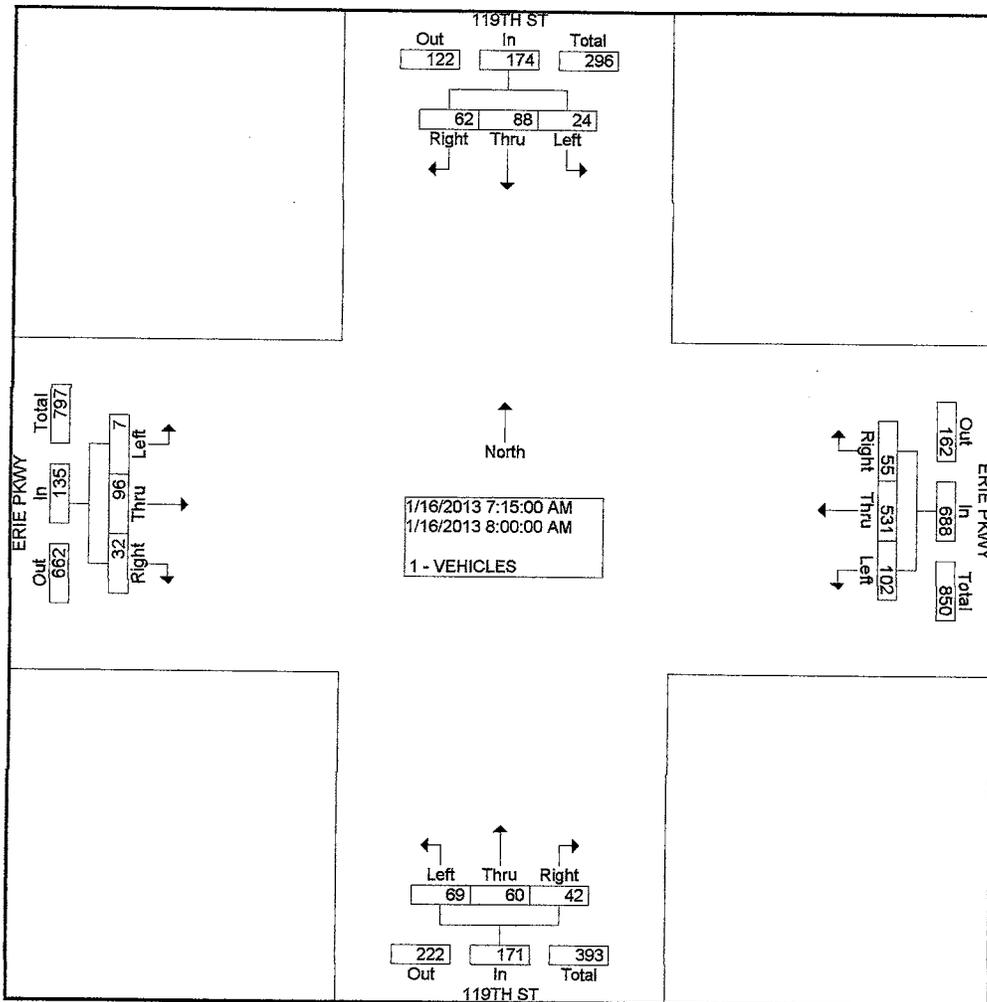
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: 119TH ST
E/W STREET: ERIE PKWY
CITY: ERIE
COUNTY: BOULDER

File Name : 119TERIE
Site Code : 0000016
Start Date : 1/16/2013
Page No : 2

Start Time	119TH ST Southbound				ERIE PKWY Westbound				119TH ST Northbound				ERIE PKWY Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	24	88	62	174	102	531	55	688	69	60	42	171	7	96	32	135	1168
Percent	13.8	50.6	35.6		14.8	77.2	8.0		40.4	35.1	24.6		5.2	71.1	23.7		
07:30																	
Volume	6	38	17	61	29	163	17	209	22	12	11	45	0	30	15	45	360
Peak Factor	0.811																
High Int.	07:30 AM																
Volume	6	38	17	61	29	163	17	209	20	23	7	50	0	30	15	45	885
Peak Factor	0.713				0.823				0.855				0.750				



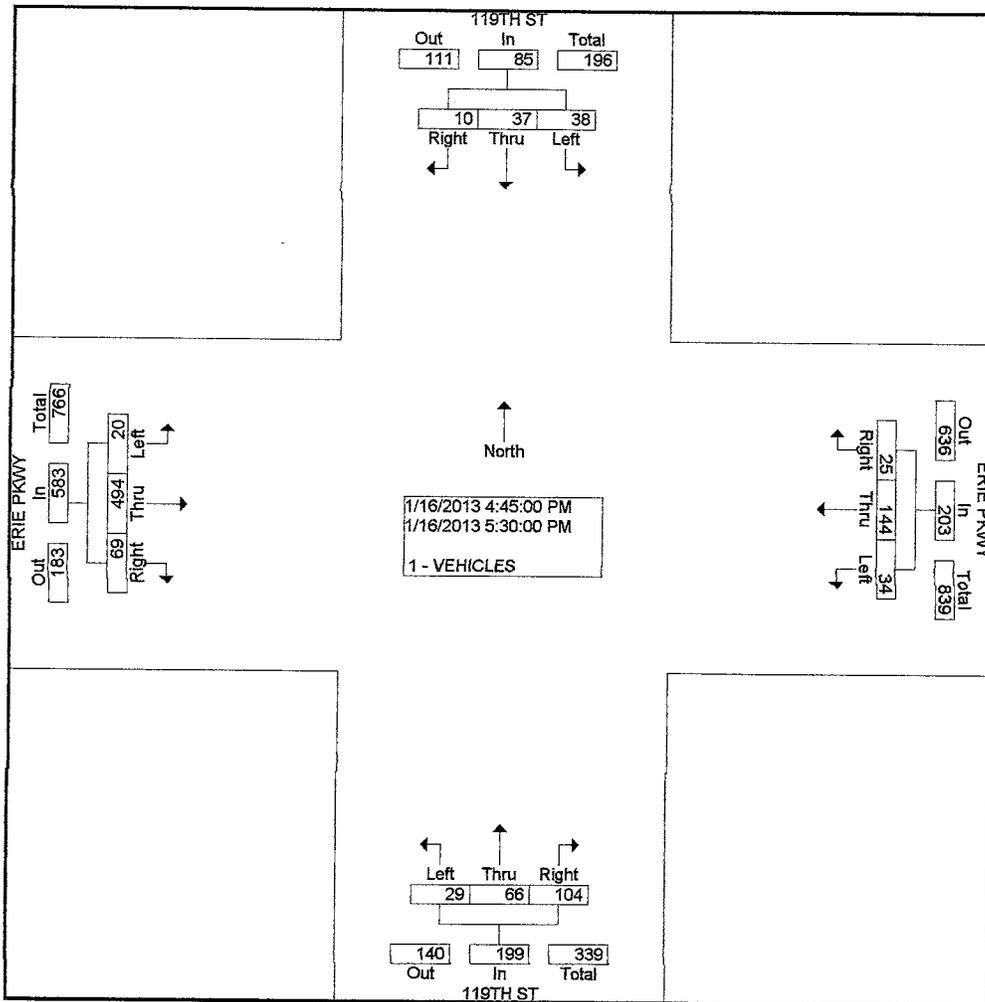
COUNTER MEASURES INC.

1889 YORK ST
DENVER, COLORADO
303-333-7409

N/S STREET: 119TH ST
E/W STREET: ERIE PKWY
CITY: ERIE
COUNTY: BOULDER

File Name : 119TERIE
Site Code : 00000016
Start Date : 1/16/2013
Page No : 2

Start Time	119TH ST Southbound				ERIE PKWY Westbound				119TH ST Northbound				ERIE PKWY Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 04:30 PM to 05:30 PM - Peak 1 of 1																	
Intersection	04:45 PM																
Volume	38	37	10	85	34	144	25	203	29	66	104	199	20	494	69	583	1070
Percent	44.7	43.5	11.8		16.7	70.9	12.3		14.6	33.2	52.3		3.4	84.7	11.8		
05:30																	
Volume	16	9	2	27	13	41	7	61	10	16	23	49	4	130	23	157	294
Peak Factor																	
High Int.	05:30 PM				05:30 PM				04:45 PM				05:15 PM				0.910
Volume	16	9	2	27	13	41	7	61	3	22	26	51	4	153	13	170	
Peak Factor	0.787				0.832				0.975				0.857				



COUNTER MEASURES INC.

1889 YORK STREET
DENVER, COLORADO 80206
303-333-7409

N/S STREET: 109TH ST
E/W STREET: JASPER RD
CITY: ERIE
COUNTY: WELD

File Name : 109TJASP
Site Code : 0000021
Start Date : 2/11/2014
Page No : 1

Groups Printed- VEHICLES

Start Time	109TH ST Southbound			JASPER RD Westbound			109TH ST Northbound			JASPER RD Eastbound			Int. Total
	Left	Thru	Right										
Factor	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
06:30 AM	0	0	1	1	23	1	4	0	0	0	2	0	32
06:45 AM	0	1	0	3	15	0	2	0	0	1	9	0	31
Total	0	1	1	4	38	1	6	0	0	1	11	0	63
07:00 AM	0	2	0	3	29	0	2	0	0	1	9	1	47
07:15 AM	1	0	0	10	39	1	5	0	1	0	14	2	73
07:30 AM	0	0	0	5	71	0	21	1	3	0	13	1	115
07:45 AM	0	0	0	9	73	0	13	0	0	0	10	0	105
Total	1	2	0	27	212	1	41	1	4	1	46	4	340
08:00 AM	1	0	0	1	59	1	3	0	1	0	16	1	83
08:15 AM	0	1	0	5	39	1	3	0	0	0	13	0	62
Total	1	1	0	6	98	2	6	0	1	0	29	1	145
04:00 PM	0	3	1	3	14	1	2	1	2	0	36	3	66
04:15 PM	0	0	0	1	8	0	0	0	1	1	41	2	54
04:30 PM	0	0	0	3	10	0	1	0	1	1	32	5	53
04:45 PM	0	0	1	4	9	0	0	0	1	0	37	6	58
Total	0	3	2	11	41	1	3	1	5	2	146	16	231
05:00 PM	0	0	0	2	9	0	0	0	4	1	54	5	75
05:15 PM	0	0	0	0	10	0	3	1	3	0	56	7	80
05:30 PM	0	0	0	9	15	0	1	1	0	2	59	3	90
05:45 PM	1	1	0	1	5	0	2	1	3	0	48	1	63
Total	1	1	0	12	39	0	6	3	10	3	217	16	308
Grand Total	3	8	3	60	428	5	62	5	20	7	449	37	1087
Apprch %	21.4	57.1	21.4	12.2	86.8	1.0	71.3	5.7	23.0	1.4	91.1	7.5	
Total %	0.3	0.7	0.3	5.5	39.4	0.5	5.7	0.5	1.8	0.6	41.3	3.4	

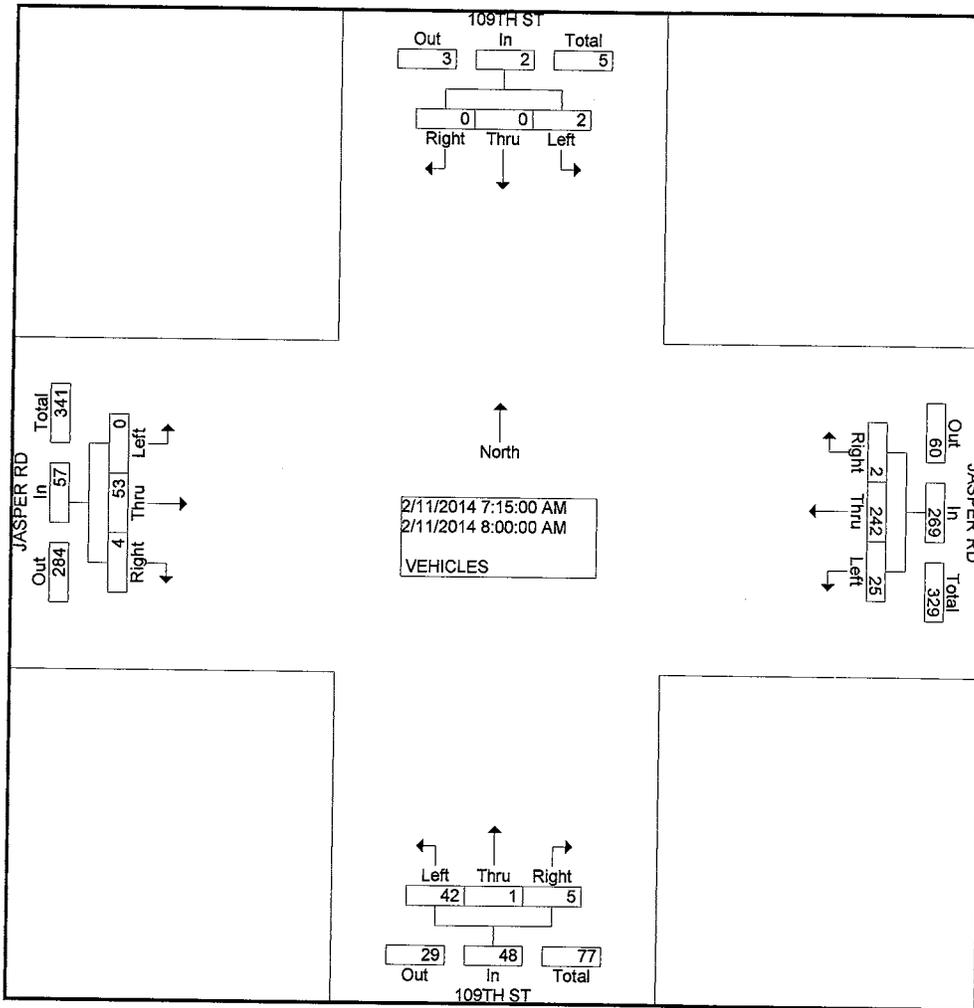
COUNTER MEASURES INC.

1889 YORK STREET
DENVER, COLORADO 80206
303-333-7409

N/S STREET: 109TH ST
E/W STREET: JASPER RD
CITY: ERIE
COUNTY: WELD

File Name : 109TJASP
Site Code : 0000021
Start Date : 2/11/2014
Page No : 2

Start Time	109TH ST Southbound				JASPER RD Westbound				109TH ST Northbound				JASPER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 06:30 AM to 08:30 AM - Peak 1 of 1																	
Intersection 07:15 AM																	
Volume	2	0	0	2	25	242	2	269	42	1	5	48	0	53	4	57	376
Percent	100.0	0.0	0.0		9.3	90.0	0.7		87.5	2.1	10.4		0.0	93.0	7.0		
07:30																	
Volume	0	0	0	0	5	71	0	76	21	1	3	25	0	13	1	14	115
Peak Factor																	
High Int.	07:15 AM				07:45 AM				07:30 AM				08:00 AM				0.817
Volume	1	0	0	1	9	73	0	82	21	1	3	25	0	16	1	17	
Peak Factor	0.500				0.820				0.480				0.838				

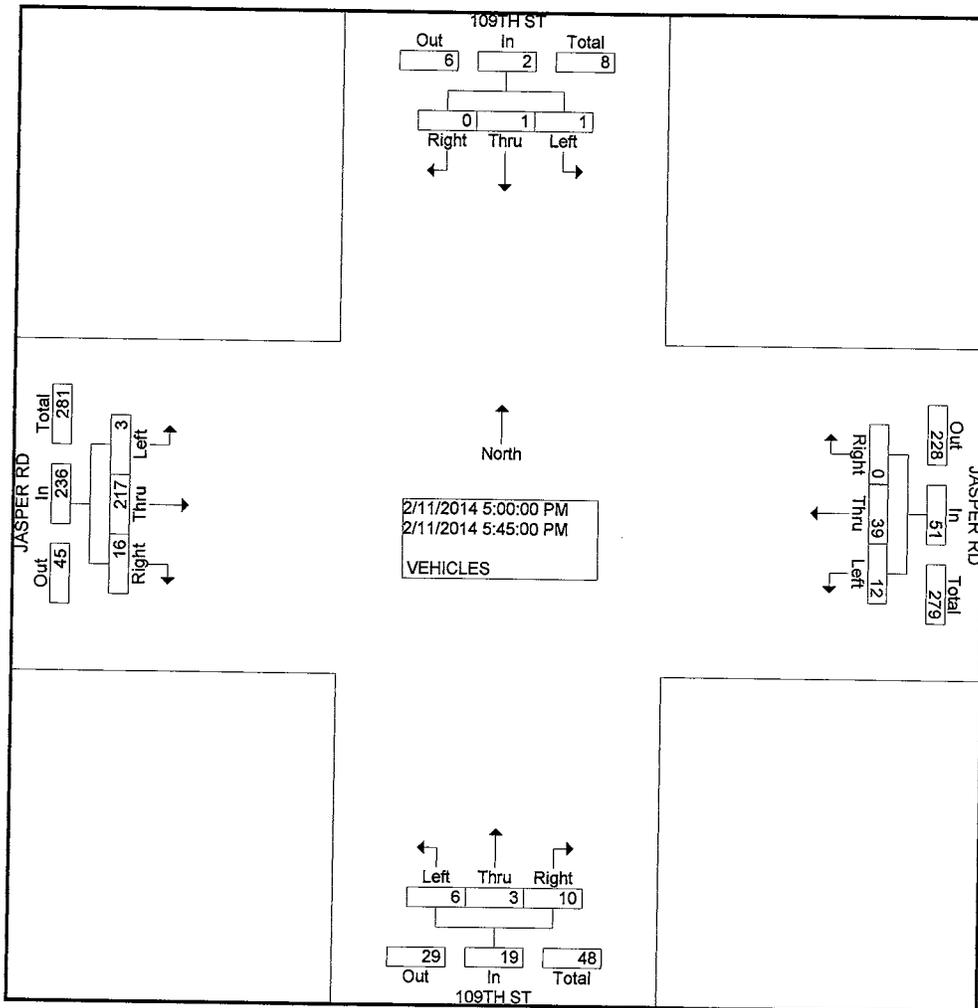


COUNTER MEASURES INC.
 1889 YORK STREET
 DENVER, COLORADO 80206
 303-333-7409

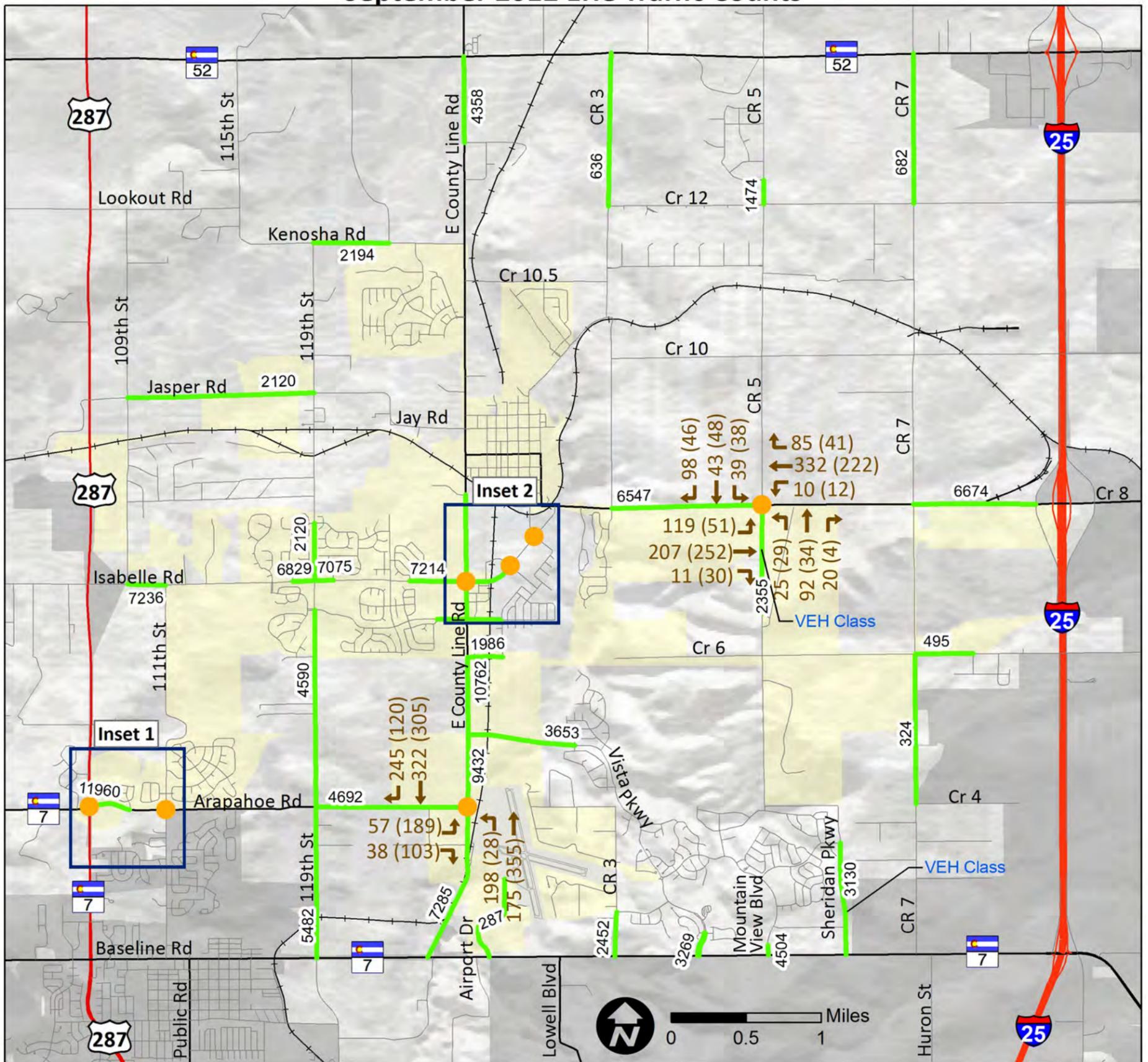
N/S STREET: 109TH ST
 EW STREET: JASPER RD
 CITY: ERIE
 COUNTY: WELD

File Name : 109TJASP
 Site Code : 00000021
 Start Date : 2/11/2014
 Page No : 2

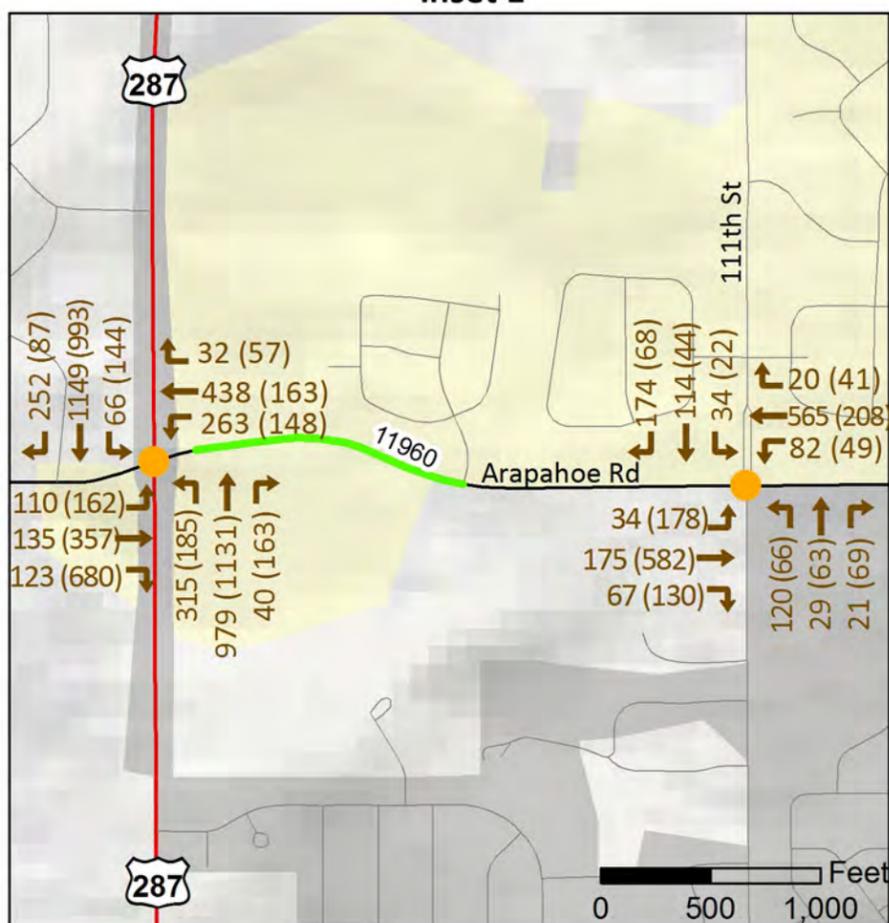
Start Time	109TH ST Southbound				JASPER RD Westbound				109TH ST Northbound				JASPER RD Eastbound				Int. Total
	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	
Peak Hour From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	05:00 PM																
Volume	1	1	0	2	12	39	0	51	6	3	10	19	3	217	16	236	308
Percent	50.0	50.0	0.0		23.5	76.5	0.0		31.6	15.8	52.6		1.3	91.9	6.8		
05:30 Volume	0	0	0	0	9	15	0	24	1	1	0	2	2	59	3	64	90
Peak Factor	0.250																
High Int.	05:45 PM																
Volume	1	1	0	2	05:30 PM				05:15 PM				05:30 PM				0.856
Peak Factor					0.531				0.679				0.922				



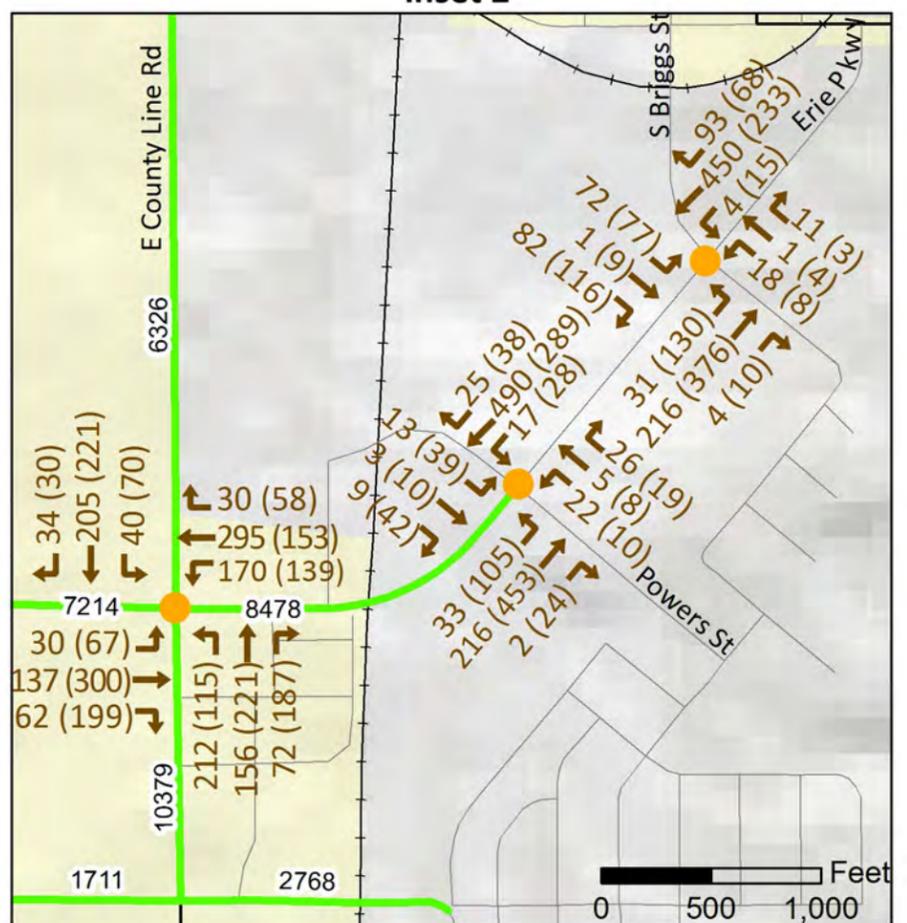
September 2012 Erie Traffic Counts



Inset 1



Inset 2



Accident Data

Chris McGranahan

From: Mike Lowder [mtlowder@erieco.gov]
Sent: Friday, February 21, 2014 1:18 PM
To: Chris McGranahan
Subject: RE: Accident data request
Attachments: 09-1782.pdf; 09-3325.pdf; 10-2344.pdf

Mr. McGranahan,

Here attached are the most recent cases that we have for that intersection of Jasper and N119th. We have another 19 cases from our old records management system that sometimes have narratives and sometimes, due to the age of the cases, I only have access to "screen shots" and not able to print them off. So, I can send them to you by mail or I can email them to you after I scan them in. I may have to email them in more than one email due to the size of the whole lot of them. Just let me know. Also the 4-way stop did not go in until after a bad accident occurred there in July of 2005. The 4-way stop went in a few months after that accident. Up until that time it was only a stop sign for N119th north and south bound with Jasper uncontrolled.

Hope this helps and please let me know if you want me to mail the rest, they cover 1997 through 2006.

Thanks,

Mike Lowder
Erie Police Department Records Division
645 Holbrook Street
Erie, CO 80516
Office: 303-926-2800
Fax: 303-926-2805

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-----Original Message-----

From: Chris McGranahan [mailto:csmcgranahan@lscctrans.com]
Sent: Tuesday, February 18, 2014 12:00 PM
To: Mike Lowder
Subject: RE: Accident data request

Mike,

Thank you for the quick response. It would also be nice to know, if possible, if the all-way stop-sign control was implemented to address the issue of if the all-way stop has been there the whole time.

I look forward to seeing what you can find,

Christopher S. McGranahan, PE, PTOE
Principal
LSC Transportation Consultants, Inc.
1889 York Street

Denver, CO 80206
303-333-1105
csmcgranahan@lscctrans.com

-----Original Message-----

From: Mike Lowder [mailto:mtlowder@erieco.gov]
Sent: Tuesday, February 18, 2014 11:53 AM
To: Chris McGranahan
Subject: RE: Accident data request

Mr. McGranahan,
I have received your request and will run a search to locate the reports showing accident data for that intersection. I remember at least two fairly serious collisions in the past 15 years, but I know there are more.
I will let you know when I have the information ready.
Thanks,

Mike Lowder
Erie Police Department Records Division
645 Holbrook Street
Erie, CO 80516
Office: 303-926-2800
Fax: 303-926-2805

Confidentiality Notice: This communication contains police confidential information. If you are not the intended recipient, or an agent or employee responsible for delivering this communication to the intended recipient, or if you have received this communication in error, please do not print, copy, retransmit, disseminate or otherwise use the information. Also, please indicate to the sender that you have received this communication in error, and delete the copy you received. Thank you.

Thank you

-----Original Message-----

From: Chris McGranahan [mailto:csmcgranahan@lscctrans.com]
Sent: Tuesday, February 18, 2014 11:13 AM
To: Mike Lowder
Cc: Wendi Palmer; Matthew Wiederspahn
Subject: FW: Accident data request

Mike,

Please see the email chain below. I have been asked to review accident data for the past several years at the intersection of Jasper Road and 119th Street. Please consider this a formal request for any accident data you may have for this intersection.

Feel free to contact me if you have any questions.

Thank you and have a great day,

Christopher S. McGranahan, PE, PTOE
Principal
LSC Transportation Consultants, Inc.

1889 York Street
Denver, CO 80206
303-333-1105
csmcgranahan@lscctrans.com

-----Original Message-----

From: Matthew Wiederspahn [mailto:mwiederspahn@erieco.gov]
Sent: Tuesday, February 18, 2014 11:09 AM
To: Chris McGranahan
Cc: Mike Lowder; Wendi Palmer
Subject: RE: Accident data request

Hi Chris,

Our Police Department handles our accident data. Please contact Mike Lowder (mtlowder@erieco.gov, 303-926-2800) to request the data.

Thanks,

Matt Wiederspahn, P.E., CFM
Development Engineer
Town of Erie | Public Works Department
645 Holbrook Street | P.O. Box 750 | Erie, CO 80516
303-926-2865 | mwiederspahn@erieco.gov | www.erieco.gov

-----Original Message-----

From: Chris McGranahan [mailto:csmcgranahan@lscctrans.com]
Sent: Tuesday, February 18, 2014 10:40 AM
To: Wendi Palmer; Matthew Wiederspahn
Subject: Accident data request

Wendi and Matt,

I received comments from the Town via FHU for the Wise Farms property. We are in the process of updating the traffic study to address comments and accommodate a revised site plan. One of the FHU comments was to review accident history at Jasper/119th. Can one of you provide accident data for the past several years or pass me along to the correct person that can?

Thank you,

Christopher S. McGranahan, PE, PTOE
Principal
LSC Transportation Consultants, Inc.
1889 York Street
Denver, CO 80206
303-333-1105
csmcgranahan@lscctrans.com



Erie Police Department

Officer Report for Incident 09-1782

Nature: PD Accident
Location: GEN B

Address: N 119TH ST & JASPER RD
Erie CO 80516

Offense Codes:

Received By: J Shupe

How Received: B

Agency: EPD

Responding Officers:

Responsible Officers: J Shupe

Disposition: CCI 06/05/09

When Reported: 09:13:00 06/05/09

Occurred Between: 09:13:00 06/05/09 and 09:40:00 06/05/09

Assigned To:

Detail:

Date Assigned: **/**/**

Status:

Status Date: **/**/**

Due Date: **/**/**

Complainant: X

Last: Unknown

First:

Mid:

DOB: **/**/**

Dr Lic:

Address:

Race: **Sex:**

Phone: () -

City: ,

Work Phone: () -

Alert Codes:

Offense Codes

Reported:

Observed: TAPD Traffic Accident, Prop Damage

Additional Offense: TAPD Traffic Accident, Prop Damage

Circumstances

DAY Day (6 a.m. - 6 p.m.)

Responding Officers:

Unit :

J Shupe

R Vesco

Responsible Officer: J Shupe

Agency: EPD

Received By: J Shupe

Last Radio Log: **.**.** **/**/**

How Received: B Boulder Co Comm

Clearance: CRO

When Reported: 09:13:00 06/05/09

Disposition: CCI **Date:** 06/05/09

Judicial Status:

Occurred between: 09:13:00 06/05/09

Misc Entry:

and: 09:40:00 06/05/09

Modus Operandi:

Description :

Method :

Involvements

Date	Type	Description	
06/05/09	Name	Unknown,	Complainant
06/05/09	Name	Shupe, James Ofc	Reporting Officer
06/05/09	Name	Vesco, Robert	Assisting Officer
06/05/09	Name	Bever, Thomas J.	Involved Person
06/05/09	Name	Gorrillo, Oscar	Involved Person
06/05/09	Citation	Moving Violation	Summons
06/05/09	Vehicle	WHI 2000 FORD F150 CO	Vehicle #2
06/05/09	Vehicle	RED 1991 CHEV CO	Vehicle #1

Narrative

OFFICER: Shupe E22 DATE/TIME: Fri Jun 05 15:01:05 DT 2009
MEDIA RELEASE: Officer responded to the intersection of Jasper Rd. and N. 119th St. on a non injury, property damage accident. One adult male was cited for a stop sign violation.

On 06-05-2009 at approximately 0913hrs, I, Officer Shupe (E22 EPD) was dispatched to Jasper Road and N. 119th Street, Town of Erie, County of Boulder, State of Colorado on a non-injury property damage accident.

Upon arrival, I observed a 1991 red Chevy truck (LP# 130-GKI)(Vehicle #1) stopped in the intersection, facing westbound. The truck was hauling a trailer loaded with landscaping equipment. I observed a set of skid marks in the westbound lane leading up to and stopping at the truck. I also observed a white 2000 Ford Truck (LP#426-ELO)(Vehicle #2) stopped on N. 119th Street, facing north, in the northbound lane.

I contacted the driver of the red truck, Thomas Bever (DOB 05-23-1949), who stated that he hit the white truck. Thomas did not appear to be injured in any way. Thomas stated that he was driving westbound and tried to stop his truck but the road was slick and the truck slid through the stop sign when he tried to stop. Thomas also stated that there were two trucks that did not stop completely at the intersection and he hit one of them because they failed to stop. One truck was heading southbound and the other, the one he hit, was traveling northbound.

Officer Vesco arrived on scene and took measurements of the intersection. Measurements of the accident were not taken due to the fact that the vehicles were moved prior to arrival. I photographed the scene.

I then contacted Oscar who stated that he started driving north after stopping at the stop sign and was hit by the red truck. Oscar spoke in broken English and had a hard time explaining what happened.

It was determined, based on the red truck's tire skids, that the red truck was traveling too fast and was unable to stop at the stop sign. Jasper Road was dry at the time of the crash. The left tire skid measured 110'11" and the right tire skid measured 95'5". The speed limit on Jasper Road is 35mph. The stop sign was posted upright and clearly visible to all. The red truck sustained moderate front end damage and the white truck sustained no damage.

I issued Thomas an Erie Municipal Summons (#M002426) for MTC 703(3) Failed to stop at a stop sign as required with an Erie Municipal court date of 07-07-09 at 0900hrs. Thomas signed the summons acknowledging the charge and court date.

During my contact with both drivers it did not appear that either was under the influence of drugs or alcohol. No injuries were reported and no airbags deployed.

End of Report

Vehicles

Vehicle Number: 3070

License Plate: 426ELO

State: CO

Vehicle Year: 2000

Make: FORD Ford

Color: WHI /

Vehicle Type: PTK Passenger Truck

License Type: PC Regular Passenger Automobile

Expires: 09/01/09

VIN: 1FDWW36F9YEA9705

3

Model: F150

Doors: 2

Value: \$0.00

Owner:

Last: Rock Creek

First:

Mid:

Landscape

DOB: **/**/**

Dr Lic:

Address: 1222 Commerce Ct

Race:

Sex:

Phone: () -

City: Lafayette, CO 80026

:

:

Work Phone: () -

:

Height: ' "

Weight: 0

Hair:

Eyes:

:

Agency: EPD Erie Police Department

Date Recov/Revd: **/**/**

Officer: J Shupe

Area: GEN B

GENERAL

BOULDER

UCR Status:

Wrecker Service:

Local Status:

Storage Location:

Status Date: **/**/**

Release Date: **/**/**

Comments:

Vehicle Number: 3071

License Plate: 130GKI

State: CO

Vehicle Year: 1991

Make: CHEV Chevrolet

Color: RED /

Vehicle Type: PTK Passenger Truck

License Type: PC Regular Passenger Automobile

Expires: 09/01/09

VIN: 1GCFK24K6ME216424

Model:

Doors: 2

Value: \$0.00

Owner:

Last: Bever

First: Thomas

Mid: J.

DOB: 05/23/49

Dr Lic: 920196951

Address: 10117 WCR 1

Race: W

Sex: M

Phone: (720)480-0856

City: Erie, CO 80516

:

:

Work Phone: (303)417-6266)

:

Height: 6'01"

Weight: 155

Hair: Brown

Eyes: Blue

:

Agency: EPD Erie Police Department

Date Recov/Revd: **/**/**

Officer: J Shupe

Area: GEN B
GENERAL
BOULDER

UCR Status:

Wrecker Service:

Local Status:

Storage Location:

Status Date: **/**/**

Release Date: **/**/**

Comments:

Name Involvements:

Involved Person9617

:
Last: Gorrillo **First:** Oscar **Mid:**
DOB: 05/29/72 **Dr Lic:** 95-109-2087 **Address:** 1815 Meadow St
Race: W **Sex:** M **Phone:** (303)774-7608 **City:** Longmont, CO 80501
 : : **Work Phone:** (303)604-7608) :
Height: 5'05" **Weight:** 170 **Hair:** Black **Eyes:** Brown :

Involved Person2178

:
Last: Bever **First:** Thomas **Mid:** J.
DOB: 05/23/49 **Dr Lic:** 920196951 **Address:** 10117 WCR 1
Race: W **Sex:** M **Phone:** (720)480-0856 **City:** Erie, CO 80516
 : : **Work Phone:** (303)417-6266) :
Height: 6'01" **Weight:** 155 **Hair:** Brown **Eyes:** Blue :

Assisting Officer2003

:
Last: Vesco **First:** Robert **Mid:**
DOB: **/**/** **Dr Lic:** **Address:** 645 HOLBROOK ST
Race: **Sex:** **Phone:** () - **City:** Erie, CO 80516
 : : **Work Phone:** (303)926-2800) :
Height: ' " **Weight:** 0 **Hair:** **Eyes:** :

Complainant : X

Last: Unknown **First:** **Mid:**
DOB: **/**/** **Dr Lic:** **Address:**
Race: **Sex:** **Phone:** () - **City:** ,
 : : **Work Phone:** () - :
Height: ' " **Weight:** 0 **Hair:** **Eyes:** :

Reporting16

Officer :

Last: Shupe **First:** James **Mid:**
DOB: **/**/** **Dr Lic:** **Address:** 645 HOLBROOK ST
Race: **Sex:** **Phone:** () - **City:** Erie, CO 80516
 : : **Work Phone:** (303)926-2800) :
Height: ' " **Weight:** 0 **Hair:** **Eyes:** :



Erie Police Department

Officer Report for Incident 09-3325

Nature: PI Accident

Address: N 119TH ST & JASPER RD; 119TH ST

Location: GEN B

Erie CO 80516

Offense Codes:

Received By: G Turner

How Received: B

Agency: EPD

Responding Officers:

Responsible Officers: G Turner

Disposition: CCI 09/30/09

When Reported: 15:47:00 09/30/09

Occurred Between: 16:44:23 09/30/09 and 16:44:23 09/30/09

Assigned To:

Detail:

Date Assigned: **/**/**

Status:

Status Date: **/**/**

Due Date: **/**/**

Complainant: X

Last: Unknown

First:

Mid:

DOB: **/**/**

Dr Lic:

Address:

Race: **Sex:**

Phone: () -

City: ,

Work Phone: () -

Alert Codes:

Offense Codes

Reported:

Observed: TAPI Traffic Accident, Pers Injury

Additional Offense: TAPI Traffic Accident, Pers Injury

Circumstances

LT13 Highway, Road, Alley

DAY Day (6 a.m. - 6 p.m.)

ACCI Accident

MEDI Medical Attention

PROP Property Damage

Responding Officers:

Unit :

G Turner

A Nevarez

P Lukens

K Jamison

Responsible Officer: G Turner**Received By:** G Turner**How Received:** B Boulder Co Comm**When Reported:** 15:47:00 09/30/09**Judicial Status:****Misc Entry:****Agency:** EPD**Last Radio Log:** **:*** ***/**/****Clearance:** CRO**Disposition:** CCI **Date:** 09/30/09**Occurred between:** 16:44:23 09/30/09**and:** 16:44:23 09/30/09**Modus Operandi:****Description :****Method :****Involvements**

Date	Type	Description	
09/30/09	Name	Nevarez, Alfredo Sgt	Asst Officer
09/30/09	Name	Unknown,	Complainant
09/30/09	Name	Lukens, Phil Cpl	Asst Officer
09/30/09	Name	Turner, Greg	Invest Officer
09/30/09	Name	Langer, Lisa J	V2 Driver
09/30/09	Name	Langer, Ben	Juvenile Relayed
09/30/09	Name	Langer, Josh	Juvenile Relayed
09/30/09	Name	Langer, Victor Ambrose	Guardian for juvenil
09/30/09	Name	Hopperstad, Yvette D	V1 Driver
10/03/09	Citation	Moving Violation	Citation Issued
09/30/09	Vehicle	RED 2003 OLDS SILHOUET CO	Vehicle #2
09/30/09	Vehicle	WHI 2004 CADI CO	Vehicle #1
10/07/09	DS	Lisa Langer	Lisa Langer Copy

Narrative

OFFICER: G Turner E20 DATE: 09-30-09

MEDIA RELEASE: Accident involving two vehicles that occurred at the intersection on Jasper Rd and N 119th St. One vehicle, traveling west, failed to stop at the stop sign and struck a vehicle in the intersection.

On 09-30-09, at approximately 1547hrs, I, Officer Greg Turner (E20 EPD), responded to a reported injury accident at the intersection of N 119th St and Jasper Rd, Town of Erie, County of Boulder, State of Colorado. Sgt Nevarez (E5) also responded.

When I arrived, I observed that Mtn View Fire and Rescue were already on scene, along with Boulder County SO and Lafayette PD who responded to assist. I also observed that Sgt Jamison (E6) was on scene.

I observed a red 2003 Oldsmobile minivan (CO license 169-SVZ), on its passenger side, facing north, on the shoulder of the southbound lane, south of Jasper Rd. I observed that Mtn View was in the process of attempting to extricate its driver, later identified as Lisa Langer. I observed that the van had severe damage to its driver's side, and the side air bag of the driver's seat had deployed.

I observed a white 2004 Cadillac sedan (CO license 997SHZ) facing south, in the southbound lane, south of Jasper Rd. I observed that the sedan had severe damage to the front of the vehicle. This vehicle was unoccupied. I observed the front driver's airbag had deployed.

I observed vehicle debris and fluids in the intersection that belonged to the vehicles.

Mtn View advised me that they were extricating the driver of the van and that the driver of the sedan was on the other side of the vehicle. I was advised that the driver of the sedan was not complaining of injuries, but that they were going to try to talk her into seeking an evaluation at the hospital.

Sgt Nevarez assisted with traffic control and took digital photos of the accident scene. These photos are attached to the case file.

I contacted the driver of the sedan, who identified herself to me as Yvette Hopperstad. Yvette stated that she was not injured. I observed an abrasion on Yvette's left shoulder, which she stated was from the seatbelt. Yvette also showed me abrasions on her arms which she stated were from the airbag being deployed.

Yvette stated that she was driving the sedan west on Jasper Rd and does not normally drive this route. Yvette stated that, as she approached the intersection of N 119th St, she did not observe the stop sign and proceeded through the intersection without stopping. Yvette stated that she did not see the van approaching the intersection and did not observe it until it was directly in front of her, at which time she ran into it. Yvette stated that she did not know what direction the van had been traveling in.

I observed that the stop sign for west-bound Jasper Rd, at N 119th St, was clearly posted with a large stop sign. This sign was clear of debris or branches.

I observed the vehicle debris and skid marks indicated that the point of impact for the accident occurred in the north-east portion of the intersection, which indicated that the van had been traveling south on N 119th St and was turning left (east) onto Jasper Rd.

After Mtn View extracted Lisa from the van, they advised me that they were going to transport her to Exempla Hospital for an evaluation, although there were no visible injuries and Lisa was not complaining of any pain.

I spoke with Lisa who advised me that she had been traveling south on N 119th St and had stopped at the stop sign at Jasper Rd. Lisa stated that she started to turn left (east) onto Jasper Rd, when she observed a white car

heading west, towards her, "very fast". Lisa stated that she started to turn to the right, away from the other car, but was then stuck on her driver's side and rolled onto the side.

I advised Lisa that her vehicle would be towed, due to damage, and she requested that the tow company at County Line Auto respond to tow her vehicle.

All About towing responded and towed the Oldsmobile van and Blue Sky

Towing responded to tow the Cadillac sedan.

I advised Yvette that I would be contacting her within the next couple days, regarding the accident, to receive a summons.

Follow-up is planned to determine extent of injuries, if any, that Lisa sustained. Additional follow-up planned with issuing Yvette a summons for the appropriate violation.

Supplement 1

Officer:P. Lukens E-18 Date:Wed Sep 30 17:14:29 MDT 2009

On Wednesday, September 30, 2009 at approximately 1600 hours, Sergeant Nevarez contacted me by phone and asked that I go to Erie Middle School and pick up Josh Langer, (DOB 04-12-98) and go to Erie Elementary to pick up Ben Langer, (DOB 12-11-04). He asked me to relay them to 11638 Kenosha Rd and wait there until their grandfather, Victor Langer, (DOB 02-24-35) arrived to watch them.

I retrieved Josh and we were walking out of the middle school when we were contacted by Victor who already had picked up Ben from school. He provided his Colorado driver's license and proved his identification. I released Josh to him.

I then responded to 119th & Jasper and helped with scene investigation.

Supplement 2

Officer: G Turner E20 Sup 2 Date: 10-02-09

On 10-02-09, I, Officer Greg Turner (E20 EPD), spoke with Lisa Langer, by phone, about this incident.

Lisa advised me that she had been discharged from the hospital and had not received any major injuries, other than soreness and bruises, from the accident. Lisa stated that she did have a follow-up appointment with her doctor today.

I attempted to contact Yvette Hopperstad, by phone, and left a voice message requesting to meet with her today, at the Erie Police Department, after she got off of work.

At approximately 1530hrs, I was contacted at the Erie Police Department by Yvette. I issued Yvette Erie Municipal summons #M002677 for one count of MTC 703(3) Failed to Stop at Stop Sign as Required with a court date and time of 11-03-09 at 1030 hrs.

Vehicles

Vehicle Number: 3978

License Plate: 169SVZ	License Type: PC Regular Passenger Automobile
State: CO	Expires: **/**/**
Vehicle Year: 2003	VIN: 1GHDX13E33D196257
Make: OLDS Oldsmobile	Model: SILHOUET
Color: RED /	Doors: 5
Vehicle Type: PVAN Passenger Van	Value: \$0.00

Owner:

Last: Langer	First: Lisa	Mid: J
DOB: 12/18/63	Dr Lic: 921407883	Address: 11638 Kenosha
Race: W	Sex: F	Phone: (303)828-2832
Height: 5'08"	Weight: 135	Hair: Black
Eyes: Brown	Work Phone: () - ()	City: Longmont, CO 80504

Agency: EPD Erie Police Department

Date Recov/Rcvd: **/**/**

Officer: P Lukens

Area:

UCR Status:

Wrecker Service:

Local Status:

Storage Location:

Status Date: **/**/**

Release Date: **/**/**

Comments:

Vehicle Number: 3979

License Plate: 997SHZ	License Type: PC Regular Passenger Automobile
State: CO	Expires: 06/30/10
Vehicle Year: 2004	VIN: 1G6DM577540166996
Make: CADI Cadillac	Model:
Color: WHI /	Doors: 4
Vehicle Type: PCAR Passenger Car	Value: \$0.00

Owner:

Last: Hopperstad	First: James	Mid: Richard
DOB: 10/29/60	Dr Lic: 921060374	Address: 2287 Indian Peaks Circle
Race: W	Sex: M	Phone: (303)651-7695
Height: 5'11"	Weight: 170	Hair: Blond
Eyes: Blue	Work Phone: () - ()	City: Longmont, CO 80501

Agency: EPD Erie Police Department

Date Recov/Rcvd: **/**/**

Officer: P Lukens

Area:

UCR Status:

Wrecker Service:

Local Status: III Involved in Incident

Storage Location:

Status Date: **/**/**

Release Date: **/**/**

Comments:

Name Involvements:

Asst Officer : 4

Last: Nevarez	First: Alfredo	Mid:
DOB: **/**/**	Dr Lic:	Address: 645 HOLBROOK ST
Race:	Sex:	City: Erie, CO 80516
:	Phone: () -	:
:	Work Phone: (303)926-2800)	:
Height: ' "	Weight: 0	Hair:
		Eyes:

V1 Driver : 11382

Last: Hopperstad	First: Yvette	Mid: D
DOB: 04/24/59	Dr Lic: 921060611	Address: 2287 Indian Peaks Cir
Race: W	Sex: F	City: Longmont, CO 80504
:	Phone: (720)299-3202	:
:	Work Phone: () -)	:
Height: 5'08"	Weight: 122	Hair: Sandy
		Eyes: Blue

Juvenile11357

Relayed :

Last: Langer	First: Josh	Mid:
DOB: 04/12/98	Dr Lic:	Address: 11638 Kenosha
Race: W	Sex: M	City: Longmont, CO 80504
:	Phone: (303)828-2832	:
:	Work Phone: () -)	:
Height: 4'00"	Weight: 80	Hair: Brown
		Eyes: Brown

Complainant : X

Last: Unknown	First:	Mid:
DOB: **/**/**	Dr Lic:	Address:
Race:	Sex:	City: ,
:	Phone: () -	:
:	Work Phone: () -)	:
Height: ' "	Weight: 0	Hair:
		Eyes:

Juvenile11356

Relayed :

Last: Langer	First: Ben	Mid:
DOB: 12/11/04	Dr Lic:	Address: 11638 Kenosha Rd
Race: W	Sex: M	City: Longmont, CO 80504
:	Phone: (303)828-2832	:
:	Work Phone: () -)	:
Height: 3'00"	Weight: 50	Hair: Brown
		Eyes: Brown

V2 Driver : 11353

Last: Langer	First: Lisa	Mid: J
DOB: 12/18/63	Dr Lic: 921407883	Address: 11638 Kenosha
Race: W	Sex: F	City: Longmont, CO 80504
:	Phone: (303)828-2832	:
:	Work Phone: () -)	:
Height: 5'08"	Weight: 135	Hair: Black
		Eyes: Brown

Guardian for11358

juvenil:

Last: Langer	First: Victor	Mid: Ambrose
DOB: 02/24/35	Dr Lic: 950094250	Address: 11073 W 67th Way
Race: W	Sex: M	Phone: (303)421-6871
Height: 6'02"	Weight: 230	City: Arvada, CO 80004
	Work Phone: () -	
	Hair: Gray	Eyes: Brown

Asst Officer : 21

Last: Lukens	First: Phil	Mid:
DOB: **/**/**	Dr Lic:	Address: 645 Holbrook St
Race:	Sex:	Phone: (303) -
Height: ' "	Weight: 0	City: Erie, CO 80516
	Work Phone: (303)926-2800)	
	Hair:	Eyes:

Invest Officer :192

Last: Turner	First: Greg	Mid:
DOB: **/**/**	Dr Lic:	Address: 645 HOLBROOK ST
Race:	Sex:	Phone: () -
Height: ' "	Weight: 0	City: Erie, CO 80516
	Work Phone: (303)926-2800)	
	Hair:	Eyes:



Erie Police Department

Officer Report for Incident 10-2344

Nature: PD Accident
Location: GEN B

Address: N 119TH ST & JASPER RD
Erie CO 80516

Offense Codes:

Received By: C Mayhue

How Received: B

Agency: EPD

Responding Officers:

Responsible Officers: C Mayhue

Disposition: CAA 07/15/10

When Reported: 19:30:00 07/15/10

Occurred Between: 19:30:00 07/15/10 and 19:55:00 07/15/10

Assigned To:

Detail:

Date Assigned: **/**/**

Status:

Status Date: **/**/**

Due Date: **/**/**

Complainant: 15033

Last: Emerson

First: Cherriethel

Mid: Kathleen

DOB: 03/20/40

Dr Lic: 92-065-7866

Address: 3844 N 119TH ST

Race: W

Sex: F

Phone: (303)818-7666

City: Boulder County, CO 80516

Work Phone: () -

Alert Codes:

Offense Codes

Reported:

Observed: TAPD Traffic Accident, Prop Damage

Additional Offense: TAPD Traffic Accident, Prop Damage

Circumstances

LT13 Highway, Road, Alley

Responding Officers:

Unit :

C Mayhue

K Jamison

Responsible Officer: C Mayhue

Agency: EPD

Received By: C Mayhue

Last Radio Log: **.*.*.* **/**/**

How Received: B Boulder Co Comm

Clearance: CRO

When Reported: 19:30:00 07/15/10

Disposition: CAA **Date:** 07/15/10

Judicial Status:

Occurred between: 19:30:00 07/15/10

Misc Entry:

and: 19:55:00 07/15/10

Modus Operandi:

Description :

Method :

Involvements

Date	Type	Description	
07/15/10	Name	Jamison, Kevin Sgt	Assisting Officer
07/15/10	Name	Mayhue, Chris	Responsible Officer
07/15/10	Name	Tsering, Tenzin Kunchok	Juvenile Victim
07/15/10	Name	Kronsbein, George William III	Suspect Arrested
07/15/10	Name	Emerson, Cherriethel Kathleen	Complainant
07/15/10	Vehicle	MAR 1990 GMC PICKUP CO	Suspect Vehicle(TU1)
07/15/10	Vehicle	2000 HOND ACCORD CO	Victim Vehicle (TU2)
08/19/10	DS	Meredith Shook	owner of truck

Narrative

OFFICER: C. Mayhue E24 DATE/TIME: Thu Jul 15 21:59:23 MDT 2010
MEDIA RELEASE: Jasper Rd & N 119th St, Traffic Accident, Officers advised of a traffic accident. Officers arrived, investigated the incident and found no injuries and a driver was later arrested for driving with a revoked license.

On 07-15-2010, at approximately 1930 hours, I, Officer Mayhue (E24 EPD), was dispatched to the intersection of Jasper Rd & N 119th St, Town of Erie, County of Boulder, State of Colorado, for an unknown-if-injury traffic accident. While en route I was advised that the suspect vehicle, a maroon GMC pick-up, was attempting to flee the scene westbound on Jasper Rd from N 119th St. We were also advised that a Hispanic male had jumped out of the GMC and fled on foot southbound on N. 119th St. I arrived and observed a maroon GMC pick-up with heavy damage to the front driver side of the vehicle and a green Honda coupe with heavy damage to the driver side rear tire area, approximately 600 feet west of the intersection. I contacted all drivers involved and no injuries were reported. I observed that all stop signs in the intersection were clear and upright.

I contacted the reporting party, identified as Cherriethel Emerson (DOB: 03-20-1940), and questioned her about the incident. Cherriethel advised me that she had heard the collision but only observed the "end of" the collision. Cherriethel stated that she heard the sound of a vehicle's engine revving and she stated, "It sounded like one of the cars was trying to drive away." Cherriethel advised me that when she turned around she observed that both vehicles had stopped. She then drove over to the accident and George was stating that he was at fault and he would "make it right." Cherriethel stated that George had requested that the police not be contacted. Cherriethel completed a voluntary witness statement and it is included in the case file. I contacted the driver of the GMC, identified as George Kronsbein (DOB: 10-12-1957), and questioned him about the incident. I asked George who the person was that ran from his vehicle and he stated that it was a guy he "didn't know too well" who was working on his residence. I asked George if the person who ran was the driver and George stated that he was driving. George would not give me anymore information about the identity of the passenger that fled. George advised me that he was traveling westbound in a maroon 1990 GMC Pickup (CO License# 036MJH), on Jasper Rd when he approached the intersection at N 119th St. George stated that he did not see the stop sign at the intersection because of the sun, and struck another vehicle that had entered the intersection. I asked George on two separate occasions if he was driving the GMC and he stated that he was the driver of the vehicle. I then asked George why his vehicle had ended up so far from the intersection and he stated, "I was looking for a place to pull off, and this was it."

I asked George for his driver's license, registration, and vehicle proof of insurance, and George advised me that he did not have vehicle insurance, due to it being a customer's vehicle, and he did not have his driver's license with him. I asked George if his driver's license was suspended or revoked and he stated, "Yeah, my driver's license is revoked HTO." I asked George if his driving status as HTO was due to alcohol and he stated that it was. I returned to my patrol vehicle and cleared George through Boulder County Dispatch. I was advised that George was confirmed Revoked as a Habitual Traffic Offender from 04-29-1992 to 04-28-1997 (CR#9211032C). George completed a voluntary witness statement and it is included in the case file.

I then contacted the victim driver, identified as Tenzin Tsering (DOB: 02-28-1993), who stated that she was traveling southbound on N. 119th St approaching the intersection at Jasper Rd. Tenzin stated that she was driving a green 2000 Honda Coupe (CO License# 190EBB), when she stopped at the

intersection. Tenzin stated that she observed George's vehicle approaching the intersection and she assumed that his vehicle would stop at the 4-way stop sign. Tenzin advised that she entered the intersection and attempted to make a left turn when George's vehicle struck her vehicle causing heavy damage to the rear driver side tire area. Tenzin advised me that George then attempted to drive away westbound on Jasper Rd, and she was able to follow him. Tenzin completed a voluntary witness statement and it is included in the case file.

Sergeant Jamison (E6 EPD), arrived on scene and conducted the traffic accident investigation. Sergeant Jamison took measurements and digital photos were taken. Sergeant Jamison later completed a Colorado State Accident Form and it is included in the case file. Sergeant Jamison later advised me that an expired Unitrin Direct vehicle insurance (Policy# 1257668) was located inside George's vehicle showing that it expired on 05-01-2010. The GMC was impounded by Cozy Corner Towing out of Lafayette, CO, and the Honda was towed privately from the scene. A copy of the vehicle impound form is included in the case file. All of the digital photos were later downloaded into a secure database at the Erie Police Department and attached to the case file.

I later placed George under arrest at 1955 hours for 42-2-206(1)(b): Drove a Vehicle When License Revoked (HTO), 42-4-1409(2): No Proof of Vehicle Insurance (Driver), 42-4-703(3): Failed to Stop at a Stop Sign as Required, and 42-4-1602(1): Accident Involving Damage - Duty. George was served a Proof of Service and a copy is included in the case file. George was later transported to Boulder County Jail and booked on the above charges. A copy of the arrest affidavit is included in the case file.

Vehicles

Vehicle Number: 5995

License Plate: 036MJH	License Type: PC Regular Passenger Automobile
State: CO	Expires: 03/31/11
Vehicle Year: 1990	VIN: 1GTDK14K8LZ511369
Make: GMC General Motors Corp	Model: PICKUP
Color: MAR /	Doors: 2
Vehicle Type: PTK Passenger Truck	Value: \$0.00

Owner:

Last: Manford	First: Shook	Mid: L
DOB: **/**/**	Dr Lic:	Address: 1400 S Collyer St; #286
Race:	Sex:	Phone: () -
:	:	City: Longmont, CO 80501
Height: ' "	Weight: 0	Work Phone: () -
Hair:	Eyes:	:

Agency: EPD Erie Police Department	Date Recov/Rcvd: **/**/**
Officer: C Mayhue	Area:
UCR Status: DDV Destroyed/Damaged/Vandalized	Wrecker Service:
Local Status:	Storage Location:
Status Date: **/**/**	Release Date: **/**/**

Comments:

Vehicle Number: 5996

License Plate: 190EBB	License Type: PC Regular Passenger Automobile
State: CO	Expires: 06/30/11
Vehicle Year: 2000	VIN: 1HGCG564XYA005973
Make: HOND Honda	Model: ACCORD
Color: /	Doors: 4
Vehicle Type: PCAR Passenger Car	Value: \$0.00

Owner:

Last: Tsering	First: Tenzin	Mid: Kunchok
DOB: 02/28/93	Dr Lic: 09-175-0672	Address: 1201 N DAVENPORT CT
Race: A	Sex: F	Phone: (303)828-4582
:	:	City: Erie, CO 80516
Height: 5'09"	Weight: 135	Work Phone: () -
Hair: Black	Eyes: Brown	:

Agency: EPD Erie Police Department	Date Recov/Rcvd: **/**/**
Officer: C Mayhue	Area:
UCR Status:	Wrecker Service:
Local Status:	Storage Location:
Status Date: **/**/**	Release Date: **/**/**

Comments:

Name Involvements:**Complainant :** 15033

Last: Emerson	First: Cherriethel	Mid: Kathleen
DOB: 03/20/40	Dr Lic: 92-065-7866	Address: 3844 N 119TH ST
Race: W	Sex: F	Phone: (303)818-7666
:	:	Work Phone: () -)
Height: 5'02"	Weight: 190	Hair: Gray
	Eyes: Brown	:

Suspect15030**Arrested :**

Last: Kronsbein	First: George	Mid: William
DOB: 10/12/57	Dr Lic: 92-126-6948	Address: 2111 WELD COUNTY RD 10
Race: W	Sex: M	Phone: (303)834-0093
:	:	Work Phone: () -)
Height: 5'08"	Weight: 200	Hair: Brown
	Eyes: Brown	:

Responsible117**Officer :**

Last: Mayhue	First: Chris	Mid:
DOB: **/**/**	Dr Lic:	Address: 645 HOLBROOK ST
Race:	Sex:	Phone: () -
:	:	Work Phone: (303)926-2800)
Height: ' "	Weight: 0	Hair:
	Eyes:	:

Assisting Officer15

:

Last: Jamison	First: Kevin	Mid:
DOB: **/**/**	Dr Lic:	Address: 645 HOLBROOK ST
Race:	Sex:	Phone: () -
:	:	Work Phone: (303)926-2800)
Height: ' "	Weight: 0	Hair:
	Eyes:	:

Juvenile Victim7110

:

Last: Tsering	First: Tenzin	Mid: Kunchok
DOB: 02/28/93	Dr Lic: 09-175-0672	Address: 1201 N DAVENPORT CT
Race: A	Sex: F	Phone: (303)828-4582
:	:	Work Phone: () -)
Height: 5'09"	Weight: 135	Hair: Black
	Eyes: Brown	:

LEVEL OF SERVICE DEFINITIONS

From *Highway Capacity Manual*, Transportation Research Board, 2010

UNSIGNALIZED INTERSECTION LEVEL OF SERVICE (LOS)

Applicable to Two-Way Stop Control, All-Way Stop Control, and Roundabouts

LOS	Average Vehicle Control Delay	<u>Operational Characteristics</u>
A	<10 seconds	Normally, vehicles on the stop-controlled approach only have to wait up to 10 seconds before being able to clear the intersection. Left-turning vehicles on the uncontrolled street do not have to wait to make their turn.
B	10 to 15 seconds	Vehicles on the stop-controlled approach will experience delays before being able to clear the intersection. <u>The delay could be up to 20 seconds.</u> Left-turning vehicles on the uncontrolled street may have to wait to make their turn.
C	15 to 25 seconds	Vehicles on the stop-controlled approach can expect delays in the range of 30 to 40 seconds before clearing the intersection. Motorists may begin to take chances due to the long delays, thereby posing a safety risk to through traffic. <u>Left-turning vehicles on the uncontrolled street will now be required to wait to make their turn causing a queue to be created in the turn lane.</u>
D	25 to 35 seconds	<u>This is the point at which a traffic signal may be warranted for this intersection.</u> The delays for the stop-controlled intersection are not considered to be excessive, exceeding 35 seconds on a regular basis. The length of the queue may begin to block other public and private access points.
E	35 to 50 seconds	The delays for all critical traffic movements are considered to be unacceptable. The length of the queues for the stop-controlled approaches as well as the left-turn movements are extremely long. <u>There is a high probability that this intersection will meet traffic signal warrants.</u> The ability to install a traffic signal is affected by the location of other existing traffic signals. Consideration may be given to restricting the accesses by eliminating the left-turn movements from and to the stop-controlled approach.
F	>50 seconds	The delay for the critical traffic movements are probably in excess of 100 seconds. The length of the queues are extremely long. Motorists are selecting alternative routes due to the long delays. <u>The only remedy for these long delays is installing a traffic signal or restricting the accesses.</u> The potential for accidents at this intersection are extremely high due to motorist taking more risky chances. If the median permits, motorists begin making two-stage left-turns.

HCM 2010 AWSC
1: 119th Street & Jasper Road

Existing
AM Peak

Intersection												
Intersection Delay, s/veh	8.9											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	10	25	20	12	115	2	125	28	14	0	26	15
Peak Hour Factor	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	12	31	25	15	144	2	156	35	18	0	32	19
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8	8.9	9.4	7.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	75%	18%	9%	0%
Vol Thru, %	17%	45%	89%	63%
Vol Right, %	8%	36%	2%	37%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	167	55	129	41
LT Vol	28	25	115	26
Through Vol	14	20	2	15
RT Vol	125	10	12	0
Lane Flow Rate	209	69	161	51
Geometry Grp	1	1	1	1
Degree of Util (X)	0.269	0.087	0.208	0.064
Departure Headway (Hd)	4.635	4.564	4.642	4.506
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	774	784	772	793
Service Time	2.662	2.599	2.671	2.542
HCM Lane V/C Ratio	0.27	0.088	0.209	0.064
HCM Control Delay	9.4	8	8.9	7.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.1	0.3	0.8	0.2

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 36.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	1	7	45	0	240	1	1229	20	36	1264	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	1	8	50	0	267	1	1366	22	40	1404	0

Major/Minor

	Minor2		Minor1			Major1			Major2			
Conflicting Flow All	2169	2852	702	2151	2852	683	1404	0	0	1366	0	0
Stage 1	1484	1484	-	1368	1368	-	-	-	-	-	-	-
Stage 2	685	1368	-	783	1484	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	26	17	381	# 27	17	392	482	-	-	499	-	-
Stage 1	131	187	-	155	213	-	-	-	-	-	-	-
Stage 2	404	213	-	353	187	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-	-	-	-
Mov Capacity-1 Maneuver	8	16	381	# 23	16	392	482	-	-	499	-	-
Mov Capacity-2 Maneuver	8	16	-	# 23	16	-	-	-	-	-	-	-
Stage 1	131	172	-	155	213	-	-	-	-	-	-	-
Stage 2	129	213	-	316	172	-	-	-	-	-	-	-

Approach

	EB	WB	NB	SB
HCM Control Delay, s	44.9	\$ 357.5	0	0.4
HCM LOS	E	F		

Minor Lane / Major Mvmt

	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	482	-	-	99	58	392	499	-	-
HCM Lane V/C Ratio	0.002	-	-	0.09	2.395	0.454	0.08	-	-
HCM Control Delay (s)	12.486	-	-	44.9	\$ 787.5	21.6	12.842	-	-
HCM Lane LOS	B			E	F	C	B		
HCM 95th %tile Q(veh)	0.007	-	-	0.289	13.867	2.293	0.26	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	2.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	0	53	4	25	242	2	42	1	5	2	0	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	66	5	31	302	2	52	1	6	2	0	0
Major/Minor	Major1	Major2			Minor1			Minor2				
Conflicting Flow All	305	0	0	71	0	0	435	437	69	439	437	304
Stage 1	-	-	-	-	-	-	69	69	-	366	366	-
Stage 2	-	-	-	-	-	-	366	368	-	73	71	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1256	-	-	1529	-	-	531	513	994	528	513	736
Stage 1	-	-	-	-	-	-	941	837	-	653	623	-
Stage 2	-	-	-	-	-	-	653	621	-	937	836	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1256	-	-	1529	-	-	521	501	994	514	501	736
Mov Capacity-2 Maneuver	-	-	-	-	-	-	521	501	-	514	501	-
Stage 1	-	-	-	-	-	-	941	837	-	653	608	-
Stage 2	-	-	-	-	-	-	637	606	-	930	836	-
Approach	EB	WB			NB			SB				
HCM Control Delay, s	0	0.7			12.4			12				
HCM LOS					B			B				
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	548	1256	-	-	1529	-	-	514				
HCM Lane V/C Ratio	0.109	-	-	-	0.02	-	-	0.005				
HCM Control Delay (s)	12.4	0	-	-	7.404	0	-	12				
HCM Lane LOS	B	A	-	-	A	A	-	B				
HCM 95th %tile Q(veh)	0.367	0	-	-	0.063	-	-	0.015				

Notes
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

HCM 2010 AWSC
1: 119th Street & Jasper Road

Existing
PM Peak

Intersection												
Intersection Delay, s/veh	8.4											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	58	110	50	8	23	2	12	30	6	4	31	14
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	65	124	56	9	26	2	13	34	7	4	35	16
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.7	7.7	7.9	7.8
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	25%	27%	24%	8%
Vol Thru, %	62%	50%	70%	63%
Vol Right, %	12%	23%	6%	29%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	48	218	33	49
LT Vol	30	110	23	31
Through Vol	6	50	2	14
RT Vol	12	58	8	4
Lane Flow Rate	54	245	37	55
Geometry Grp	1	1	1	1
Degree of Util (X)	0.069	0.277	0.046	0.068
Departure Headway (Hd)	4.597	4.067	4.452	4.467
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	784	870	808	806
Service Time	2.6	2.156	2.46	2.47
HCM Lane V/C Ratio	0.069	0.282	0.046	0.068
HCM Control Delay	7.9	8.7	7.7	7.8
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	1.1	0.1	0.2

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	1	2	15	0	30	6	1383	115	120	1366	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	1	2	16	0	32	6	1456	121	126	1438	0

Major/Minor

	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	2432	3159	719	2440	3159	728	1438	0	0	1456	0	0
Stage 1	1691	1691	-	1468	1468	-	-	-	-	-	-	-
Stage 2	741	1468	-	972	1691	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	16	10	371	16	10	366	468	-	-	461	-	-
Stage 1	97	148	-	134	190	-	-	-	-	-	-	-
Stage 2	374	190	-	271	148	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-	-	-	-
Mov Capacity-1 Maneuver	11	7	371	# 11	7	366	468	-	-	461	-	-
Mov Capacity-2 Maneuver	11	7	-	# 11	7	-	-	-	-	-	-	-
Stage 1	96	108	-	132	188	-	-	-	-	-	-	-
Stage 2	337	188	-	194	108	-	-	-	-	-	-	-

Approach

	EB	WB	NB	SB
HCM Control Delay, s	\$ 342.3	\$ 388.1	0.1	1.3
HCM LOS	F	F		

Minor Lane / Major Mvmt

	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	468	-	-	15	18	366	461	-	-
HCM Lane V/C Ratio	0.013	-	-	0.351	1.462	0.058	0.274	-	-
HCM Control Delay (s)	12.798	-	-	\$ 342.3	\$ 686.3	15.4	15.73	-	-
HCM Lane LOS	B			F	F	C	C		
HCM 95th %tile Q(veh)	0.041	-	-	0.922	3.704	0.182	1.103	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	217	16	12	39	0	6	3	10	1	1	0
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	241	18	13	43	0	7	3	11	1	1	0
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	43	0	0	259	0	0	328	327	250	334	336	43
Stage 1	-	-	-	-	-	-	257	257	-	70	70	-
Stage 2	-	-	-	-	-	-	71	70	-	264	266	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1566	-	-	1306	-	-	625	591	789	620	585	1027
Stage 1	-	-	-	-	-	-	748	695	-	940	837	-
Stage 2	-	-	-	-	-	-	939	837	-	741	689	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1566	-	-	1306	-	-	618	584	789	603	578	1027
Mov Capacity-2 Maneuver	-	-	-	-	-	-	618	584	-	603	578	-
Stage 1	-	-	-	-	-	-	747	694	-	938	829	-
Stage 2	-	-	-	-	-	-	928	829	-	726	688	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			1.8			10.4			11.1		
HCM LOS	B			A			B			B		
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	690	1566	-	-	1306	-	-	590				
HCM Lane V/C Ratio	0.031	0.002	-	-	0.01	-	-	0.004				
HCM Control Delay (s)	10.4	7.304	0	-	7.785	0	-	11.1				
HCM Lane LOS	B	A	A	-	A	A	-	B				
HCM 95th %tile Q(veh)	0.095	0.006	-	-	0.031	-	-	0.011				
Notes												
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined												

Intersection												
Intersection Delay, s/veh	8.9											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	11	26	22	13	120	2	135	30	15	1	28	16
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	31	26	15	141	2	159	35	18	1	33	19
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8	8.9	9.4	7.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	75%	19%	10%	2%
Vol Thru, %	17%	44%	89%	62%
Vol Right, %	8%	37%	1%	36%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	180	59	135	45
LT Vol	30	26	120	28
Through Vol	15	22	2	16
RT Vol	135	11	13	1
Lane Flow Rate	212	69	159	53
Geometry Grp	1	1	1	1
Degree of Util (X)	0.273	0.088	0.205	0.066
Departure Headway (Hd)	4.635	4.569	4.655	4.519
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	775	783	770	791
Service Time	2.661	2.603	2.684	2.552
HCM Lane V/C Ratio	0.274	0.088	0.206	0.067
HCM Control Delay	9.4	8	8.9	7.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.1	0.3	0.8	0.2

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 61.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	1	8	47	1	255	1	1340	22	38	1375	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	1	9	52	1	283	1	1489	24	42	1528	1

Major/Minor

	Minor2	Minor1	Major1	Major2
Conflicting Flow All	2360	3104	744	1529
Stage 1	1613	1613	-	-
Stage 2	747	1491	-	-
Follow-up Headway	3.52	4.02	3.32	2.22
Pot Capacity-1 Maneuver	19	11	346	432
Stage 1	109	161	-	-
Stage 2	371	185	-	-
Time blocked-Platoon, %				
Mov Capacity-1 Maneuver	3	10	346	432
Mov Capacity-2 Maneuver	3	10	-	-
Stage 1	109	146	-	-
Stage 2	76	185	-	-

Approach

	EB	WB	NB	SB
HCM Control Delay, s	280	\$ 618.4	0	0.4
HCM LOS	F	F		

Minor Lane / Major Mvmt

	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	432	-	-	22	41	357	447	-	-
HCM Lane V/C Ratio	0.003	-	-	0.505	3.604	0.529	0.094	-	-
HCM Control Delay (s)	13.355	-	-	280	\$ 1375.8	25.9	13.892	-	-
HCM Lane LOS	B			F	F	D	B		
HCM 95th %tile Q(veh)	0.008	-	-	1.471	16.671	2.955	0.311	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	2.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	55	5	25	260	2	43	1	5	2	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	80	80	80	80	80	80	80	80	80	80	80	80
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	69	6	31	325	2	54	1	6	2	1	1
Major/Minor	Major1	Major2			Minor1			Minor2				
Conflicting Flow All	328	0	0	75	0	0	464	464	72	467	467	326
Stage 1	-	-	-	-	-	-	74	74	-	389	389	-
Stage 2	-	-	-	-	-	-	390	390	-	78	78	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1232	-	-	1524	-	-	508	495	990	506	493	715
Stage 1	-	-	-	-	-	-	935	833	-	635	608	-
Stage 2	-	-	-	-	-	-	634	608	-	931	830	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1232	-	-	1524	-	-	498	484	990	494	482	715
Mov Capacity-2 Maneuver	-	-	-	-	-	-	498	484	-	494	482	-
Stage 1	-	-	-	-	-	-	934	832	-	634	596	-
Stage 2	-	-	-	-	-	-	619	596	-	923	829	-
Approach	EB	WB			NB			SB				
HCM Control Delay, s	0.1	0.6			12.8			11.8				
HCM LOS					B			B				
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	524	1232	-	-	1524	-	-	532				
HCM Lane V/C Ratio	0.117	0.001	-	-	0.021	-	-	0.009				
HCM Control Delay (s)	12.8	7.925	0	-	7.412	-	-	11.8				
HCM Lane LOS	B	A	A	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.394	0.003	-	-	0.063	-	-	0.028				

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh	8.5
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	60	115	55	9	25	2	14	32	6	5	33	15
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	67	129	62	10	28	2	16	36	7	6	37	17
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.9	7.7	8	7.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	27%	26%	25%	9%
Vol Thru, %	62%	50%	69%	62%
Vol Right, %	12%	24%	6%	28%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	52	230	36	53
LT Vol	32	115	25	33
Through Vol	6	55	2	15
RT Vol	14	60	9	5
Lane Flow Rate	58	258	40	60
Geometry Grp	1	1	1	1
Degree of Util (X)	0.075	0.293	0.051	0.075
Departure Headway (Hd)	4.651	4.179	4.495	4.515
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	774	866	800	797
Service Time	2.657	2.179	2.506	2.521
HCM Lane V/C Ratio	0.075	0.298	0.05	0.075
HCM Control Delay	8	8.9	7.7	7.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.2	1.2	0.2	0.2

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 13.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	1	3	16	1	32	6	1505	120	125	1490	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	1	3	17	1	34	6	1584	126	132	1568	1

Major/Minor

	Minor2	Minor1		Major1		Major2						
Conflicting Flow All	2637	3429	785	2645	3430	792	1569	0	0	1584	0	0
Stage 1	1832	1832	-	1597	1597	-	-	-	-	-	-	-
Stage 2	805	1597	-	1048	1833	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	11	7	336	# 11	7	332	417	-	-	411	-	-
Stage 1	79	126	-	111	164	-	-	-	-	-	-	-
Stage 2	342	164	-	244	125	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-	-	-	-
Mov Capacity-1 Maneuver	6	5	336	# 7	5	332	417	-	-	411	-	-
Mov Capacity-2 Maneuver	6	5	-	# 7	5	-	-	-	-	-	-	-
Stage 1	78	86	-	109	162	-	-	-	-	-	-	-
Stage 2	301	162	-	162	85	-	-	-	-	-	-	-

Approach

	EB	WB	NB	SB
HCM Control Delay, s	\$ 542.6	\$ 814.1	0.1	1.4
HCM LOS	F	F		

Minor Lane / Major Mvmt

	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	417	-	-	11	11	332	411	-	-
HCM Lane V/C Ratio	0.015	-	-	0.574	2.648	0.068	0.32	-	-
HCM Control Delay (s)	13.766	-	-	\$ 542.6	\$ 1429.1	16.6	17.83	-	-
HCM Lane LOS	B			F	F	C	C		
HCM 95th %tile Q(veh)	0.046	-	-	1.274	4.626	0.216	1.36	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	1.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	255	17	13	40	1	7	3	10	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	283	19	14	44	1	8	3	11	1	1	1
Major/Minor	Major1	Major2			Minor1			Minor2				
Conflicting Flow All	46	0	0	302	0	0	374	373	293	381	383	45
Stage 1	-	-	-	-	-	-	299	299	-	74	74	-
Stage 2	-	-	-	-	-	-	75	74	-	307	309	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1562	-	-	1259	-	-	583	557	746	577	550	1025
Stage 1	-	-	-	-	-	-	710	666	-	935	833	-
Stage 2	-	-	-	-	-	-	934	833	-	703	660	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1562	-	-	1259	-	-	576	550	746	560	543	1025
Mov Capacity-2 Maneuver	-	-	-	-	-	-	576	550	-	560	543	-
Stage 1	-	-	-	-	-	-	709	665	-	933	824	-
Stage 2	-	-	-	-	-	-	921	824	-	688	659	-
Approach	EB	WB			NB			SB				
HCM Control Delay, s	0.1	1.9			10.8			10.6				
HCM LOS					B			B				
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	645	1562	-	-	1259	-	-	652				
HCM Lane V/C Ratio	0.034	0.002	-	-	0.011	-	-	0.005				
HCM Control Delay (s)	10.8	7.31	0	-	7.893	-	-	10.6				
HCM Lane LOS	B	A	A	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.107	0.006	-	-	0.035	-	-	0.015				

Notes
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh	8.9
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	12	37	39	14	125	2	144	30	18	1	28	16
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	13	41	43	16	139	2	160	33	20	1	31	18
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.2	8.9	9.5	7.9
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	75%	14%	10%	2%
Vol Thru, %	16%	42%	89%	62%
Vol Right, %	9%	44%	1%	36%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	192	88	141	45
LT Vol	30	37	125	28
Through Vol	18	39	2	16
RT Vol	144	12	14	1
Lane Flow Rate	213	98	157	50
Geometry Grp	1	1	1	1
Degree of Util (X)	0.277	0.123	0.204	0.064
Departure Headway (Hd)	4.682	4.517	4.69	4.582
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	766	792	765	780
Service Time	2.716	2.554	2.725	2.624
HCM Lane V/C Ratio	0.278	0.124	0.205	0.064
HCM Control Delay	9.5	8.2	8.9	7.9
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	1.1	0.4	0.8	0.2

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 81.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	1	8	59	1	270	1	1340	33	43	1375	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	1	9	64	1	293	1	1457	36	47	1495	1

Major/Minor

	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2320	3048	748	2300	3048	728	1496	0	0	1457	0	0
Stage 1	1589	1589	-	1459	1459	-	-	-	-	-	-	-
Stage 2	731	1459	-	841	1589	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	20	12	355	# 21	12	366	444	-	-	460	-	-
Stage 1	112	166	-	136	192	-	-	-	-	-	-	-
Stage 2	379	192	-	326	166	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-		-	-
Mov Capacity-1 Maneuver	3	11	355	# 17	11	366	444	-	-	460	-	-
Mov Capacity-2 Maneuver	3	11	-	# 17	11	-	-	-	-	-	-	-
Stage 1	112	149	-	136	192	-	-	-	-	-	-	-
Stage 2	75	192	-	283	149	-	-	-	-	-	-	-

Approach

	EB			WB			NB			SB		
HCM Control Delay, s	276.9			\$ 759.9			0			0.4		
HCM LOS	F			F								

Minor Lane / Major Mvmt

	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	444	-	-	22	39	366	460	-	-
HCM Lane V/C Ratio	0.002	-	-	0.494	4.181	0.535	0.102	-	-
HCM Control Delay (s)	13.128	-	-	276.9	\$ 1641.1	25.6	13.709	-	-
HCM Lane LOS	B			F	F	D	B		
HCM 95th %tile Q(veh)	0.007	-	-	1.44	18.764	3.018	0.337	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	85	1	3	285	4	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	94	1	3	317	4	7

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	96
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1498
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1498
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	9.8
HCM LOS			A

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	768	-	-	1498	-
HCM Lane V/C Ratio	0.014	-	-	0.002	-
HCM Control Delay (s)	9.8	-	-	7.409	0
HCM Lane LOS	A			A	A
HCM 95th %tile Q(veh)	0.044	-	-	0.007	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 1.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	65	13	7	280	39	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	320	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	72	14	8	311	43	24

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	72
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1528
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1528
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	10.7
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	702	-	-	1528	-
HCM Lane V/C Ratio	0.097	-	-	0.005	-
HCM Control Delay (s)	10.7	-	-	7.368	0
HCM Lane LOS	B			A	A
HCM 95th %tile Q(veh)	0.319	-	-	0.015	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	2.2											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	71	5	45	287	2	43	1	5	2	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	320	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	77	5	49	312	2	47	1	5	2	1	1
Major/Minor	Major1	Major2			Minor1			Minor2				
Conflicting Flow All	314	0	0	83	0	0	494	494	80	496	496	313
Stage 1	-	-	-	-	-	-	82	82	-	411	411	-
Stage 2	-	-	-	-	-	-	412	412	-	85	85	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1246	-	-	1514	-	-	486	476	980	484	475	727
Stage 1	-	-	-	-	-	-	926	827	-	618	595	-
Stage 2	-	-	-	-	-	-	617	594	-	923	824	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1246	-	-	1514	-	-	472	460	980	468	459	727
Mov Capacity-2 Maneuver	-	-	-	-	-	-	472	460	-	468	459	-
Stage 1	-	-	-	-	-	-	925	826	-	617	576	-
Stage 2	-	-	-	-	-	-	595	575	-	916	823	-
Approach	EB	WB			NB			SB				
HCM Control Delay, s	0.1	1			13.1			12.1				
HCM LOS					B			B				
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	498	1246	-	-	1514	-	-	511				
HCM Lane V/C Ratio	0.107	0.001	-	-	0.032	-	-	0.009				
HCM Control Delay (s)	13.1	7.892	0	-	7.457	-	-	12.1				
HCM Lane LOS	B	A	A	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.357	0.003	-	-	0.1	-	-	0.026				
Notes												
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined												

Intersection

Intersection Delay, s/veh 0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	8	15	5	185	80	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	17	6	206	89	3

Major/Minor	Minor2	Major1			Major2	
Conflicting Flow All	308	91	92	0	-	0
Stage 1	91	-	-	-	-	-
Stage 2	217	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	684	967	1503	-	-	-
Stage 1	933	-	-	-	-	-
Stage 2	819	-	-	-	-	-
Time blocked-Platoon, %				-	-	-
Mov Capacity-1 Maneuver	681	967	1503	-	-	-
Mov Capacity-2 Maneuver	681	-	-	-	-	-
Stage 1	933	-	-	-	-	-
Stage 2	815	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.4	0.2	0
HCM LOS	A		

Minor Lane / Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1503	-	844	-	-
HCM Lane V/C Ratio	0.004	-	0.03	-	-
HCM Control Delay (s)	7.404	0	9.4	-	-
HCM Lane LOS	A	A	A		
HCM 95th %tile Q(veh)	0.011	-	0.094	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh	8.8
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	61	122	70	13	37	2	34	32	8	5	34	17
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	68	136	78	14	41	2	38	36	9	6	38	19
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.3	8	8.4	8.1
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	46%	24%	25%	9%
Vol Thru, %	43%	48%	71%	61%
Vol Right, %	11%	28%	4%	30%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	74	253	52	56
LT Vol	32	122	37	34
Through Vol	8	70	2	17
RT Vol	34	61	13	5
Lane Flow Rate	82	281	58	62
Geometry Grp	1	1	1	1
Degree of Util (X)	0.109	0.33	0.074	0.08
Departure Headway (Hd)	4.792	4.23	4.606	4.629
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	748	852	778	774
Service Time	2.819	2.249	2.63	2.656
HCM Lane V/C Ratio	0.11	0.33	0.075	0.08
HCM Control Delay	8.4	9.3	8	8.1
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	1.4	0.2	0.3

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 45.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	1	3	23	1	42	6	1505	156	142	1490	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	1	3	25	1	46	7	1636	170	154	1620	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	2761	3578	810	2768	3578	818	1621	0	0	1636	0	0
Stage 1	1929	1929	-	1649	1649	-	-	-	-	-	-	-
Stage 2	832	1649	-	1119	1929	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	9	5	323	# 9	5	319	398	-	-	392	-	-
Stage 1	68	112	-	103	155	-	-	-	-	-	-	-
Stage 2	330	155	-	220	112	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-	-	-	-
Mov Capacity-1 Maneuver	4	3	323	# 4	3	319	398	-	-	392	-	-
Mov Capacity-2 Maneuver	4	3	-	# 4	3	-	-	-	-	-	-	-
Stage 1	67	68	-	101	152	-	-	-	-	-	-	-
Stage 2	276	152	-	130	68	-	-	-	-	-	-	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	\$ 968.5			\$ 2212.2			0.1			1.7		
HCM LOS	F			F								

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	398	-	-	7	6	319	392	-	-
HCM Lane V/C Ratio	0.016	-	-	0.932	6.884	0.095	0.394	-	-
HCM Control Delay (s)	14.196	-	-	\$ 968.5	\$ 3829.3	17.5	20.023	-	-
HCM Lane LOS	B			F	F	C	C		
HCM 95th %tile Q(veh)	0.05	-	-	1.534	6.718	0.314	1.835	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 0.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	250	5	7	80	3	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	278	6	8	89	3	4

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	283
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1279
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1279
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.6	10.3
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	689	-	-	1279	-
HCM Lane V/C Ratio	0.011	-	-	0.006	-
HCM Control Delay (s)	10.3	-	-	7.832	0
HCM Lane LOS	B			A	A
HCM 95th %tile Q(veh)	0.034	-	-	0.018	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 1.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	240	43	24	60	26	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	320	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	267	48	27	67	29	17

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	267
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1297
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1297
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	2.2	10.9
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	655	-	-	1297	-
HCM Lane V/C Ratio	0.07	-	-	0.021	-
HCM Control Delay (s)	10.9	-	-	7.834	0
HCM Lane LOS	B			A	A
HCM 95th %tile Q(veh)	0.224	-	-	0.063	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 1.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	277	17	27	57	1	7	3	10	1	1	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	308	19	30	63	1	8	3	11	1	1	1

Major/Minor

	Major1	Major2	Minor1	Minor2
Conflicting Flow All	64	0	0	327
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Follow-up Headway	2.218	-	-	2.218
Pot Capacity-1 Maneuver	1538	-	-	1233
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Time blocked-Platoon, %	-	-	-	-
Mov Capacity-1 Maneuver	1538	-	-	1233
Mov Capacity-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach

	EB	WB	NB	SB
HCM Control Delay, s	0.1	2.5	11.3	11.1
HCM LOS			B	B

Minor Lane / Major Mvmt

	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	594	1538	-	-	1233	-	-	591
HCM Lane V/C Ratio	0.037	0.002	-	-	0.024	-	-	0.006
HCM Control Delay (s)	11.3	7.346	0	-	7.993	-	-	11.1
HCM Lane LOS	B	A	A	-	A	-	-	B
HCM 95th %tile Q(veh)	0.116	0.007	-	-	0.075	-	-	0.017

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 1.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	5	10	17	70	110	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	6	11	19	78	122	10

Major/Minor	Minor2	Major1			Major2	
Conflicting Flow All	243	127	132	0	-	0
Stage 1	127	-	-	-	-	-
Stage 2	116	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	745	923	1453	-	-	-
Stage 1	899	-	-	-	-	-
Stage 2	909	-	-	-	-	-
Time blocked-Platoon, %				-	-	-
Mov Capacity-1 Maneuver	735	923	1453	-	-	-
Mov Capacity-2 Maneuver	735	-	-	-	-	-
Stage 1	899	-	-	-	-	-
Stage 2	896	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	1.5	0
HCM LOS	A		

Minor Lane / Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1453	-	850	-	-
HCM Lane V/C Ratio	0.013	-	0.02	-	-
HCM Control Delay (s)	7.51	0	9.3	-	-
HCM Lane LOS	A	A	A		
HCM 95th %tile Q(veh)	0.04	-	0.06	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh	9.7
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	15	30	30	17	160	3	180	39	20	2	36	20
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	17	33	33	19	178	3	200	43	22	2	40	22
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.5	9.7	10.5	8.3
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	75%	20%	9%	3%
Vol Thru, %	16%	40%	89%	62%
Vol Right, %	8%	40%	2%	34%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	239	75	180	58
LT Vol	39	30	160	36
Through Vol	20	30	3	20
RT Vol	180	15	17	2
Lane Flow Rate	266	83	200	64
Geometry Grp	1	1	1	1
Degree of Util (X)	0.354	0.111	0.269	0.085
Departure Headway (Hd)	4.798	4.795	4.849	4.756
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	746	743	738	748
Service Time	2.847	2.855	2.9	2.82
HCM Lane V/C Ratio	0.357	0.112	0.271	0.086
HCM Control Delay	10.5	8.5	9.7	8.3
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	1.6	0.4	1.1	0.3

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 0.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	2	10	60	2	330	2	1975	30	45	2030	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	2	11	65	2	359	2	2147	33	49	2207	1

Major/Minor	Minor2		Minor1			Major1		Major2				
Conflicting Flow All	3384	4456	1104	3353	4456	1073	2208	0	0	2147	0	0
Stage 1	2305	2305	-	2151	2151	-	-	-	-	-	-	-
Stage 2	1079	2151	-	1202	2305	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	3	# 1	206	# 3	# 1	# 216	234	-	-	248	-	-
Stage 1	39	72	-	# 49	86	-	-	-	-	-	-	-
Stage 2	233	86	-	196	72	-	-	-	-	-	-	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	-	# 1	206	-	# 1	# 216	234	-	-	248	-	-
Mov Capacity-2 Maneuver	-	# 1	-	-	# 1	-	-	-	-	-	-	-
Stage 1	39	58	-	# 49	85	-	-	-	-	-	-	-
Stage 2	-	85	-	143	58	-	-	-	-	-	-	-

Approach	EB		WB			NB		SB		
HCM Control Delay, s	+		+			0		0.5		
HCM LOS	-		-							

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	234	-	-	+	+	216	248	-	-
HCM Lane V/C Ratio	0.009	-	-	+	+	1.107	0.197	-	-
HCM Control Delay (s)	20.529	-	-	+	+	140	23.048	-	-
HCM Lane LOS	C		+		+	F	C		
HCM 95th %tile Q(veh)	0.028	-	-	+	+	11.025	0.716	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	2.1											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	70	6	30	345	4	45	2	8	4	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	78	7	33	383	4	50	2	9	4	2	2
Major/Minor	Major1	Major2			Minor1			Minor2				
Conflicting Flow All	388	0	0	84	0	0	537	537	81	541	539	386
Stage 1	-	-	-	-	-	-	83	83	-	452	452	-
Stage 2	-	-	-	-	-	-	454	454	-	89	87	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1170	-	-	1513	-	-	455	450	979	452	449	662
Stage 1	-	-	-	-	-	-	925	826	-	587	570	-
Stage 2	-	-	-	-	-	-	586	569	-	918	823	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1170	-	-	1513	-	-	444	440	979	438	439	662
Mov Capacity-2 Maneuver	-	-	-	-	-	-	444	440	-	438	439	-
Stage 1	-	-	-	-	-	-	924	825	-	586	558	-
Stage 2	-	-	-	-	-	-	569	557	-	906	822	-
Approach	EB	WB			NB			SB				
HCM Control Delay, s	0.1	0.6			13.6			12.7				
HCM LOS					B			B				
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	482	1170	-	-	1513	-	-	479				
HCM Lane V/C Ratio	0.127	0.001	-	-	0.022	-	-	0.019				
HCM Control Delay (s)	13.6	8.08	0	-	7.433	-	-	12.7				
HCM Lane LOS	B	A	A	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.432	0.003	-	-	0.068	-	-	0.057				

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh	9.3
Intersection LOS	A

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	75	140	70	11	35	3	20	42	8	6	43	20
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	83	156	78	12	39	3	22	47	9	7	48	22
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	9.9	8	8.5	8.3
HCM LOS	A	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	29%	26%	22%	9%
Vol Thru, %	60%	49%	71%	62%
Vol Right, %	11%	25%	6%	29%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	70	285	49	69
LT Vol	42	140	35	43
Through Vol	8	70	3	20
RT Vol	20	75	11	6
Lane Flow Rate	78	317	54	77
Geometry Grp	1	1	1	1
Degree of Util (X)	0.105	0.376	0.07	0.1
Departure Headway (Hd)	4.852	4.277	4.656	4.711
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	738	842	769	761
Service Time	2.884	2.299	2.687	2.743
HCM Lane V/C Ratio	0.106	0.376	0.07	0.101
HCM Control Delay	8.5	9.9	8	8.3
HCM Lane LOS	A	A	A	A
HCM 95th-tile Q	0.4	1.8	0.2	0.3

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	2	4	25	2	45	7	2220	155	150	2195	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	0	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	2	4	27	2	49	8	2413	168	163	2386	2

Major/Minor

	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	3936	5141	1194	3948	5142	1207	2388	0	0	2413	0	0
Stage 1	2713	2713	-	2428	2428	-	-	-	-	-	-	-
Stage 2	1223	2428	-	1520	2714	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	# 1	# 0	179	# 1	# 0	175	199	-	-	194	-	-
Stage 1	21	44	-	33	62	-	-	-	-	-	-	-
Stage 2	190	62	-	124	44	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-		-	-
Mov Capacity-1 Maneuver	# 0	# 0	179	# 0	# 0	175	199	-	-	194	-	-
Mov Capacity-2 Maneuver	# 0	# 0	-	# 0	# 0	-	-	-	-	-	-	-
Stage 1	20	7	-	32	60	-	-	-	-	-	-	-
Stage 2	127	60	-	# 13	7	-	-	-	-	-	-	-

Approach

	EB			WB			NB			SB		
HCM Control Delay, s	26.3			31.7			0.1			5		
HCM LOS	D			D								

Minor Lane / Major Mvmt

	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	199	-	-	179	175	175	194	-	-
HCM Lane V/C Ratio	0.038	-	-	0.055	0.261	0.186	0.84	-	-
HCM Control Delay (s)	23.808	-	-	26.3	32.7	30.2	78.797	-	-
HCM Lane LOS	C			D	D	D	F		
HCM 95th %tile Q(veh)	0.119	-	-	0.172	0.997	0.662	6.12	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	1.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	280	20	15	60	2	10	4	15	2	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	304	22	16	65	2	11	4	16	2	2	2
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	67	0	0	326	0	0	427	426	315	435	436	66
Stage 1	-	-	-	-	-	-	326	326	-	99	99	-
Stage 2	-	-	-	-	-	-	101	100	-	336	337	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1535	-	-	1234	-	-	538	520	725	531	514	998
Stage 1	-	-	-	-	-	-	687	648	-	907	813	-
Stage 2	-	-	-	-	-	-	905	812	-	678	641	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1535	-	-	1234	-	-	528	511	725	509	505	998
Mov Capacity-2 Maneuver	-	-	-	-	-	-	528	511	-	509	505	-
Stage 1	-	-	-	-	-	-	684	645	-	903	802	-
Stage 2	-	-	-	-	-	-	889	801	-	656	638	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			1.5			11.2			11		
HCM LOS	B			A			B			B		
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	611	1535	-	-	1234	-	-	606				
HCM Lane V/C Ratio	0.052	0.004	-	-	0.013	-	-	0.011				
HCM Control Delay (s)	11.2	7.354	0	-	7.956	-	-	11				
HCM Lane LOS	B	A	A	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.163	0.011	-	-	0.04	-	-	0.033				

Notes
 ~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	10.1											
Intersection LOS	B											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	16	41	47	18	165	3	189	39	23	2	36	22
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	18	46	52	20	183	3	210	43	26	2	40	24
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.8	10	11	8.4
HCM LOS	A	A	B	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	75%	15%	10%	3%
Vol Thru, %	16%	39%	89%	60%
Vol Right, %	9%	45%	2%	37%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	251	104	186	60
LT Vol	39	41	165	36
Through Vol	23	47	3	22
RT Vol	189	16	18	2
Lane Flow Rate	279	116	207	67
Geometry Grp	1	1	1	1
Degree of Util (X)	0.379	0.155	0.284	0.09
Departure Headway (Hd)	4.894	4.819	4.942	4.87
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	731	737	721	728
Service Time	2.957	2.891	3.006	2.953
HCM Lane V/C Ratio	0.382	0.157	0.287	0.092
HCM Control Delay	11	8.8	10	8.4
HCM Lane LOS	B	A	A	A
HCM 95th-tile Q	1.8	0.5	1.2	0.3

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	2	10	72	2	345	2	1975	41	50	2030	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	2	11	78	2	375	2	2147	45	54	2207	1

Major/Minor	Minor2		Minor1			Major1			Major2			
Conflicting Flow All	3395	4467	1104	3364	4467	1073	2208	0	0	2147	0	0
Stage 1	2316	2316	-	2151	2151	-	-	-	-	-	-	-
Stage 2	1079	2151	-	1213	2316	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	3	# 1	206	# 3	# 1	# 216	234	-	-	248	-	-
Stage 1	38	71	-	# 49	86	-	-	-	-	-	-	-
Stage 2	233	86	-	193	71	-	-	-	-	-	-	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	-	# 1	206	-	# 1	# 216	234	-	-	248	-	-
Mov Capacity-2 Maneuver	-	# 1	-	-	# 1	-	-	-	-	-	-	-
Stage 1	38	56	-	# 49	85	-	-	-	-	-	-	-
Stage 2	-	85	-	137	56	-	-	-	-	-	-	-

Approach	EB		WB			NB			SB		
HCM Control Delay, s	+		+			0			0.6		
HCM LOS	-		-								

Minor Lane / Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	234	-	-	+	+	216	248	-	-
HCM Lane V/C Ratio	0.009	-	-	+	+	1.157	0.219	-	-
HCM Control Delay (s)	20.529	-	-	+	+	156.8	23.544	-	-
HCM Lane LOS	C		+		+	F	C		
HCM 95th %tile Q(veh)	0.028	-	-	+	+	12.038	0.815	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	100	1	3	375	4	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	111	1	3	417	4	7

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	112
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1478
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1478
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	10.2
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	699	-	-	1478	-
HCM Lane V/C Ratio	0.016	-	-	0.002	-
HCM Control Delay (s)	10.2	-	-	7.441	0
HCM Lane LOS	B			A	A
HCM 95th %tile Q(veh)	0.048	-	-	0.007	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	80	13	7	372	39	22
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	320	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	89	14	8	413	43	24

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	89
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1506
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1506
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.1	11.5
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	619	-	-	1506	-
HCM Lane V/C Ratio	0.109	-	-	0.005	-
HCM Control Delay (s)	11.5	-	-	7.403	0
HCM Lane LOS	B			A	A
HCM 95th %tile Q(veh)	0.367	-	-	0.016	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	2.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	86	6	50	372	4	45	2	8	4	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	96	7	56	413	4	50	2	9	4	2	2
Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	418	0	0	102	0	0	630	630	99	634	631	416
Stage 1	-	-	-	-	-	-	101	101	-	527	527	-
Stage 2	-	-	-	-	-	-	529	529	-	107	104	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1141	-	-	1490	-	-	394	399	957	392	398	637
Stage 1	-	-	-	-	-	-	905	811	-	535	528	-
Stage 2	-	-	-	-	-	-	533	527	-	898	809	-
Time blocked-Platoon, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Capacity-1 Maneuver	1141	-	-	1490	-	-	379	384	957	375	383	637
Mov Capacity-2 Maneuver	-	-	-	-	-	-	379	384	-	375	383	-
Stage 1	-	-	-	-	-	-	904	810	-	534	508	-
Stage 2	-	-	-	-	-	-	509	507	-	886	808	-
Approach	EB			WB			NB			SB		
HCM Control Delay, s	0.1			0.9			15.1			13.8		
HCM LOS	C			A			C			B		
Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1				
Capacity (veh/h)	416	1141	-	-	1490	-	-	420				
HCM Lane V/C Ratio	0.147	0.001	-	-	0.037	-	-	0.021				
HCM Control Delay (s)	15.1	8.158	0	-	7.51	-	-	13.8				
HCM Lane LOS	C	A	A	-	A	-	-	B				
HCM 95th %tile Q(veh)	0.511	0.003	-	-	0.116	-	-	0.065				
Notes												
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined												

Intersection

Intersection Delay, s/veh 0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	8	15	5	245	100	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	17	6	272	111	3

Major/Minor	Minor2	Major1			Major2	
Conflicting Flow All	396	113	114	0	-	0
Stage 1	113	-	-	-	-	-
Stage 2	283	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	609	940	1475	-	-	-
Stage 1	912	-	-	-	-	-
Stage 2	765	-	-	-	-	-
Time blocked-Platoon, %				-	-	-
Mov Capacity-1 Maneuver	606	940	1475	-	-	-
Mov Capacity-2 Maneuver	606	-	-	-	-	-
Stage 1	912	-	-	-	-	-
Stage 2	761	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.7	0.1	0
HCM LOS	A		

Minor Lane / Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1475	-	789	-	-
HCM Lane V/C Ratio	0.004	-	0.032	-	-
HCM Control Delay (s)	7.45	0	9.7	-	-
HCM Lane LOS	A	A	A		
HCM 95th %tile Q(veh)	0.011	-	0.1	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection												
Intersection Delay, s/veh	9.7											
Intersection LOS	A											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	76	147	85	15	47	3	40	42	10	6	44	22
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	84	163	94	17	52	3	44	47	11	7	49	24
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	10.5	8.3	8.9	8.5
HCM LOS	B	A	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	43%	25%	23%	8%
Vol Thru, %	46%	48%	72%	61%
Vol Right, %	11%	28%	5%	31%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	92	308	65	72
LT Vol	42	147	47	44
Through Vol	10	85	3	22
RT Vol	40	76	15	6
Lane Flow Rate	102	342	72	80
Geometry Grp	1	1	1	1
Degree of Util (X)	0.142	0.414	0.096	0.108
Departure Headway (Hd)	4.999	4.355	4.781	4.844
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	715	825	747	737
Service Time	3.047	2.389	2.828	2.893
HCM Lane V/C Ratio	0.143	0.415	0.096	0.109
HCM Control Delay	8.9	10.5	8.3	8.5
HCM Lane LOS	A	B	A	A
HCM 95th-tile Q	0.5	2	0.3	0.4

Notes

- : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 4.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	3	2	4	32	2	55	7	2220	191	167	2195	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	None
Storage Length	-	-	-	-	-	50	300	-	415	515	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	3	2	4	35	2	60	8	2413	208	182	2386	2

Major/Minor

	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	3973	5178	1194	3985	5179	1207	2388	0	0	2413	0	0
Stage 1	2750	2750	-	2428	2428	-	-	-	-	-	-	-
Stage 2	1223	2428	-	1557	2751	-	-	-	-	-	-	-
Follow-up Headway	3.52	4.02	3.32	3.52	4.02	3.32	2.22	-	-	2.22	-	-
Pot Capacity-1 Maneuver	# 1	# 0	179	# 1	# 0	175	199	-	-	194	-	-
Stage 1	20	42	-	# 33	62	-	-	-	-	-	-	-
Stage 2	190	62	-	118	42	-	-	-	-	-	-	-
Time blocked-Platoon, %								-	-	-	-	-
Mov Capacity-1 Maneuver	# 0	# 0	179	# 0	# 0	175	199	-	-	194	-	-
Mov Capacity-2 Maneuver	# 0	# 0	-	# 0	# 0	-	-	-	-	-	-	-
Stage 1	19	3	-	# 32	60	-	-	-	-	-	-	-
Stage 2	116	60	-	# 2	3	-	-	-	-	-	-	-

Approach

	EB		WB		NB		SB
HCM Control Delay, s	26.3		33.7		0.1		7
HCM LOS	D		D				

Minor Lane / Major Mvmt

	NBL	NBT	NBR	EBLn1	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	199	-	-	179	175	175	194	-	-
HCM Lane V/C Ratio	0.038	-	-	0.055	0.325	0.228	0.936	-	-
HCM Control Delay (s)	23.808	-	-	26.3	35.2	31.5	98.655	-	-
HCM Lane LOS	C			D	E	D	F		
HCM 95th %tile Q(veh)	0.119	-	-	0.172	1.326	0.843	7.507	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 0.3

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	305	5	7	100	3	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	339	6	8	111	3	4

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	344
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1215
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1215
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.5	10.8
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	627	-	-	1215	-
HCM Lane V/C Ratio	0.012	-	-	0.006	-
HCM Control Delay (s)	10.8	-	-	7.982	0
HCM Lane LOS	B			A	A
HCM 95th %tile Q(veh)	0.038	-	-	0.019	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 1.4

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	305	43	24	80	26	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	320	-	-	0	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	339	48	27	89	29	17

Major/Minor	Major1	Major2	Minor1
Conflicting Flow All	0	0	339
Stage 1	-	-	-
Stage 2	-	-	-
Follow-up Headway	-	-	2.218
Pot Capacity-1 Maneuver	-	-	1220
Stage 1	-	-	-
Stage 2	-	-	-
Time blocked-Platoon, %	-	-	-
Mov Capacity-1 Maneuver	-	-	1220
Mov Capacity-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.9	11.7
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	583	-	-	1220	-
HCM Lane V/C Ratio	0.078	-	-	0.022	-
HCM Control Delay (s)	11.7	-	-	8.017	0
HCM Lane LOS	B			A	A
HCM 95th %tile Q(veh)	0.253	-	-	0.067	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	5	332	20	29	77	2	10	4	15	2	2	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None									
Storage Length	-	-	-	0	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	6	369	22	32	86	2	11	4	17	2	2	2

Major/Minor	Major1	Major2	Minor1	Minor2
Conflicting Flow All	88	0	0	391
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Follow-up Headway	2.218	-	-	2.218
Pot Capacity-1 Maneuver	1508	-	-	1168
Stage 1	-	-	-	-
Stage 2	-	-	-	-
Time blocked-Platoon, %	-	-	-	-
Mov Capacity-1 Maneuver	1508	-	-	1168
Mov Capacity-2 Maneuver	-	-	-	-
Stage 1	-	-	-	-
Stage 2	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	2.2	12.2	12
HCM LOS			B	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	531	1508	-	-	1168	-	-	521
HCM Lane V/C Ratio	0.061	0.004	-	-	0.028	-	-	0.013
HCM Control Delay (s)	12.2	7.396	0	-	8.17	-	-	12
HCM Lane LOS	B	A	A	-	A	-	-	B
HCM 95th %tile Q(veh)	0.193	0.011	-	-	0.085	-	-	0.039

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection

Intersection Delay, s/veh 1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	5	10	17	90	135	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	6	11	19	100	150	10

Major/Minor	Minor2	Major1			Major2	
Conflicting Flow All	293	155	160	0	-	0
Stage 1	155	-	-	-	-	-
Stage 2	138	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	698	891	1419	-	-	-
Stage 1	873	-	-	-	-	-
Stage 2	889	-	-	-	-	-
Time blocked-Platoon, %				-	-	-
Mov Capacity-1 Maneuver	688	891	1419	-	-	-
Mov Capacity-2 Maneuver	688	-	-	-	-	-
Stage 1	873	-	-	-	-	-
Stage 2	877	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.5	1.2	0
HCM LOS	A		

Minor Lane / Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1419	-	811	-	-
HCM Lane V/C Ratio	0.013	-	0.021	-	-
HCM Control Delay (s)	7.571	0	9.5	-	-
HCM Lane LOS	A	A	A		
HCM 95th %tile Q(veh)	0.04	-	0.063	-	-

Notes

~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	8/17/2013						N/S Street Name	119th Street								
Time Period	AM Peak						Analysis Year	Existing								
Peak Hour Factor	0.85						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	7	96	32	0	102	531	55	0	69	60	42	0	24	88	62	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	257			163			152			842						
Exiting Flow (V_{ex}), pc/h	194			794			146			266						
Entry Flow (V_e), pc/h		162			826			205			209					
Entry Volume veh/h		159			810			201			205					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1184			1271			1282			757					
Capacity (c), veh/h		1160			1246			1257			742					
v/c Ratio (X)		0.14			0.65			0.16			0.28					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		4.3			11.3			4.2			8.1					
Lane LOS		A			B			A			A					
Lane 95% Queue		0.5			5.1			0.6			1.1					
Approach Delay, s/veh	4.28			11.33			4.21			8.07						
Approach LOS, s/veh	A			B			A			A						
Intersection Delay, s/veh	8.99															
Intersection LOS	A															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	8/17/2013						N/S Street Name	119th Street								
Time Period	PM Peak						Analysis Year	Existing								
Peak Hour Factor	0.91						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	20	494	69	0	34	144	25	0	29	66	104	0	38	37	10	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	122			129			619			232						
Exiting Flow (V_{ex}), pc/h	713			205			124			157						
Entry Flow (V_e), pc/h		653			228			223			95					
Entry Volume veh/h		640			224			219			93					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1312			1305			898			1206					
Capacity (c), veh/h		1286			1279			880			1182					
v/c Ratio (X)		0.50			0.17			0.25			0.08					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		8.0			4.3			6.7			3.7					
Lane LOS		A			A			A			A					
Lane 95% Queue		2.9			0.6			1.0			0.3					
Approach Delay, s/veh	8.03			4.28			6.68			3.70						
Approach LOS, s/veh	A			A			A			A						
Intersection Delay, s/veh	6.72															
Intersection LOS	A															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	8/17/2013						N/S Street Name	119th Street								
Time Period	AM Peak						Analysis Year	2017 Background								
Peak Hour Factor	0.90						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	8	105	37	0	120	560	60	0	80	65	50	0	26	95	65	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	273			174			157			862						
Exiting Flow (V_{ex}), pc/h	205			799			151			286						
Entry Flow (V_e), pc/h		170			839			221			211					
Entry Volume veh/h		167			823			217			207					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1169			1261			1277			746					
Capacity (c), veh/h		1146			1237			1252			731					
v/c Ratio (X)		0.15			0.66			0.17			0.28					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		4.4			11.8			4.3			8.3					
Lane LOS		A			B			A			A					
Lane 95% Queue		0.5			5.4			0.6			1.2					
Approach Delay, s/veh	4.40			11.81			4.34			8.27						
Approach LOS, s/veh	A			B			A			A						
Intersection Delay, s/veh	9.27															
Intersection LOS	A															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	8/17/2013						N/S Street Name	119th Street								
Time Period	PM Peak						Analysis Year	2017 Background								
Peak Hour Factor	0.90						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	22	520	80	0	40	150	27	0	35	70	120	0	41	40	11	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	136			144			660			255						
Exiting Flow (V_{ex}), pc/h	772			222			135			181						
Entry Flow (V_e), pc/h		705			246			255			104					
Entry Volume veh/h		691			241			250			102					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1297			1290			869			1185					
Capacity (c), veh/h		1271			1265			852			1162					
v/c Ratio (X)		0.54			0.19			0.29			0.09					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		8.9			4.5			7.4			3.8					
Lane LOS		A			A			A			A					
Lane 95% Queue		3.4			0.7			1.2			0.3					
Approach Delay, s/veh	8.87			4.47			7.44			3.83						
Approach LOS, s/veh	A			A			A			A						
Intersection Delay, s/veh	7.37															
Intersection LOS	A															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	2/27/2014						N/S Street Name	119th Street								
Time Period	AM Peak						Analysis Year	2017 Total								
Peak Hour Factor	0.90						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	12	105	37	0	120	560	65	0	80	67	50	0	40	102	75	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	297			181			178			862						
Exiting Flow (V_{ex}), pc/h	221			810			163			294						
Entry Flow (V_e), pc/h		175			844			223			246					
Entry Volume veh/h		172			827			219			241					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1148			1255			1257			746					
Capacity (c), veh/h		1125			1230			1232			731					
v/c Ratio (X)		0.15			0.67			0.18			0.33					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		4.5			12.1			4.4			9.0					
Lane LOS		A			B			A			A					
Lane 95% Queue		0.5			5.6			0.6			1.4					
Approach Delay, s/veh	4.54			12.08			4.44			8.98						
Approach LOS, s/veh	A			B			A			A						
Intersection Delay, s/veh	9.53															
Intersection LOS	A															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	2/27/2014						N/S Street Name	119th Street								
Time Period	PM Peak						Analysis Year	2017 Total								
Peak Hour Factor	0.90						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	34	520	80	0	40	150	43	0	35	77	120	0	50	44	18	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	152			166			685			255						
Exiting Flow (V_{ex}), pc/h	782			230			175			186						
Entry Flow (V_e), pc/h		719			264			263			127					
Entry Volume veh/h		705			259			258			125					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1282			1269			854			1185					
Capacity (c), veh/h		1257			1244			837			1162					
v/c Ratio (X)		0.56			0.21			0.31			0.11					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		9.3			4.7			7.7			4.0					
Lane LOS		A			A			A			A					
Lane 95% Queue		3.6			0.8			1.3			0.4					
Approach Delay, s/veh	9.26			4.69			7.74			4.01						
Approach LOS, s/veh	A			A			A			A						
Intersection Delay, s/veh	7.60															
Intersection LOS	A															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	2/27/2014						N/S Street Name	119th Street								
Time Period	AM Peak						Analysis Year	2035 Background								
Peak Hour Factor	0.92						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	10	155	60	0	195	690	75	0	130	85	80	0	35	120	85	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	388			249			222			1125						
Exiting Flow (V_{ex}), pc/h	299			1003			188			416						
Entry Flow (V_e), pc/h		249			1064			327			266					
Entry Volume veh/h		244			1043			321			261					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1071			1190			1216			610					
Capacity (c), veh/h		1050			1167			1192			598					
v/c Ratio (X)		0.23			0.89			0.27			0.44					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		5.6			26.2			5.5			12.8					
Lane LOS		A			D			A			B					
Lane 95% Queue		0.9			13.5			1.1			2.2					
Approach Delay, s/veh	5.63			26.23			5.47			12.77						
Approach LOS, s/veh	A			D			A			B						
Intersection Delay, s/veh	18.10															
Intersection LOS	C															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	2/27/2014						N/S Street Name	119th Street								
Time Period	PM Peak						Analysis Year	2035 Background								
Peak Hour Factor	0.92						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	30	740	130	0	65	275	35	0	55	95	195	0	55	50	15	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	188			199			914			438						
Exiting Flow (V_{ex}), pc/h	1098			382			177			272						
Entry Flow (V_e), pc/h		998			416			382			133					
Entry Volume veh/h		978			408			375			130					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1247			1236			716			1031					
Capacity (c), veh/h		1222			1212			702			1010					
v/c Ratio (X)		0.80			0.34			0.53			0.13					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		17.5			6.2			13.5			4.7					
Lane LOS		C			A			B			A					
Lane 95% Queue		9.2			1.5			3.2			0.4					
Approach Delay, s/veh	17.53			6.15			13.50			4.74						
Approach LOS, s/veh	C			A			B			A						
Intersection Delay, s/veh	13.40															
Intersection LOS	B															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	2/27/2014						N/S Street Name	N. 119th Street								
Time Period	AM Peak						Analysis Year	2035 Total								
Peak Hour Factor	0.92						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	14	155	60	0	195	690	80	0	130	87	80	0	49	127	95	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	411			256			242			1125						
Exiting Flow (V_{ex}), pc/h	315			1014			201			424						
Entry Flow (V_e), pc/h		254			1070			329			300					
Entry Volume veh/h		249			1049			323			294					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1052			1184			1197			610					
Capacity (c), veh/h		1031			1161			1174			598					
v/c Ratio (X)		0.24			0.90			0.27			0.49					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		5.8			27.5			5.6			14.2					
Lane LOS		A			D			A			B					
Lane 95% Queue		0.9			14.0			1.1			2.7					
Approach Delay, s/veh	5.81			27.53			5.60			14.16						
Approach LOS, s/veh	A			D			A			B						
Intersection Delay, s/veh	18.95															
Intersection LOS	C															

ROUNDBABOUT REPORT																
General Information							Site Information									
Analyst	CSM						Intersection	Erie Parkway / 119th Street								
Agency or Co.	LSC						E/W Street Name	Erie Parkway								
Date Performed	2/27/2014						N/S Street Name	119th Street								
Time Period	PM Peak						Analysis Year	2035 Total								
Peak Hour Factor	0.92						Project ID	LSC #120760								
Project Description:																
Volume Adjustment and Site Characteristics																
	EB				WB				NB				SB			
	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	U
Number of Lanes (N)	0	1	0		0	1	0		0	1	0		0	1	0	
Lane Assignment	LTR				LTR				LTR				LTR			
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Volume (V), veh/h	42	740	130	0	65	275	51	0	55	102	195	0	64	54	22	0
Heavy Veh. Adj. (f_{HV}), %	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pedestrians Crossing	0				0				0				0			
Critical and Follow-Up Headway Adjustment																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Critical Headway (sec)	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929	5.1929	4.0000	5.1929				
Follow-Up Headway (sec)	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858	3.1858	2.5000	3.1858				
Flow Computations																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Circulating Flow (V_c), pc/h	203			221			938			438						
Exiting Flow (V_{ex}), pc/h	1108			390			216			276						
Entry Flow (V_e), pc/h		1011			433			390			155					
Entry Volume veh/h		991			425			382			152					
Capacity and v/c Ratios																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Capacity (c_{PCE}), pc/h		1233			1217			703			1031					
Capacity (c), veh/h		1209			1193			690			1010					
v/c Ratio (X)		0.82			0.36			0.55			0.15					
Delay and Level of Service																
	EB			WB			NB			SB						
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass				
Lane Control Delay (d), s/veh		18.9			6.5			14.3			4.9					
Lane LOS		C			A			B			A					
Lane 95% Queue		10.0			1.6			3.4			0.5					
Approach Delay, s/veh	18.90			6.45			14.28			4.95						
Approach LOS, s/veh	C			A			B			A						
Intersection Delay, s/veh	14.19															
Intersection LOS	B															