



**FLATIRON MEADOWS – PLANNING AREA H  
PHASE II DRAINAGE REPORT**

**JULY 2017**

**For:**  
**HT FLATIRON LP**  
**1515 WYNKOOP STREET, SUITE 800**  
**DENVER, CO 80202**



# FLATIRON MEADOWS – PLANNING AREA H

## PHASE II DRAINAGE REPORT

Page ii of ii

### TABLE OF CONTENTS

<b>SCOPE</b> .....	<b>1</b>
<b>I. INTRODUCTION</b> .....	<b>1</b>
A. Location .....	1
B. Description of Property .....	1
<b>II. DRAINAGE BASINS</b> .....	<b>1</b>
A. Major Basin Description .....	1
B. Sub-Basin Description .....	2
<b>III. DRAINAGE DESIGN CRITERIA</b> .....	<b>2</b>
A. Development Criteria Reference and Constraints .....	2
B. Hydrologic Criteria .....	2
C. Hydraulic Criteria .....	2
D. Adaptations from Criteria .....	3
<b>IV. DRAINAGE FACILITY DESIGN</b> .....	<b>3</b>
A. General Concept .....	3
B. Specific Details .....	3
<b>V. BEST MANAGEMENT PRACTICES</b> .....	<b>4</b>
A. Construction BMP's .....	4
B. Permanent BMP's .....	4
<b>VI. SUMMARY</b> .....	<b>5</b>
A. Compliance with CRITERIA, MANUAL, and OSP .....	5
B. Drainage Concept .....	5
<b>VII. LIST OF REFERENCES</b> .....	<b>5</b>

### APPENDICES

- A. Maps and Exhibits
- B. Hydrologic Computations
- C. Hydraulic Computations
- D. Copies of Graphs, Tables, and Nomographs Used

# FLATIRON MEADOWS – PLANNING AREA H

## PHASE II DRAINAGE REPORT

Page 1 of 5

### SCOPE

The purpose of this report is to support the projected drainage patterns of the Master Drainage Plan for the Flatiron Meadows development and to describe how the current design has incorporated the recommendations set forth in the *Town of Erie Outfall Systems Plan, West of Coal Creek (OSP)*, dated January 2014. This report includes analysis and design of locations of proposed inlets and storm systems in general accordance with the standards and specifications of the Town of Erie and Urban Drainage Flood Control District (UDFCD).

## I. INTRODUCTION

### A. Location

- The site is bound to the west by North 111<sup>th</sup> Street, to the south by Prince Lake Number 2, to the east by Flatiron Meadows Boulevard, and to the north by Filing 11 and Planning Area C.
- Within the southwest quarter of Section 23, Township 1 North, Range 69 West of the 6<sup>th</sup> Principal Meridian, Town of Erie, County of Boulder, State of Colorado.
- The Prince Tributary is adjacent to the site, flowing from south to north.
- An existing oil/gas facility and the Regional Detention Pond 1029 are north of the site.
- See the Vicinity Map and Filing Map in Appendix A.

### B. Description of Property

- Flatiron Meadows – Planning Area H is approximately 19 acres of single family attached development.
- The existing ground cover is farmed land with agricultural soils.
- The drainage way is lined with shrubs, native grasses, and large cottonwood trees.
- The site has gentle to moderate slopes between 1% and 4%, sloping towards the northeast.
- According to the *Natural Resources Conservation Service Web Soil Survey* for the County of Boulder, the site is Hydrologic Soil Group B as Ascalon Sandy Loam (AcC).
- The Leyner Cottonwood Ditch is north of the site, flowing from west to east.
- The proposed Planning Area H development will consist of approximately 122 single family residential units, open space and roadways.
- There are delineated wetland areas within the Prince Tributary; however, no wetlands will be disturbed with the development of Planning Area H.

## II. DRAINAGE BASINS

### A. Major Basin Description

- Flatiron Meadows – Planning Area H is located within the limits of the *Town of Erie Outfall Systems Plan, West of Coal Creek (OSP)*. Planning Area H is within the OSP major Basins 215 and 211. The OSP indicates both these basins will drain to the Prince

# FLATIRON MEADOWS – PLANNING AREA H

## PHASE II DRAINAGE REPORT

### Page 2 of 5

Tributary and then to Regional Detention Facility 1029. Copies of applicable pages from the OSP are included in Appendix A.

- The site is found on FEMA Flood Insurance Rate Map (FIRM) panels 08013C0437J and 08013C0439J. A portion of the site is within Zone AE and the mapped 100-year floodplain. A CLOMR was approved in May 2008 for a modification of the floodplain.
- There are no lots within the existing FEMA floodplain.
- The ownership of all lakes and ponds will not influence or be influenced by the local drainage. There are no jurisdictional dams onsite.

#### B. Sub-Basin Description

- There are no Master Plan improvements designated for the site. The Regional Detention Pond has been constructed.
- Currently the site drains to the northeast towards the Prince Tributary.
- From west side of 111<sup>th</sup> will follow historic patterns.
- The increase in storm runoff due to the proposed development will be detained in the Regional Detention Pond 1029 via Prince Tributary. The proposed development will not increase historic runoff and therefore downstream properties should not be adversely affected by the development of the proposed site.

### III. DRAINAGE DESIGN CRITERIA

#### A. Development Criteria Reference and Constraints

- Criteria and references used in the development of this Phase II Drainage Report include:
  - The Town of Erie Standards and Specifications Storm Criteria
  - The Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual* was also used as a reference and guide for criteria.
  - The Town of Erie *Outfall Systems Plan, West of Coal Creek* (OSP) prepared by RESPEC Consulting and Services, January 2014.
  - There are delineated wetlands onsite. Any impact to wetlands is described in the *Flatiron Meadows Phase II Regional Drainage Improvements Report*.

#### B. Hydrologic Criteria

Per the *Town of Erie Standards and Specifications Storm Criteria*:

- The minor event is the 2-year storm.
- The major event is the 100-year storm.
- The one hour design rainfall depths are:
  - 2-year = 1.01 inches per hour.
  - 100-year = 2.70 inches per hour.
- The Rational Method was used for all hydrologic calculations.
- The Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual* (USDGM) was also used as a reference and guide for criteria.

# FLATIRON MEADOWS – PLANNING AREA H

## PHASE II DRAINAGE REPORT

### Page 3 of 5

- Per the *Town of Erie Standards and Specifications Storm Criteria*, Table 800-3 was used to determine the appropriate imperviousness values.
- Per UDFCD Volume 1, Table 6-3, the percent imperviousness for Single Family use with lots less than a ¼ acre in size is 45%.
- Runoff coefficients were determined by the equations found in UDFCD Volume 1, Table 6-4.

#### C. Hydraulic Criteria

- Per the OSP, regional detention facilities will be constructed on the Flatiron Meadows Development, controlling the release rates before leaving the site.
- A Hydraflow Storm Sewer model was used to size storm pipes. Results are included in Appendix C.
- Per *Town of Erie Standards and Specifications Storm Criteria*, Tables 800-7 and 800-8, allowable flow depths within the streets are:
  - To the top of curb (4.0" for mountable, 6.0" for vertical curb), flow may spread to crown of street for the minor event (5.6").
  - Residential dwellings should be no less than 12 inches above the 100-year flood at the ground line or lowest water entry of the building. The depth of water over the gutter flow line will not exceed 18 inches for the major storm.
- For this analysis, a more conservative flow depth to the Right-of-Way (6.92" for mountable, 9" for vertical curb) will be used for the major storm event.
- The Urban Drainage Inlet Spreadsheet was used to size inlets and calculate street capacity. Results are included in Appendix C.

#### D. Adaptations from Criteria

- The drainage study for Flatiron Meadows – Planning Area H improvements is in general compliance with the *Town of Erie Standards and Specifications Drainage Criteria* and *Urban Drainage & Flood Control District Storm Drainage Criteria Manuals 1-3*.

## IV. DRAINAGE FACILITY DESIGN

#### A. General Concept

- The proposed drainage patterns will follow existing drainage patterns as closely as possible. Runoff will flow from the southwest to the northeast, either by the streets, natural drainage ways or the proposed storm sewer system.
- Runoff from all developed areas will be routed to the Regional Detention Pond. In accordance with the OSP and Flatiron Meadows *Master Drainage Study*.

#### B. Specific Details

- Proposed drainage basins have been broken down further on site to calculate street capacity, inlet capacity and size the storm system.
  - Basin A consists of single family uses and lawn. Runoff generated in this basin is routed via curb and gutter to a Type-R inlet in sump at Design Point (DP) 1. The minor and major events are captured at this point.

# FLATIRON MEADOWS – PLANNING AREA H

## PHASE II DRAINAGE REPORT

### Page 4 of 5

- Basin B consists of single family uses and roadway. Runoff generated in this basin is routed via curb and gutter to a Type-R inlet in sump at Design Point (DP) 2. The minor and major events are captured at this design point and outfall to Prince Tributary.
- Basin C consists of single family uses. Runoff generated in this basin is conveyed in a proposed onsite vegetated swale to Design Point (DP) 3. The minor and major events are captured at this design point and outfall to Prince Tributary.
- Basins A-C utilize the same storm system, and outfall to Prince Tributary.
- Basin D consists of roadway. Runoff generated in this basin is routed via curb and gutter to a Type-R inlet in sump at Design Point (DP) 4. The minor and major events are captured at this point.
- Basin E consists of single family uses and lawn. Runoff generated in this basin is routed via curb and gutter to a Type-R inlet in sump at Design Point (DP) 5. The minor and major events are captured at this design point and outfall to Prince Tributary.
- Basins D-E utilize the same storm system, and outfall to Prince Tributary.
- Existing Basin ST2 contains a portion of the improved N 111<sup>th</sup> Street and lawn. This basin is included with the Phase II Drainage Report for Planning Area C.
- Storm sewer systems will be accessed from the proposed roads onsite.
- Easements and tracts will be used for drainage purposes in specific locations where flooding in the 100-year storm may occur.
- Other storm sewer will be kept within the right-of-way to minimize special drainage easements and tracts.
- Downstream properties will not be affected by the development of the proposed site. The regional detention and water quality pond will provide the appropriate detention to control the release from the Flatiron Meadows Development to the downstream properties to the north.
- All lots platted with Planning Area H are outside of the 100-year floodplain as shown on both the FEMA (FIRM) Map Number 0801810012E and the approved CLOMR for the site.

## V. BEST MANAGEMENT PRACTICES

### A. Construction BMP's

- Construction BMP's are discussed in a separate SWMP report.

### B. Permanent BMP's

- Permanent stabilization BMP's are discussed in a separate SWMP report.
- Detention and water quality treatment will be provided by Regional Pond 1029.

# FLATIRON MEADOWS – PLANNING AREA H

## PHASE II DRAINAGE REPORT

Page 5 of 5

### VI. SUMMARY

- A. Compliance with CRITERIA, MANUAL, and OSP
- This drainage report is in general compliance with the Town of Erie Standards and Specifications Drainage Criteria.
  - The Urban Drainage and Flood Control District's *Urban Storm Drainage Criteria Manual* was also used as a reference and guide for criteria.
  - Regional detention facilities will be constructed prior to this phase of development per the OSP recommendations.
  - Construction and Permanent Best Management Practices will be utilized for the development of Flatiron Meadows Planning Area H.
- B. Drainage Concept
- Onsite flow will be conveyed in storm sewer systems designed for the minor and major storm events.
  - A regional detention and water quality pond will control the release of runoff generated in Planning Area H.

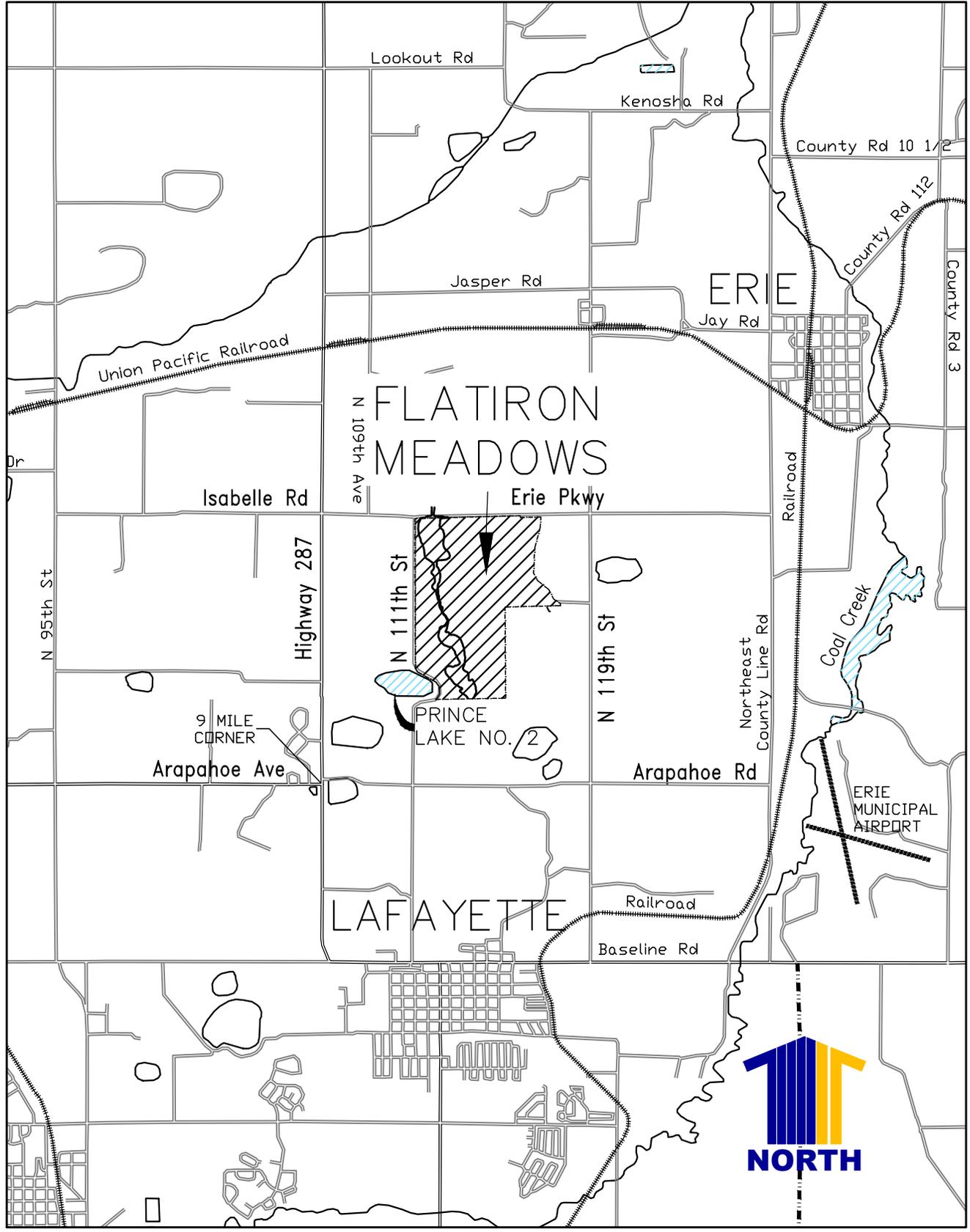
### VII. LIST OF REFERENCES

1. *The Town of Erie, Standards and Specifications for Design and Construction of Public Improvements, Section 800, Storm Drainage Facilities*, 2012 Edition.
2. *Urban Storm Drainage Criteria Manuals*, Urban Drainage Flood Control District, Jan 2007.
3. *Town of Erie Outfall Systems Plan (West of Coal Creek) Alternatives Analysis Report (referred to as OSP in this report)*, prepared by WRC Engineering, Inc., June 2013.
4. *Flood Insurance Rate Map, Map Numbers 08013C0437J and 08013C0439J*, Effective Date December 18, 2012, Federal Emergency Management Agency.
5. Hydrologic Group Rating for Adams County, CO, USDA Natural Resources Conservation Service.
6. *Flatiron Meadows Master Drainage Study*, Calibre Engineering Inc., September 2008
7. *Flatiron Meadows Phase III Drainage Report, Regional Drainage Improvements*, Calibre Engineering Inc., January 2014.
8. *Flatiron Meadows Phase II Drainage Report, Planning Area C*, Calibre Engineering Inc., January 2017.
9. *Prince Lake No. 2 Dam Breach Analysis*, Olsson Associates, March 31, 2008.

APPENDIX A.  
MAPS AND EXHIBITS

P:\WORTH FLATIRON\CADD\Exhibits\10DR-VICINITY MAP.dwg, 3/26/2014 9:15:30 AM, KHouse, 1:1

DRAWING NAME: 10DR-VICINITY MAP.dwg PATH: P:\WORTH FLATIRON\CADD\Exhibits\ PLOTTED BY: KHouse XREFS:



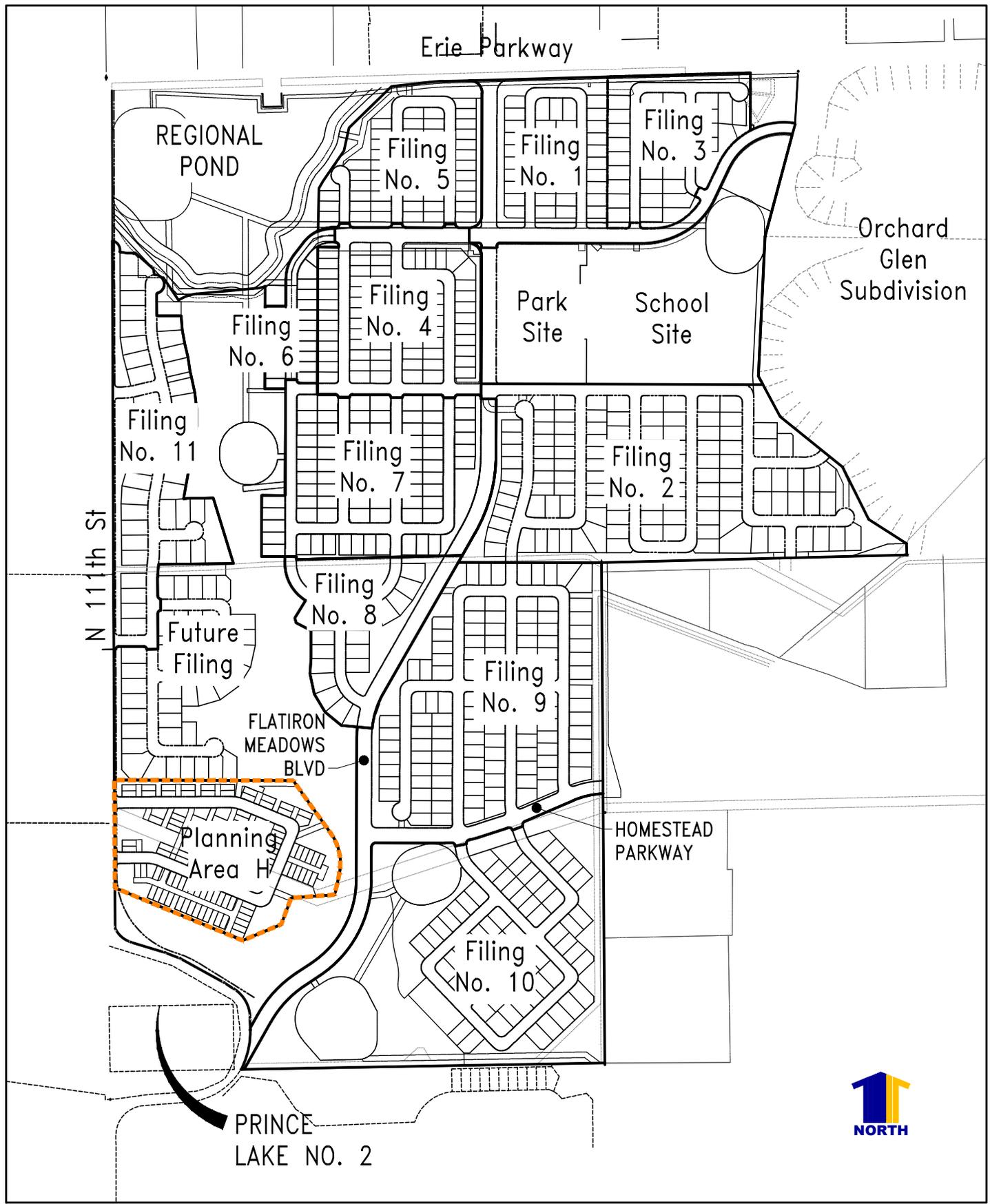
Calibre Engineering, Inc.  
 9090 South Ridgeline Boulevard, Suite 105  
 Highlands Ranch, CO 80129 (303) 730-0434  
 www.calibre-engineering.com  
 Construction Management Civil Engineering Surveying

# FLATIRON MEADOWS VICINITY MAP

SHEET  
**VM1**

SCALE: N.T.S.  
DATE:  
MAY 2016

DRAWING NAME: 140DR-FILING MAP.dwg PLOT BY: LAIF XREFS: 140BASE, 52BASE, 51BASE, 120BASE, 90BASE, 42BASE, 80BASE, 70BASE, 41BASE, 34BASE



**Calibre**

Calibre Engineering, Inc.  
 9090 South Ridgeline Boulevard, Suite 105  
 Highlands Ranch, CO 80129 (303) 730-0434  
 www.calibre-engineering.com  
 Construction Management Civil Engineering Surveying

**FLATIRON MEADOWS**  
**FILING MAP**

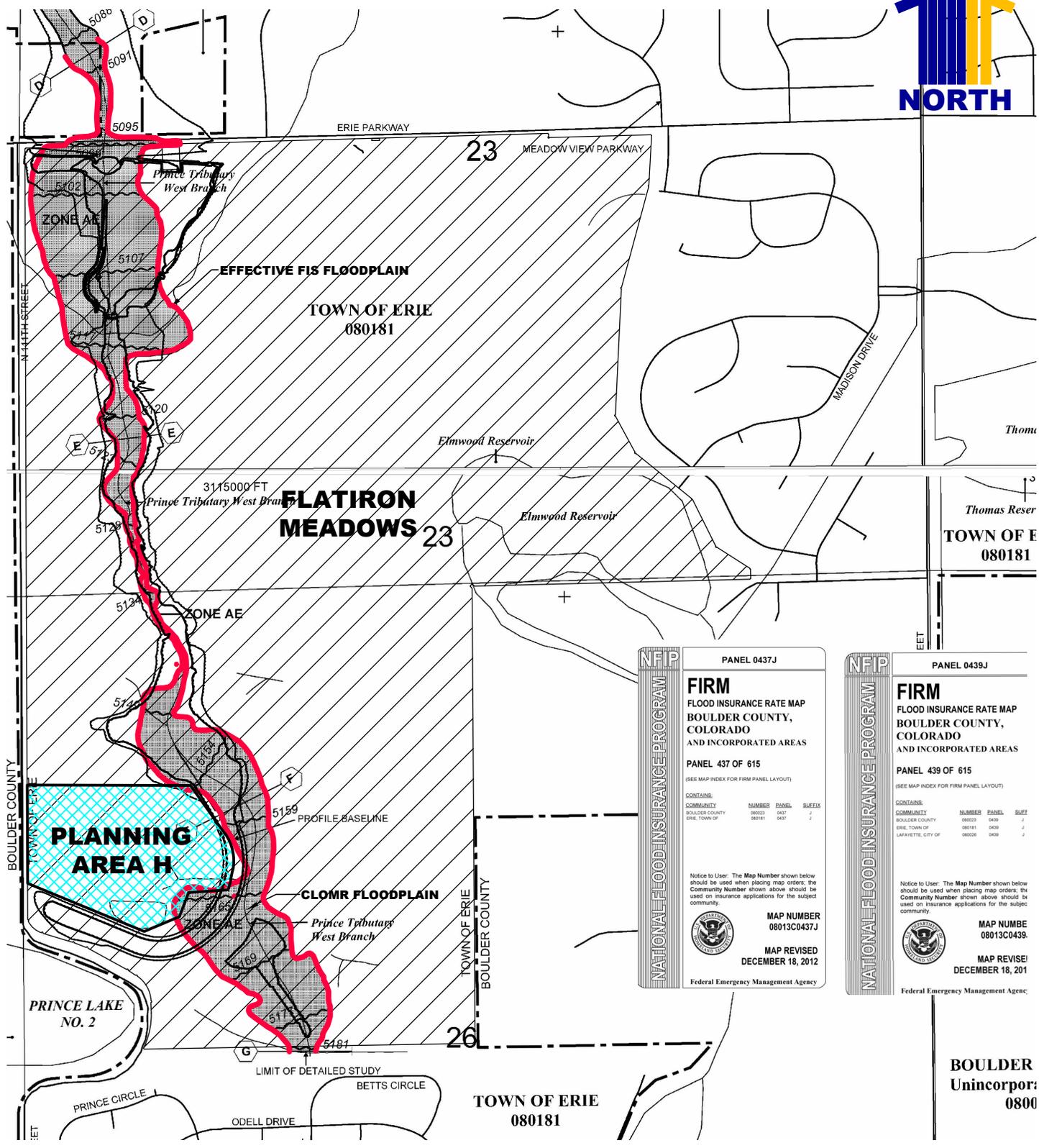
SHEET

SCALE: N.T.S.  
 DATE:  
 FEBRUARY 2017

DRAWING NAME: 140DR-FEMA.dwg

PATH: P:\WORTH FLATIRON\CADD\Exhibits\ PLOTTED BY: LAIF

XREFS: 140BASE, W=Water Surface, FIS-Fldplanr, ACAD-30BASE.



**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	08023	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

**NATIONAL FLOOD INSURANCE PROGRAM**

**PANEL 0439J**

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

**PANEL 439 OF 615**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS	COMMUNITY	NUMBER	PANEL	SUFFIX
BOULDER COUNTY	08023	0439	J	
ERIE, TOWN OF	080181	0439	J	
LAFAYETTE, CITY OF	08028	0439	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**  
08013C0439J

**MAP REVISED**  
DECEMBER 18, 2012

Federal Emergency Management Agency

**BOULDER**  
Unincorporated  
0800

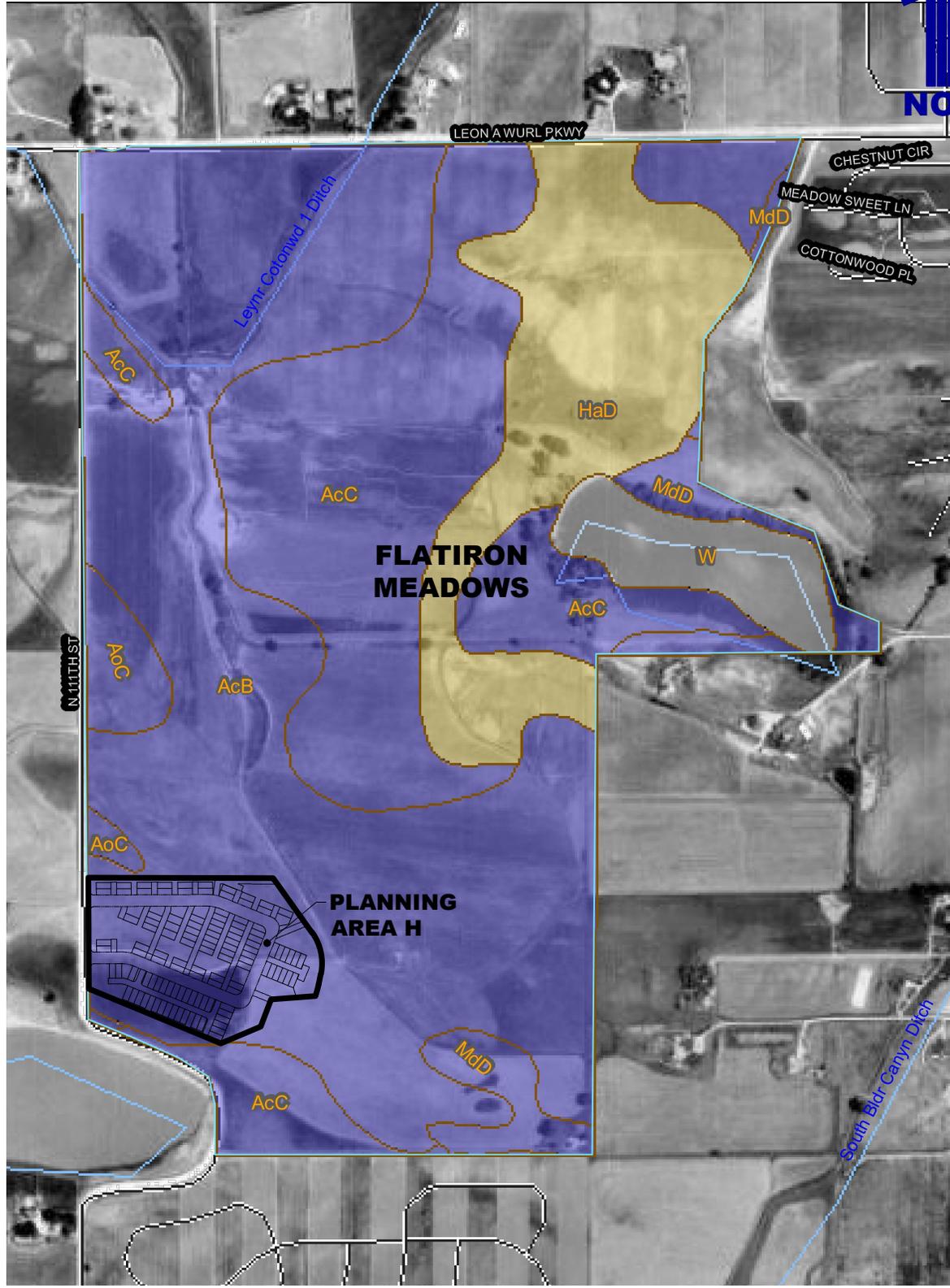


Calibre Engineering, Inc.  
9090 South Ridgeline Boulevard, Suite 105  
Highlands Ranch, CO 80129 (303) 730-0434  
www.calibre-engineering.com  
Construction Management Civil Engineering Surveying

# FLATIRON MEADOWS PLANNING AREA H FEMA MAP

SHEET  
**FM1**

SCALE: 1" = 800'  
DATE:  
FEBRUARY 2017



XREFS: 140BASE

P:\WORTH FLATIRON\CADD\Exhibits\ PLOTTED BY: LAIF

PATH:

DRAWING NAME: 140DR-SOILS.dwg



Calibre Engineering, Inc.  
9090 South Ridgeline Boulevard, Suite 105  
Highlands Ranch, CO 80129 (303) 730-0434  
www.calibre-engineering.com  
Construction Management Civil Engineering Surveying

# FLATIRON MEADOWS PLANNING AREA H SOILS MAP

SHEET

## SM1

SCALE: 1" = 800'

DATE:  
FEBRUARY 2017

## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Units

### Soil Ratings

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

### Political Features

 Cities  
 PLSS Township and Range  
 PLSS Section

### Water Features

 Streams and Canals

### Transportation

 Rails  
 Interstate Highways  
 US Routes  
 Major Roads  
 Local Roads

## MAP INFORMATION

Map Scale: 1:3,590 if printed on A size (8.5" × 11") sheet.

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 accurate map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>

Coordinate System: UTM Zone 13N NAD83

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 9, May 1, 2009

Date(s) aerial images were photographed: 8/6/2005

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
AcB	Ascalon sandy loam, 1 to 3 percent slopes	B	14.3	21.8%
AcC	Ascalon sandy loam, 3 to 5 percent slopes	B	46.8	71.1%
HaD	Hargreave fine sandy loam, 3 to 9 percent slopes	C	4.7	7.2%
<b>Totals for Area of Interest</b>			<b>65.8</b>	<b>100.0%</b>

### 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:

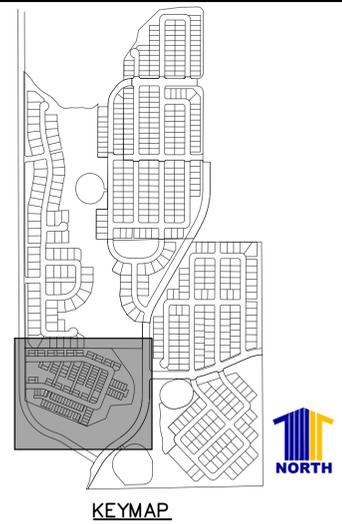
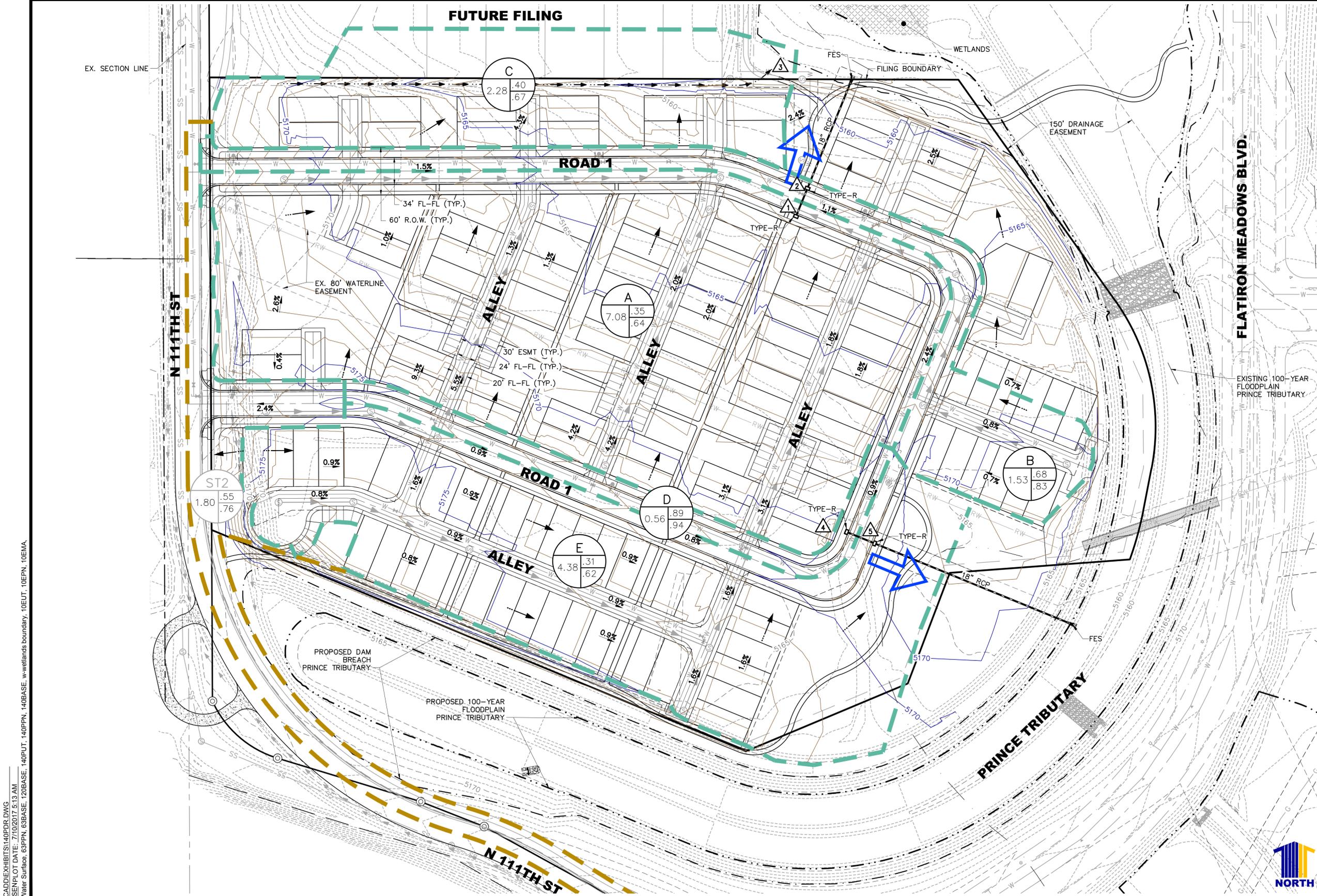
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

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.



**LEGEND**

- PROPOSED MAJOR CONTOUR (5') — 5250 —
- PROPOSED MINOR CONTOUR (1') - - - - -
- EXISTING MINOR CONTOUR (1') - - - - -
- EXISTING MAJOR CONTOUR (5') - - - - - 5250 - - - - -
- PROPOSED STORM DRAIN PIPE ————
- PROPOSED STORM DRAIN INLET [Symbol]
- DIRECTIONAL FLOW ARROW [Symbol]
- PROPOSED BASIN LINE ————
- EXISTING BASIN LINE ————
- SWALE [Symbol]
- DESIGN POINT [Symbol]
- EMERGENCY OVERFLOW [Symbol]

PROPOSED BASIN LABEL

C-6	BASIN DESIGNATION
	AREA (AC.) 1.00
.40	MINOR RUNOFF COEF.
	.60
.60	MAJOR RUNOFF COEF.

EXISTING BASIN LABEL

C-6	BASIN DESIGNATION
	AREA (AC.) 1.00
.40	MINOR RUNOFF COEF.
	.60
.60	MAJOR RUNOFF COEF.

**SUMMARY RUNOFF TABLE**

DESIGN PT.	BASIN	AREA (ACRES)	ROUTED Q <sub>2</sub> (CFS)	ROUTED Q <sub>100</sub> (CFS)
1	A	7.08	5.3	14.3
2	B	1.53	6.7	17.9
3	C	2.28	7.5	20.1
4	D	0.56	1.6	4.3
5	E	4.38	4.1	10.9

PATH: P:\WORTH FLATIRON\CAD\EXHIBITS\140PDR.DWG  
 PLOTTED BY: COREY PETERSEN\DATE: 7/10/2017 5:13 AM  
 XREFS: 63PJT, 120PUT, W-Water Surface, 63PPN, 63BASE, 120BASE, 140PUT, 140PPN, 140BASE, W-wetlands boundary, 10EUT, 10EPPN, 10EMA

DATE	REVISION	DESCRIPTION

Drawing Name	140PDR.dwg
Job Number	HINES PA C PP
Prepared For	HT FLATIRON LP

Designer	LMA	Drafter	LMA	Checked	BKM
----------	-----	---------	-----	---------	-----

**Calibre**  
 Calibre Engineering, Inc.  
 9090 South Ridgeline Boulevard, Suite 105  
 Highlands Ranch, CO 80129 (303) 730-0434  
 www.calibre-engineering.com  
 Construction Management Civil Engineering Surveying

**FLATIRON MEADOWS**  
**PLANNING AREA H - IMPROVEMENT PLANS**  
**PROPOSED DRAINAGE PLAN**

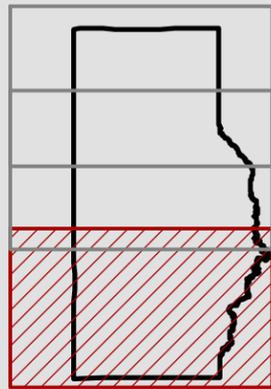
Sheet  
**DR1**  
 Date  
 JULY 2017

# LEGEND

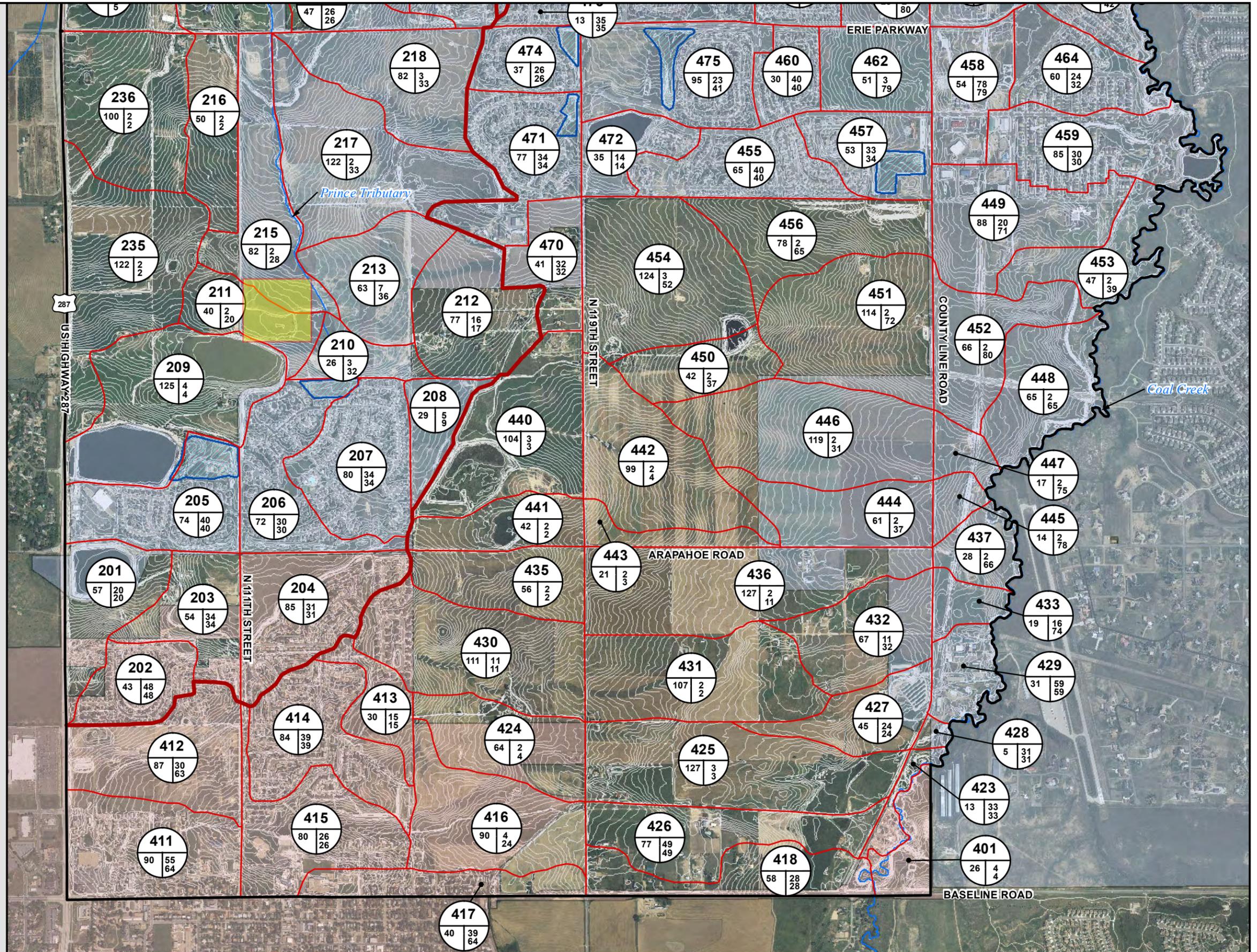
- Study Area Boundary
- Town of Erie
- City of Lafayette
- Subbasin Boundary
- Major Watershed Boundary
- Regional Detention Ponds

- Subbasin ID  
 % Impervious (Existing Land Use)  
 % Impervious (Future Land Use)  
 Area (Acres)

## KEY MAP



0 750 1,500 3,000 Feet  
 1" = 1,500 FT



M:\2234\GIS\2234\_MXD - 12/12/12 - NRT

APPENDIX B.  
HYDROLOGIC COMPUTATIONS



COMPOSITE 'C' FACTORS

LOCATION:

TOWN OF ERIE

DATE : 2/22/2017

BASIN DESIGNATION						SOIL TYPE	PAVED			LAWNS			SINGLE FAMILY			WALK			COMP. C FACTOR		
	PAVED	LAWNS	SINGLE FAMILY	WALK	TOTAL		%I	2YR	100 YR	%I	2YR	100 YR	%I	2YR	100 YR	%I	2YR	100 YR	%I	2YR	100 YR
A		1.02	6.06		7.08	B	100	0.89	0.94	2	0.02	0.46	45	0.40	0.67	90	0.80	0.90	39	0.35	0.64
B	0.88		0.65		1.53	B	100	0.89	0.94	2	0.02	0.46	45	0.40	0.67	90	0.80	0.90	77	0.68	0.83
C			2.28		2.28	B	100	0.89	0.94	2	0.02	0.46	45	0.40	0.67	90	0.80	0.90	45	0.40	0.67
D	0.56				0.56	B	100	0.89	0.94	2	0.02	0.46	45	0.40	0.67	90	0.80	0.90	100	0.89	0.94
E		1.08	3.30		4.38	B	100	0.89	0.94	2	0.02	0.46	45	0.40	0.67	90	0.80	0.90	34	0.31	0.62



TIME OF CONCENTRATION															REMARKS	
LOCATION:			PLANNING AREA H				FLATIRON MEADOWS				BY: LMA		DATE: 2/22/2017		* $V=Cv(Sw^{1/2})$ ** $Ti = 0.395 (1.1-C5)L^{0.5}/S^{1/3}$ *** $Tc = (18-15i)+L/[60*(24i+12)]*So^{0.5}$ where Cv=15 for grassed waterways and 20 for paved areas	
BASIN DATA			INIT./OVERLAND TIME (Ti)				TRAVEL TIME (Tt)				TOTAL	Tc Check	FINAL Tc			
DESIGNATION	% Imperv	C5	AREA (AC)	LENGTH (FT)	SLOPE %	Ti (Min.)*	GRASS/PAVED	LENGTH (FT)	SLOPE %	VEL. (FPS)**	Tt(Min.)	Tt+Ti(Min.)	LENGTH (FT)	Urbanized Basins Tc (min)***		
A	39	0.36	7.08	296	2.0	18.5	PAVED	689	1.5	2.4	4.7	23.2	985	16.6	16.6	
B	30	0.71	1.53	43	2.0	3.7	PAVED	713	1.5	2.4	4.9	8.5	756	18.6	8.5	
C	45	0.42	2.28	122	3.0	9.6	GRASS	633	2.0	2.1	5.0	14.5	755	14.5	14.5	
D	100	0.93	0.56	8	2.0	0.7	PAVED	698	0.9	1.9	6.1	6.8	706	6.4	6.4	
E	34	0.32	4.38	80	3.0	8.9	PAVED	863	1.0	2.0	7.2	16.1	943	19.9	16.1	



STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)  
DESIGN STORM: 2-YEAR DEVELOPED

LMA  
KLH  
2/22/2017

LOCATION:                      PLANNING AREA H                      FLATIRON MEADOWS                      TOWN OF ERIE

STRUCTURE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF					REMARKS
		BASIN	AREA (AC)	COEFF. (C)	Tc (Min.)	C*A	I (in./hr.)	Q (cfs)	SUM AREA	SUM Tc (min.)	I (in./hr.)	SUM CA	TOTAL Q (cfs)	
IN-1	1	A	7.08	0.35	17	2.45	2.19	5.3						A
IN-2	2	B	1.53	0.68	9	1.04	2.90	3.0	8.61	21.4	1.92	3.49	6.7	A+B
SWALE	3	C	2.28	0.40	15	0.91	2.33	2.1	10.89	26.4	1.71	4.40	7.5	A+B+C
IN-3	4	D	0.56	0.89	6	0.50	3.19	1.6						D
IN-4	5	E	4.38	0.31	16	1.34	2.22	3.0	4.94	16.1	2.22	1.84	4.1	D+E

Notes: "Total Runoff" reflects total routed runoff using rational method. For total runoff plus carryover see "Storm Drainage System Design" sheet.



# STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

DESIGN STORM: 100-YEAR DEVELOPED

LMA

KLH

LOCATION:

PLANNING AREA H

FLATIRON MEADOWS

TOWN OF ERIE 2/22/2017

STRUCTURE	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF					REMARKS
		BASIN	AREA (AC)	COEFF. (C)	Tc (Min.)	C*A	I (in./hr.)	Q (cfs)	SUM AREA	SUM Tc (min.)	I (in./hr.)	SUM CA	Total Q (cfs)	
IN-1	1	A	7.08	0.35	17	2.45	5.84	14.3						A
IN-2	2	B	1.53	0.68	9	1.04	7.75	8.1	8.61	21.4	5.12	3.49	17.9	A+B
SWALE	3	C	2.28	0.40	15	0.91	6.22	5.7	10.89	26.4	4.56	4.40	20.1	A+B+C
IN-3	4	D	0.56	0.89	6	0.50	8.54	4.3						D
IN-4	5	E	4.38	0.31	16	1.34	5.93	8.0	4.94	16.1	5.93	1.84	10.9	D+E

Notes: "Total Runoff" reflects total routed runoff using rational method. For total runoff plus carryover see "Storm Drainage System Design" sheet.

APPENDIX C.  
HYDRAULIC COMPUTATIONS

STORM DRAINAGE SYSTEM DESIGN



Calc. by: LMA

Chk'd by: KLH

Date: 2/22/2017

LOCATION: PLANNING AREA H

CITY OF: TOWN OF ERIE

Design Point	Basin	Allowable Street Capacities				MINOR STORM EVENT (2YR)					MAJOR STORM EVENT (100YR)					Structure Label	Inlet Type (ft)	Design Event	Comments
		Slope (%)	Q <sub>2</sub> (CFS)	Q <sub>100</sub> (CFS)	St. Crown	Q <sub>2</sub> (Direct) (cfs)	Q <sub>2</sub> (Routed) (cfs)	Q <sub>2</sub> + CO (cfs)	Captured Q <sub>2</sub> (cfs)	Q <sub>2</sub> Flow CO (cfs)	Q <sub>100</sub> (Direct) (cfs)	Q <sub>100</sub> (Routed) (cfs)	Q <sub>100</sub> + CO (cfs)	Captured Q <sub>100</sub> (cfs)	Q <sub>100</sub> Flow CO (cfs)				
1	A	1.5	13.3	59.5	13.3	5.3	5.3	5.3	5.3	0.0	14.3	14.3	14.3	14.3	0.0	IN-1	10 ' Type-R	100-year	Sump inlet, events captured
2	B	1.5	13.3	59.5	13.3	3.0	6.7	6.7	6.7	0.0	8.1	17.9	17.9	17.9	0.0	IN-2	10 ' Type-R	100-year	Sump inlet, events captured
4	D	0.9	10.3	46.1	10.3	1.6	1.6	1.6	1.6	0.0	4.3	4.3	4.3	4.3	0.0	IN-3	5 ' Type-R	100-year	Sump inlet, events captured
5	E	0.9	10.3	46.1	10.3	3.0	4.1	4.1	4.1	0.0	8.0	10.9	10.9	10.9	0.0	IN-4	10 ' Type-R	100-year	Sump inlet, events captured

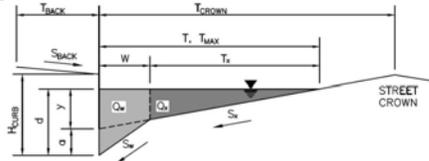
Notes:

1. Local Street: Allowable flow depth based on curb height or street crown for the minor event and spread at ROW for major event.  
Collector Street: Allowable flow depth based on 10' travel path in minor event, spread at ROW for major event.
2. Street capacities were calculated with UDFCDs UD-Inlet

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

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

Project: Flatiron Meadows  
 Inlet ID: Basin A - DP1

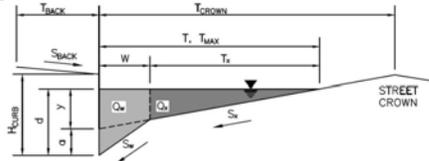


Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 13.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft						
Gutter Width	$W = 2.00$ 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	$S_o = 0.015$ 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"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>ft</th> </tr> <tr> <td><math>T_{MAX} = 17.0</math></td> <td><math>T_{MAX} = 17.0</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	ft	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$	
Minor Storm	Major Storm	ft					
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>inches</th> </tr> <tr> <td><math>d_{MAX} = 5.6</math></td> <td><math>d_{MAX} = 9.0</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	inches	$d_{MAX} = 5.6$	$d_{MAX} = 9.0$	
Minor Storm	Major Storm	inches					
$d_{MAX} = 5.6$	$d_{MAX} = 9.0$						
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> Minor Storm <input checked="" type="checkbox"/> Major Storm    check = yes						
<b>MINOR STORM Allowable Capacity is based on Spread Criterion</b>							
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>							
Allowable Capacity	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>cfs</th> </tr> <tr> <td><math>Q_{allow} = 13.3</math></td> <td><math>Q_{allow} = 59.5</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	cfs	$Q_{allow} = 13.3$	$Q_{allow} = 59.5$	
Minor Storm	Major Storm	cfs					
$Q_{allow} = 13.3$	$Q_{allow} = 59.5$						
<p><b>Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</b></p> <p><b>Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</b></p>							

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

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

Project: Flatiron Meadows  
 Inlet ID: Basin B - DP2

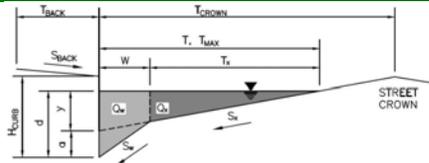


Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 13.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft						
Gutter Width	$W = 2.00$ 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	$S_o = 0.015$ 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"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>ft</th> </tr> <tr> <td><math>T_{MAX} = 17.0</math></td> <td><math>T_{MAX} = 17.0</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	ft	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$	
Minor Storm	Major Storm	ft					
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>inches</th> </tr> <tr> <td><math>d_{MAX} = 5.6</math></td> <td><math>d_{MAX} = 9.0</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	inches	$d_{MAX} = 5.6$	$d_{MAX} = 9.0$	
Minor Storm	Major Storm	inches					
$d_{MAX} = 5.6$	$d_{MAX} = 9.0$						
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> Minor Storm <input checked="" type="checkbox"/> Major Storm    check = yes						
<b>MINOR STORM Allowable Capacity is based on Spread Criterion</b>							
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>							
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>cfs</th> </tr> <tr> <td><math>Q_{allow} = 13.3</math></td> <td><math>Q_{allow} = 59.5</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	cfs	$Q_{allow} = 13.3$	$Q_{allow} = 59.5$	
Minor Storm	Major Storm	cfs					
$Q_{allow} = 13.3$	$Q_{allow} = 59.5$						
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'							

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

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

Project: Flatiron Meadows  
 Inlet ID: Basin D - DP4

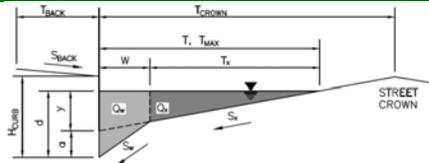


Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 13.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.020$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft						
Gutter Width	$W = 2.00$ 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	$S_o = 0.009$ 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"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>ft</th> </tr> <tr> <td><math>T_{MAX} = 17.0</math></td> <td><math>T_{MAX} = 17.0</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	ft	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$	
Minor Storm	Major Storm	ft					
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>inches</th> </tr> <tr> <td><math>d_{MAX} = 5.6</math></td> <td><math>d_{MAX} = 9.0</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	inches	$d_{MAX} = 5.6$	$d_{MAX} = 9.0$	
Minor Storm	Major Storm	inches					
$d_{MAX} = 5.6$	$d_{MAX} = 9.0$						
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/> check = yes						
<b>MINOR STORM Allowable Capacity is based on Spread Criterion</b>							
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>							
	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>cfs</th> </tr> <tr> <td><math>Q_{allow} = 10.3</math></td> <td><math>Q_{allow} = 46.1</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	cfs	$Q_{allow} = 10.3$	$Q_{allow} = 46.1$	
Minor Storm	Major Storm	cfs					
$Q_{allow} = 10.3$	$Q_{allow} = 46.1$						
<p><b>Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</b></p> <p><b>Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</b></p>							

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

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

Project: Flatiron Meadows  
 Inlet ID: Basin E - DP5



Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 13.0$ 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	$T_{CROWN} = 17.0$ ft						
Gutter Width	$W = 2.00$ 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	$S_o = 0.009$ 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"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>ft</th> </tr> <tr> <td><math>T_{MAX} = 17.0</math></td> <td><math>T_{MAX} = 17.0</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	ft	$T_{MAX} = 17.0$	$T_{MAX} = 17.0$	
Minor Storm	Major Storm	ft					
$T_{MAX} = 17.0$	$T_{MAX} = 17.0$						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>inches</th> </tr> <tr> <td><math>d_{MAX} = 5.6</math></td> <td><math>d_{MAX} = 9.0</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	inches	$d_{MAX} = 5.6$	$d_{MAX} = 9.0$	
Minor Storm	Major Storm	inches					
$d_{MAX} = 5.6$	$d_{MAX} = 9.0$						
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/> check = yes						
<b>MINOR STORM Allowable Capacity is based on Spread Criterion</b>							
<b>MAJOR STORM Allowable Capacity is based on Depth Criterion</b>							
	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th>cfs</th> </tr> <tr> <td><math>Q_{allow} = 10.3</math></td> <td><math>Q_{allow} = 46.1</math></td> <td></td> </tr> </table>	Minor Storm	Major Storm	cfs	$Q_{allow} = 10.3$	$Q_{allow} = 46.1$	
Minor Storm	Major Storm	cfs					
$Q_{allow} = 10.3$	$Q_{allow} = 46.1$						
<p><b>Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</b></p> <p><b>Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</b></p>							

APPENDIX D.  
COPIES OF GRAPHS, TABLES, AND NOMOGRAPHS USED

**Table 6-3. Recommended percentage imperviousness values**

Land Use or Surface Characteristics	Percentage Imperviousness (%)
<b>Business:</b>	
Downtown Areas	95
Suburban Areas	75
<b>Residential:</b>	
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
<b>Industrial:</b>	
Light areas	80
Heavy areas	90
<b>Parks, cemeteries</b>	10
<b>Playgrounds</b>	25
<b>Schools</b>	55
<b>Railroad yard areas</b>	50
<b>Undeveloped Areas:</b>	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
<b>Streets:</b>	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2



# **STORMWATER MANAGEMENT PLAN (SWMP) PLANNING AREA H**

**MARCH 2017**

For:  
HT Flatiron LP  
1515 Wynkoop Street, Suite 800  
Denver, CO 80202

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

Page ii

### TABLE OF CONTENTS

<b>STORMWATER MANAGEMENT PLAN CHECKLIST .....</b>	<b>iii</b>
<b>1.0 PURPOSE OF STORMWATER MANAGEMENT PLAN.....</b>	<b>1</b>
<b>2.0 NARRATIVE SITE DESCRIPTION .....</b>	<b>1</b>
a. Site Location .....	1
b. Site Description.....	1
<b>3.0 SWMP ADMINISTRATOR .....</b>	<b>2</b>
<b>4.0 STORMWATER MANAGEMENT CONTROLS.....</b>	<b>3</b>
a. Identification of Potential Pollutant Sources.....	3
b. BMPs for Stormwater Pollution Prevention .....	3
c. Revising BMPs and the SWMP .....	7
<b>5.0 FINAL STABILIZATION AND LONGTERM STORMWATER MANAGEMENT .....</b>	<b>7</b>
<b>6.0 INSPECTION AND MAINTENANCE PROCEDURES .....</b>	<b>8</b>
a. Inspection Schedule .....	8
b. Inspection Procedures .....	8
c. BMP Maintenance/Replacement and Failed BMPs .....	8
d. Record Keeping and Document Inspection.....	9
<b>7.0 REFERENCES.....</b>	<b>11</b>

### APPENDICES

- A. MAPS AND PLANS**
- B. SITE FORMS AND REPORTS**
- C. CDPHE FORMS**
- D. FIELD NOTES, CONTACTS, ETC.**

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

Page iii

### STORMWATER MANAGEMENT PLAN CHECKLIST

Permit Part I.C.1...	SWMP Site Description Required Element	Location
a.	The nature of the construction activity at the site.	Part 2.0.b
b.	The proposed sequence for major activities.	Part 2.0.b
c.	Estimates of the total area of the site, and the area and location expected to be disturbed by clearing, excavation, grading, or other construction activities.	Part 2.0.b
d.	A summary of any existing data used in the development of the site construction plans or SWMP that describe the soil or existing potential for soil erosion.	Part 2.0.b
e.	A description of the existing vegetation at the site and an estimate of the percent vegetative ground cover.	Part 2.0.b
f.	The location and description of all potential pollution sources, including ground surface disturbing activities, vehicle fueling, storage of fertilizers or chemicals, etc.	Part 2.0.b
g.	The location and description of any anticipated allowable sources of non-stormwater discharge at the site, e.g., uncontaminated springs, landscape irrigation return flow, construction dewatering, and concrete washout.	Part 2.0.b
h.	The name of the receiving water(s) and the size, type and location of any outfall(s). If the stormwater discharge is to a municipal separate storm sewer system, the name of that system, the location of the storm sewer discharge, and the ultimate receiving water(s).	Part 2.0.b
Permit Part I.C.2...	Site map, to include locations of the following:	Location
a.	construction site boundaries;	Sheets GE1-GE4 / BMP1-BMP4
b.	all areas of ground surface disturbance;	
c.	areas of cut and fill;	
d.	areas used for storage of building materials, equipment, soil, or waste;	
e.	locations of dedicated asphalt or concrete batch plants;	N/A
f.	locations of all structural BMPs;	Sheets GE1-GE4 / BMP1-BMP4
g.	locations of non-structural BMPs as applicable; and	
h.	locations of springs, streams, wetlands and other surface waters.	N/A
Permit Part I.C.3...	The following sources and activities have been evaluated for the potential to contribute pollutants to stormwater discharges:	Potential Pollutant
1.	Disturbed and stored soils;	Yes
2.	vehicle tracking of sediments;	Yes
3.	management of contaminated soils;	N/A
4.	loading and unloading operations;	Yes
5.	outdoor storage activities (building materials, fertilizers, chemicals, etc.);	Yes
6.	vehicle and equipment maintenance and fueling;	Yes
7.	significant dust or particulate generating processes;	Yes
8.	routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.	Yes
9.	on-site waste management practices (waste piles, liquid wastes, dumpsters, etc.)	Yes
10.	concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment;	Yes
11.	dedicated asphalt and concrete batch plants;	N/A
12.	non-industrial waste sources such as worker trash and portable toilets; and	Yes
13.	other areas or procedures where potential spills can occur.	N/A



# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 1

## 1.0 PURPOSE OF STORMWATER MANAGEMENT PLAN

The purpose of this Stormwater Management Plan (SWMP) is to identify possible pollutant sources that may contribute pollutants to stormwater, and identify Best Management Practices (BMPs) that, when implemented, will reduce or eliminate any possible water quality impacts. The SWMP must be completed and implemented at the time the project breaks ground and shall be located on site.

The plan has been prepared to meet the common requirements of the CDPS General Permit, Stormwater Discharges Associated With Construction Activity, Permit No. COR-030000. The plan incorporates elements that can be found in construction plans and specifications, as well as the following documents:

Urban Drainage & Flood Control District

Urban Storm Drainage Criteria Manual – Volume 3 Best Management Practices

Revised November 2010

## 2.0 NARRATIVE SITE DESCRIPTION

### a. Site Location

The Planning Area H property is located as follows:

- Within the South half of Section 23, Township 1 North, Range 69 West of the 6th Principal Meridian, Town of Erie, County of Boulder, State of Colorado.
- West of Flatiron Meadows Boulevard.
- South of Leyner Cottonwood Ditch and Erie Parkway.
- East of North 111<sup>th</sup> Street.
- North of Prince Lake Number 2.
- Surrounding developments include Candlelight Estates and Subdivision to the north, Meadow Sweet Farm to the northeast, Orchard Glen to the west, Baxter Farm to the northwest, and future Rex Ranch Subdivision to the east.
- Refer to Vicinity Map in Appendix A
- At an approximate latitude of 40°1'34" and longitude of 105°5'12".

### b. Site Description

- This SWMP covers Planning Area H construction activities including:
  - Preliminary grading of the single family residential development.
  - Utility placement within the roads where needed.

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 2

- Erosion control and landscaping.
- The proposed sequence for major activities will be:
  - Placement of erosion control measures.
  - Clearing and grubbing.
  - Rough roadway grading, single family grading.
  - Utility excavation, utility placement.
  - Street and single family fine grading, street construction, and seeding and mulching around unpaved areas.
  - Additional erosion control measures may be added at any time during the construction process if the measures in place are not sufficient. Please refer to the contractor's schedule on site for final detailed schedule of all construction activities.
- Planning Area H consists of approximately 29 acres, historically used for agricultural purposes.
- 18 acres of the site will be disturbed with construction.
- According to the *Natural Resources Conservation Service Web Soil Survey* for the Boulder County area, Colorado, the site is dominantly Hydrologic Soil Group B as Ascalon Sandy Loam.
- The existing ground cover is native grasses with agricultural soils.
- Potential pollution will come from the land disturbance caused with the construction activities.
- The site will impact Jurisdictional Waters of the US as regulated under Section 404 of the Clean Water Act. A Wetland Delineation Report has been prepared for this area mapping and identifying all Waters of the US and jurisdictional field verification from the US Army Corps of Engineers (USACE) Denver Regulatory Office has been completed with the limits to jurisdictional waters shown.
- The proposed site is located within the limits of the Town of Erie Outfall Systems Plan (West of Coal Creek) (OSP).

### 3.0 SWMP ADMINISTRATOR

The SWMP Administrator can be an individual(s), position or title responsible for developing, implementing, maintaining, and revising the SWMP. The SWMP Administrator is the contact for all SWMP-related issues and is the person responsible for its accuracy, completeness, and implementation. Therefore, the SWMP Administrator should be a person with authority to adequately manage and direct day-to-day stormwater quality management activities at the site. The SWMP Administrator for this site shall be recorded in Appendix B.

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

Page 3

### 4.0 STORMWATER MANAGEMENT CONTROLS

#### a. Identification of Potential Pollutant Sources

The following sources and activities have been identified as having potential to contribute pollutants to stormwater discharges:

- Disturbed and stored soils;
- Vehicle tracking of sediments;
- Management of contaminated soils;
- Loading and unloading operations;
- Outdoor storage activities (building materials, fertilizers, chemicals, etc.);
- Vehicle and equipment maintenance and fuelling;
- Significant dust or particulate generating processes;
- Routine maintenance activities involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.;
- On-site waste management practices (waste piles, liquid wastes, dumpsters, etc.);
- Concrete truck/equipment washing, including the concrete truck chute and associated fixtures and equipment;
- Dedicated asphalt and concrete batch plants;
- Non-industrial waste sources such as worker trash and portable toilets;
- Other areas or procedures where potential spills can occur.

#### b. BMPs for Stormwater Pollution Prevention

##### 1) Structural Practices for Erosion and Sediment Control

- A Stabilized Staging Area (SSA) consists of stripping topsoil and spreading a layer of granular material in the area to be used for a trailer, parking, storage, unloading and loading. A stabilized staging area reduces the likelihood that the vehicles most frequently entering a site are going to come in contact with mud.
- Silt Fence (SF) is a temporary sediment barrier constructed of woven fabric stretched across supporting posts. The bottom edge of the fabric is placed in an anchor trench that is backfilled with compacted soil.
- Inlet Protection (IP) consists of a reinforced rock berm placed in front of (but not blocking) a curb-opening inlet or around an area inlet to reduce sediment in runoff approaching the inlet.
- Culvert Inlet Protection (CIP) consists of a reinforced rock berm placed in front of (but not blocking) a culvert opening to reduce sediment in runoff approaching the inlet.

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 4

- Outlet Protection (OP) consists of riprap pad placed in front of (but not blocking) a culvert outlet to reduce sediment in runoff and erosion from pipe or culvert outlet.
- A Sediment Control Log (SCL) consists of a cylindrical bundle of wood, coconut, compost, excelsior, or straw fiber designed to form a semi-porous filter, able to withstand overtopping. The log can be staked into the ground and promotes sediment deposition on its upstream side.
- Construction Fence (CF) consists of orange plastic or other accepted material to delineate limits of construction and control the access to the site.
- A Diversion Ditch (DD) is a small earth channel used to divert and convey runoff.
- Reinforced Check Dam (RCD) is a small reinforced rock dam, designed to withstand overtopping, that is placed in a stream or drainageway. The purpose of the check dam is to trap water-borne sediment in the backwater zone upstream if the check.
- Rough Cut Street Control (RCS) are rock or earthen berms placed along dirt roadways that are under construction or used for construction access. These temporary berms intercept sheet flow and divert runoff from the roadway, and control erosion by minimizing concentration of flow and reducing runoff velocity.
- A Sediment Basin (SB) is an impoundment that captures sediment-laden runoff and releases it slowly, providing prolonged settling times to capture coarse and fine-grained soil particles.
- Details for the construction of these BMPs are included in the construction documents for the site.

## 2) Non-Structural Practices for Erosion and Sediment Control

- Surface Roughening (SR) consists of creating a series of grooves or furrows on the contour in disturbed, graded areas to trap rainfall and reduce the formation of rill and gully erosion. It will be required on all slopes greater than 4:1.
- Temporary Seeding and Mulching (TS) consists of drill seeding disturbed areas with grasses and crimping in straw mulch to provide immediate protection against raindrop and wind erosion and, as the grass cover becomes established, to provide long-term stabilization of exposed soils. It will be required in all areas not to be paved after completion of the finished grade.
- Enhanced Native Turf is required in the pond, swales and other select areas after completion of the finished grade. See Temporary Seeding Plan for details.
- All tributary bare areas will be seeded and stabilized prior to the removal of sediment control.
- Scraping and Sweeping (SS) of roadways will occur to remove mud tracking as needed.



# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 5

- Water trucks will be used for Dust Control on disturbed areas not yet ready to be seeded, landscaped, or paved to preclude visible dust emissions.

### 3) Phased BMP Implementation

- Construction for Planning Area H will occur in three major stages. Stage 1 consists of over-lot grading. Stage 2 consists of the construction of streets, curb and gutter and utility improvements. Stage 3 consists of stabilization in preparation of construction of the single homes and final landscaping.
- Stage 1 of development consists of over-lot grading and construction of temporary sediment basins. The location of each erosion control measure is outlined on the Grading and Erosion Control Sheets GE1-GE2 for Planning Area H. These sheets are located in Appendix A and will be updated as necessary. Erosion control measures provided on that sheet for the site are summarized below.
  - Installation of Silt Fence
  - Construction of Temporary Sediment Basin
  - Construction of a Stabilized Staging Area
  - Installation of Vehicle Tracking Control
  - Installation of Concrete Washout Area
  - Construction Fence
  - Surface Roughen exposed soil areas that will be exposed for a period greater than 30 days prior to building construction.
  - All soil stockpiles shall be protected from sediment transport by surface roughening, watering and perimeter silt fencing. Any soil stockpile remaining after 30 days shall be seeded and mulched.
  - All BMPs shall be properly maintained.
- During Stage 2 of construction, the site infrastructure (roads and utilities) will be built and installed. Storm drains will be placed under pavement prior to the road construction and inlet protection will be required. The location of each erosion control measure is outlined on the Grading and Erosion Control Sheets GE1 for Planning Area H. That sheet is located in Appendix A and will be updated as necessary. Erosion control measures provided in those sheets for the site are summarized below.
  - Seed and Mulch open areas.
  - Install and maintain Inlet/Outlet Protection
  - Maintain all BMPs constructed with Stage 1 that are to remain
  - Remove Vehicle Tracking Control after paving of all interior roads is complete

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 6

- Stage 3 consists of stabilization in preparation of the construction of the single-family homes. The location of each erosion control measure is outlined on the BMP Map for Planning Area H. The sheet is located in Appendix A and will be updated as construction progresses. The master developer is responsible for all common areas including Tracts. Erosion control measures provided in those sheets for the site are summarized below.
  - Install and maintain Silt Fence at the perimeter of the lots as shown
  - Maintain streets by scraping and sweeping to remove mud tracking as needed
  - Permanent landscaping in all common areas
  - Remove sediment basin, and exterior silt fence and construction fence when 70% stabilization is complete.

#### 4) Materials Handling and Spill Prevention

- All chemical substances on site shall be identified.
- All of the chemical substances used in the workplace shall be listed, and the Material Safety Data Sheet (MSDS) obtained for each. The MSDSs will be readily available for use; i.e., posted at the locations where the materials are stored and handled.
- All containers shall be labelled to show the name and type of substance, stock number, expiration date, health hazards including reactivity, corrosivity, ignitability and toxicity, suggestions for handling, and first aid information. (This information can usually be found on the MSDS. Unlabelled chemicals and chemicals with deteriorated labels are often disposed of unnecessarily or improperly).
- In the event of a chemical spill from service trucks, Chemtrek shall be contacted at 1-800-424-9300. The local emergency center shall be contacted through a 911 call.
- Bulk storage structures for petroleum products and other chemicals shall have adequate protection so as to contain all spills and prevent any spilled material from the storm sewer system.

#### 5) Dedicated Concrete or Asphalt Batch Plants

- There are no dedicated concrete or asphalt batch plants associated with this project.

#### 6) Vehicle Tracking Control

- Off-site vehicle tracking of sediments shall be minimized.
- Vehicle Tracking Control (VTC) consists of a pad of 3" to 6" angular rock at all entrance/exit points for a site that is intended to help strip mud from tires prior to vehicles leaving the construction site.
- Vehicle Tracking Control will be placed at the job site entrance with a Concrete Washout Area and Stabilized Staging Area.

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 7

#### 7) Waste Management and Disposal, Including Concrete Washout

- All trash receptacles and dumpsters will have covers preventing precipitation from entering.
- Regular trash pick-up is to occur when receptacles are near full capacity.
- Portable toilets will be cleaned regularly and securely pinned down to the ground.
- All wastes composed of building materials must be removed from the site for disposal in licensed disposal facilities. No building material wastes or unused building materials shall be buried, dumped, or discharged at the site.
- A Concrete Washout Area (CWA) is a shallow excavation with a small perimeter berm to isolate concrete washout operations. Concrete wash water shall not be discharged into the storm sewer system. Unused concrete shall be discharged in a designated Concrete Washout Area.

#### 8) Groundwater and Stormwater Dewatering

- Dewatering of groundwater and/or stormwater is not anticipated for the Planning Area H site at this time.

#### c. Revising BMPs and the SWMP

- The pollutant sources and management practices at the site must be reviewed on an ongoing basis see part 6.0 Inspection and Maintenance Procedures.
- When BMPs or other site conditions change, the SWMP must be modified to accurately reflect the actual field conditions.
- SWMP revisions must be made immediately after changes are made in the field to address BMP installation and/or implementation issues; or
- SWMP revisions must be made as soon as practicable, but in no case more than 72 hours, after change(s) in BMP installation and/or implementation occur at the site that requires development of materials to modify the SWMP.

## 5.0 FINAL STABILIZATION AND LONGTERM STORMWATER MANAGEMENT

- Final stabilization will be achieved by seeding all areas not paved, sodded, or covered by other erosion resistant material. See Planning Area H GESD Plan sheet GN1 for approved seed mixtures.
- Final stabilization is reached when all ground surface disturbing activities at the site have been completed, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance levels, or equivalent permanent, physical erosion reduction methods have been employed.

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 8

- Sediment that collects within the site's drainage system and permanent water quality or quantity controls is also considered unstabilized soil, and must be removed prior to the site being considered finally stabilized.
- Permanent long-term (post-construction) stormwater management controls for the site include the regional detention pond which will provide detention and water quality for Planning Area H.

## 6.0 INSPECTION AND MAINTENANCE PROCEDURES

### a. Inspection Schedule

- All vegetation, erosion control measures, and other protective measures identified in this SWMP will be inspected at least every 14 days and within 24 hours after any precipitation or snowmelt event causing surface runoff or erosion.

### b. Inspection Procedures

Inspection must include observation of:

- The construction site perimeter and discharge points (including discharges into a storm sewer system);
- All disturbed areas;
- Areas used for material/waste storage that are exposed to precipitation;
- Other areas determined to have a significant potential for stormwater pollution, such as demolition areas or concrete washout locations, or locations where vehicles enter or leave the site;
- Erosion and sediment control measures identified in the SWMP; and
- Any other structural BMPs that may require maintenance, such as secondary containment around fuel tanks, or the condition of spill response kits.
- The inspection must determine if there is evidence of, or the potential for, pollutants entering the drainage system. BMPs should be reviewed to determine if they still meet the design and operational criteria in the SWMP, and if they continue to adequately control pollutants at the site. Any BMPs not operating in accordance with the SWMP must be addressed as soon as possible, immediately in most cases, to minimize the discharge of pollutants, and the SWMP must be updated as described in Section 4.0 c. above. Inspections must be documented as discussed in the Record Keeping section, below.

### c. BMP Maintenance/Replacement and Failed BMPs

- All erosion and sediment control practices and other protective measures identified in the SWMP shall be maintained in effective operating condition and in accordance with good engineering, hydrologic and pollution control practices.

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 9

- Sediment that has been collected by sediment controls, such as silt fence and inlet protection, should be removed on a regular basis, to prevent failure of BMPs. Removed sediment must be moved to an appropriate location where it will not become an additional pollutant source, and should never be placed in ditches or streams.
- Maintenance activities to correct problems noted during inspections must be documented as discussed in the Record Keeping section, below.
- BMPs that have been identified through inspection to have failed or the potential to fail without maintenance or modifications must be addressed as soon as possible, immediately in most cases, to prevent the discharge of pollutants.

#### d. Record Keeping and Document Inspection

- Keeping records of spills, leaks, inspections, etc. is a requirement of the Stormwater Construction Permit. Therefore enforcement action, including fines, could result if records are not adequate. Keeping accurate and detailed records also provides documentation of events which could prove invaluable should complications arise concerning the permit, lawsuits, etc.
- The permittee must document inspection results and maintain a record of the results for a period of 3 years following expiration or inactivation of permit coverage. These records must be made available to the Division or EPA upon request.
- A sample inspection report has been included in Appendix B. The following items must be documented as part of the site inspections:
  - The inspection date;
  - Name(s) and title(s) of personnel making the inspection;
  - Location(s) of discharges of sediment or other pollutants from the site;
  - Location(s) of BMPs that need to be maintained;
  - Location(s) of BMPs that failed to operate as designed or proved inadequate for a particular location;
  - Location(s) where additional BMPs are needed that were not in place at the time of inspection;
  - Deviations from the minimum inspection schedule as provided above;
  - Description of corrective action for items above, dates corrective action(s) taken, and measures taken to prevent future violations, including requisite changes to the SWMP, as necessary; and
  - After adequate corrective action(s) has been taken, or where a report does not identify any incidents requiring corrective action, the report shall contain a signed statement indicating the site is in compliance with the permit to the best of the signer's knowledge and belief.

# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

### Page 10

- In addition to inspection records, a log book may be kept for use in tracking other items related to the SWMP such as those listed below. Additional information such as dated photographs, field notebooks, drawings and maps, and the items below, etc. can also be included where appropriate.
  - BMP operation and maintenance
  - Contacts with suppliers, regulatory agencies and personnel
  - Implementation of specific items in this SWMP
  - Training events (given or attended)
  - Events involving materials handling and storage
  - Preventive maintenance activities
- Records of spills, leaks, or overflows that result in the discharge of pollutants must be documented and maintained. Other spills that are responded to, even if they do not result in a discharge of pollutants may be recorded. Information that should be recorded for all occurrences includes the time and date, weather conditions, reasons for the spill, etc.
- A release of any chemical, oil, petroleum product, sewage, etc., which may enter waters of the State of Colorado (which include surface water, ground water and dry gullies or storm sewers leading to surface water) must be reported. More guidance is available on the web at [www.cdphe.state.co.us/hm/spillsandreleases.htm](http://www.cdphe.state.co.us/hm/spillsandreleases.htm). The Division's toll-free 24-hour number for environmental hazards and chemical spills and releases is 1-877-518-5608.



# STORMWATER MANAGEMENT PLAN (SWMP)

## PLANNING AREA H

Page 11

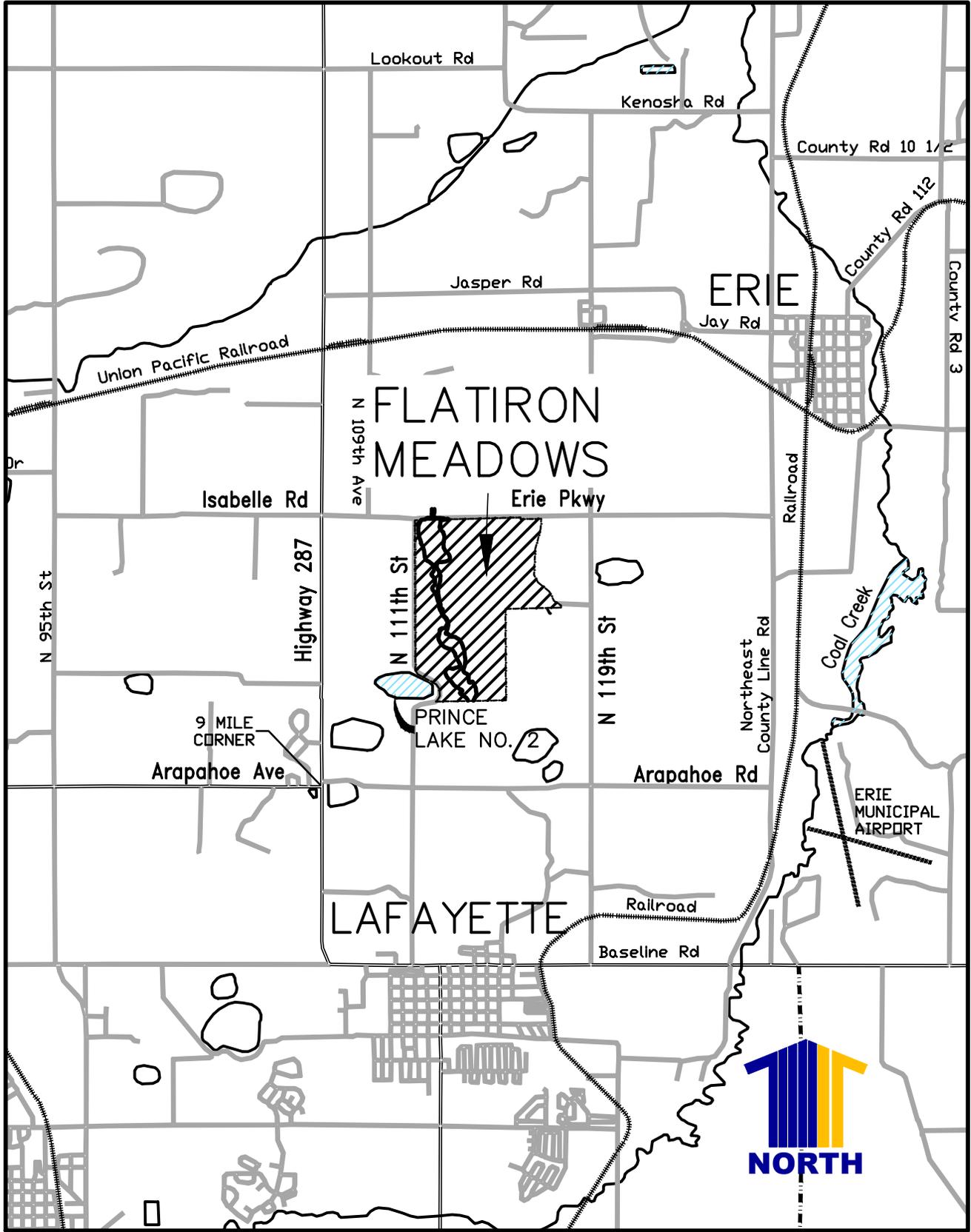
### 7.0 REFERENCES

1. *CDPS General Permit No. COR-03-0000, Stormwater Discharges Associated with Construction Activity, Authorization to Discharge Under the Colorado Discharge Permit System*, Administratively continued effective July 1, 2012.
2. Colorado Department of Public Health and Environment  
Water Quality Control Division – Stormwater Program  
General Permit Application and Stormwater Management Plan Preparation Guidance  
Revised April 2011
3. *Urban Storm Drainage Criteria Manual – Volume 3 Best Management Practices*, Urban Drainage & Flood Control District, Revised November 2010



APPENDIX A  
MAPS AND PLANS

DRAWING NAME: 52DR-VICINITY MAP.dwg PLOT BY: misawyer XREFS: P:\WORTH FLATIRON\CADD\Exhibits\



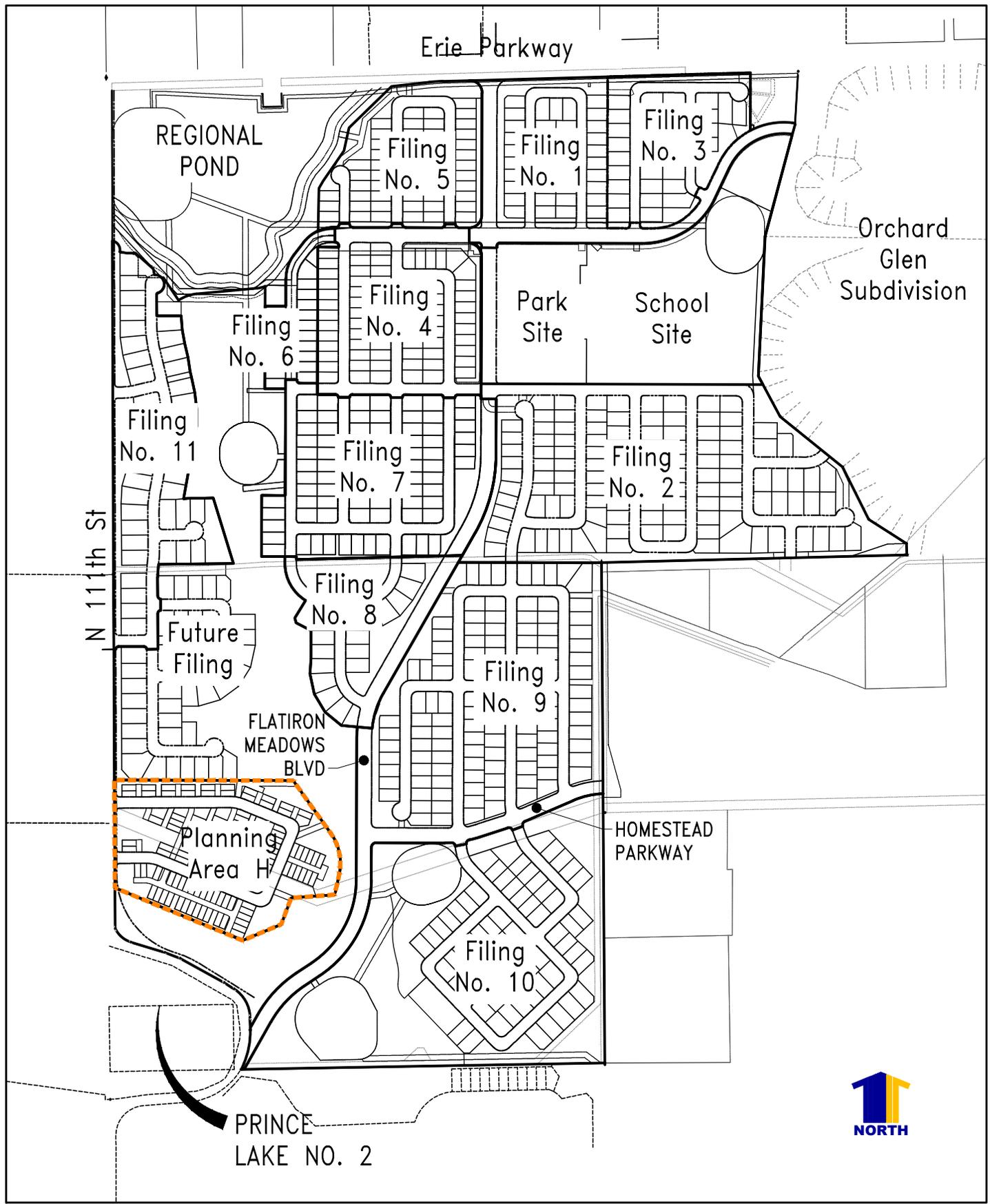
Calibre Engineering, Inc.  
 9090 South Ridgeline Boulevard, Suite 105  
 Highlands Ranch, CO 80129 (303) 730-0434  
 www.calibre-engineering.com  
 Construction Management Civil Engineering Surveying

# FLATIRON MEADOWS VICINITY MAP

SHEET  
**VM1**

SCALE: N.T.S.  
DATE:  
DECEMBER 2015

DRAWING NAME: 140DR-FILING MAP.dwg PLOT BY: LAIF XREFS: 140BASE, 52BASE, 51BASE, 120BASE, 90BASE, 42BASE, 80BASE, 70BASE, 41BASE, 34BASE



**Calibre**

Calibre Engineering, Inc.  
 9090 South Ridgeline Boulevard, Suite 105  
 Highlands Ranch, CO 80129 (303) 730-0434  
 www.calibre-engineering.com  
 Construction Management Civil Engineering Surveying

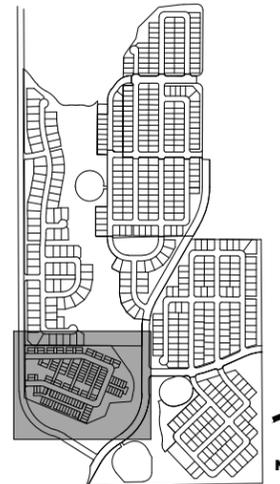
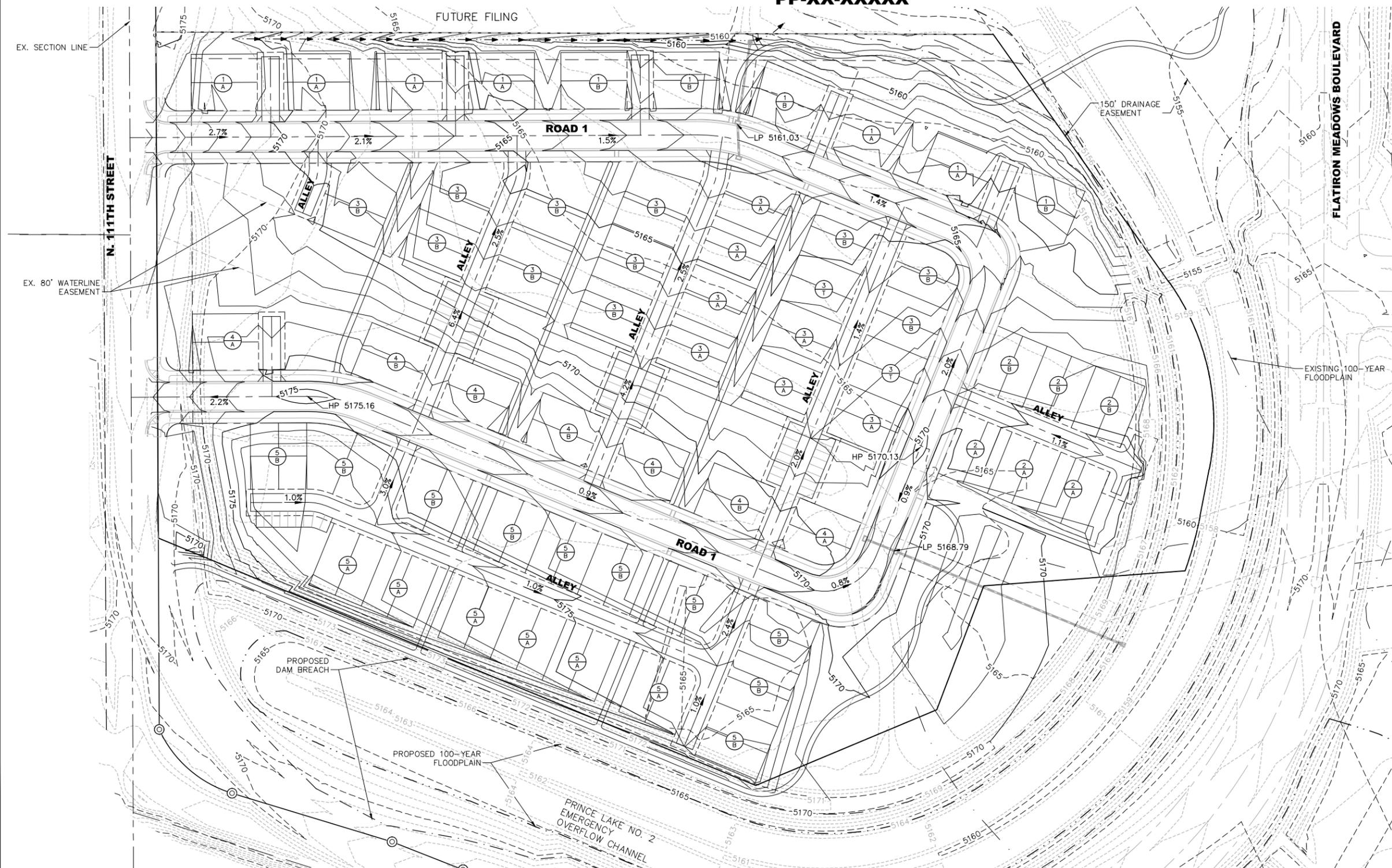
**FLATIRON MEADOWS**  
**FILING MAP**

SHEET

SCALE: N.T.S.  
 DATE:  
 FEBRUARY 2017

# FLATIRON MEADOWS PRELIMINARY PLAT, AMENDMENT NO. 3

LOCATED IN A PORTION OF THE SOUTH HALF OF SECTION 23, TOWNSHIP 1 NORTH,  
 RANGE 69 OF THE 6TH PRINCIPLE MERIDIAN,  
 TOWN OF ERIE, COUNTY OF BOULDER, STATE OF COLORADO  
 18.403 ACRES - 118 LOTS - 21 TRACTS  
 PP-XX-XXXX



KEYMAP

**NOTES:**

1. THE LOT, STREET, AND UTILITY LAYOUTS ARE PRELIMINARY AND SUBJECT TO CHANGE DURING THE FINAL PLAT PROCESS.
2. SLOPE GRADING DOES NOT EXCEED 4:1 UNLESS NOTED.

**LEGEND**

- 5130 --- EXISTING MAJOR CONTOURS
- --- EXISTING MINOR CONTOURS
- - - - - EXISTING FLOODPLAIN
- 5130 --- PROPOSED MAJOR CONTOURS
- --- PROPOSED MINOR CONTOURS
- - - - - PROPOSED FLOODPLAIN
- - - - - PROPOSED DAM BREACH
- --- PROPERTY BOUNDARY

- |      |                  |     |                  |
|------|------------------|-----|------------------|
| (97) | LOT NUMBER       | W   | WALKOUT LOT      |
| W    | LOT TYPE         | G   | GARDEN LEVEL LOT |
| A    | FRONT-DRAIN LOT  | HP= | HIGH POINT       |
| B    | SPLIT-DRAIN LOT  | LP= | LOW POINT        |
| T    | TRANSITIONAL LOT |     |                  |

- EXISTING WETLANDS
- SWALE



PATH: P:\NORTH FLATIRON\CADD\CIVIL\141 PA H PRELIMINARY PLAN & PLAT\141GR1.DWG  
 PLOTTED BY: LORRAINE ALFF PLOT DATE: 3/2/2017 11:33 AM  
 XREFS: 140PUT, 63PPN, 63BASE, 140PPN, 120BASE, 10EWA, W-Water Surface, 141TB, 140BASE.

DATE	REVISION	DESCRIPTION
	1	
	2	
	3	
	4	
	5	
	6	



Drawing Name 141GR1.dwg		
Job Number HINES:PA H		
Prepared For HT FLATIRON LP		
Designer LMA	Drafter LMA	Checked BKM



**Calibre**  
 Calibre Engineering, Inc.  
 9090 South Ridgeline Boulevard, Suite 105  
 Highlands Ranch, CO 80129 (303) 730-0434  
 www.calibre-engineering.com  
 Construction Management Civil Engineering Surveying

**FLATIRON MEADOWS**  
**PRELIMINARY PLAT**  
**GRADING PLAN**

Sheet	7
<b>GR1</b>	of 12
Date	MARCH 3, 2017

APPENDIX B  
SITE FORMS AND REPORTS

**STORMWATER MANAGEMENT PLAN (SWMP)  
FLATIRON MEADOWS PLANNING AREA H  
APPENDIX B**

**THE SWMP ADMINISTRATOR FOR THE (DEVELOPMENT) SITE IS:**

Individual(s), Position or Title Dave Klebba  
Company HT Flatiron LP  
Address 1515 Wynkoop Street, Suite 800  
Denver, CO 80202  
Telephone 720-932-0522  
E-mail [dave.klebba@hines.com](mailto:dave.klebba@hines.com)

**ALTERNATE:**

Individual(s), Position or Title \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
\_\_\_\_\_  
Telephone \_\_\_\_\_  
E-mail \_\_\_\_\_

# STORMWATER MANAGEMENT PLAN (SWMP)

## FLATIRON MEADOWS PLANNING AREA H

### APPENDIX B

#### CONSTRUCTION SITE INSPECTION REPORT:

General Information			
Project Name:			
Date of Inspection:		Start/End Time:	
Inspector's Name(s) / Title(s):			
Inspector's Contact Information:			
Describe present phase of construction:			
<b>Type of Inspection:</b> <input type="checkbox"/> Regular – Every 14 days <input type="checkbox"/> Post-storm event – within 24 hours after precipitation or snowmelt event <input type="checkbox"/> Deviation from minimum inspection schedule			
Weather Information			
<b>Has there been a storm event since the last inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>If yes, provide:</b> Storm Start Date & Time:          Storm Duration (hrs):          Approximate Amount of Precipitation (in):			
<b>Weather at time of this inspection?</b> <input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Rain <input type="checkbox"/> Sleet <input type="checkbox"/> Fog <input type="checkbox"/> Snowing <input type="checkbox"/> High Winds <input type="checkbox"/> Other:			
<b>Temperature:</b>			
<b>Have any discharges occurred since the last inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>If yes, describe:</b>			
<b>Are there any discharges at the time of inspection?</b> <input type="checkbox"/> Yes <input type="checkbox"/> No <b>If yes, describe:</b>			

#### Site-specific BMPs

- Number the structural and non-structural BMPs identified in your SWMP on your site map and list them below (add as many BMPs as necessary). Carry a copy of the numbered site map with you during your inspections. This list will ensure that you are inspecting all required BMPs at your site.
- Describe corrective actions initiated (due to BMP failing to operate as designed or proves inadequate for a particular location); date completed, and note the person that completed the work in the Corrective Action Log.

	BMP / Location	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed / Completed and Notes
1		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	



# STORMWATER MANAGEMENT PLAN (SWMP)

## FLATIRON MEADOWS PLANNING AREA H

### APPENDIX B

	BMP / Location	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed / Completed and Notes
9		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
13		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
14		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
15		<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

# STORMWATER MANAGEMENT PLAN (SWMP)

## FLATIRON MEADOWS PLANNING AREA H

### APPENDIX B

#### Overall Site Issues

- Below are some general site issues that should be assessed during inspections. Customize this list as needed for conditions at the site.

	BMP / Activity	Implemented?	Maintenance Required?	Corrective Action Needed / Completed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
4	Are discharge points and receiving waters free of any sediment deposits?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
5	Are storm drain inlets properly protected?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
6	Is the construction exit preventing sediment from being tracked into the street?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
11	Are non-stormwater discharges (e.g., wash water, dewatering) properly controlled?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	
12	Any additional BMPs needed?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	

#### Certification Statement

"The information documented heron is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title \_\_\_\_\_

Signature and date \_\_\_\_\_



**STORMWATER MANAGEMENT PLAN (SWMP)**  
**FLATIRON MEADOWS PLANNING AREA H**  
APPENDIX B

**CHEMICAL SUBSTANCES KEPT ON SITE:**

List chemical substances expected to be on site and the reportable quantity of each. Copy and attach multiple sheets as needed.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_
9. \_\_\_\_\_
10. \_\_\_\_\_
11. \_\_\_\_\_
12. \_\_\_\_\_
13. \_\_\_\_\_
14. \_\_\_\_\_
15. \_\_\_\_\_
16. \_\_\_\_\_
17. \_\_\_\_\_
18. \_\_\_\_\_
19. \_\_\_\_\_
20. \_\_\_\_\_

**STORMWATER MANAGEMENT PLAN (SWMP)**  
**FLATIRON MEADOWS PLANNING AREA H**  
APPENDIX B

**SPILL/RELEASE INCIDENT REPORTING FORM:**

1. Date of spill/release: \_\_\_\_\_
2. Location: \_\_\_\_\_
3. Time of spill/release: \_\_\_\_\_ a.m. / p.m.
4. Material spilled/released: \_\_\_\_\_
5. Amount spilled/released: \_\_\_\_\_
6. Cause of spill/release: \_\_\_\_\_
7. Description of scene (e.g., type of media contaminated (e.g., soil), distance to storm sewers, if spill/release was contained): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
8. Description of clean-up actions taken (e.g., how spill/release was contained (e.g., absorbent pillows), where recovered material was placed, how much material was not recovered, remaining actions to be taken): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
9. List of offsite emergency responders contacted:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
10. List of offsite emergency responders at scene:  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
11. Action taken to prevent recurrence: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
12. Signature: \_\_\_\_\_ Printed Name: \_\_\_\_\_

*Use back of form for additional space as needed. Completed forms should be kept onsite.*



# STORMWATER MANAGEMENT PLAN (SWMP)

## FLATIRON MEADOWS PLANNING AREA H

### APPENDIX B

## STORMWATER POLLUTION PREVENTION TRAINING LOG

Instructor's Title (s): \_\_\_\_\_

Course Location: \_\_\_\_\_ Date: \_\_\_\_\_

Course Length (hours): \_\_\_\_\_

Stormwater Training Topic: *(check as appropriate)*

- Sediment and Erosion Controls
- Stabilization Controls
- Emergency Procedures
- Pollution Prevention Measures
- Inspections/Corrective Actions

Specific Training Objective: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Attendee Roster: *(attach additional pages as necessary)*

No.	Name of Attendee	Company
1		
2		
3		
4		
5		
6		
7		
8		

**STORMWATER MANAGEMENT PLAN (SWMP)**  
**FLATIRON MEADOWS PLANNING AREA H**  
APPENDIX B

**SUBCONTRACTOR CERTIFICATION:**

Operator(s): \_\_\_\_\_

As a subcontractor, you are required to comply with the Stormwater Management Plan (SWMP) for any work that you perform on-site. Any person or group who violates any condition of the SWMP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWMP. A copy of the SWMP is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

**I certify that I have read and understand the terms and conditions of the SWMP for the above designated project and agree to follow the practices described in the SWMP.**

This certification is hereby signed in reference to the above named project:

Company: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

Type of construction service to be provided: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Signature: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

APPENDIX C  
CDPHE FORMS

# STATE OF COLORADO

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.  
Denver, Colorado 80246-1530  
Phone (303) 692-2000  
TDD Line (303) 691-7700  
Located in Glendale, Colorado  
<http://www.cdph.state.co.us>



Colorado Department  
of Public Health  
and Environment

For Agency Use Only

Permit Number Assigned

COR03- \_\_\_\_\_

Date Received \_\_\_\_/\_\_\_\_/\_\_\_\_  
Month Day Year

## COLORADO DISCHARGE PERMIT SYSTEM (CDPS) STORMWATER DISCHARGE ASSOCIATED WITH CONSTRUCTION ACTIVITIES APPLICATION **PHOTO COPIES, FAXED COPIES, PDF COPIES OR EMAILS WILL NOT BE ACCEPTED.**

**Please print or type. Original signatures are required.** All items must be completed accurately and in their entirety for the application to be deemed complete. Incomplete applications will not be processed until all information is received which will ultimately delay the issuance of a permit. If more space is required to answer any question, please attach additional sheets to the application form. Applications must be submitted by mail or hand delivered to:

**Colorado Department of Public Health and Environment  
Water Quality Control Division  
4300 Cherry Creek Drive South  
WQCD-P-B2  
Denver, Colorado 80246-1530**

Any additional information that you would like the Division to consider in developing the permit should be provided with the application. Examples include effluent data and/or modeling and planned pollutant removal strategies.

### PERMIT INFORMATION

Reason for Application:  NEW CERT  
 RENEW CERT      EXISTING CERT # \_\_\_\_\_

Applicant is:  Property Owner  Contractor/Operator

### A. CONTACT INFORMATION - NOT ALL CONTACT TYPES MAY APPLY \* indicates required

**\*PERMITTEE (If more than one please add additional pages)**

**\*ORGANIZATION FORMAL NAME:** \_\_\_\_\_

1) **\*PERMITTEE** the person **authorized to sign and certify** the permit application. This person receives all permit correspondences and is **legally responsible** for compliance with the permit.

Responsible Position (Title): \_\_\_\_\_

Currently Held By (Person): \_\_\_\_\_

Telephone No: \_\_\_\_\_

email address \_\_\_\_\_

Organization: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

**This form must be signed by the Permittee (listed in item 1) to be considered complete.**

**Per Regulation 61 In all cases,** it shall be signed as follows:

- In the case of corporations, by a responsible corporate officer. For the purposes of this section, the responsible corporate officer is responsible for the overall operation of the facility from which the discharge described in the application originates.
- In the case of a partnership, by a general partner.
- In the case of a sole proprietorship, by the proprietor.
- In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official

- 2) **DMR COGNIZANT OFFICIAL (i.e. authorized agent)** the person or position authorized to **sign and certify reports required by the Division** including Discharge Monitoring Reports \*DMR's, Annual Reports, Compliance Schedule submittals, and other information requested by the Division. The Division will transmit pre-printed reports (ie. DMR's) to this person. If more than one, please add additional pages. Same As 1) Permittee

Responsible Position (Title): \_\_\_\_\_

Currently Held By (Person): \_\_\_\_\_

Telephone No: \_\_\_\_\_

email address \_\_\_\_\_

Organization: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

**Per Regulation 61** : All reports required by permits, and other information requested by the Division shall be signed by the permittee or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(i) The authorization is made in writing by the permittee

(ii) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a **named individual** or any individual occupying a **named position**); and

(iii) The written authorization is submitted to the Division

- 3) **\*SITE CONTACT** local contact for questions relating to the facility & discharge authorized by this permit for the facility.

Same As 1) Permittee

Responsible Position (Title): \_\_\_\_\_

Currently Held By (Person): \_\_\_\_\_

Telephone No: \_\_\_\_\_

email address \_\_\_\_\_

Organization: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

- 4) **\* BILLING CONTACT** if different than the permittee

Responsible Position (Title): \_\_\_\_\_

Currently Held By (Person): \_\_\_\_\_

Telephone No: \_\_\_\_\_

email address \_\_\_\_\_

Organization: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

5) OTHER CONTACT TYPES (check below) Add pages if necessary:

Responsible Position (Title): \_\_\_\_\_

Currently Held By (Person): \_\_\_\_\_

Telephone No: \_\_\_\_\_

email address \_\_\_\_\_

Organization: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

- Pretreatment Coordinator
- Environmental Contact
- Biosolids Responsible Party
- Property Owner
- Inspection Facility Contact
- Consultant
- Compliance Contact
- Stormwater MS4 Responsible Person
- Stormwater Authorized Representative
- Other \_\_\_\_\_

B. Permitted Project/Facility Information

Project/Facility Name \_\_\_\_\_

Street Address or cross streets \_\_\_\_\_

(e.g., "S. of Park St. between 5<sup>th</sup> Ave. and 10<sup>th</sup> Ave.", or "W. side of C.R. 21, 3.25 miles N. of Hwy 10"; A street name without an address, intersection, mile marker, or other identifying information describing the location of the project is not adequate. For **linear projects**, the route of the project should be described as best as possible with the location more accurately indicated by a map.)

City, \_\_\_\_\_ Zip Code \_\_\_\_\_ County \_\_\_\_\_

Facility Latitude/Longitude— (approximate center of site to nearest 15 seconds using one of following formats

001A Latitude \_\_\_\_\_ . \_\_\_\_\_ Longitude \_\_\_\_\_ . \_\_\_\_\_ (e.g., 39.703°, 104.933°)  
degrees (to 3 decimal places) degrees (to 3 decimal places)

or

001A Latitude \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ " Longitude \_\_\_\_\_ ° \_\_\_\_\_ ' \_\_\_\_\_ " (e.g., 39°46'11"N, 104°53'11"W)  
degrees minutes seconds degrees minutes seconds

For the approximate center point of the property, to the nearest 15 seconds. The latitude and longitude must be provided as either degrees, minutes, and seconds, or in decimal degrees with three decimal places. This information may be obtained from a variety of sources, including:

- Surveyors or engineers for the project should have, or be able to calculate, this information.
- EPA maintains a **web-based siting tool** as part of their Toxic Release Inventory program that uses interactive maps and aerial photography to help users get latitude and longitude. The siting tool can be accessed at [www.epa.gov/tri/report/siting\\_tool/index.htm](http://www.epa.gov/tri/report/siting_tool/index.htm)
- U.S. Geological Survey **topographical map(s)**, available at area map stores.
- Using a **Global Positioning System (GPS) unit** to obtain a direct reading.

**Note:** the latitude/longitude required above is not the directional degrees, minutes, and seconds provided on a site legal description to define property boundaries.

C. MAP (Attachment) If no map is submitted, the permit will not be issued.

**Map:** Attach a map that indicates the site location and that CLEARLY shows the boundaries of the area that will be disturbed. Maps must be **no larger** than 11x17 inches.

D. LEGAL DESCRIPTION

**Legal description:** If subdivided, provide the legal description below, or indicate that it is not applicable (**do not** supply Township/Range/Section or metes and bounds description of site)

Subdivision(s): \_\_\_\_\_ Lot(s): \_\_\_\_\_ Block(s): \_\_\_\_\_

OR

- Not applicable (site has not been subdivided)

**E. AREA OF CONSTRUCTION SITE**

---

Total area of project site (acres): \_\_\_\_\_ Area of project site to undergo disturbance (acres): \_\_\_\_\_

**Note:** aside from clearing, grading and excavation activities, disturbed areas also include areas receiving overburden (e.g., stockpiles), demolition areas, and areas with heavy equipment/vehicle traffic and storage that disturb existing vegetative cover

Total disturbed area of Larger Common Plan of Development or Sale, if applicable: \_\_\_\_\_  
(i.e., total, including all phases, filings, lots, and infrastructure not covered by this application)

Provide both the total area of the construction site, and the area that will undergo disturbance, in acres. **Note:** aside from clearing, grading and excavation activities, disturbed areas also include areas receiving overburden (e.g., stockpiles), demolition areas, and areas with heavy equipment/vehicle traffic and storage that disturb existing vegetative cover (see construction activity description under the APPLICABILITY section on page 1).

If the project is part of a **larger common plan of development or sale** (see the definition under the APPLICABILITY section on page 1), the disturbed area of the total plan must also be included.

**F. NATURE OF CONSTRUCTION ACTIVITY**

---

Check the appropriate box(s) or provide a brief description that indicates the general nature of the construction activities. (The full description of activities must be included in the Stormwater Management Plan.)

- Single Family Residential Development
- Multi-Family Residential Development
- Commercial Development
- Oil and Gas Production and/or Exploration (including pad sites and associated infrastructure)
- Highway/Road Development (not including roadways associated with commercial or residential development)
- Other – Description: \_\_\_\_\_

**G. ANTICIPATED CONSTRUCTION SCHEDULE**

---

Construction Start Date: \_\_\_\_\_ Final Stabilization Date: \_\_\_\_\_

- *Construction Start Date* - This is the day you expect to begin ground disturbing activities, including grubbing, stockpiling, excavating, demolition, and grading activities.
- *Final Stabilization Date* - in terms of permit coverage, this is when the site is finally stabilized. This means that all ground surface disturbing activities at the site have been completed, and all disturbed areas have been either built on, paved, or a uniform vegetative cover has been established with an individual plant density of at least 70 percent of pre-disturbance levels. **Permit coverage must be maintained until the site is finally stabilized. Even if you are only doing one part of the project, the estimated final stabilization date must be for the overall project.** If permit coverage is still required once your part is completed, the permit certification may be transferred or reassigned to a new responsible entity(s).

**H. RECEIVING WATERS (If discharge is to a ditch or storm sewer, include the name of the ultimate receiving waters)**

Immediate Receiving Water(s): \_\_\_\_\_

Ultimate Receiving Water(s): \_\_\_\_\_

Identify the receiving water of the stormwater from your site. Receiving waters are any waters of the State of Colorado. This includes all water courses, even if they are usually dry. If stormwater from the construction site enters a ditch or storm sewer system, identify that system and indicate the ultimate receiving water for the ditch or storm sewer. **Note:** a stormwater discharge permit does not allow a discharge into a ditch or storm sewer system without the approval of the owner/operator of that system.

**I. REQUIRED SIGNATURES (Both parts i. and ii. must be signed)**

**Signature of Applicant:** The applicant must be either the owner and/or operator of the construction site. Refer to Part B of the instructions for additional information.

The application must be signed by the applicant to be considered complete. In all cases, it shall be signed as follows: (Regulation 61.4 (1e))

- a) In the case of corporations, by the responsible corporate officer is responsible for the overall operation of the facility from which the discharge described in the form originates
- b) In the case of a partnership, by a general partner.
- c) In the case of a sole proprietorship, by the proprietor.
- d) In the case of a municipal, state, or other public facility, by either a principal executive officer, ranking elected official, (a principal executive officer has responsibility for the overall operation of the facility from which the discharge originates).

**STOP!: A Stormwater Management Plan must be completed prior to signing the following certifications!**

**i. STORMWATER MANAGEMENT PLAN CERTIFICATION**

"I certify under penalty of law that a complete Stormwater Management Plan, has been prepared for my activity. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the Stormwater Management Plan is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for falsely certifying the completion of said SWMP, including the possibility of fine and imprisonment for knowing violations."

XX

---

Signature of Legally Responsible Person or Authorized Agent (submission must include original signature)	Date Signed
--	-------------

---

Name (printed)	Title
----------------	-------

**ii. SIGNATURE OF PERMIT LEGAL CONTACT**

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

"I understand that submittal of this application is for coverage under the State of Colorado General Permit for Stormwater Discharges Associated with Construction Activity **for the entirety of the construction site/project described and applied for, until such time as the application is amended or the certification is transferred, inactivated, or expired.**"

XX

---

Signature of Legally Responsible Person (submission must include original signature)	Date Signed
--	-------------

---

Name (printed)	Title
----------------	-------

**DO NOT INCLUDE A COPY OF THE STORMWATER MANAGEMENT PLAN  
DO NOT INCLUDE PAYMENT – AN INVOICE WILL BE SENT AFTER THE CERTIFICATION IS ISSUED.**

# STATE OF COLORADO

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.  
Denver, Colorado 80246-1530  
Phone (303) 692-2000  
TDD Line (303) 691-7700  
Located in Glendale, Colorado  
<http://www.cdphe.state.co.us>



Colorado Department  
of Public Health  
and Environment

**Colorado Water Quality Control Division Notice of Termination**  
**Construction Stormwater Inactivation Notice**  
[www.coloradowaterpermits.com](http://www.coloradowaterpermits.com)

Print or type all information. All items must be filled out completely and correctly. If the form is not complete, it will be returned. All permit terminations dates are effective on the date approved by the Division.

**MAIL ORIGINAL FORM WITH INK SIGNATURES TO THE FOLLOWING ADDRESS:**

Colorado Dept of Public Health and Environment  
Water Quality Control Division  
4300 Cherry Creek Dr South, WQCD-P-B2  
Denver, CO 80246-1530

**FAXED OR EMAILED FORMS WILL NOT BE ACCEPTED.**

- **PART A. IDENTIFICATION OF PERMIT** Please write the permit certification number to be terminated

Permit Certification Number (four digits, not "0000"): **COR03** \_ \_ \_ \_

- **PART B. PERMITTEE INFORMATION**

Company Name \_\_\_\_\_

Mailing Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip code \_\_\_\_\_

Legal Contact Name \_\_\_\_\_ Phone number \_\_\_\_\_

Title \_\_\_\_\_ Email \_\_\_\_\_

- **PART C. FACILITY/PROJECT INFORMATION**

Facility/Project Name \_\_\_\_\_

Location (address) \_\_\_\_\_

City \_\_\_\_\_ County \_\_\_\_\_ Zip code \_\_\_\_\_

Local Contact Name \_\_\_\_\_ Phone number \_\_\_\_\_

Title \_\_\_\_\_ Email \_\_\_\_\_

**PART D. TERMINATION VALIDATION CRITERIA**

One of the criteria (1,2, or 3) below must be met, the appropriate box checked, and the required additional information provided. Part E includes a certification that the criteria indicated has been met.

- 1: FINALLY STABILIZED OR CONSTRUCTION NOT STARTED** - The permitted activities covered under the certification listed in Part A meet the requirements for **FINAL STABILIZATION in accordance with the permit, the Stormwater Management Plan, and as described below.** This criterion should also be selected if construction was never started and no land was disturbed, and an explanation of this condition provided in the description below.

**Final stabilization is reached when:** all ground surface disturbing activities at the site have been completed including removal of all temporary erosion and sediment control measure, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of predisturbance levels, or equivalent permanent, physical erosion reduction methods have been employed.

**REQUIRED** - Describe the methods used to meet the final stabilization c described above (include additional pages if necessary)

- 2: ALTERNATIVE PERMIT COVERAGE OR FULL REASSIGNMENT** - All ongoing construction activities, including all disturbed areas, covered under the permit certification listed in Part A have coverage under a separate CDPS stormwater construction permit, including the permit certification issued when Division’s Reassignment Form was used by the permittee to reassign all areas/activities.

**REQUIRED** – Provide the permit certification number covering the ongoing activities: **COR03** \_ \_ \_ \_

- 3: PERMITTEE IS NO LONGER THE OWNER/OPERATOR** of the site and all efforts have been made to transfer the permit to appropriate parties. Please attach copies of registered mail receipt, letters, etc.

**STOP!** One of the three criteria above **MUST BE CHECKED** and the required information for that criterion provided, or this form will not be processed and the permit will remain active.

**PART E. CERTIFICATION SIGNATURE (Required for all Termination Requests)**

I understand that by submitting this notice of inactivation, I am no longer authorized to discharge stormwater associated with construction activity by the general permit. I understand that discharging pollutants in stormwater associated with construction activities to the waters of the State of Colorado, where such discharges are not authorized by a CDPS permit, is unlawful under the Colorado Water Quality Control Act and the Clean Water Act.

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein, and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. (See 18 U.S.C 1001 and 33 U.S.C. 1319.)

I also certify that I am a duly authorized representative of the permittee named in Part B.

Signature of Legally Responsible Party

Date Signed

Name (printed)

Title

**Signatory requirements:** This form shall be signed, dated, and certified for accuracy by the permittee in accordance with the following criteria:

1. In the case of a corporation, by a principal executive officer of at least the level of vice-president, or his or her duly authorized representative, if such representative is responsible for the overall operation of the operation from which the discharge described herein originates;
2. In the case of a partnership, by a general partner;
3. In the case of a sole proprietorship, by the proprietor;
4. In the case of a municipal, state, or other public operation, by wither a principal executive officer, ranking elected official, or other duly authorized employee.

# STATE OF COLORADO

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.  
Denver, Colorado 80246-1530  
Phone (303) 692-2000  
TDD Line (303) 691-7700  
Located in Glendale, Colorado  
<http://www.cdph.state.co.us>



Colorado Department  
of Public Health  
and Environment

For Agency Use Only
Permit Number Assigned
COR03-_____
Date Received ____/____/____ Month Day Year

## NOTICE OF REASSIGNMENT OF PERMIT COVERAGE AND GENERAL PERMIT APPLICATION STORMWATER DISCHARGE ASSOCIATED WITH CONSTRUCTION ACTIVITIES PHOTO COPIES, FAXED COPIES, PDF COPIES OR EMAILS WILL NOT BE ACCEPTED.

Please print or type. Original signatures are required. This application must be considered complete by the Division prior to initiation of permit processing. The Division will notify the applicant if additional information is needed to complete the application. If more space is required to answer any question, please attach additional sheets to the application form. Applications must be mailed or delivered to:

Colorado Department of Public Health and Environment  
Water Quality Control Division  
4300 Cherry Creek Drive South  
WQCD-P-B2  
Denver, Colorado 80246-1530

**\*\*Part I** of the application beginning below is to be filled out by the new permit applicant that will be assuming permitting liability for the reassigned portion of the original applicant's site.

**\*\*Part II** of the application, starting on page 3 of the form, is to be completed by the current permittee.

**Both Parts I (pages 1-4) and II (page 5) must be completed.**

EXISTING CERT \*\* \_\_\_\_\_ (from Part II)

**\*\* NOTE: THIS WILL CREATE A NEW PERMIT FOR PART 1 APPLICANT. THE EXISTING PERMIT WILL NOT BE TERMINATED. THIS IS NOT A TRANSFER FORM.**

### PART I - To be completed by the New permit applicant:

I hereby accept the reassignment of permit coverage for the area described in this application. I have reviewed the terms and conditions of this permit and the Stormwater Management Plan and accept full responsibility, coverage and liability

REASSIGNMENT WILL BE EFFECTIVE \_\_\_\_\_  
MONTH/ DAY/ YEAR

Applicant is : Property Owner Contractor/Operator

### A. CONTACT INFORMATION - NOT ALL CONTACT TYPES MAY APPLY \* indicates required

**\*PERMITTEE (If more than one please add additional pages)**

**\*ORGANIZATION FORMAL NAME:** \_\_\_\_\_

1) **\*PERMITTEE** the person **authorized to sign and certify** the permit application. This person receives all permit correspondences and is **legally responsible** for compliance with the permit.

Responsible Position (Title): \_\_\_\_\_

Currently Held By Person): \_\_\_\_\_

Telephone No: \_\_\_\_\_ email address \_\_\_\_\_

Organization: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

**This form must be signed by the Permittee to be considered complete.**

**Per Regulation 61** In all cases, it shall be signed as follows:

- a) In the case of corporations, by a responsible corporate officer. For the purposes of this section, the responsible corporate officer is responsible for the overall operation of the facility from which the discharge described in the application originates.
- b) In the case of a partnership, by a general partner.
- c) In the case of a sole proprietorship, by the proprietor.
- d) In the case of a municipal, state, or other public facility, by either a principal executive officer or ranking elected official

2) **DMR COGNIZANT OFFICIAL (i.e. authorized agent)** the person or position authorized to **sign and certify reports required by the Division** including Discharge Monitoring Reports \*DMR's, Annual Reports, Compliance Schedule submittals, and other information requested by the Division. The Division will transmit pre-printed reports (ie. DMR's) to this person. If more than one, please add additional pages.  Same As 1) Permittee

Responsible Position (Title): \_\_\_\_\_  
Currently Held By (Person): \_\_\_\_\_  
Telephone No: \_\_\_\_\_ email address \_\_\_\_\_  
Organization: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

**Per Regulation 61** : All reports required by permits, and other information requested by the Division shall be signed by the permittee or by a duly authorized representative of that person. A person is a duly authorized representative only if: (i) The authorization is made in writing by the permittee  
(ii) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a **named individual** or any individual occupying a **named position**); and  
(iii) The written authorization is submitted to the Division

3) **\*SITE CONTACT** local contact for questions relating to the facility & discharge authorized by this permit for the facility.

Same As 1) Permittee

Responsible Position (Title): \_\_\_\_\_  
Currently Held By (Person): \_\_\_\_\_  
Telephone No: \_\_\_\_\_ email address \_\_\_\_\_  
Organization: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

4) **\* BILLING CONTACT** if different than the permittee

Responsible Position (Title): \_\_\_\_\_  
Currently Held By (Person): \_\_\_\_\_  
Telephone No: \_\_\_\_\_ email address \_\_\_\_\_  
Organization: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

5) **OTHER (Please describe)** \_\_\_\_\_

Responsible Position (Title): \_\_\_\_\_  
Currently Held By (Person): \_\_\_\_\_  
Telephone No: \_\_\_\_\_ email address \_\_\_\_\_  
Organization: \_\_\_\_\_  
Mailing Address: \_\_\_\_\_  
City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

## B. Permitted Project/Facility Information

Project/Facility Name \_\_\_\_\_

Street Address or cross streets \_\_\_\_\_

City, \_\_\_\_\_ Zip Code \_\_\_\_\_ County \_\_\_\_\_

**Facility Latitude/Longitude**— (approximate center of site to nearest 15 seconds using one of following formats)

001A Latitude \_\_\_\_\_ Longitude \_\_\_\_\_ (e.g., 39.703°, 104.933°)  
degrees (to 3 decimal places) degrees (to 3 decimal places)

or  
001A Latitude \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_" Longitude \_\_\_\_\_° \_\_\_\_\_' \_\_\_\_\_" (e.g., 39°46'11"N, 104°53'11"W)  
degrees minutes seconds degrees minutes seconds

## C. MAP (Attachment)

**Map:** Attach a map that indicates the site location and that CLEARLY shows the boundaries of the area that will be disturbed. Maps must be **no larger** than 11x17 inches.

## D. LEGAL DESCRIPTION

**Legal description:** If subdivided, provide the legal description below, or indicate that it is not applicable (**do not** supply Township/Range/Section or metes and bounds description of site)

Subdivision(s): \_\_\_\_\_ Lot(s): \_\_\_\_\_ Block(s): \_\_\_\_\_

**OR**

Not applicable (site has not been subdivided)

## E. AREA OF CONSTRUCTION SITE

Total area of project site (acres): \_\_\_\_\_

Area of project site to undergo disturbance (acres): \_\_\_\_\_

Total disturbed area of Larger Common Plan of Development or Sale, if applicable: \_\_\_\_\_  
(i.e., total, including all phases, filings, lots, and infrastructure not covered by this application)

## F. NATURE OF CONSTRUCTION ACTIVITY

Check the appropriate box(s) or provide a brief description that indicates the general nature of the construction activities. (The full description of activities must be included in the Stormwater Management Plan.)

- Single Family Residential Development
- Multi-Family Residential Development
- Commercial Development
- Oil and Gas Production and/or Exploration  
(including pad sites and associated infrastructure)
- Highway/Road Development  
(not including roadways associated with commercial or residential development)
- Other, Describe: \_\_\_\_\_

## G. ANTICIPATED CONSTRUCTION SCHEDULE

Construction Start Date: \_\_\_\_\_ Final Stabilization Date: \_\_\_\_\_

**NOTICE OF REASSIGNMENT OF PERMIT COVERAGE AND GENERAL PERMIT APPLICATION  
STORMWATER DISCHARGE ASSOCIATED WITH CONSTRUCTION ACTIVITIES**

**H. RECEIVING WATERS**

(If discharge is to a ditch or storm sewer, include the name of the ultimate receiving waters)

Immediate Receiving Water(s): \_\_\_\_\_

Ultimate Receiving Water(s): \_\_\_\_\_

**I. REQUIRED SIGNATURES (Both parts i. and ii. must be signed)**

**Signature of Applicant:** The applicant must be either the owner and/or operator of the construction site. Refer to Part B of the instructions for additional information. The application must be signed by the applicant to be considered complete. In all cases, it shall be signed as follows:

- a) In the case of corporations, by a principal executive officer of at least the level of vice-president or his or her duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge described in the application originates.
- b) In the case of a partnership, by a general partner.
- c) In the case of a sole proprietorship, by the proprietor.
- d) In the case of a municipal, state, or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee if such representative is responsible for the overall operation of the facility from which the discharge described in the form originates.

**STOP! A Stormwater Management Plan must be completed prior to signing the following certifications!**

**i. Stormwater Management Plan Certification**

"I certify under penalty of law that a complete Stormwater Management Plan, as described in Appendix A of this application, has been prepared for my activity. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the Stormwater Management Plan is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for falsely certifying the completion of said SWMP, including the possibility of fine and imprisonment for knowing violations."

XX

Signature of Legally Responsible Person or Authorized Agent (submission must include original signature)      Date Signed

Name (printed)      Title

**ii. Signature of Permit Legal Contact**

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.

"I understand that submittal of this application is for coverage under the State of Colorado General Permit for Stormwater Discharges Associated with Construction Activity **for the entirety of the construction site/project described and applied for, until such time as the application is amended or the certification is transferred, inactivated, or expired.**"

XX

Signature of Legally Responsible Person (submission must include original signature)      Date Signed

Name (printed)      Title

**DO NOT INCLUDE A COPY OF THE STORMWATER MANAGEMENT PLAN**

**DO NOT INCLUDE PAYMENT – AN INVOICE WILL BE SENT AFTER THE CERTIFICATION IS ISSUED.**

**NOTICE OF REASSIGNMENT OF PERMIT COVERAGE AND GENERAL PERMIT APPLICATION  
STORMWATER DISCHARGE ASSOCIATED WITH CONSTRUCTION ACTIVITIES**

**PART II - AMENDMENT TO THE CURRENT PERMIT CERTIFICATION  
TO BE COMPLETED BY CURRENT PERMITTEE**

CERTIFICATION NUMBER COR03 \_\_\_\_\_ **THIS PERMIT WILL NOT BE TERMINATED**

**II.A. CURRENT PERMIT LEGAL CONTACT INFORMATION**

Check if information has changed

Company Name: \_\_\_\_\_

Legally Responsible Person: First Name: \_\_\_\_\_ Last Name: \_\_\_\_\_

Title: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City, State and Zip Code: \_\_\_\_\_

Phone: \_\_\_\_\_

Email Address: \_\_\_\_\_

**2. PERMITTED FACILITY INFORMATION**

Name of Plan, Project or Development: \_\_\_\_\_

Latitude and Longitude (approximate center of site to nearest 15 seconds using one of following formats):

Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_ (e.g., 39°42'11", 104°55'57")  
degrees /minutes/ seconds degrees/ minutes/ seconds

OR

Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_ (e.g., 39.703°, 104.933')  
degrees (to 3 decimal places) degrees (to 3 decimal places)

**3. MAP (Attachment)**

**Map:** Attach a map that indicates the site location and that CLEARLY shows the boundaries of the area that will be retained under this current certification. Maps must be **no larger** than 11x17 inches.

**4. NATURE OF CONSTRUCTION ACTIVITY**

Check the appropriate box(s) or provide a brief description that indicates the general nature of the construction activities. (The full description of activities must be included in the Stormwater Management Plan.)

Single Family Residential Development

Multi-Family Residential Development

Commercial Development

Other, Describe: \_\_\_\_\_

**9. REQUIRED SIGNATURES Certification for Reassignment**

"I certify under penalty of law that I have personally examined and am familiar with the information submitted in Part II of this application and all attachments in reference to Part II and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment.

"As the permittee currently covered by the above-referenced certification, I hereby agree to reassign the permit coverage for the area and activity described in Items I.b. and I.c., and all responsibilities thereof, from the above-referenced permit certification to the new permittee listed in Part I of this form."

Signature of Legally Responsible Person (submission must include original ink signature) \_\_\_\_\_ Date Signed \_\_\_\_\_

Name (printed) \_\_\_\_\_ Title \_\_\_\_\_

# STATE OF COLORADO

Dedicated to protecting and improving the health and environment of the people of Colorado

**COLORADO DEPARTMENT OF PUBLIC  
HEALTH AND ENVIRONMENT**  
Water Quality Control Division  
4300 Cherry Creek Drive South B2 Permits  
Denver, Colorado 80246-1530



Colorado Department  
of Public Health  
and Environment

## For Agency Use Only

Date Received \_\_\_\_/\_\_\_\_/\_\_\_\_

Complete \_\_\_\_\_

Paid \_\_\_\_\_

Effective Date \_\_\_\_/\_\_\_\_/\_\_\_\_

### APPLICATION FOR TRANSFER OF OWNERSHIP FOR ALL PERMITS, CERTIFICATIONS, AND AUTHORIZATIONS

**PHOTO COPIES, FAXED COPIES, PDF COPIES OR EMAILS WILL NOT BE ACCEPTED.**

**TO BE COMPLETED BY NEW PERMITTEE:** Permit or Certification or Authorization Number \_\_\_\_\_

I hereby apply for a transfer of ownership of this Colorado Discharge Permit, Certification, or Authorization listed above, which was issued to (permittee listed in Part 2, page 2) \_\_\_\_\_.

I have reviewed the terms and conditions of this permit and accept responsibilities, coverage and liability (including Stormwater Management Plan where applicable).

If all information is correct, form is complete, and transfer approved, I request this transfer to be effective on \_\_\_\_\_.

I have ensured that all of the following requirements have been met:

- 1. **BOTH parties have completed and signed this form – pages 1 and 2**
- 2. **ORIGINAL Form mailed to Division 30 Days Prior to the Transfer Effective Date (which may be the date property exchanges hands. Copies, PDF versions, and Faxes will NOT be accepted and will delay the issuance of the transfer.**
- 3. **All existing invoices paid and verified by the Division. Payment MUST be received prior to transfer issuance**

### PROJECT OR FACILITY INFORMATION

Project or Facility Name: \_\_\_\_\_

Facility Address (location) \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ County: \_\_\_\_\_

### NEW PERMITTEE INFORMATION (fill out all appropriate contacts)

Company name: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ Telephone No: \_\_\_\_\_

- **Legal Contact:** will receive all future permit correspondences and is legally responsible for compliance with the permit

Name: \_\_\_\_\_ email address \_\_\_\_\_

Title: \_\_\_\_\_ Telephone No: \_\_\_\_\_

- **Local Contact:** will be contacted for questions relating to the facility and the discharge authorized by the permit for the facility.

Name: \_\_\_\_\_ email address \_\_\_\_\_

Title: \_\_\_\_\_ Telephone No: \_\_\_\_\_

- **Authorized Agent(s)** - may sign reports (such as DMR's or Annual Reports) required by the permit.

**Authorized Agent** \_\_\_\_\_ email address \_\_\_\_\_

Title: \_\_\_\_\_ Telephone No: \_\_\_\_\_

**Authorized Position** \_\_\_\_\_ Telephone No: \_\_\_\_\_

Currently held by: \_\_\_\_\_ email address: \_\_\_\_\_

**APPLICATION FOR TRANSFER OF OWNERSHIP FOR ALL PERMITS, CERTIFICATIONS, AND AUTHORIZATIONS**

- **Billing Contact Information** - if billing address is different than legal contact

Name: \_\_\_\_\_ email address \_\_\_\_\_

Company Name: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ Telephone No: \_\_\_\_\_

**REQUIRED SIGNATURE:**

**Signature of Applicant:** The applicant must be either the owner and/or operator of the construction site. Refer to Part B of the instructions for additional information. The application must be signed by the applicant to be considered complete. In all cases, it shall be signed as follows:

- a) In the case of corporations, by a principal executive officer of at least the level of vice-president or his or her duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge described in the application originates.
- b) In the case of a partnership, by a general partner.
- c) In the case of a sole proprietorship, by the proprietor.
- d) In the case of a municipal, state, or other public facility, by either a principal executive officer, ranking elected official, or other duly authorized employee if such representative is responsible for the overall operation of the facility from which the discharge described in the form originates.

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein, and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signature(Legally Responsible Party)\_\_\_\_\_ Date \_\_\_\_\_

Name (printed) \_\_\_\_\_ Title \_\_\_\_\_

.....  
**PART 2 - TO BE COMPLETED BY PREVIOUS PERMITTEE**

As previous owner, I hereby agree to the transfer of the above-referenced permit and all responsibilities thereof.

Company Name: \_\_\_\_\_

Mailing Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_ Telephone No: \_\_\_\_\_

Signature (Legally Responsible Party)\_\_\_\_\_ Date \_\_\_\_\_

Name (printed) \_\_\_\_\_ Title \_\_\_\_\_

Email address \_\_\_\_\_

APPENDIX D  
FIELD NOTES, CONTACTS, ETC.



# Ecological Resource Consultants, Inc.

5672 Juhls Drive ~ Boulder, CO ~ 80301 ~ (303) 679-4820

---

**Date:** February 17, 2017

**To:** Town of Erie, Community Development Department – Planning Division  
645 Holbrook Street  
PO Box 750  
Erie, Colorado 80516

**Project:** **Development Report**  
**Threatened and Endangered Species, Habitat, and Wetlands Review**  
**Flatiron Meadows Development Project, Preliminary Plat, Planning Area H**  
**Erie, Colorado 80516**

Ecological Resource Consultants, Inc. (ERC), on behalf of Calibre Engineering (Project Engineer), provides this summary letter to address Threatened and Endangered Species, Habitat, and Wetlands for the Flatiron Meadows Development, Preliminary Plat, Planning Area H to ensure compliance with the subdivision standards and requirements set forth in Municipal Code, Title 10, Chapter 6, Subdivision Design and Improvements, of the Unified Development Code and in accordance with the Preliminary Plat-User's Guide (February 5, 2008) specifically, Section 10.f.

Planning Area H is generally located southeast of the intersection of Erie Parkway and North 111<sup>th</sup> Street in Section 26, Township 1 North, Range 69 West, west of Erie, Boulder County, Colorado, (**Latitude 40.024814 ° North, Longitude -105.091308° West**) (Site). The Site is surrounded by fallow agricultural land, North 111<sup>th</sup> Street to the west/southwest, and several oil and gas well production sites towards the south, east, and west. Prince Lake Reservoir is located offsite across North 111<sup>th</sup> Street to the southwest. The total area of the Site is approximately 30 acres (**Figures 1 and 2**).

The following summarizes threatened and endangered species, habitat, and wetland evaluations completed for the Site. Refer to **Appendix A – Site Photos** for characteristics of the Site.

## **1. Threatened and Endangered Species**

ERC previously completed a Screening Report for Federal and State Threatened and Endangered Species dated April 26, 2012 (ERC 2012 Report) for a larger property which specifically included the Site. The ERC 2012 Report detailed the results of field assessments and screened the Site for potential habitat for both state listed and federally listed threatened and endangered species. The following summarizes the findings of the ERC 2012 Report and subsequent determinations.

- A. Federal or state listed threatened and endangered species and/or habitat protected under the Endangered Species Act (ESA) does not exist within the larger property and specifically on the Site. No individuals or habitat for federally or state listed threatened and endangered species was identified and it was determined that no adverse effect would likely occur by any future land use changes. Furthermore, connectivity to known populations was limited due to geographic, hydrologic, and other habitat constraints.

- In a letter dated May 18, 2012 the US Fish and Wildlife Service (USFWS) concurred with the ERC 2012 Report that federally-listed threatened or endangered species are not likely to be present on or within the Site. (**Attachment A**).
  - As part of Department of Army Permit (NWO-2012-2944) dated November 4, 2014 for the larger property and overall project which also included the Site, the USFWS further concluded that no adverse effect would occur to federally-listed threatened or endangered species on or in the vicinity of the Site.
- B. The ERC 2012 Report also addressed migratory birds including raptors that could potentially use and nest in vegetation and trees in and around the Site. These birds are protected under the Migratory Bird Treaty Act (MBTA), and killing or possession of these birds is prohibited. Generally, the active nesting season for most migratory birds in this region of Colorado occurs between April 1 and August 15. In summary, migratory birds likely utilize the Site and potentially nest in understory grasslands, shrubs and trees.
- Vegetation removal, specifically trees and shrubs, on the Site during the active nesting season (April 1-August 15) should first ensure that active nests are not disturbed.
  - Raptor nest sites are further protected by the Colorado Parks and Wildlife (CPW). The CPW has established recommended buffer zones and seasonal activity restrictions for a variety of Colorado raptors. At the time of this letter, no raptors sites were observed in the vicinity of the Site, however raptors have been known to nest in the vicinity in the Site. Prior to proposed land disturbance, the vicinity of the Site should be evaluated to ensure no raptor nest sites are present.
- C. ERC conducted a site reconnaissance on February 10 and 13, 2017 to identify any changes in conditions from previous studies. The site reconnaissance confirmed that no new threatened or endangered species are likely to occur on the Site and no active raptor nests currently exist.

## **2. Wetlands and Waters of the US**

ERC completed a Wetland Delineation Report dated January 15, 2013 (ERC 2013 Report) for the larger property which specifically included the Site (**Figure 2**). The ERC 2013 Report detailed the results of a formal wetland delineation which was subsequently verified by the USACE through an Approved Jurisdictional Determination dated May 3, 2013 (2013 AJD) (**USACE File No. 199880700**) (**Attachment B**). The 2013 AJD remains valid. The 2013 AJD addressed two features (Wetland Area 5 and Prince Tributary) within the Site.

- A. Wetland Area 5 within the Site comprises approximately 3.07 acres and is characterized as Palustrine Emergent (PEM) situated in the southwestern portion of the Site. The 2013 AJD determined that Wetland Area 5 within the Site was non-jurisdictional and is not regulated under Section 404 of the Clean Water Act (CWA) based on lack of connectivity to other downstream waters of the US. Wetland Area 5 within the Site is not considered a regulated water of the US under CWA and this area is authorized for disturbance.
- B. Prince Tributary flows south to north through the eastern portion of the Site and comprises approximately 0.03 acres within the Site. This feature is a highly modified manmade ditch that conveys

flows from stormwater facilities south of the Site. The portion of Prince Tributary within the Site comprises upland soils and vegetation within and/or along the banks; however, the ditch exhibits evidence of flow and more distinct wetland characteristics offsite to the north. Prince Tributary is considered a jurisdictional waters of the US and is regulated under the CWA. Any disturbance to Prince Tributary requires prior authorization from the USACE (Refer to **Figure 3** for location of Prince Tributary in relation to the proposed development area).

- C. ERC conducted the site reconnaissance on February 10 and 13, 2017 to identify any changes in condition from previous studies. The site reconnaissance confirmed the general findings of the ERC 2013 Report and did not identify any new potential waters of the US.

### SUMMARY OF FINDINGS

The occurrence of threatened and endangered species, habitat, and wetlands has been assessed for the Site in accordance within Section 10.f of the Preliminary Plat-User's Guide. Field investigations and subsequent regulatory agency review have determined no federal or state threatened and endangered species, and/or habitat, exists on the Site. In addition, Site assessment has determined that no active raptor nests or buffer zones are currently present within the vicinity of the Site. However, prior to proposed land disturbance the vicinity of the Site should be evaluated to ensure no active migratory bird or raptor nest sites are present.

Formal wetland delineation and USACE verification has determined that only Prince Tributary is considered a jurisdictional water of the US regulated under the CWA within the Site. Based on review of Planning Area H proposed plans and limits of disturbance (**Figure 3**), no disturbance will occur to Prince Tributary on the Site, therefore no further USACE permitting or coordination will be required.

If you have any questions or require additional information please feel free to contact me.

Sincerely,

**ECOLOGICAL RESOURCE CONSULTANTS, INC.**



Kyle Medash, Ecologist

Reviewed and approved by:



David J. Blaich, V.P., Senior Ecologist

### Appendix A - Site Photos



*Photo 1. View south at Prince Tributary near the southeastern Site boundary.*



*Photo 2. View south at Prince Tributary near the northern Site boundary.*



*Photo 3. View northwest at Prince Tributary where it crosses the access road at the eastern Site boundary. Fallow agricultural land typical of the Site is evident in this photo.*



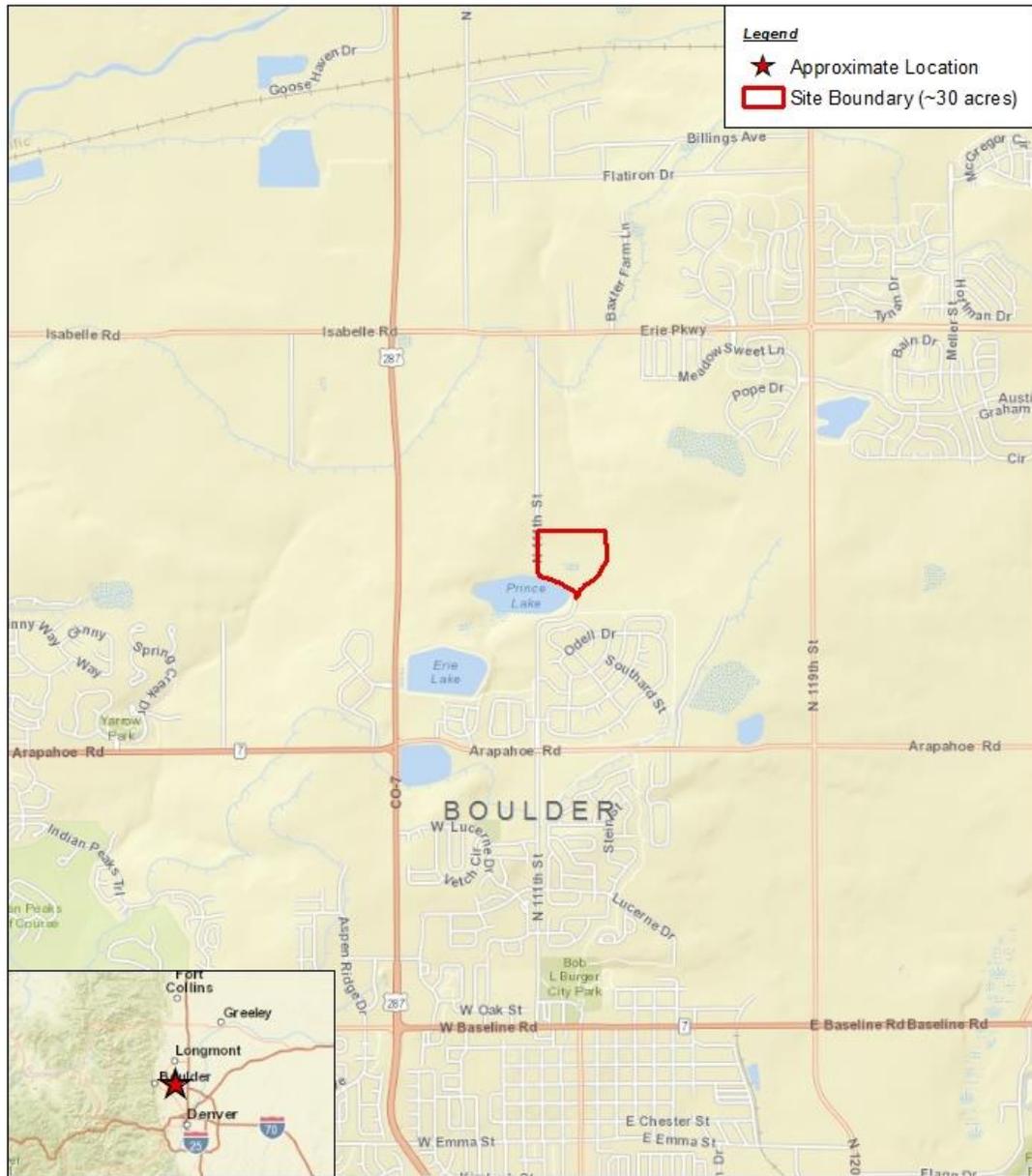
*Photo 4. View south at PEM Wetland Area 5 (non-jurisdictional) and a cluster of small cottonwood trees in the south central portion of the Site*

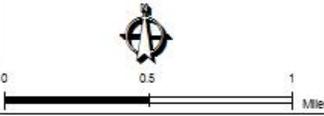


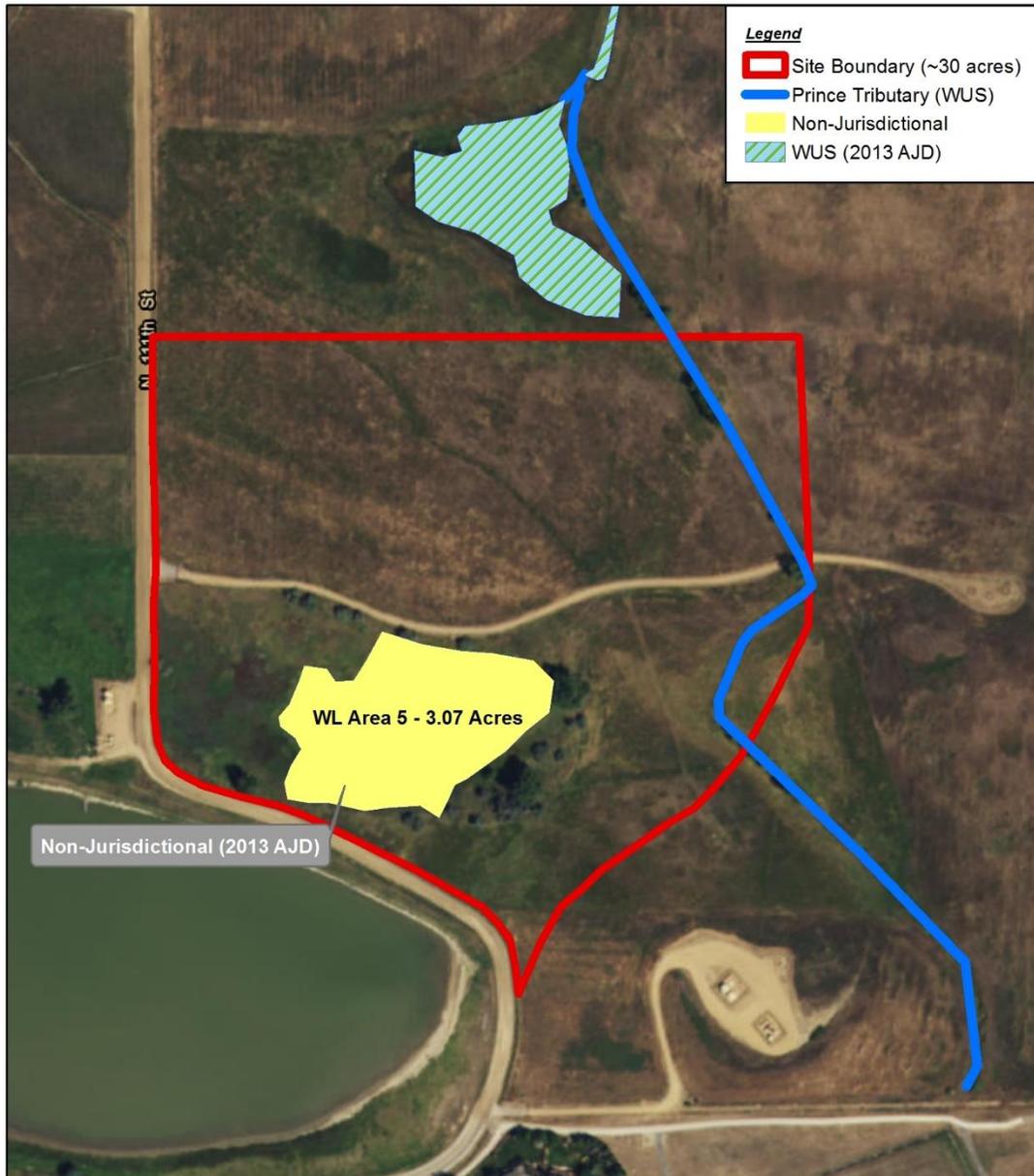
*Photo 5. View southeast of the southern portion of the Site comprising fallow agricultural land and Wetland Area 5 PEM habitat in the background.*



*Photo 6. View north at the northern portion of Site comprised of fallow agricultural land dominated by non-native grasses and ruderal herbaceous species.*



<p>Prepared By:</p>  <p>5672 Juhl's Drive Boulder, CO 80301 (303) 679-4820 ERC #: 240-1701</p>	<p><b>FIGURE 1. VICINITY MAP</b></p> <p><b>PRELIMINARY PLAT, PLANNING AREA H BOULDER COUNTY, COLORADO</b></p>	 <p>Prepared For: Calibre Engineering</p>
---	---	--

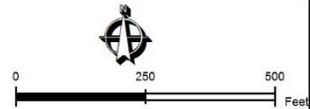


Prepared By:

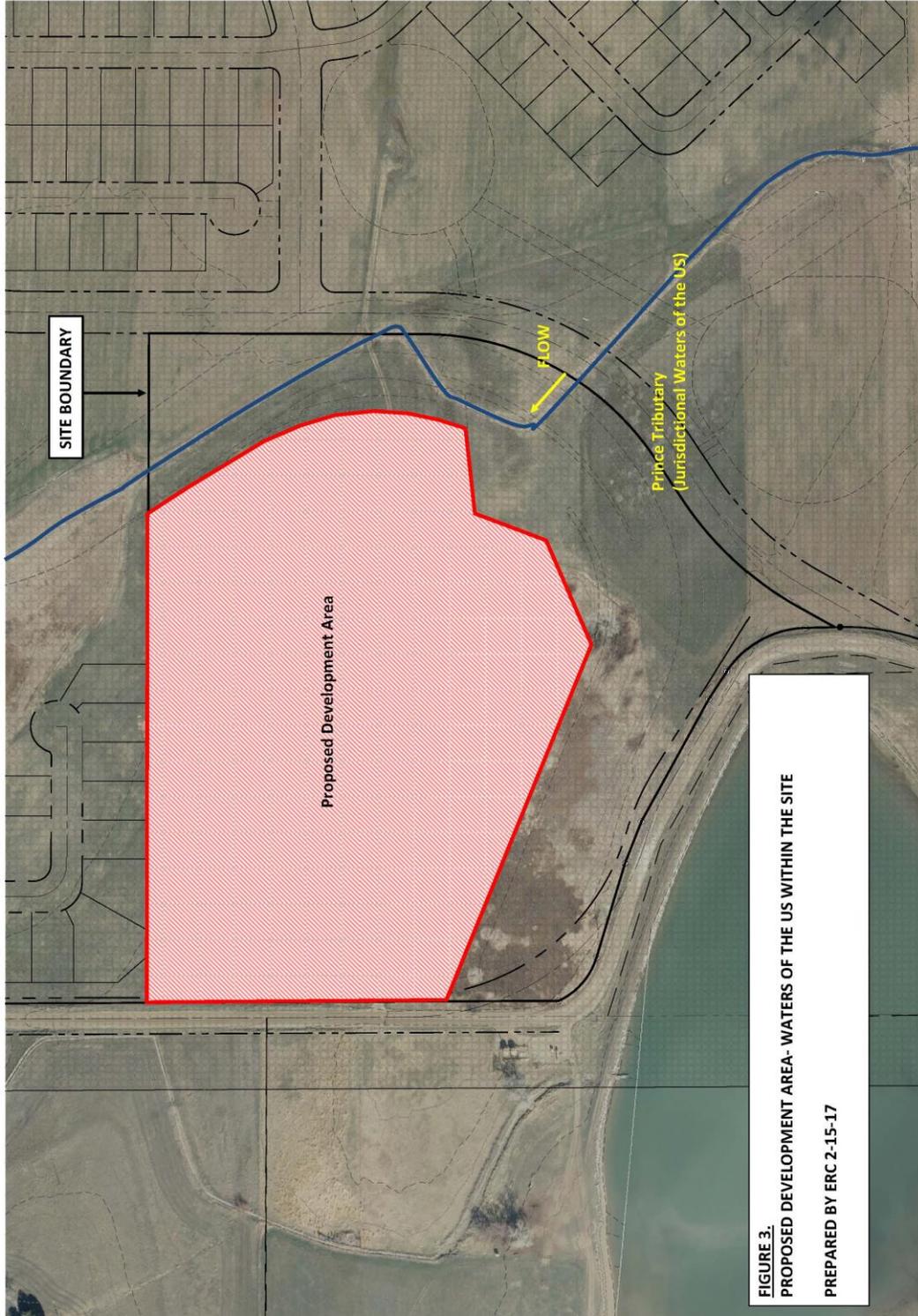


5672 Juhls Drive  
Boulder, CO 80301  
(303) 679-4820  
ERC #: 240-1701

**FIGURE 2.**  
**WETLAND & WATERS OF THE US MAP**  
**PRELIMINARY PLAT, PLANNING AREA H**  
**BOULDER COUNTY, COLORADO**



Prepared For:  
Calibre Engineering



ATTACHMENT A



United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Ecological Services  
Colorado Field Office  
P.O. Box 25486, DFC (65412)  
Denver, Colorado 80225-0486



IN REPLY REFER TO:  
ES/CO: T&E/Concurrence  
TAILS: 06E24000-2012-TA-0488

MAY 18 2012

Dan Morta  
Ecological Resource Consultants, Inc.  
5672 Juhls Drive  
Boulder, Colorado 80301

Dear Mr. Morta:

The U.S. Fish and Wildlife Service (Service) received your letter of May 9, 2012, and accompanying report of April 26, 2012, regarding the Flatirons Meadow, Filings 1-3 property located in Erie, Boulder County, Colorado (Sections 23 and 26, Township 1 North, Range 69 West). You requested concurrence that future land use changes on the property associated with a proposed residential development are not likely to adversely affect federally-listed threatened or endangered species. The following comments have been prepared based on the authority conferred to the Service by the Endangered Species Act of 1973 (ESA), as amended (50 CFR §402.14), and the Migratory Bird Treaty Act (MBTA) (16 U.S.C. 703).

The site of the proposed development covers approximately 369 acres, with 85 percent of the area in agricultural fields. Also present are a home site, the former Elmwood Reservoir (now decommissioned), the Leyner Ditch, an unnamed drainage, and low depressions that may support wetlands. Based on the information and analysis you have provided regarding the habitats present, the Service concurs with your conclusion that federally-listed threatened or endangered species are not likely to be present on the site and, therefore, the proposed project is not likely to directly affect federally-listed species.

However, as acknowledged on page 5 of your report, actions with a Federal nexus that result in depletions to flows in the Platte River system may require consultation under section 7 of the ESA, since they are likely to adversely affect listed species and designated critical habitat in the central Platte River in Nebraska. You conclude that "the proposed project is not anticipated to be considered a water deletion (*sic*) to the Platte River Basin and is therefore not likely to adversely affect the continued existence or available habitat of these species." Be aware that a wide range of project elements could be associated with depletions to the Platte River system, including, but not limited to, ponds (detention/recreation/irrigation storage), lakes (recreation/municipal storage/power generation), reservoirs (recreation/ irrigation storage/ municipal storage/power generation), pipelines, wells, diversion structures, and water treatment facilities. We have received no development plans for the site, do not know which if any of these elements may be proposed, and therefore have no basis to concur with your conclusion that

Approximate SITE BOUNDARY



Page 2

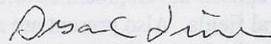
depletions will not likely occur. If a Federal agency is associated with the proposed project (e.g., the U.S. Army Corps of Engineers (Corps) under section 404 of the Clean Water Act) and the Federal agency and the applicant determine that there are depletions associated with the project, the Federal agency should request initiation of formal section 7 consultation in a letter to this office.

Regarding wetlands on site, an 8-acre depression located in the southwest portion of the property in close proximity to Prince Lake #2 (which is just off of the site) and an area along the natural drainage just to the northeast appears to support significant area of wetlands. While these wetlands may or may not fall under Corps jurisdictional, we urge that development plans avoid adverse impact to wetlands and wildlife habitat present on this portion of the site.

Lastly, on pages 3 and 4 of your report you address MBTA concerns and cite Colorado Division of Parks and Wildlife (CPW) suggested buffer zones and seasonal restrictions for raptor nests. You further discuss "negotiations" with the Service to modify CPW-recommended buffers. To clarify our position, the Colorado Ecological Services Field Office is in general agreement with CPW over their raptor protection guidance. While we acknowledge that some human activities inside CPW recommended buffers may have no effect on nesting raptors, we can provide no assurance as to how individual raptors will respond or preclude potential liability under MBTA for human activities occurring near a nest.

If the Service can be of further assistance, please contact Peter Plage of this office at (303) 236-4750 or, for issues regarding Platte River depletions, Sandy Vana-Miller at 303-236-4748.

Sincerely,



Susan C. Linner  
Colorado Field Supervisor

pc: COE, Littleton, CO  
ec: Plage  
Vana-Miller

Pplage:T&amp;E\2012.09:051712

**ATTACHMENT B**



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

May 3, 2013

Mr. Dan Morta  
Ecological Resource Consultants, Inc.  
35715 US Hwy 40, Suite D204  
Evergreen, CO 80439

**RE: Flatiron Meadows Filings 1-3 Area 5, Approved Jurisdictional Determination  
Corps File No. 199880700**

Dear Mr. Morta:

Reference is made to the above-mentioned project located at 40.024267; -105.0909005, Boulder County, Colorado.

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.

Wetland areas 1A, 1B, 2, 3 and 4, Including the Leyner Cottonwood No. 1 Ditch were determined to be jurisdictional and are regulated under Section 404 of the Clean Water Act. Isolated Wetland Area 5 was determined to be non-jurisdictional and is not regulated under Section 404 of the Clean Water Act.

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 Wetland areas 1A, 1B, 2, 3 and 4, Including 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.

Work in jurisdictional aquatic sites should be shown on a map identifying the latitude, longitude 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

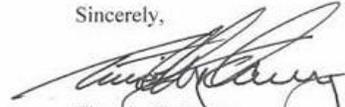
review.

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. 199880700**.

Sincerely,



Timothy T. Carey  
Chief, Denver Regulatory Office

tm



# Ecological Resource Consultants, Inc.

5672 Juhls Drive ~ Boulder, CO ~ 80301 ~ (303) 679-4820

---

**Date:** February 17, 2017

**To:** Town of Erie, Community Development Department – Planning Division  
645 Holbrook Street  
PO Box 750  
Erie, Colorado 80516

**Project:** **Development Report**  
**Cultural, Archaeological, and Historical Review**  
**Flatiron Meadows Development Project, Preliminary Plat, Planning Area H**  
**Erie, Colorado 80516**

Ecological Resource Consultants, Inc. (ERC), on behalf of Calibre Engineering (Project Engineer), provides this summary letter to address cultural, archaeological, and historical resources for the Flatiron Meadows Development, Preliminary Plat, Planning Area H to ensure compliance with the subdivision standards and requirements set forth in Municipal Code, Title 10, Chapter 6, Subdivision Design and Improvements, of the Unified Development Code and in accordance with the Preliminary Plat-User's Guide (February 5, 2008) specifically, Section 10.g.

Planning Area H is generally located southeast of the intersection of Erie Parkway and North 111<sup>th</sup> Street in Section 26, Township 1 North, Range 69 West, west of Erie, Boulder County, Colorado, (**Latitude 40.024814 ° North, Longitude -105.091308° West**) (Site). The Site is surrounded by fallow agricultural land, North 111<sup>th</sup> Street to the west/southwest, and several oil and gas well production sites towards the south, east, and west. Prince Lake Reservoir is located offsite across North 111<sup>th</sup> Street to the southwest. The total area of the Site is approximately 30 acres (**Figures 1 and 2**).

The following summarizes the preliminary review completed to identify potential Cultural, Archaeological, and Historical features on the Site.

*Flatirons Meadows Regional Drainage Improvements, Cultural Resources Report, Boulder County, Colorado, A & B Cultural Consultants, LLC, March 2014*

A&B Cultural Consultants, LLC completed a cultural resources survey (March 2014) which specifically included the proposed 30 acre Site (**Figure 2**). The survey comprised a file search, literature review and reconnaissance-level cultural resources investigation. The report concluded the following key items:

1. No cultural, archaeological or historic features were identified on the Site.
2. Two potential historic sites were identified in the vicinity of Site: a segment of the Leyner-Cottonwood No. 1 Ditch (**5BL862.11**) and the Meadow Sweet Farm (**5BL.6886**).
  - **5BL.862.11** is located approximately 0.50 miles north of the northern Site boundary, and comprises a segment the Leyner-Cottonwood No. 1 Ditch. The cultural resource report recommended that the Leyner-Cottonwood No. 1 Ditch segment (**5BL862.11**) be considered

- to retain sufficient integrity to support the eligibility of the entire ditch of which it is a part and for which there is no official determination, but which nonetheless appears to be eligible.
- Activities on the Site will not disturb 5BL.862.11 which is over 0.5 miles to the north.
3. **5BL.6886** is located approximately 0.50 miles north of the northern Site boundary (refer to **Figure 2**) and is comprised of the ruins of a farmstead. The cultural resource report determined this feature as not eligible for listing in the National Register of Historic Places (NRHP) by the Bureau of Reclamation and the SHPO has concurred with this. This features appear to have since been demolished and removed.
  4. The cultural resource report was issued to and confirmed by the Colorado Historical Society, Office of Archaeology and Historic Preservation as part of Department of Army Permit (NWO-2012-2944) dated November 4, 2014 for the larger property and overall project which also included the Site.

### **SUMMARY OF FINDINGS**

The occurrence of Cultural, Archaeological and Historical Resources has been assessed for the Site in accordance within Section 10.g of the Preliminary Plat-User's Guide. The Cultural Resource Report (A&B Cultural Consultants, LLC 2014) which specifically included the Site, had determined that no eligible historic properties are located within the Site.

If you have any questions or require additional information please feel free to contact me.

Sincerely,

### **ECOLOGICAL RESOURCE CONSULTANTS, INC.**

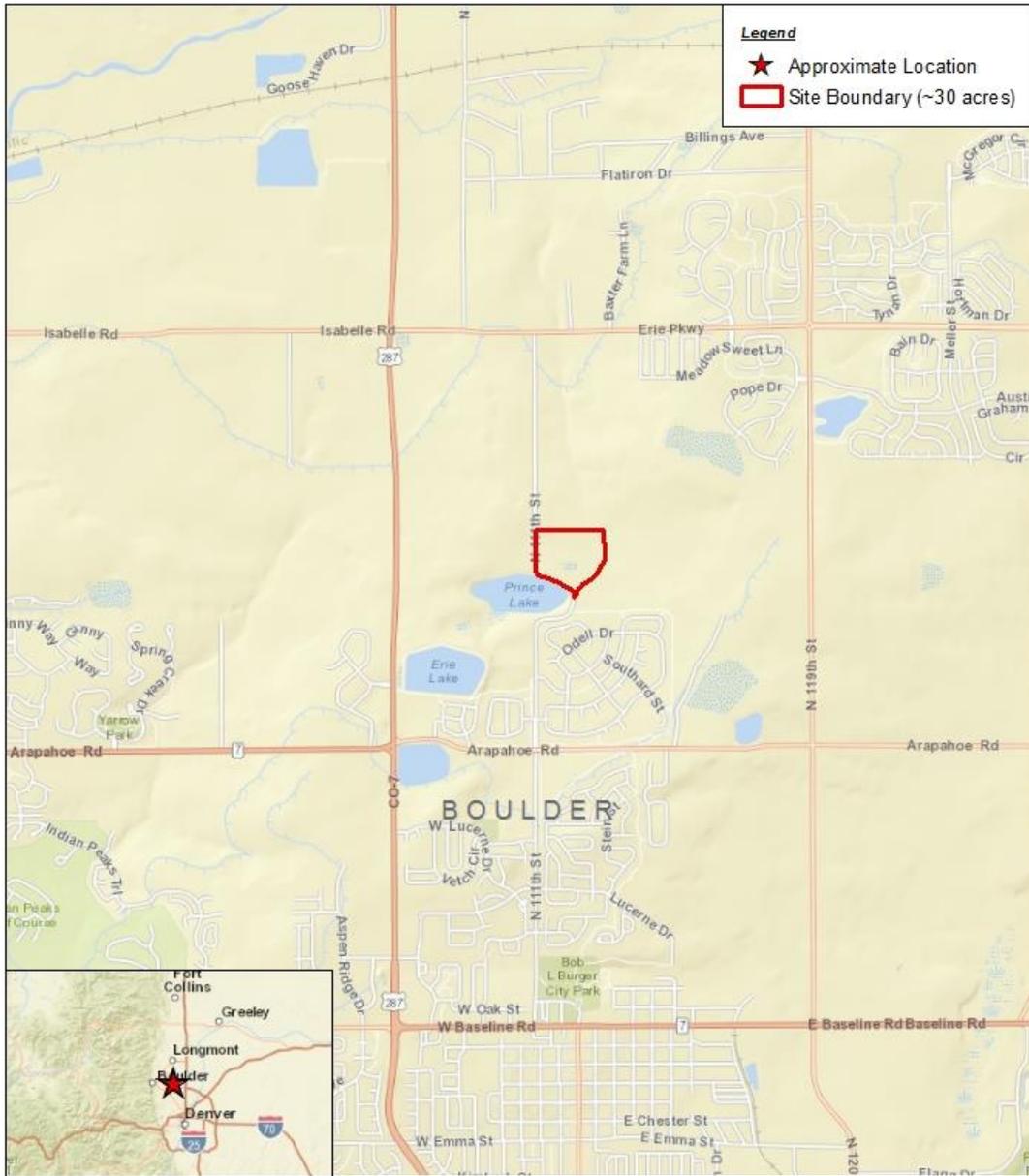


Kyle Medash, Ecologist

Reviewed and approved by:



David J. Blanch, V.P., Senior Ecologist



Prepared By:

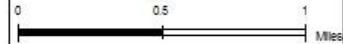


5672 Juhl's Drive  
 Boulder, CO 80301  
 (303) 679-4820

ERC #: 240-1701

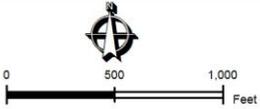
**FIGURE 1.  
 VICINITY MAP**

**PRELIMINARY PLAT, PLANNING AREA H  
 BOULDER COUNTY, COLORADO**



Prepared For:  
 Calibre Engineering



<p>Prepared By:</p>  <p>5672 Juhls Drive        Boulder, CO 80301        (303) 679-4820        ERC #: 240-1701</p>	<p><b>FIGURE 2.</b>  <b>CULTURAL RESOURCES</b></p> <p><b>PRELIMINARY PLAT, PLANNING AREA H</b>  <b>BOULDER COUNTY, COLORADO</b></p>	 <p>Prepared For:        Calibre Engineering</p>
---	---	---



# Ecological Resource Consultants, Inc.

5672 Juhls Drive ~ Boulder, CO ~ 80301 ~ (303) 679-4820

---

**Date:** February 17, 2017

**To:** Town of Erie, Community Development Department – Planning Division  
645 Holbrook Street  
PO Box 750  
Erie, Colorado 80516

**Project:** **Development Report -Environmental Hazards Preliminary Assessment  
Flatiron Meadows Development Project, Preliminary Plat, Planning Area H  
Erie, Colorado 80516**

Ecological Resource Consultants, Inc. (ERC), on behalf of Calibre Engineering (Project Engineer), provides this Environmental Hazards Preliminary Assessment for the Flatiron Meadows Development Preliminary Plat, Planning Area H (Project) to ensure compliance with the subdivision standards and requirements set forth in Municipal Code, Title 10, Chapter 6, *Development and Design and Standards*, of the Unified Development Code and in accordance with the Preliminary Plat-User's Guide (February 5, 2008) specifically, Section 10(k). Environmental hazards herein have been considered as "*recognized environmental conditions*" (RECs) per American Society for Testing and Materials 1527-13 (ASTM 2013). RECs are generally defined as the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property: (1) due to release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment.

Planning Area H is generally located southeast of the intersection of Erie Parkway and North 111<sup>th</sup> Street in Section 26, Township 1 North, Range 69 West, west of Erie, Boulder County, Colorado, (**Latitude 40.024814 ° North, Longitude -105.091308° West**) (Site). The Site is surrounded by fallow agricultural land, North 111<sup>th</sup> Street to the west/southwest, and several oil and gas well production sites towards the south, east, and west. Prince Lake Reservoir is located offsite across North 111<sup>th</sup> Street to the southwest. The total area of the Site is approximately 30 acres (**Figures 1 and 2**).

The following summarizes the preliminary review completed to identify potential environmental hazards on the Site. This review is not considered a formal and complete Phase I environmental site assessment.

## **1. Limited Environmental Review, ATC Associates Inc., July 30, 2007**

ATC Associates Inc. completed a Limited Environmental Review (July 30, 2007) (ATC 2007) which included the Site (**Figure 3**). The scope of ATC 2007 included a site visit, federal, state and local environmental records reviews, and a summary letter report of the findings. ATC 2007 was not considered a formal Phase I Environmental Site Assessment in accordance with ASTM Standards but was intended to summarize findings at the Property since a previous Phase I Environmental Assessment completed on February 6, 2006 and a Phase II Sub-Surface Investigation completed on March 6, 2006.

- ATC 2007 did not identify evidence of RECs on the Property, which included the Site.

- ATC 2007 did note oil production equipment (including tank batteries, pumps, high-pressure gas lines and associated piping) located offsite to the north, east, and south (refer to **Figure 3**). ATC had previously performed sub-surface investigations (March 6, 2006) in the vicinity of the oil production equipment which did not identify groundwater contamination.

## **2. ERC 2017 Preliminary Assessment**

ERC conducted a site reconnaissance, in general accordance with ASTM 1527-13 practices on February 10 and 13, 2017. The site reconnaissance was specific to the Site and did not include the entire property as evaluated by ATC 2007. The site reconnaissance included a walk-through of the grounds to identify evidence of activities, conditions and/or *contamination indicators* that may be relevant to this assessment. Observations made during the site reconnaissance included current conditions and potential indicators of RECs.

- The Site reconnaissance generally confirmed the findings of the ATC 2007. No obvious RECs, contamination indicators nor hazardous substances were identified.
- ERC did confirm the presence of three oil production facilities off the Site to the east, west, and south. As these facilities are up gradient of the Site and do store petroleum product they can be considered a potential material threat. Upon visual inspection the facilities appeared to be clean with no indication of spills or leaks and general housekeeping appeared to be good. ERC conducted a search using the COGCC website to evaluate if any spills or issues have been reported for wells near the Site. The search results provided no records of spills or issues that have been reported for the wells in the vicinity of the Site (**Figure 3**).
- Typical correct operation and maintenance of these facilities does not generally constitute a REC. Available records indicate these facilities are in compliance with State regulations and there was no direct observation of contamination indicators during the site reconnaissance. While the presence and operations of these facilities has not been considered a REC in connection with the Site the facilities can be considered as a potential increased risk for contamination to the environment.
- ERC conducted an aerial imagery time step analysis of the Site and the surrounding area using Google Earth Aerial Imagery from 1993 to present. The majority of the Site and the surrounding area appears to have been in agricultural production throughout this time frame. An access road that was likely constructed originally for agricultural use bisects the Site east-west. Currently, the access road remains but is now used for access to oil production equipment east of the Site. It appears the oil well offsite to the west was constructed between 1993-1999, and the oil well and associated equipment to the east and south was constructed between 2008 and 2010 (**Figure 3**). Residential development increased to the south between 1993-1999, and has been steadily increasing toward the north and east from 2012 to present. The Site itself has remained relatively unchanged from 1993 to present. Based on Google Earth Aerial Imagery and USGS Topographic Mapping no structures have been historically present on the Site or within the immediate vicinity. Aerial imagery review does not indicate potential contamination indicators on the Site.

**SUMMARY OF FINDINGS**

Previous reports did not identify potential environmental hazards in connection with the Site or the larger surrounding property. ERC 2017 Preliminary Assessment generally confirmed previous findings and did not identify any new obvious RECs, contamination indicators nor hazardous substances in connection with the Site.

Three oil production facilities are located up gradient off the Site. Typical correct operation and maintenance of these facilities does not generally constitute a REC, however can be considered as an increased risk for contamination to the environment. Previous subsurface investigation, visual inspection and records review do not indicate any past leaks, spills or contamination indicators which would impact the Site.

Based on this preliminary review, no potential environmental hazards appear to be present in connection with the Site.

If you have any questions or require additional information please feel free to contact me.

Sincerely,

**ECOLOGICAL RESOURCE CONSULTANTS, INC.**

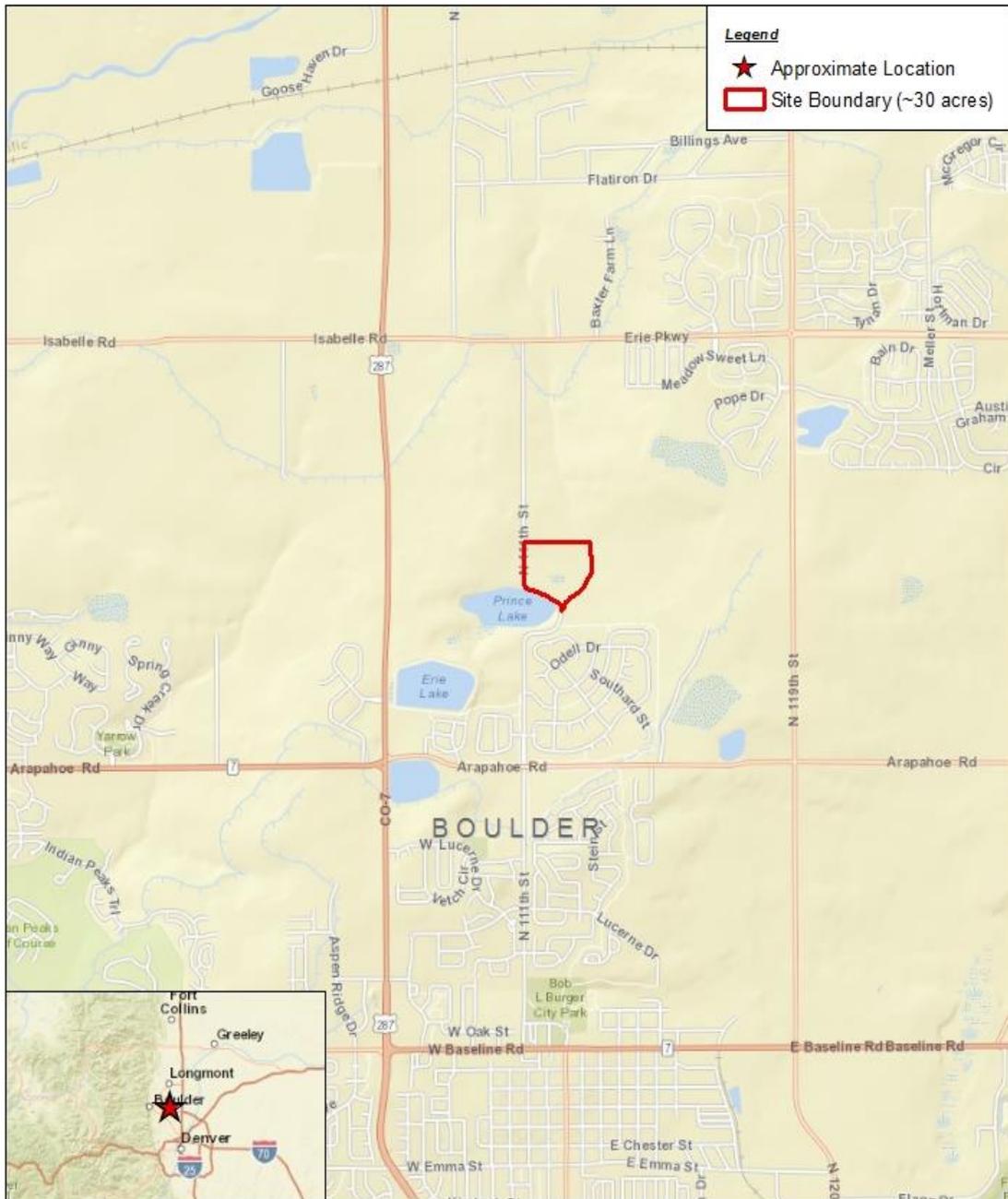


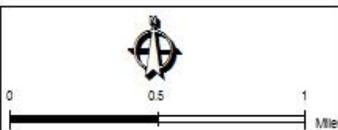
Kyle Medash, Ecologist

Reviewed and approved by:



David J. Blanch, V.P., Senior Ecologist



<p>Prepared By:</p>  <p>5672 Juhls Drive Boulder, CO 80301 (303) 679-4820 ERC # 240-1701</p>	<p><b>FIGURE 1.</b> <b>VICINITY MAP</b></p> <p><b>PRELIMINARY PLAT, PLANNING AREA H</b> <b>BOULDER COUNTY, COLORADO</b></p>	 <p>Prepared For: Calibre Engineering</p>
---	---	--



Prepared By:



5672 Juhls Drive  
Boulder, CO 80301  
(303) 679-4820  
ERC #: 240-1701

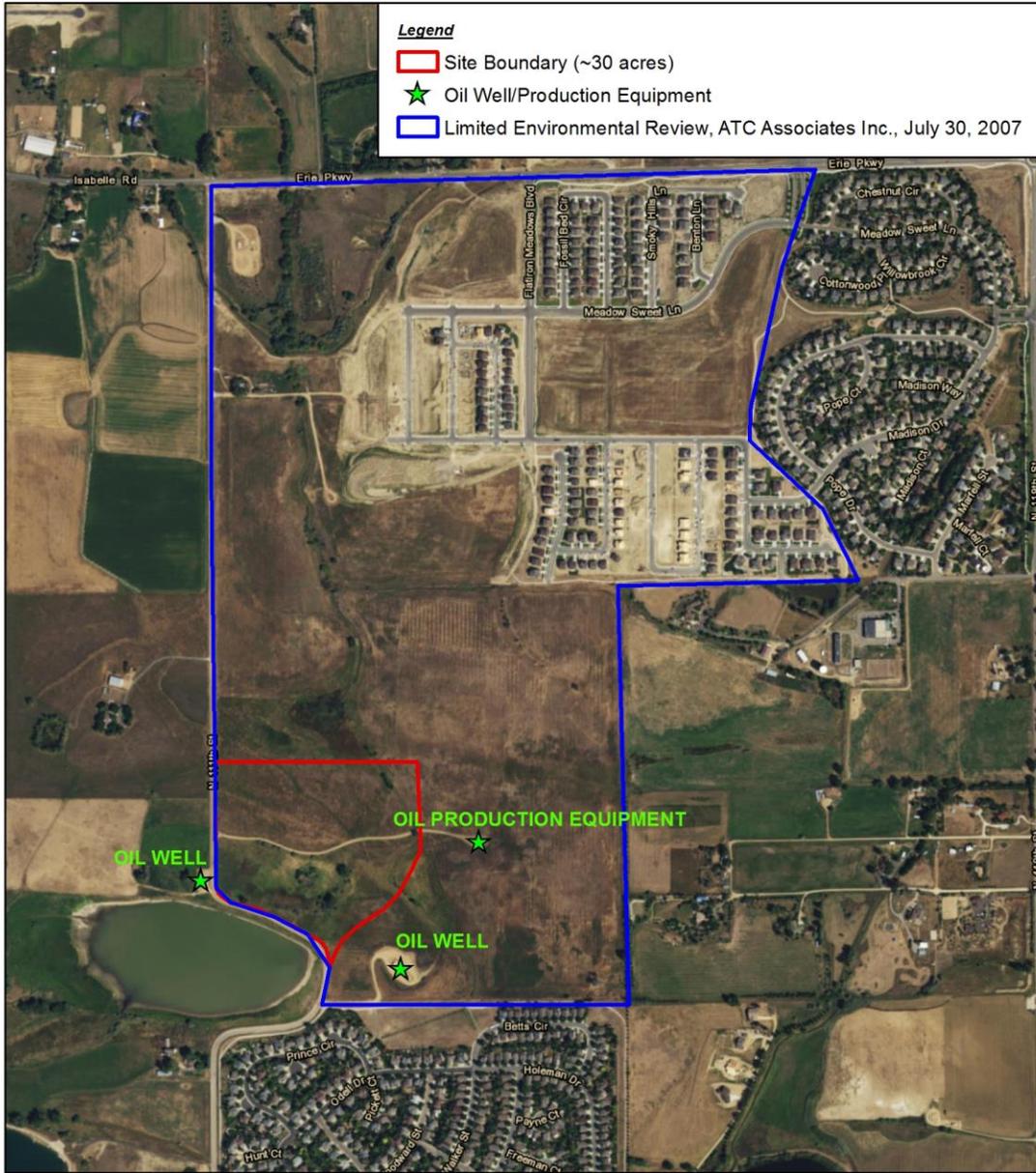
**FIGURE 2.  
SITE MAP**

**PRELIMINARY PLAT, PLANNING AREA H  
BOULDER COUNTY, COLORADO**



0 375 750 Feet

Prepared For:  
Calibre Engineering



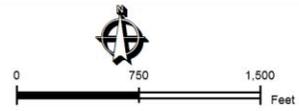
Prepared By:



5672 Juhls Drive  
Boulder, CO 80301  
(303) 679-4820  
ERC #: 240-1701

**FIGURE 3.  
ENVIRONMENTAL HAZARDS  
PRELIMINARY ASSESSMENT**

**PRELIMINARY PLAT, PLANNING AREA H  
BOULDER COUNTY, COLORADO**



Prepared For:  
Calibre Engineering

**PRELIMINARY  
GEOTECHNICAL INVESTIGATION  
FLATIRON MEADOWS SUBDIVISION  
PHASE 6A  
PLANNING AREAS A-H  
SOUTHEAST OF ERIE PARKWAY AND  
NORTH 111<sup>TH</sup> STREET  
ERIE, COLORADO**

**Prepared For:**

**HT FLATIRON LP  
1515 Wynkoop Street, Suite 800  
Denver, Colorado 80202**

**Attention: David Klebba  
Chad Murphy**

**Project No. DN47,910-115**

**October 13, 2015**



## TABLE OF CONTENTS

SCOPE .....	1
SUMMARY OF CONCLUSIONS .....	2
SITE CONDITIONS .....	4
PROPOSED DEVELOPMENT.....	5
PREVIOUS INVESTIGATIONS .....	6
INVESTIGATION .....	7
SUBSURFACE CONDITIONS.....	8
Groundwater.....	10
GEOLOGIC HAZARDS.....	10
Seismicity .....	12
Radioactivity .....	12
ESTIMATED POTENTIAL HEAVE .....	13
SITE DEVELOPMENT .....	14
Demolition.....	14
Excavation.....	15
Stabilization, Dewatering and Shallow Groundwater Mitigation.....	16
Sub-Excavation .....	18
Fill and Backfill.....	21
Slopes .....	22
Pavements.....	23
BUILDING CONSTRUCTION CONSIDERATIONS.....	24
Foundations.....	24
Floor Construction .....	24
Basements and Crawl Spaces.....	26
Concrete.....	27
Surface Drainage.....	27
RECOMMENDED FUTURE INVESTIGATIONS.....	28
LIMITATIONS .....	29
FIG. 1 – LOCATIONS OF EXPLORATORY BORINGS	
FIG. 2 – DEPTH TO APPROXIMATE GROUNDWATER AND SURFACE ELEVATION	
FIG. 3 – DEPTH TO APPROXIMATE BEDROCK AND SURFACE ELEVATION	
FIG. 4 – POTENTIAL RISK DUE TO EXPANSIVE SOIL AND BEDROCK	
FIG. 5 – BENCHED FILL	



FIG. 6 – FILL SUBDRAIN

FIG. 7 – TYPICAL INTERCEPTOR DRAIN

FIG. 8 – CONCEPTUAL INTERCEPTOR/UNDERDRAIN PROFILE

FIG. 9 – CONCEPTUAL SEWER UNDERDRAIN DETAIL

FIG. 10 – UNDERDRAIN CUTOFF WALL DRAIN

FIGS. 11 AND 12 – CONCEPTUAL SUB-EXCAVATION PROFILE

APPENDIX A – SUMMARY LOGS OF EXPLORATORY BORINGS

APPENDIX B – LABORATORY TEST RESULTS AND TABLE B-I

APPENDIX C – GEOTECHNICAL SITE DEVELOPMENT STUDY FOR PLANNING  
AREA C

APPENDIX D – GUIDELINE SITE GRADING SPECIFICATIONS

APPENDIX E – GUIDELINE SITE GRADING SPECIFICATIONS (SUB-EXCAVATION)



## SCOPE

This report presents the results of our Preliminary Geotechnical Investigation for the planned Phase 6A of development of the Flatiron Meadows Subdivision (431 single-family residences and park/drainage improvements) being considered on vacant parcels located southeast of Erie Parkway and North 111<sup>th</sup> Street in Erie, Colorado (Fig. 1). The subject areas are denoted as Planning Areas A through H. The purpose of our investigation was to evaluate the subsurface conditions to assist in due diligence and planning of site development and construction. The report includes descriptions of soil and bedrock strata and groundwater levels encountered in our exploratory borings, and discussions of site development and construction as influenced by geotechnical considerations. The scope was described in our Service Agreement (DN 15-0250) dated May 13, 2015. A Phase I Environmental Site Assessment was completed recently under our Project No. DN47,911-200 (report dated July 2, 2015). We also conducted a Limited Phase II Environmental Site Assessment under Project No. DN47,911-205 (letter dated August 3, 2015) and a Construction Dewatering Permit Application under Project No. DN47,911-210 (letter dated September 22, 2015).

This report is based on our understanding of the planned construction, subsurface conditions disclosed by exploratory drilling and sampling, site reconnaissance, results of field and laboratory tests, engineering analysis of field and laboratory data, previous investigation, and our experience with similar conditions and projects. It contains descriptions of the soil and bedrock conditions and groundwater levels found in our exploratory borings, preliminary discussions of site development, and preliminary design and construction criteria for foundations, floor systems, pavements, and surface and subsurface drainage. The discussions of foundation and floor system alternatives are intended for planning purposes only. Additional, site-specific investigations will be necessary to design



structures, pavements and other improvements. A brief summary of our conclusions and recommendations follows, with more detailed discussion in the report.

## SUMMARY OF CONCLUSIONS

1. Most of the site is judged suitable for the planned development. The primary geotechnical concerns are shallow groundwater and soft/loose soils in the western portion of the site, and expansive soil and bedrock in the east-central area. We believe 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 of the majority of the site. Planning Areas C and H appear to have shallow groundwater levels and measures will need to be taken in planning and design (such as raising site grades and/or installation of interceptor drains and grout/slurry walls) to properly develop. **Because the site is zoned, we assume a mine subsidence hazard evaluation was conducted by others.**
2. Strata found in our borings consisted of nil to about 7.5 feet of sandy clay fill and/or 4 to more than 35 feet of natural clay and sand underlain by weathered and comparatively unweathered claystone and sandstone bedrock. Most of the soils and bedrock samples tested were non-expansive or low swelling. Expansive claystone was found at shallow depths in TH-6 and TH-8 drilled in the east-central part of the site. Soft/loose soils were also identified in TH-2, TH-4, TH-7, TH-8, TH-9 and TH-11 through TH-21, and generally coincided with areas of shallow groundwater. Planning and design of the development should consider the impacts of expansive soil and bedrock, shallow groundwater and soft/loose soils.
3. Groundwater was encountered during drilling in nine borings at depths of about 4 to 26 feet. When the holes were checked on several occasions after drilling, water levels were measured at depths of about 2 to 23 feet or elevations 5108 to 5177.5 feet (Fig. 2). Groundwater appears to have risen significantly since AGW's 2013 investigation. Shallow groundwater will likely preclude basements in Planning Area C and possibly portions of nearby areas unless measures are taken to protect them during planning, design and construction. We recommend providing at least 3 feet, and preferably 5 feet, of separation between basement excavations and groundwater. Site grades should be raised as much as possible in shallow groundwater areas. Shallow groundwater will also compli-



cate utility installation and sub-excavation (if used), and require the use of subsurface drainage systems (interceptor drains and underdrains) to properly mitigate. Groundwater may fluctuate seasonally and rise in response to development, precipitation, landscape irrigation, and flow in nearby drainages and ditches.

4. We estimate total potential ground heave could range from less than 0.5-inch to about 5 inches considering a depth of wetting of 24 feet below existing grades. Most of the site is judged to have low risk of damage due to expansive soil and bedrock. The area of TH-8 is judged to have moderate risk and TH-6 is judged to be high risk. Drilled pier foundations bottomed in bedrock are typically recommended for sites with significant potential heave. Sub-excavation can be considered as a means to reduce potential heave and potentially allow use of shallow foundations. Fill sub-drains, interceptor drains and sanitary sewer underdrains will likely be needed to control the water. We should perform additional investigation if sub-excavation is being considered. We judge potential movements for lightly loaded structures should be reduced to about 1 to 2 inches or less after sub-excavation. Settlement is possible in areas with soft/loose soils.
5. The near-surface clay soils are anticipated to possess relatively poor pavement support qualities. Sand is considered better sub-grade material. Sub-excavation to depths up to 3 feet may be necessary below streets where swelling materials are present. Chemical stabilization may also be needed to reduce plasticity indices to less than 30. Local streets will need at least 6.5 inches of asphalt or an equivalent composite section of 4 inches of asphalt over 8 inches of base course. A design-level subgrade investigation should be done after site grading.
6. Control of surface drainage will be critical to the performance of foundations, slabs-on-grade and pavements. Overall surface drainage should be designed to provide rapid run-off of surface water away from structures and off pavements and flatwork. Water should not be allowed to pond near the crests of slopes, near structures or on pavements and flatwork. Conservative irrigation practices should be employed to reduce the risk of subsurface wetting.



## SITE CONDITIONS

The site contains about 240 acres and is located southeast of Erie Parkway and North 111<sup>th</sup> Street in Erie, Colorado (Fig. 1 and Photo 1). According to the Boulder County Assessor, the legal description of the property is Flatiron Meadows Subdivision, Master Plat or Filing No. 4, Tracts I1, B and C. The site is bordered by Erie Parkway and residential lots on the north, vacant land and residential lots on the east, an access drive and residential development on the south, and North 111<sup>th</sup> Street on the west. Prince Lake No. 2 is across North 111<sup>th</sup> Street near the southwest corner of the site. Several drainages and ditches traverse various portions of the site. The predominant drainage (Prince Tributary) appears to initiate at the south-central end of the site via buried culvert, heads north and flows below Erie Parkway near the northwest corner of the site. A couple of small ponds or areas with very moist soils and vegetation are present adjacent to the drainage. The Leyner Cottonwood Number 1 Ditch is present in the northwest part of the site and flows over the Prince Tributary and below Erie Parkway. Remnants of Elmwood Reservoir and a couple of ditches are present at the northeast corner of Planning Area F. Marfell Lakes and the South Boulder Canyon Ditch are about ¼-mile southeast. Erie Lake and Thomas Reservoir are about ½-mile southwest and east, respectively. Several other ponds and lakes are within about 1 mile. The ground surface is covered with grass, weeds, bushes and trees and slopes gently toward the central drainage. Overall, the terrain slopes gently to the north. Google Earth historical area photos dating back to 1993 indicate the site was used for farmland and livestock purposes. The ground surface on Planning Areas C and H (between North 111<sup>th</sup> Street and the central drainage) appear to be greener than the surrounding areas in most of the photos. An abandoned residence with two or three sheds is present in the northwest part of the site on the south side of the Leyner Cottonwood Number 1 Ditch. Oil/gas wells or facilities are present at the northwest and



southwest corners of the site and an easement traverses the central part of the site from west-to-east. We understand some water wells may also be present.

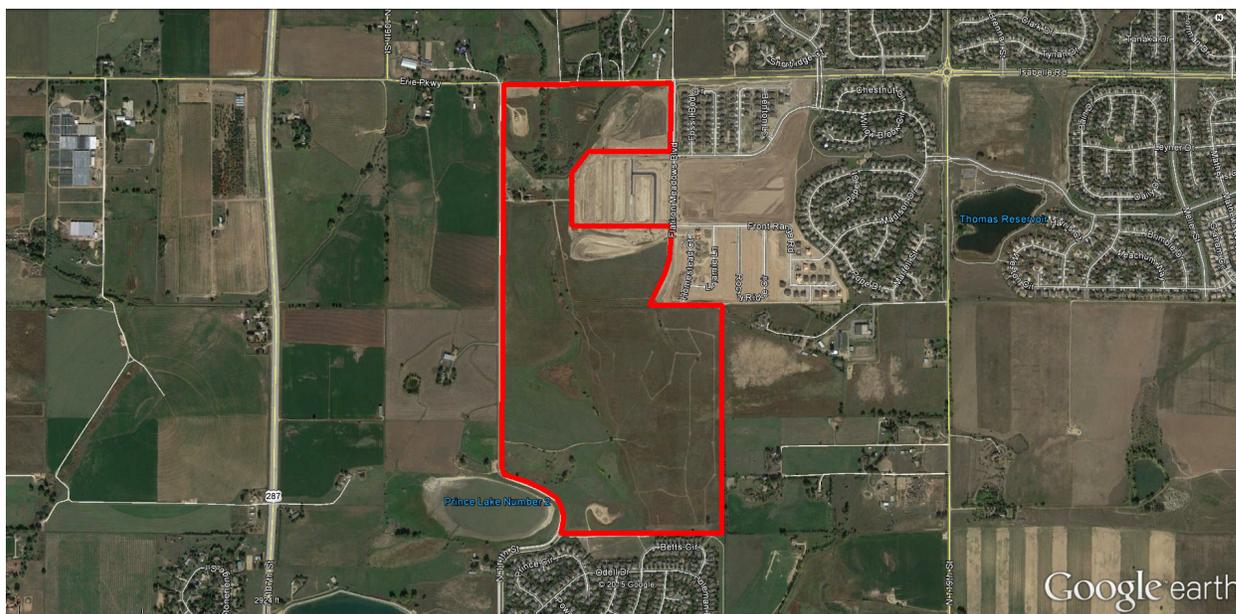


Photo 1 – Google Earth® Aerial Site Photo, October 2014

## PROPOSED DEVELOPMENT

We were provided a conceptual site plan that indicates the development may consist of 431 single-family residences with attached garages serviced by buried utilities and paved roadways (Fig. 1) within Planning Areas A through H. We anticipate the residences will be one or two-story, wood-framed structures with basements or crawl spaces below the main floor levels. The residences may have partial brick or stone veneer exterior wall treatments. Regional pond and park improvements will be made in the northwestern and southwestern part of the site in Planning Area H and along the central drainage and irrigation ditch east and north of Planning Area C. Based on existing site grades, we anticipate the site grading will mostly consist of fills up to about 10 feet. Some tree removal and grubbing of existing drainages will be necessary. The existing residence and



sheds will be removed as part of construction. Water wells will need to be abandoned.

## **PREVIOUS INVESTIGATIONS**

As part of our investigation, we reviewed a copy of a Geotechnical Site Development Study for Planning Area C prepared by A.G. Wassenaar, Inc. (AGW Project Number 133416; report dated November 12, 2013). AGW drilled and sampled 14 exploratory borings and generally found sand and clay over claystone and sandstone bedrock at depths ranging from about 18.5 to 32 feet below grade. Groundwater was measured at depths of about 3 to 20 feet. The subsurface conditions were generally consistent between our investigation and AGW's, except water levels appear to have risen significantly since 2013. Pertinent information from AGW's study were considered in preparation of this report. Their boring locations and summary logs are presented in Appendix C.

We performed a Due Diligence Geotechnical Investigation for Planning Area F under our Project No. DN47,987-115 (report dated August 24, 2015). We drilled 20 exploratory borings across the Planning Area to depths of 25 to 35 feet. We identified expansive soil and bedrock and shallow groundwater as the primary geotechnical concerns. We discussed sub-excavation of the majority the site as means to reduce potential heave and potentially allow use of footing foundations and slab-on-grade floors. It appeared the southeast corner of the Planning Area F had less potential heave risk than the remainder of the site. We recently conducted a Geotechnical Investigation for the regional pond and culvert improvements planned north of Planning Area C at the northwest corner of the site under our Project No. DN47,910-145 (report dated October 5, 2015). We drilled and sampled four exploratory borings in the pond area and found clay and sand soils, with claystone bedrock at 8 feet deep in one boring at the northeast corner



of the pond. We judged the clay and sand soils to be excavated as part of pond construction are suitable for re-use as site grading fill.

## **INVESTIGATION**

We investigated subsurface conditions by drilling and sampling 21 widely spaced exploratory borings at the approximate locations shown on Fig. 1. Boring locations were staked and ground surface elevations provided by Calibre Engineering. Prior to drilling, we contacted the Utility Notification Center of Colorado and local sewer and water districts to identify locations of buried utilities. We drilled TH-1 through TH-10 between June 11 and 22, 2015 to depths of 17.5 to 35 feet below the existing ground surface. TH-11 through TH-21 were drilled on September 14, 2015 to depths of 15 to 20 feet and were all located within Planning Area C. All borings were drilled using 4-inch diameter, continuous-flight solid-stem auger and truck-mounted CME-45 and CME-55 drill rigs.

Samples of the soil and bedrock were obtained at approximate 5-foot intervals in TH-1 through TH-10 using a 2.5-inch diameter (O.D.) modified California barrel sampler driven by an automatic 140-pound hammer falling 30 inches. Only 4 feet samples were obtained in TH-11 through TH-21. Our field representatives were present during drilling to observe drilling operations, log the strata encountered and obtain samples for laboratory tests. After drilling was completed, we installed hand-slotted PVC pipe in the holes to allow delayed groundwater measurements. The annulus around the pipe was filled with cuttings and the tops of the holes/pipes were isolated by mounding cuttings around them to reduce infiltration of surface water. Summary logs of exploratory borings with results of field penetration resistance tests and a portion of the laboratory data are presented in Appendix A.



The samples were returned to our laboratory where they were examined and testing was assigned. Laboratory tests included dry density, moisture content, percent silt and clay-sized particles (passing the No. 200 sieve), gradation, Atterberg limits, unconfined compression, swell-consolidation, and water-soluble sulfate concentration. Swell-consolidation tests were performed by wetting the samples under overburden pressures (the weight of the overlying soil). Results of laboratory tests are presented in Appendix B and summarized in Table B-I.

## **SUBSURFACE CONDITIONS**

Strata encountered in our exploratory borings generally consisted of nil to about 7.5 feet of sandy clay fill and 4 to more than 35 feet of natural clay and sand underlain by weathered and comparatively unweathered claystone and sandstone bedrock to the maximum explored depth of 35 feet. Practical drill refusal was encountered in cemented sandstone in TH-3 at a depth of about 17.5 feet. Some of the pertinent engineering characteristics of the soil and bedrock are described in the following paragraphs.

We found about 6 and 7.5 feet of fill at the ground surface in TH-6 and TH-1, respectively. The fill consisted of sandy, silty clay. The fill was very stiff based on results of field penetration resistance tests. Two fill samples swelled 1.5 and 1.7 percent when wetted under an applied pressure of 500 psf. These samples developed load-back swelling pressures of about 1,600 and 2,500 psf. We assume the fill is related to site development and grading. Fill compaction records would be helpful to judge the suitability of the fill for supporting improvements. If documentation is not available, the fill should be reworked or additional investigation performed (such as excavating test pits) to evaluate the condition of the fill.



Natural soils were encountered at the ground surface in eight borings and below fill in two borings, and consisted of sandy to very sandy, silty, clay and silty to very clayey sand. The soils became more gravelly with depth. The clay was soft to very stiff and the sand was loose to dense. Three clay samples compressed 0.2 percent and two swelled 0.1 and 1.4 percent when wetted. The highest swelling sample developed a load-back swell pressure of about 4,200 psf. A medium stiff clay sample exhibited an unconfined compressive strength of about 800 psf. A very sandy clay sample contained 54 percent silt and clay-sized particles and showed low plasticity with a liquid limit of 26 and a plasticity index of 13. A clayey sand sample did not swell when wetted. Seven sand samples had 18 to 47 percent fines and two had low plasticity with liquid limits of 20 and 25 and plasticity indices of 2 and 10. Soft/loose soils were identified in four borings, TH-2, TH-7, TH-8, TH-9 and TH-11 through TH-21, most of which were in Planning Area C and H along the west side of the site.

Bedrock was encountered in six borings at depths of about 4 to 19.5 feet below grade, or elevations 5123 to 5180.5 feet. The approximate surface elevation and depth to bedrock below existing grade are shown on Fig. 3. Bedrock was predominantly silty to clayey sandstone and siltstone, with claystone in TH-6 and TH-8 in the east-central part of the site in Planning Area F. Bedrock was shallow (less than 10 feet deep) in three borings, TH-3, TH-5 and TH-6, drilled in the central portion of the site. A sandstone sample did not swell when wetted. Four sandstone samples had 23 to 30 percent silt and clay-sized particles. One claystone sample did not swell and five swelled 1.4 to 5.4 percent when wetted. The two highest swelling samples showed load-back swelling pressures of about 6,800 and 7,800 psf. A hard claystone sample exhibited an unconfined compressive strength of approximately 14,800 psf, had 100 percent fines and had high plasticity with a liquid limit of 65 and a plasticity index of 44.



## Groundwater

Groundwater was encountered during drilling in all except one boring at depths of about 4 to 26 feet below grade. When the holes were checked on multiple occasions after drilling, shallowest water levels were measured in the same nine borings at depths of about 1.8 to 23 feet or elevations 5108 to 5178.5 feet (Fig. 2). Shallow groundwater will likely preclude basement construction in Planning Area C and possibly portions of nearby Planning Areas D, E, F and G unless measures are taken to protect them and appropriate planning, design and construction are implemented. Shallow groundwater will also complicate utility installation and sub-excavation (if used), and require the use of temporary dewatering and permanent subsurface drainage systems (interceptor drains and underdrains) to properly mitigate. Groundwater may fluctuate seasonally and rise in response to development, precipitation, landscape irrigation, and flow in nearby drainages and ditches.

Our measured water levels in Planning Area C were shallower than AGW's measurements. We are unsure why the levels were shallower. AGW's investigation was performed about 2 months after historic rain occurred in Boulder County. Our investigation is also being performed during a relatively wet summer. The tops of our boreholes were sealed to reduce surface water from infiltrating the borehole. TH-7 was located at the base of a small hill, which may have influenced the water level measurement, although we judge this was not likely the case. Similarly, cattails and vegetation were observed near TH-16 and TH-17.

## **GEOLOGIC HAZARDS**

Colorado is a challenging location to practice geotechnical engineering. The climate is relatively dry and the near-surface soils are typically dry and



comparatively stiff. These soils and related sedimentary bedrock formations react to changes in moisture conditions. Some of the soils swell as they increase in moisture and are referred to as expansive soils. Other soils can compress significantly upon wetting and are identified as compressible or collapsible soils. Most of the land available for development east of the Front Range is underlain by expansive clay or claystone bedrock near the surface. The soils that exhibit compressible behavior are more likely west of the Continental Divide; however, both types of soils occur throughout the state.

Covering the ground with structures, streets, driveways, patios, etc., coupled with lawn irrigation and changing drainage patterns, leads to an increase in subsurface moisture conditions. As a result, some soil movement due to heave or settlement is inevitable. Expansive soil and bedrock are present at this site, which constitutes a geologic hazard. There is risk that foundations and slab-on-grade floors will experience heave and damage. It is critical that precautions are taken to increase the chances that the foundations and slabs-on-grade will perform satisfactorily. Engineered planning, design and construction of grading, pavements, foundations, slabs-on-grade, and drainage can mitigate, but not eliminate, the effects of expansive soil and bedrock. Sub-excavation is a means to reduce potential heave and potentially allow wide use of shallow foundations and slab-on-grade floors. Shallow groundwater is also considered a geologic hazard and will require appropriate measures during planning, design and construction to control during construction and for long-term use. Additional investigation may reveal that the water cannot be controlled feasibly, and it may be determined that some areas are not economically practical for construction.

There are underground coal mines below parts of Boulder County. We reviewed the State of Colorado, Department of Natural Resources, Mined Land Reclamation Division, "Boulder County Subsidence Investigation," Volumes IV and V prepared by Dames & Moore (1986). The maps do not show underground



coal mines below the site. If subsidence risk is present, we assume it was evaluated by others.

### Seismicity

Based on available mapping, we found no active faults within or near the site. The soil and bedrock units are not expected to respond unusually to seismic activity. Based on methods described in Chapter 16 of the 2012 International Building Code (IBC), we judge the soil conditions justify Site Class D for seismic design. The Seismic Design Category would be “B” for structures such as schools and single-family residences.

### Radioactivity

It is normal in the Front Range of Colorado and nearby eastern plains area to measure radon gas in poorly ventilated spaces (e.g., full depth residential basements) in contact with soil or bedrock. Radon 222 gas is considered a health hazard and is just one of several radioactive products in the chain of the natural decay of uranium into lead. Radioactive nuclides are common in the soil and bedrock underlying the subject site. Because these sources exist or will exist on most sites in the area, there is a potential for radon gas accumulation in poorly ventilated spaces. The concentration of radon that can develop is a function of many factors, including the radionuclide activity of the soil and bedrock, construction methods and materials, soil gas pathways, and accumulation areas. The only reliable method to determine if a hazard exists is to perform radon testing of completed residential structures. Typical mitigation methods consist of sealing soil gas entry areas, ventilation of below-grade spaces, and venting from foundation drain systems. Radon rarely accumulates to significant levels in above-grade living spaces. We recommend provision for ventilation of foundation drain systems to allow venting if a radon problem is discovered.



## ESTIMATED POTENTIAL HEAVE

Based on the subsurface profiles, swell-consolidation test results and our experience, we calculated the potential heave at the ground surface for each test hole, as shown in the table below. We estimate potential ground heave may range from less than 0.5-inch to 1.7 inches for the majority of the site, with up to about 5 inches possible at TH-6. A depth of wetting of 24 feet relative to the existing grades was considered for the analysis. This depth of wetting is typically used for irrigated residential sites with basements. If the residences will not have basements, the depth of wetting may be less. Considering the depth to groundwater at this site, the influential depth of wetting will likely be significantly less than 24 feet, and therefore actual heave will likely be less than our estimates. Variations from our estimates should be anticipated. It is not certain whether the estimated heave will occur. Actual heave will likely be less. The planned grading will affect the potential heave estimates. Overall, we judge there is relatively low risk of problems due to expansive soil and bedrock for the majority of the site, with some isolated areas of moderate to high risk. Sub-excavation is a means to reduce potential heave and potentially allow use of shallow foundations and slab-on-grade floors. Groundwater may complicate sub-excavation and require subsurface drainage systems to properly mitigate. Settlement is more likely than heave where soft soils are present (areas represented by TH-2, TH-4, TH-7, TH-8 and TH-9).



## ESTIMATED POTENTIAL GROUND HEAVE AT GROUND SURFACE BASED ON 24 FEET DEPTH OF WETTING

Boring	Estimated Potential Ground Heave (inches)	Risk Due to Expansive Soil and Bedrock
TH-1	1.5	LOW
TH-2	<0.5*	LOW
TH-3	<0.5	LOW
TH-4	<0.5*	LOW
TH-5	<0.5	LOW
TH-6	4.9	HIGH
TH-7	<0.5*	LOW
TH-8	1.7*	MODERATE
TH-9	<0.5*	LOW
TH-10	0.6	LOW

\*Indicates soft/loose soils are present which implies settlement is more likely

### SITE DEVELOPMENT

The primary geotechnical concerns that we believe will influence development and residential construction at this site are shallow groundwater and soft/loose soils, and localized areas with expansive soil and bedrock. These concerns can likely be mitigated with proper planning, engineering, design and construction. We believe there are no geologic or geotechnical constraints that would preclude development of the majority of the site. Appropriate planning, design and construction will be necessary to address the shallow groundwater below Planning Area C (and possibly others nearby). Site grading should be planned to avoid creating conditions where water would affect site development, utility installation and basements. The following sections discuss site development recommendations considering the current development plan.

#### Demolition

Existing fill presents risk of settlement to floor/pavement slabs and other surface improvements. We should be provided with fill compaction records which



demonstrate the fill was placed in a controlled manner, or perform additional investigation to evaluate the suitability of the fill. The existing residence and sheds in the northwest part of the site will be demolished. Foundations, slabs, utilities and other improvements should be removed or abandoned. Removal excavations should be replaced with moisture conditioned, compacted fill.

### Excavation

We believe the soils and bedrock penetrated by our exploratory borings can be excavated with typical heavy-duty equipment. Hard bedrock may require heavy ripping for efficient removal (Fig. 3). We recommend the owner and the contractor become familiar with applicable local, state and federal safety regulations, including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards. Based on our investigation and OSHA standards, we anticipate the sand will classify as Type C soils, the clay as Type B or C, and the bedrock as Type A or B. Type A, B and C soils require maximum slope inclinations of  $\frac{3}{4}$ , 1:1 and 1½:1 (horizontal:vertical), respectively, for temporary excavations in dry conditions. Below groundwater or where any seepage is present, excavations will likely require flatter slopes, possibly as flat as 6:1. This could impact the efficiency of the contractor's work; they should be prepared to work in saturated and soft/loose soil conditions in shallow groundwater areas. Excavation side slopes specified by OSHA are dependent upon soil types and groundwater or seepage conditions encountered. The contractor's "competent person" should identify the soils encountered in the excavations and refer to OSHA standards to determine appropriate slopes. Stockpiles of soils and equipment should not be placed within a horizontal distance equal to one-half the excavation depth, from the edge of the excavation. A professional engineer should design excavations deeper than 20 feet.



## Stabilization, Dewatering and Shallow Groundwater Mitigation

Based on our measured water levels, groundwater appears to be manageable over the majority of the site. Shallow water levels were obtained in borings drilled within Planning Areas C, F and H. Based on current water levels, it is likely that deep sub-excavation and utility excavations will extend below groundwater in various parts of the site, mostly along North 111<sup>th</sup> Street.

Soft, very moist soils may be encountered in excavations and should be removed or stabilized. Removal is preferred to reduce settlement and seepage. Soft excavation bottoms can be stabilized by crowding crushed rock into the soils until firm. Acceptable rock materials include, but are not limited to, No. 2 and No. 57 rock. Crushed rock on a layer of geosynthetic grid or woven fabric can also be used, which should reduce the amount of aggregate needed to stabilize the subgrade. Typically, a biaxially woven fabric such as Mirafi 600x (or equal) or geogrid (such as Tensar BX1100 or equal) topped with 6 to 10 inches of 1 to 5-inch crushed rock will provide a stable working surface.

Temporary construction dewatering systems will probably be needed. We anticipate excavations can be dewatered using sumps, where the water is pumped down through the soils before being discharged. The Town of Erie, Boulder County and/or the Colorado Department of Public Health and Environment may require dewatering permits. Our experience indicates periodic environmental testing is usually required with these permits, with reporting. Permitting requirements may also influence the construction schedule. We provided a Construction Dewatering Permit Application under Project No. DN47,911-210 (letter dated September 22, 2015).

We believe it is prudent to protect basements (if used) from potential seepage. We believe installation of subsurface drain systems can be considered



as measures to possibly control shallow water. Drain systems include interceptor drain(s), underdrains, and foundation drains around basement or crawl space perimeters. A grout or slurry curtain wall can be considered to potentially “cut off” the shallow groundwater. Utilities may need to penetrate the curtain, making it less effective. We recommend additional investigation in Planning Area C to better evaluate the feasibility of subsurface systems. We can discuss potential permanent dewatering solutions once plans are more developed.

If sub-excavation is done, we recommend installation of fill subdrains along the slopes where sub-excavation exposes groundwater or seepage at shallow depths (Fig. 6). We expect this condition in Planning Area F. The fill subdrain should have a two-sided drainage board which extends at least 3 feet above any seepage and ties into the pipe. If sub-excavation is not done, an interceptor drain should be installed as shown on Fig. 7. The interceptor drain should also have a two-sided drainage board which ties into the pipe. The likely location for the interceptor drain is shown on Fig. 2. The drain should bottom at least 3 feet below adjacent basement excavations. We envision the drain can be connected to the sewer underdrain system; Fig. 8 shows a typical profile of this system. The drains should be provided with outlet(s).

Our firm generally advocates an underdrain system below sanitary sewer mains and services to control groundwater that may accumulate in response to development. The underdrain also helps to control shallow water and unusually deep wetting, which can lead to higher frequency of heave-related foundation problems and frequent pumping from basement foundation drain systems. If basements or below-grade areas are incorporated into the residences, we recommend an underdrain system. The underdrain can be “active” (perforated) where water is shallow to help with seepage.



The underdrain should consist of ¾ to 1½-inch clean, free-draining gravel surrounding a perforated PVC pipe (Fig. 9). We believe use of perforated pipe below sanitary sewer mains is the most effective approach to control groundwater and collect water from perimeter drains. The pipe should be sized for anticipated flow. The line should consist of smooth, perforated or slotted, rigid PVC pipe placed at a grade of at least 0.5 percent. A positive cutoff (concrete) should be constructed around the sewer pipe and underdrain pipe immediately downstream of the point where the underdrain pipe exits the sewer trench (Fig. 10). Solid pipe should be used down gradient of this cutoff wall. The underdrains should be designed to discharge to a gravity outfall and be provided with a permanent concrete headwall and trash rack. If the underdrain discharges into a detention pond area, the risk of flood water backflow through the underdrain into basements should be carefully evaluated. A check valve or backflow preventer can be considered. The underdrain should be provided with clean-outs and be maintained. Where feasible, the underdrain services should be installed deep enough so that the lowest point of foundation drains can be connected to the underdrain service as a gravity outlet (Fig. 8).

### Sub-Excavation

We estimated potential ground heave of up to about 5 inches is possible. Long and heavily-reinforced drilled piers and structurally supported basement floors are normally recommended for sites with significant potential heave, such as at TH-6 in Planning Area F. Sub-excavation is a ground improvement method used to reduce the potential swell and mitigate impacts of swelling soils and bedrock. Additional investigation (including reviewing grading plans and drilling/sampling additional borings) is recommended to better delineate the sub-excavation areas and appropriate depths, if this approach is desired. More information will also allow us to evaluate groundwater levels and whether or not we believe it is necessary to extend sub-excavation below groundwater.



Sub-excavation has been used in the Denver area with satisfactory performance for the large majority of the sites where this ground modification method has been completed. We have seen isolated instances where settlement of sub-excavation fill has led to damage to houses supported on footings. In most cases, the settlement was caused by wetting associated with poor surface drainage or seepage, and/or poorly compacted fill placed at the horizontal limits of excavation. Wetting of the fill may cause softening and settlement. Groundwater will likely complicate sub-excavation. Installation of a fill subdrain is recommended along the slopes where excavation exposes groundwater or seepage at shallow depths. The subdrain should be provided with an outlet. Use of drilled pier foundations would be prudent if risk of footing movement is not tolerable.

There can be cases where the sub-excavation limits and depth are not adequate to encompass an entire building footprint including deck, patio and porch. As a result, the building has to be founded on deep foundations. Proper planning of the sub-excavation limits and depth based on the largest model plan, and as-built surveying of the limits and depth during the sub-excavation are important to reduce this risk.

The excavation slopes should meet OSHA, state, and local safety standards. The bottom of the sub-excavated area should extend laterally at least 5 feet, and preferably 10 feet, outside the largest possible foundation footprints to ensure foundations are constructed over moisture-conditioned fill. Conceptual sub-excavation profiles are shown on Figs. 11 and 12.

The excavation contractor should be chosen carefully to assure they have experience with fill placement at over-optimum moisture and have the necessary compaction equipment. The contractor should provide a construction disc to break down fill materials and anticipate use of push-pull scraper operations and dozer assistance. The operation will be relatively slow. In order for the procedure



to be performed properly, close contractor control of fill placement to specifications is required. Sub-excavation fill should be moisture-conditioned between 1 and 4 percent above optimum moisture content with an average test moisture content each day of at least 1.5 percent above optimum. Fill should be compacted as recommended in Fill and Backfill.

Special precautions should be taken for compaction of fill at corners, access ramps, and along the perimeters of the sub-excavation as large compaction equipment cannot easily reach these areas. Our representative should observe placement procedures and test compaction of the fill on a nearly full-time basis. The swell of the moisture-conditioned fill should be tested during and after the fill placement. Guideline sub-excavation grading specifications are presented in Appendix E.

If the fill dries excessively prior to construction, it may be necessary to rework the upper drier materials just prior to constructing foundations. We judge the fill should retain adequate moisture for about two years and can check moisture conditions in each excavation as construction progresses, if requested.

Sub-excavation and replacement with low swell fill will likely allow use of footing foundations for lightly loaded structures and enhance performance of slab-on-grade floors. Sub-excavation will also enhance performance of concrete flatwork (driveways and sidewalks) and pavements, potentially reducing maintenance costs.

Based on our experience, several problems have been encountered from the use of sub-excavation. The most common problem arises from placement of the structure outside of the sub-excavated area. The following suggestions should aid in planning and performing sub-excavation:



1. We recommend design of the treatment area and depth to satisfy the recommendations presented above, paying particular attention to lots on corners and lots that slope to the street. Consider the side setbacks for corner lots.
2. We recommend a surveyor document the actual limits of the treatment, and create "as-built" plans. These plans should be provided to the civil/surveyor who prepares plot plans so that they can verify that each residence is over the treated area. In the case of deep sub-excavation, the "treated area" stops at the toe of the deep sub-excavation slope. It would be prudent to show the horizontal limits and bottom elevation of treatment on the plot plans.
3. Land development staff must communicate with the building and sales division about the limitations of house locations.

### Fill and Backfill

The ground surface in areas to be filled should be stripped of debris, vegetation/organics and other deleterious materials, scarified and moisture conditioned to between 1 and 4 percent above optimum moisture content for clay or within 2 percent of optimum for sand, and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698). Imported fill should ideally consist of soil having a maximum particle size of 3 inches, less than 50 percent passing the No. 200 sieve, a liquid limit less than 30 and a plasticity index less than 15. Potential fill materials should be submitted to our office for approval prior to importing to the site. We recently investigated subsurface conditions in the regional pond area and determined the soils to be excavated are suitable for re-use as site grading fill.

The properties of fill will affect the performance of foundations, slabs-on-grade, utilities, pavements, flatwork and other improvements. The on-site soils are suitable for use as new fill provided they are substantially free of debris, vegetation/organics and other deleterious materials. Fill should be placed in thin loose lifts, moisture conditioned and 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 than clay fill receiving the same compactive effort, but moisture treated below optimum moisture content. Clay fill should be moisture conditioned to between 1 and 4 percent above optimum moisture content and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698). Sand fill should be moisture conditioned to within 2 percent of optimum moisture content and compacted similarly. The placement and compaction of new fill should be observed and density tested by our representative during construction. Guideline site grading specifications are presented in Appendix D.

Our experience indicates fill and backfill can compress, even if properly compacted to the criteria provided above. Settlement of the backfill on the order of 1 to 2 percent of the fill depth due to self weight of the fill should be anticipated. Fills composed of claystone may compress more. For utility installation, our experience indicates use of a self-propelled compactor results in more reliable performance compared to backfill “compacted” by a sheepsfoot wheel attachment on a backhoe or trackhoe. The upper portion of the trenches should be widened to allow the use of a self-propelled compactor. Special attention should be paid to backfill placed adjacent to manholes as we have seen instances where settlement in excess of 2 percent has occurred. Any improvements placed over backfill should be designed to accommodate movement. We recommend trench backfill be placed, moisture conditioned, and compacted as discussed above. The placement and compaction of utility trench backfill should be observed and tested by a representative of our firm during construction.

### Slopes

We recommend permanent cut and fill slopes be designed with a maximum grade of 3:1 (horizontal to vertical). If site constraints (property boundaries



and streets) do not permit construction with recommended slopes, we should be contacted. Surface drainage should not be allowed to sheet flow across slopes or pond near the crest of slopes. All cut and fill slopes should be re-vegetated as soon as possible after grading to reduce potential for erosion problems. Erosion potential on the site is considered low to moderate, due to the gentle slopes. Uncontrolled and concentrated surface runoff has the potential to create damaging erosion. Erosion potential will increase during construction, particularly for the loose sands, but should return to pre-construction rates or less if proper grading practices, surface drainage design, and re-vegetation efforts are implemented. Construction sites within the Denver Metropolitan area are subject to the U.S. Environmental Protection Agency (EPA) regulations regarding the control of storm water discharge and soil erosion. Excavation contractors should evaluate ground conditions and control slopes in accordance with OSHA criteria. Fill placed on slopes of 20 percent or steeper should be benched as shown in Fig. 5.

### Pavements

Pavement subgrade soils will likely consist of silty to clayey sand and sandy clay. Clay soils are considered to have relatively poor support characteristics, while sand is considered better subgrade material. Depending on the swell and plasticity of the subgrade, sub-excavation up to 3 feet may be necessary for expansive subgrade mitigation. Chemical stabilization may also be needed to reduce the plasticity index to less than 30. It may be advantageous to do street sub-excavation during or after utilities are installed. Local streets will need at least 6.5 inches of asphalt or an equivalent composite section of 4 inches of asphalt over 8 inches of base course. Both sections may need to be constructed over stabilized subgrade. A design-level subgrade investigation should be done prior to paving.



## **BUILDING CONSTRUCTION CONSIDERATIONS**

The following discussions are preliminary and not intended for design or construction. After grading is completed, design-level investigations should be performed on a building-specific basis.

### Foundations

Site soils mostly include non-expansive or low swelling soils at depths likely to affect foundation performance. Expansive claystone is present in TH-6 and TH-8 drilled within Planning Area F. Drilled piers bottomed in bedrock are typically used where relatively high swelling soil and bedrock are encountered. Drilled piers (if used) will likely require dewatering or underwater concrete placement by pumped methods. Groundwater and very hard bedrock may complicate drilled pier installation. At this time, we believe 20 percent or more of the houses will require pier foundations (Parcel F). We believe deep sub-excavation could allow use of footing foundations for lightly loaded structures. The planned grading will affect the sub-excavation depths, and groundwater levels. Further investigation is recommended to better delineate potential sub-excavation areas and depths, and whether or not it may be beneficial to extend sub-excavation below groundwater. Detailed soils and foundation investigations should be performed after overlot grading (and sub-excavation) to determine the appropriate foundation types and to provide design criteria on a lot-by-lot basis.

### Floor Construction

The use of slab-on-grade floors should be limited to areas where potential movements are judged to be low to moderate. We judge slab performance risk will be low for about 75 percent of the site or more.



Sub-excavation may be considered to reduce the influence of expansive soil and bedrock on basement floors. Our experience suggests risk of poor slab performance can be reduced to low if the fill is moisture conditioned and compacted properly. The performance of garage floors, driveways, sidewalks, and other surface flatwork installed outside sub-excavated areas will likely be erratic at this site. Shallower sub-excavation can be considered in these areas.

The following precautions will be required to reduce the potential for damage due to movement of slabs-on-grade placed at this site:

1. Isolation of the slab from foundation walls, columns or other slab penetrations;
2. Voiding of interior partition walls to allow for slab movement without transferring movement to the structures;
3. Use of flexible water and gas connections to allow for slab movement. A flexible duct above furnaces will also be required; and
4. Proper surface grading and foundation drain installation to reduce water availability to sub-slab and foundation soils.

If basements are used, structurally supported basement floors are recommended for areas of high or very high risk. A structurally supported basement floor should also be used where a buyer cannot tolerate potential movement. Structurally supported floor systems should be anticipated in all non-basement finished living areas. Design and construction issues associated with structural floors include ventilation and lateral loads. Where structurally supported floors are installed in basements or over a crawl space, the required air space depends on the materials used to construct the floor and the potential expansion of the underlying soils. Building codes require a clear space of 18 inches between exposed earth and untreated wood floor components. For non-organic floor systems, we recommend a minimum clear space of 8 inches. This minimum clear space should be maintained between any point on the underside of the floor



system (including beams and floor drain traps) and the soils. If sub-excavation is not done, this clear space should be increased to allow for some heave.

Control of humidity in crawl spaces is important for indoor air quality and performance of wood floor systems. We believe the best current practices to control humidity involve the use of a vapor retarder (10 mil minimum) placed on the soils below accessible subfloor areas. The vapor retarder/barrier should be sealed at joints and attached to concrete foundation elements.

### Basements and Crawl Spaces

Surface water can penetrate relatively permeable loose backfill soils located adjacent to residences and collect at the bottom of relatively impermeable basement or crawl space excavations, causing wet or moist conditions after construction. Basement and crawl space foundation walls should be designed to resist lateral earth pressures. Foundation drains should be constructed around the lowest excavation levels of basement or crawl space areas. These drains could be connected to an underdrain system (Fig. 8) to provide a gravity outlet. Sump pits should be provided so pumps can be installed as a backup if underdrains do not perform as intended.

Relatively shallow groundwater conditions may require limiting basement depths and/or the use of under-slab gravel layers, vapor retarders and deeper than normal drains. These types of systems are recommended where groundwater will be within 5 feet of the basement excavation. Site grades should be planned based on maintaining basement excavations at least 3 feet, and preferably 5 feet, above groundwater. Basements may not be suitable for residences within Planning Area C, and possibly others nearby unless subsurface drainage systems are implemented successfully. Builders should be made aware of the shallow groundwater and likelihood of limiting basement depths.



## Concrete

Concrete in contact with soil can be subject to sulfate attack. We measured water-soluble sulfate concentrations of 0.01 to 0.35 percent in three samples from this site. For this level of sulfate concentration, ACI 332-08 *Code Requirements for Residential Concrete* indicates concrete shall be made with ASTM C150 Type V cement, or an ASTM C595 or C1157 hydraulic cement meeting high sulfate-resistant hydraulic cement (HS) designation and shall have a specified minimum compressive strength of 3,000 psi at 28 days. Alternative combination of cements and supplementary cementitious materials, such as Class F fly ash, shall be permitted with acceptable test records for sulfate durability.

Superficial damage may occur to the exposed surfaces of highly permeable concrete. To control this risk and to resist freeze-thaw deterioration, the water-to-cementitious materials 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 have a total air content of 6 percent +/- 1.5 percent. We recommend all foundation walls and grade beams in contact with the subsoils (including the inside and outside faces of garage and crawl space grade beams) be damp-proofed.

## Surface Drainage

The performance of foundations, floors, pavements and other improvements is affected by moisture changes within the soil and bedrock. This is largely influenced by surface drainage. When developing an overall drainage scheme, consideration should be given to drainage around each residence. The ground surface around the residences should be sloped to provide positive drainage away from the foundations. We recommend a slope of at least 10 percent for the



first 10 feet surrounding each building, where practical. If the distance between buildings is less than 20 feet, the slope in this area should be 10 percent to the swale between houses. Variation from these criteria is acceptable in some areas. For example, for lots graded to direct drainage from the rear yard to the front, it is difficult to achieve the recommended slope at the high point behind the house. We believe it is acceptable to use a slope of about 6 inches in the first 10 feet at this location. Roof downspouts and other water collection systems should discharge well beyond the limits of all backfill around structures.

Proper control of surface runoff is also important to control the erosion of surface soils. Sheet flow should not be directed over unprotected slopes. Water should not be allowed to pond at the crest of slopes. Permanent slopes should be prepared to reduce erosion.

Attention should be paid to compaction of the soils behind curbs and gutters adjacent to streets and in utility trenches during the construction and development. If surface drainage between preliminary development and construction phases is neglected, performance of the roadways, flatwork and foundations may be poor.

## **RECOMMENDED FUTURE INVESTIGATIONS**

We recommend the following investigations and services:

1. Additional monitoring of groundwater levels and recharge (pump) tests to better evaluate feasibility of dewatering systems;
2. We should review grading plans to better determine appropriate depths of sub-excavation. Additional drilling and testing to better delineate areas that would benefit from sub-excavation, if sub-excavation is considered;



3. Construction testing and observation during site development, sub-excavation, and building and pavement construction; including compaction testing of grading fill, utility trench backfill, and pavements, and observation and documentation of subsurface drainage systems;
4. Subgrade investigation and pavement design after grading;
5. Design-level Soils and Foundation Investigations after grading; and
6. Foundation installation observations.

## LIMITATIONS

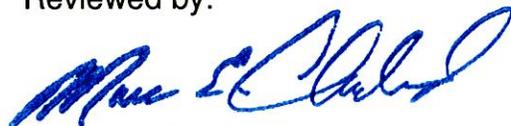
Our borings were widely spaced to provide a general picture of subsurface conditions for preliminary planning of development and residential construction. Variations from our borings should be anticipated. We should review grading plans once available. We believe this investigation was conducted in a 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 the contents of this report or analysis of the influence of subsurface conditions on the project, please call.

CTL | THOMPSON, INC.

  
Benny I. Lujan, P.E.  
Project Engineer



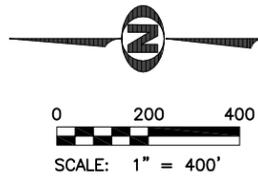
Reviewed by:



Marc E. Cleveland, P.E.  
Vice President

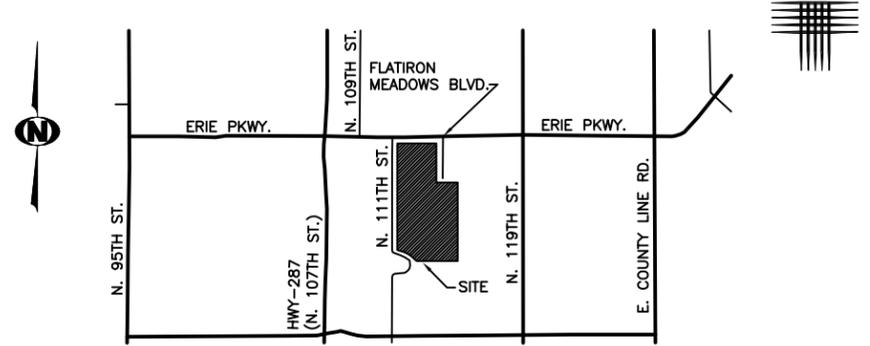
BIL:MEC/bg  
(3 copies)

Via e-mail: [david.klebba@hines.com](mailto:david.klebba@hines.com)  
[chad.murphy@hines.com](mailto:chad.murphy@hines.com)

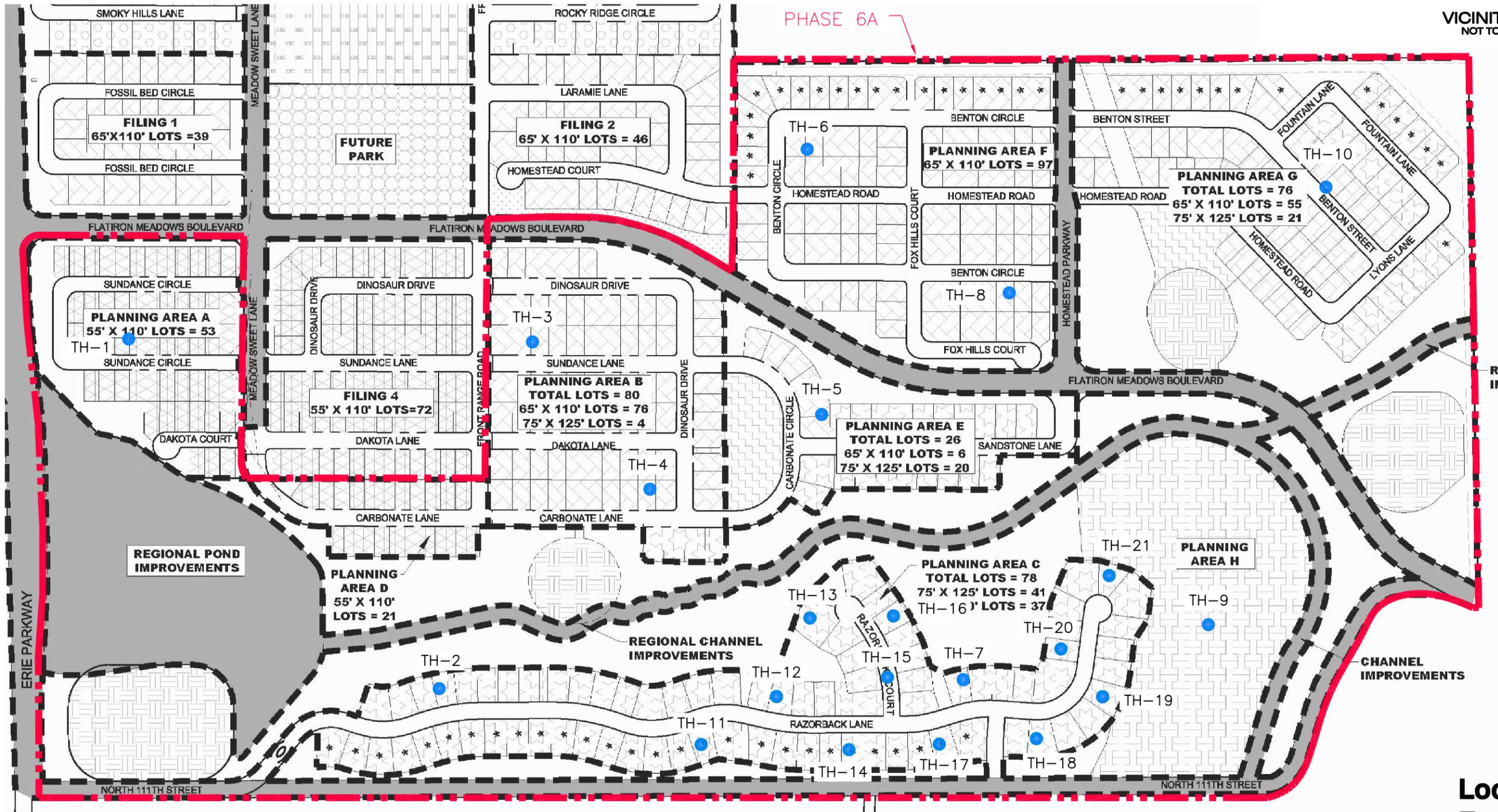


LEGEND:

- TH-1 APPROXIMATE LOCATION OF EXPLORATORY BORING



VICINITY MAP  
NOT TO SCALE



**Locations of  
Exploratory  
Borings**

LEGEND:

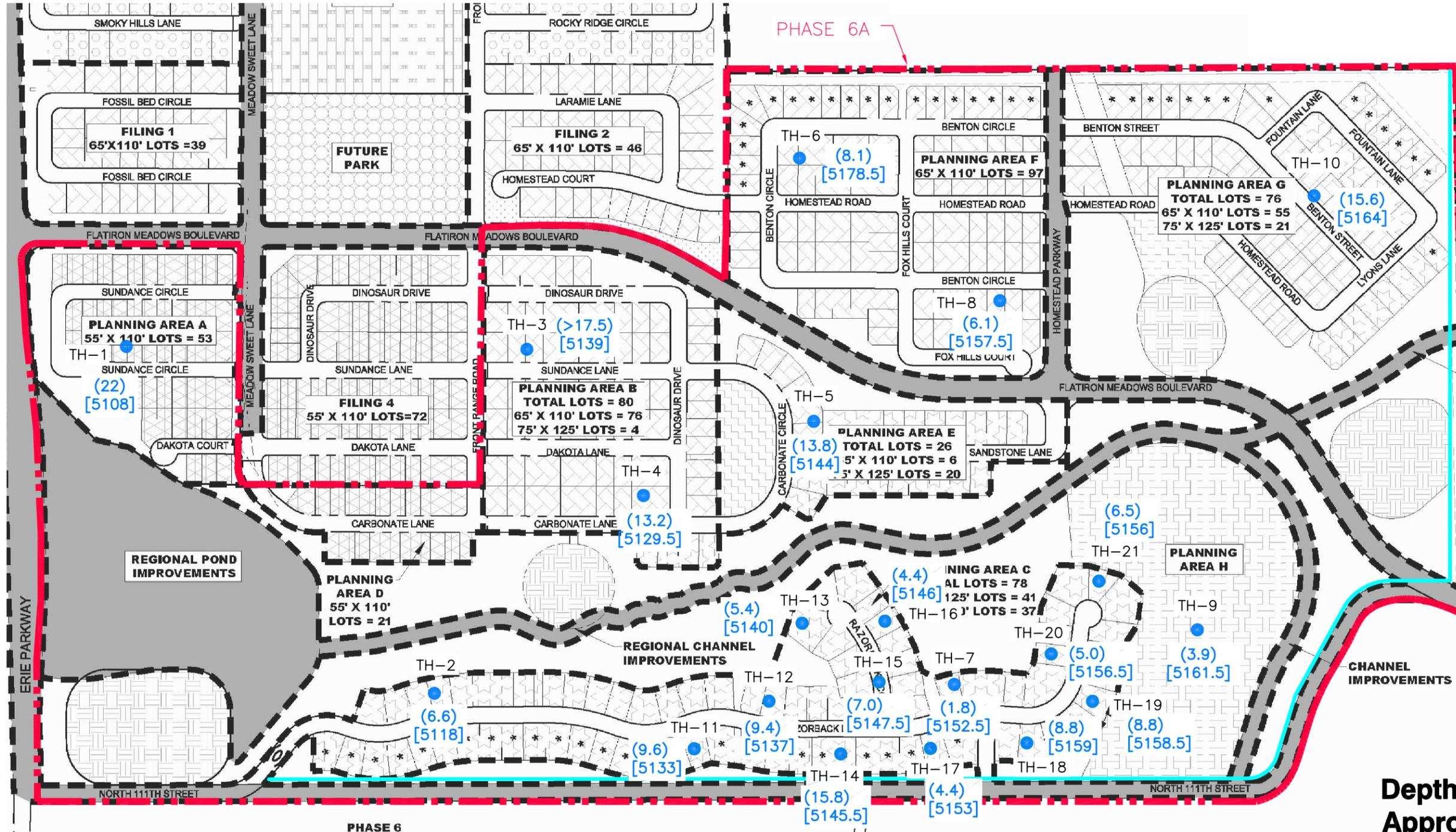
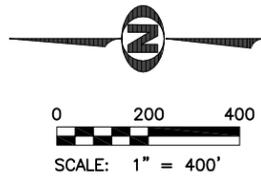
TH-1 APPROXIMATE LOCATION OF EXPLORATORY BORING

(22) INDICATES APPROXIMATE SHALLOWEST DEPTH TO GROUNDWATER IN BORING (FEET)

INDICATES POSSIBLE LOCATION OF INTERCEPTOR DRAIN AND/OR GROUT CURTAIN OR SLURRY WALL

[5108] INDICATES APPROXIMATE SHALLOWEST GROUNDWATER SURFACE ELEVATION IN BORING (FEET)

NOTE: WE RECOMMEND PROVIDING AT LEAST 3 FEET, AND PREFERABLY 5 FEET, OF SEPARATION BETWEEN BASEMENT EXCAVATIONS AND GROUNDWATER. BASEMENTS MAY NOT BE POSSIBLE IN PLANNING AREA C (AND POSSIBLY OTHERS NEARBY) UNLESS MEASURES ARE TAKEN SUCH AS RAISING SITE GRADES OR SUCCESSFULLY IMPLEMENTING INTERCEPTOR DRAIN(S) OR GROUT CURTAINS/SLURRY WALLS. REFER TO REPORT.



**Depth to Approximate Groundwater and Surface Elevation** Fig. 2

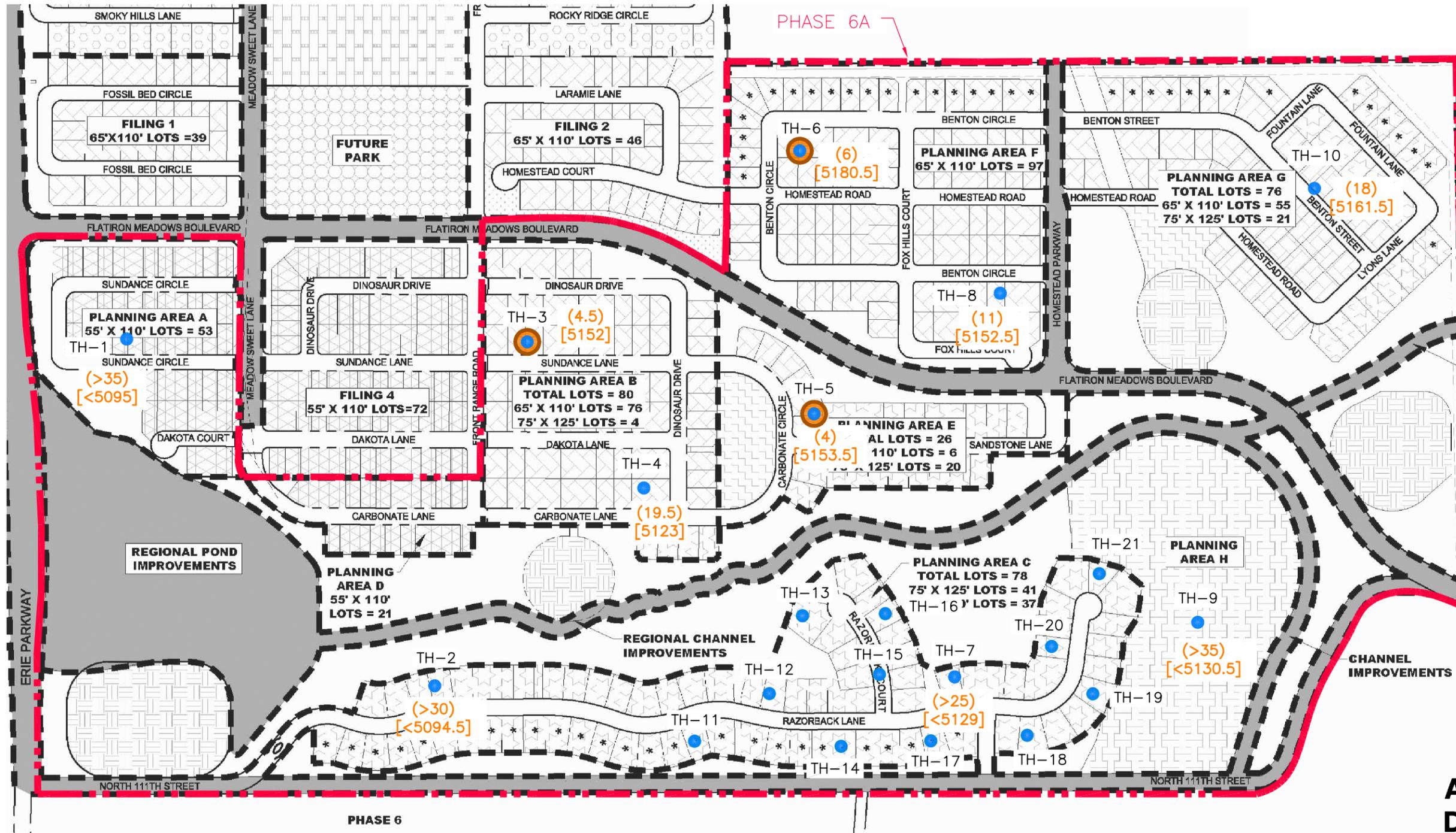
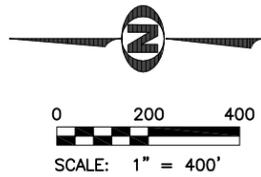
LEGEND:

TH-1 APPROXIMATE LOCATION OF EXPLORATORY BORING

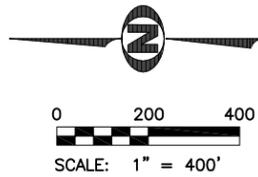
(4.5) INDICATES APPROXIMATE DEPTH TO BEDROCK IN BORING (FEET)

[5152] INDICATES APPROXIMATE BEDROCK SURFACE ELEVATION IN BORING (FEET)

INDICATES BORINGS WITH RELATIVELY SHALLOW BEDROCK WHICH MAY POSE DIFFICULTIES DURING BASEMENT AND UTILITY EXCAVATION.



**Approximate  
Depth to Bedrock  
and Surface  
Elevation**

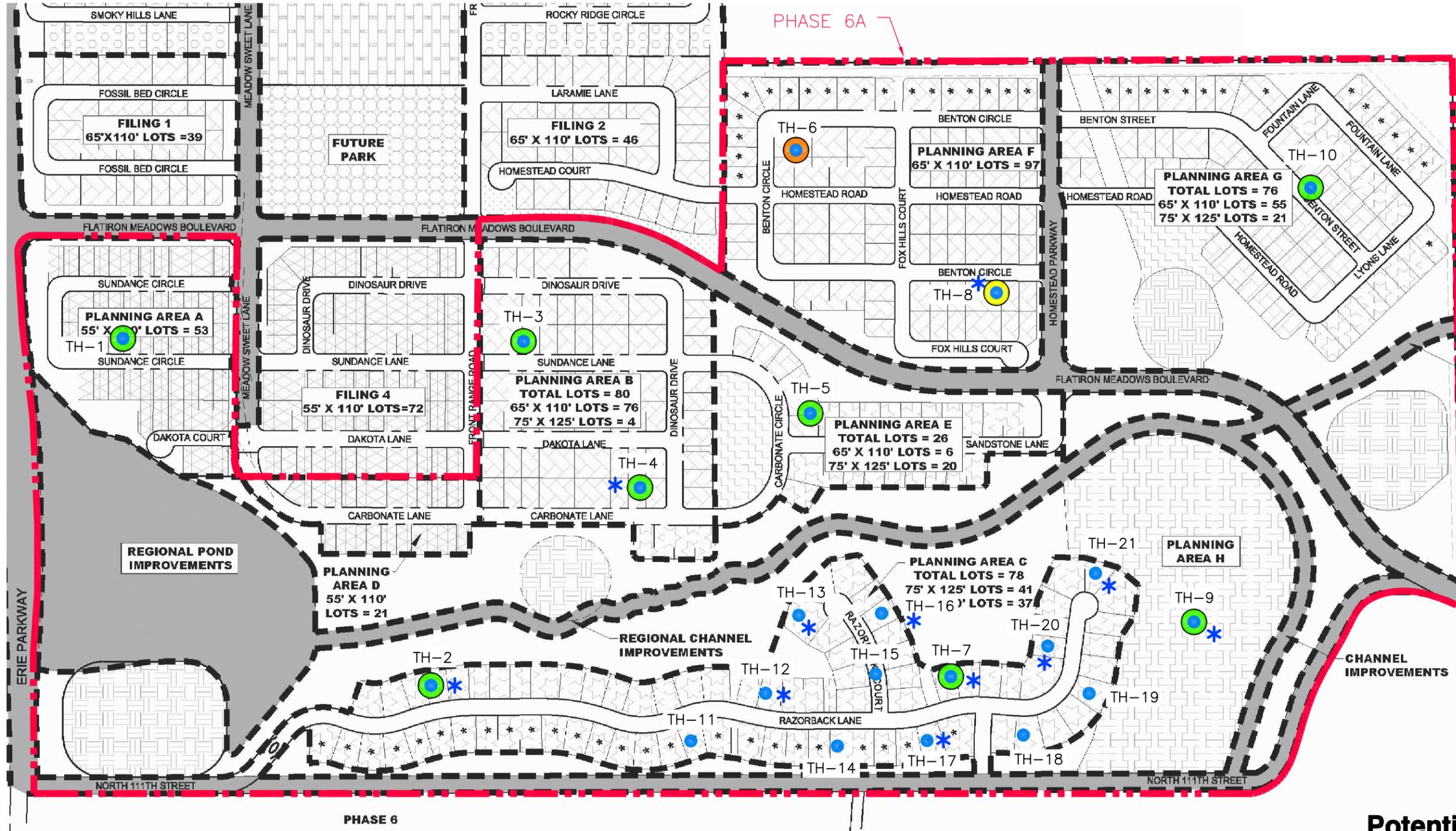


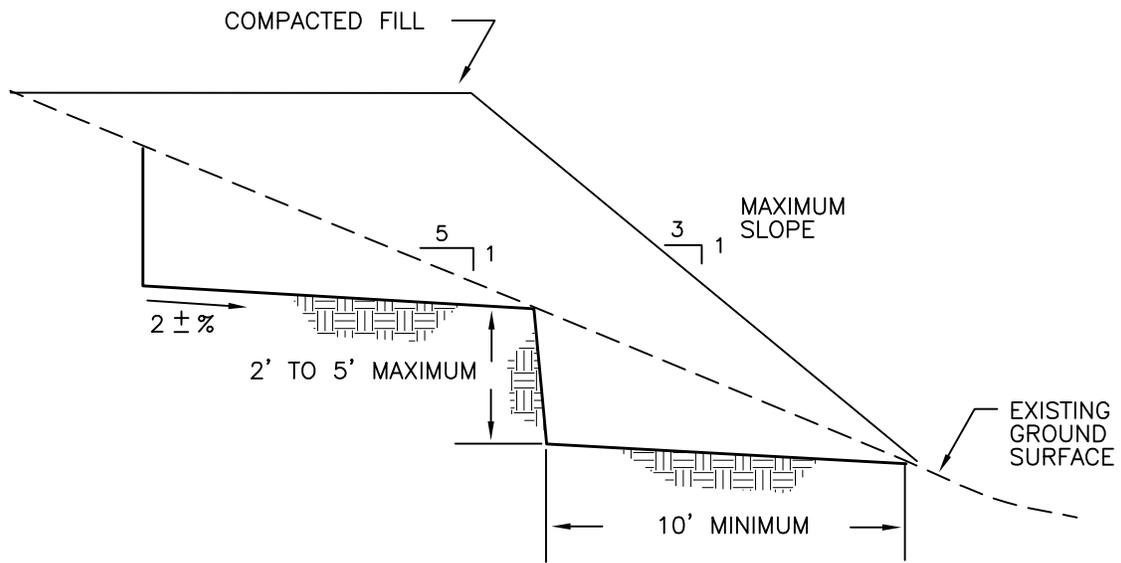
LEGEND:

- TH-1 APPROXIMATE LOCATION OF EXPLORATORY BORING
- LOW RISK
- MODERATE RISK
- HIGH RISK

NOTE: THIS ESTIMATE WAS BASED UPON A SUBJECTIVE ANALYSIS OF LABORATORY TEST RESULTS AND DRILL HOLE DATA.

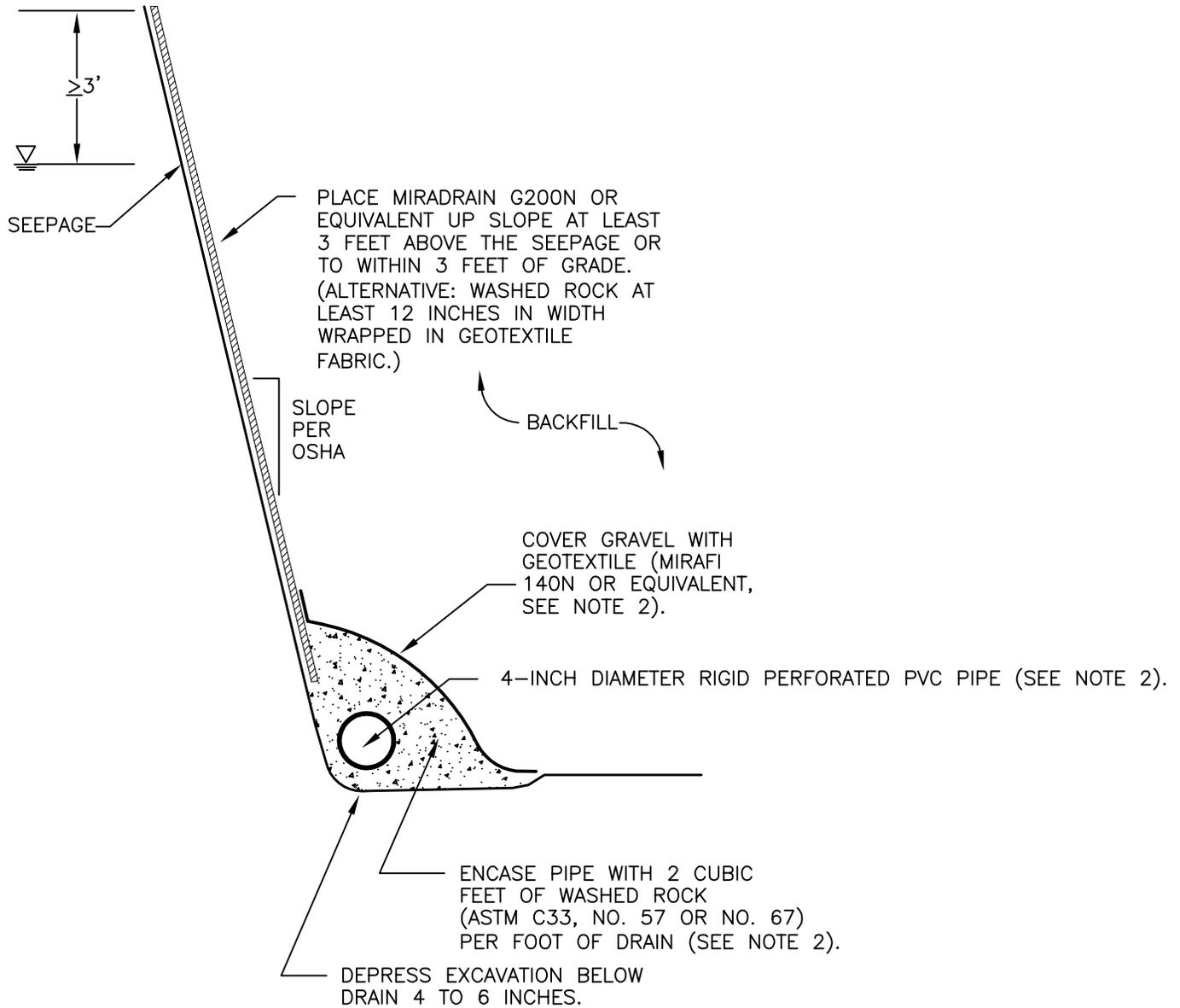
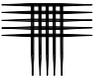
\* INDICATES BORINGS WHERE SOFT/LOOSE SOILS (AND SHALLOW GROUNDWATER) WERE ENCOUNTERED, IMPLYING SETTLEMENT IS MORE LIKELY THAN HEAVE





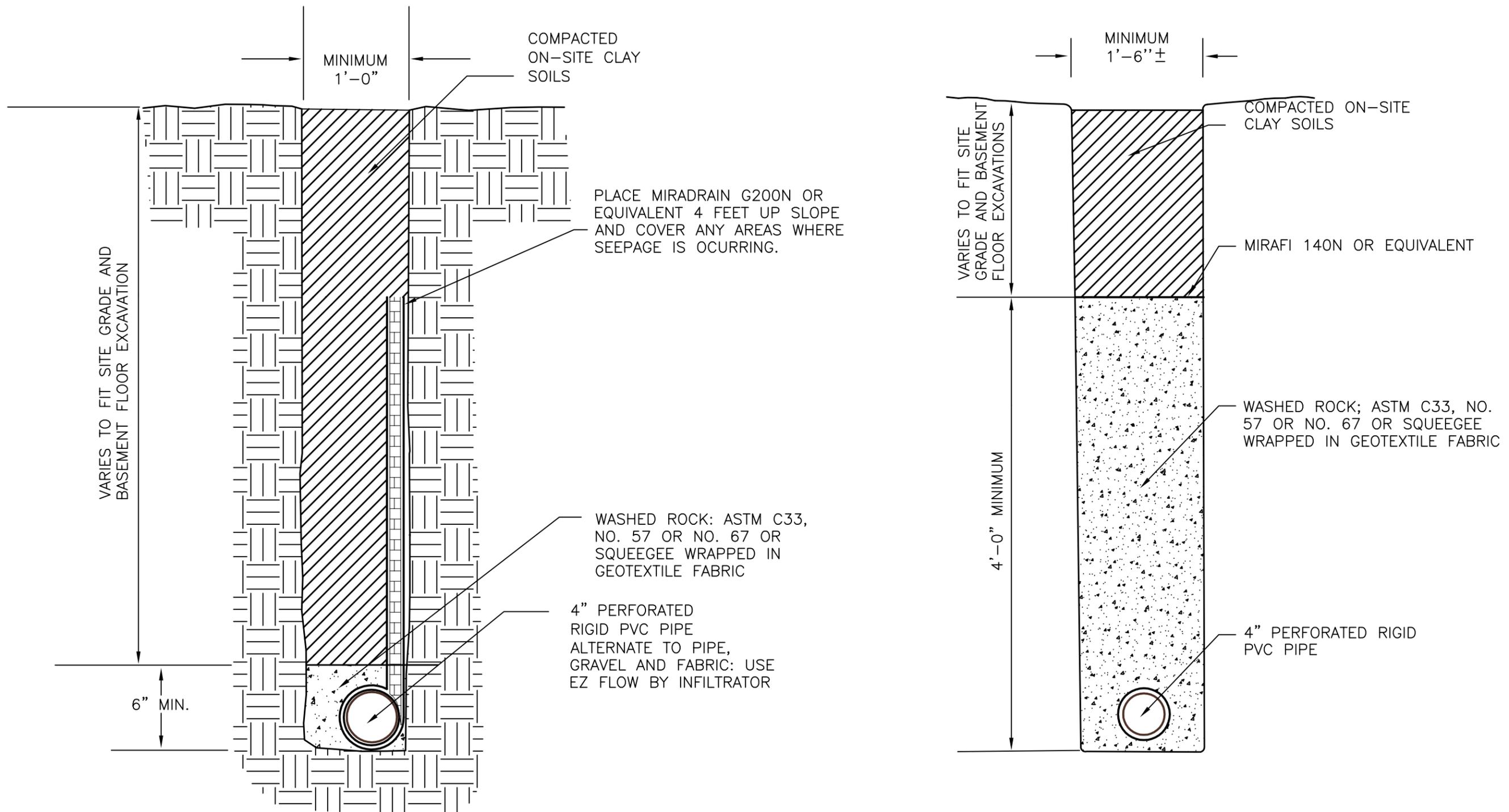
NOTES:

- 1) NATURAL SLOPES OF 20 PERCENT OR STEEPER ARE TO BE BENCHED PRIOR TO FILL PLACEMENT.
- 2) SLOPE BENCHES TO OUTSLOPE AT 2 ± PERCENT.



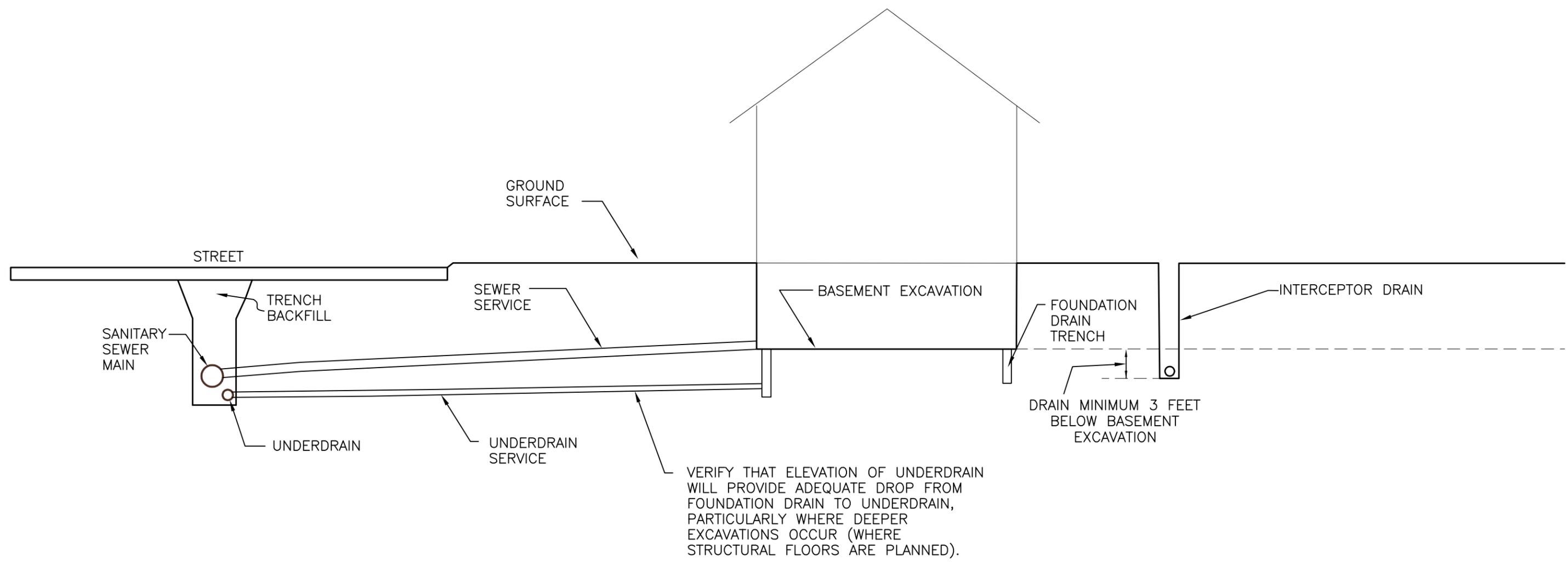
NOTES:

1. THE BOTTOM OF THE DRAIN SHOULD SLOPE AT A MINIMUM SLOPE OF 0.5 PERCENT TO A POSITIVE GRAVITY OUTLET OR A MANHOLE PUMP STATION.
2. EZflow™ BY INFILTRATOR MAY BE USED IN LIEU OF PIPE, GRAVEL AND GEOTEXTILE.

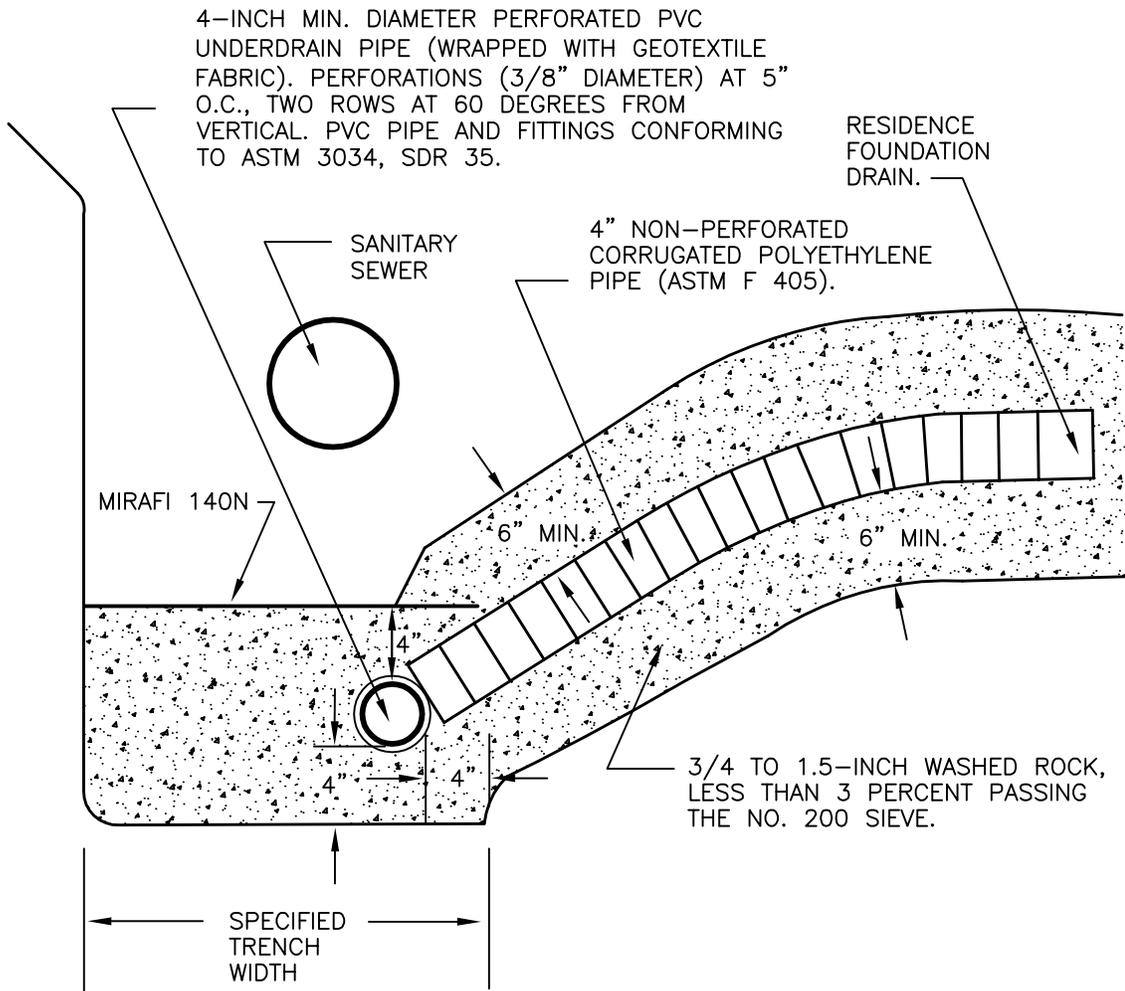
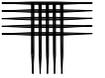


- NOTES:
- 1) THE BOTTOM OF THE DRAIN SHOULD TO A POSITIVE GRAVITY WITH A MINIMUM SLOPE OF 0.5 PERCENT.
  - 2) THE DRAIN CAN CONNECT AND DISCHARGE TO THE UNDERDRAIN, OUTFALL OR MANHOLE PUMP STATION.

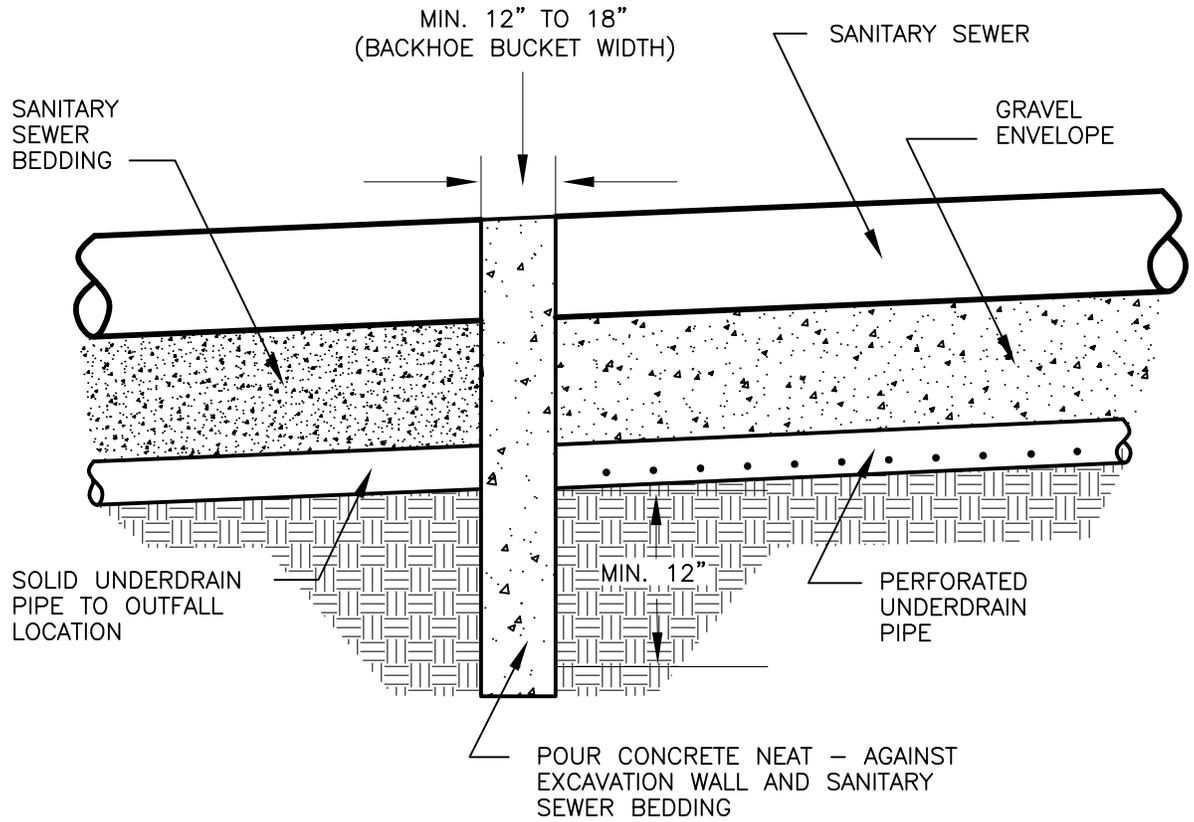
NOT TO SCALE



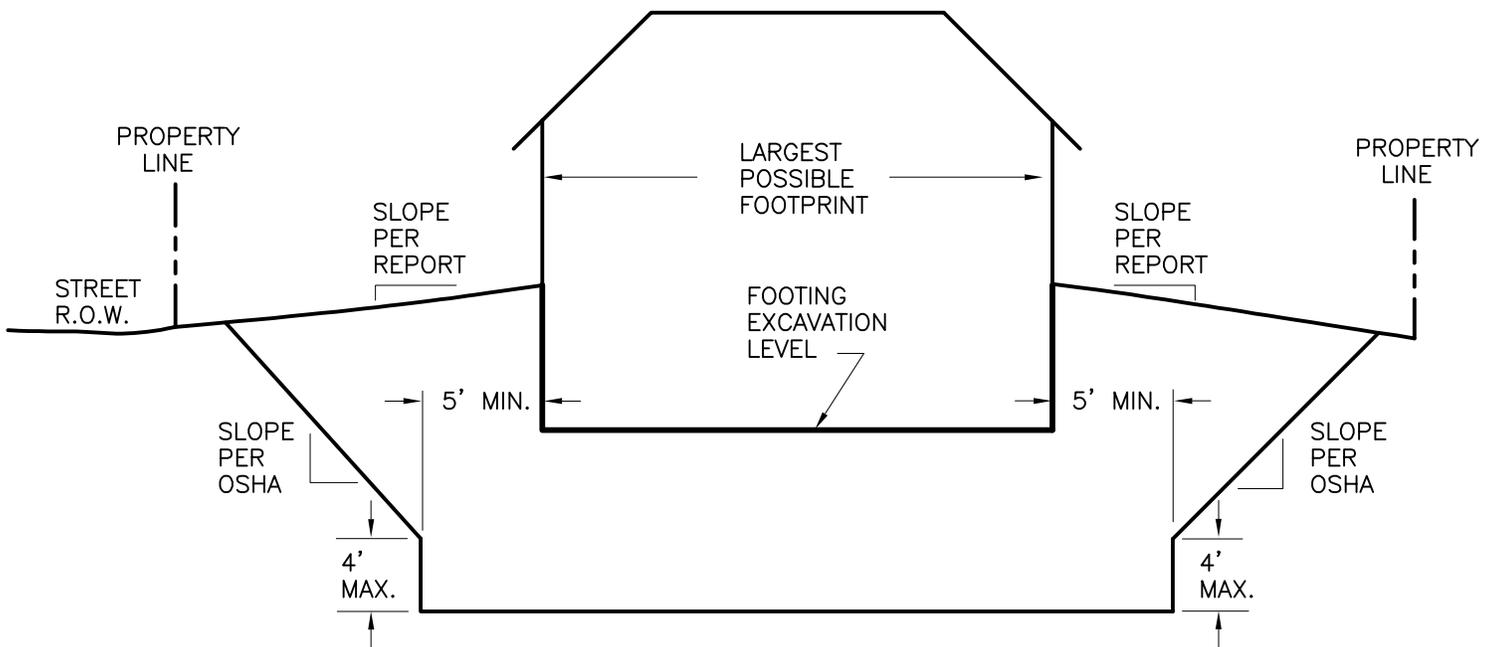
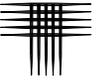
NOT TO SCALE



NOTE: NOT TO SCALE



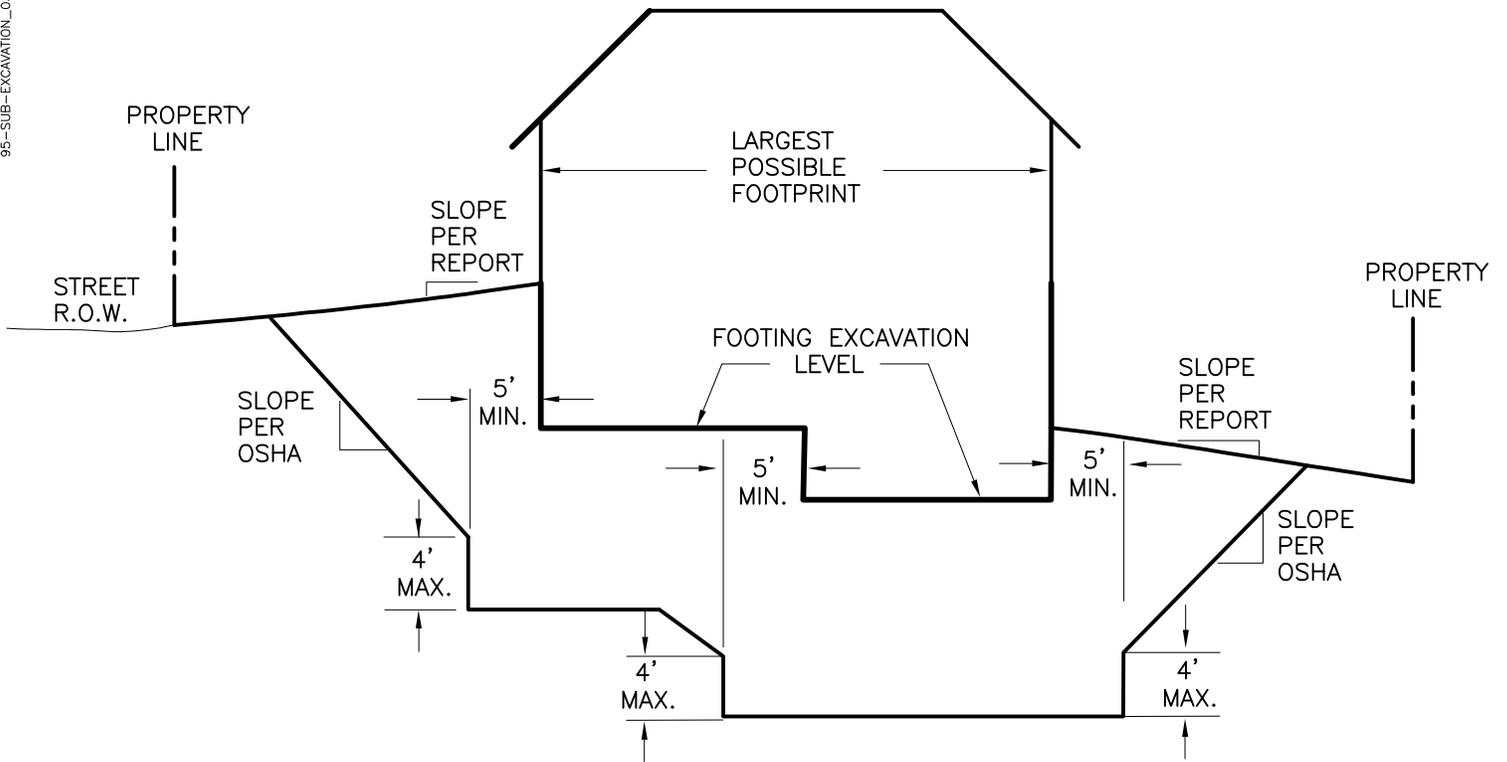
NOTE:  
 THE CONCRETE CUTOFF WALL SHOULD EXTEND INTO THE UNDISTURBED SOILS OUTSIDE THE UNDERDRAIN AND SANITARY SEWER TRENCH A MINIMUM DISTANCE OF 12 INCHES.



NOT TO SCALE



95-SUB-EXCAVATION\_03



NOT TO SCALE

# Conceptual Sub-excavation Profile



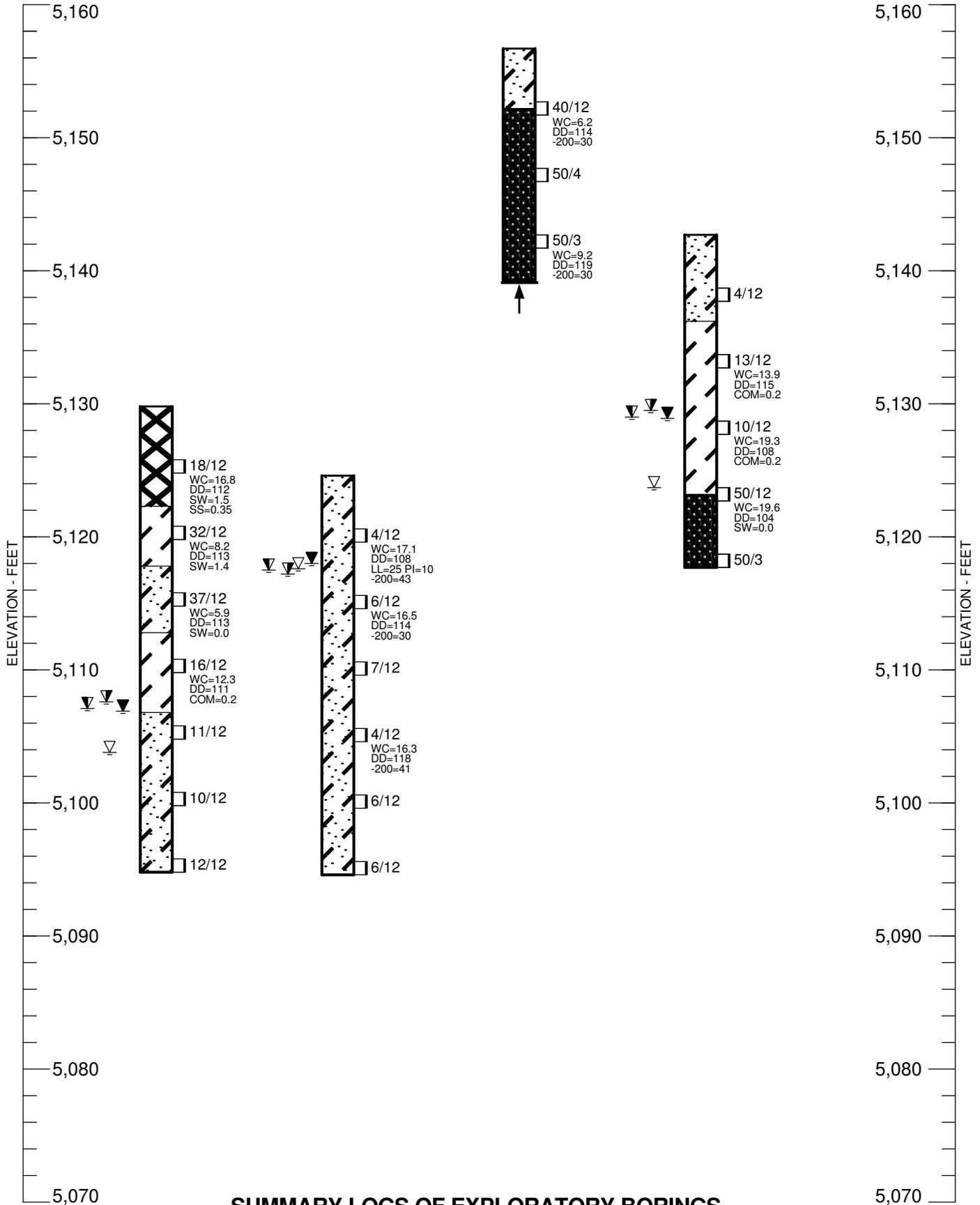
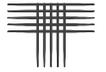
APPENDIX A  
SUMMARY LOGS OF EXPLORATORY BORINGS

TH-1  
EL. 5129.8

TH-2  
EL. 5124.6

TH-3  
EL. 5156.7

TH-4  
EL. 5142.7



### SUMMARY LOGS OF EXPLORATORY BORINGS

HT FLATIRON LP  
FLATIRON MEADOWS SUBDIVISION, PHASE 6A  
PROJECT NO. DN47,910-115

FIG. A-1

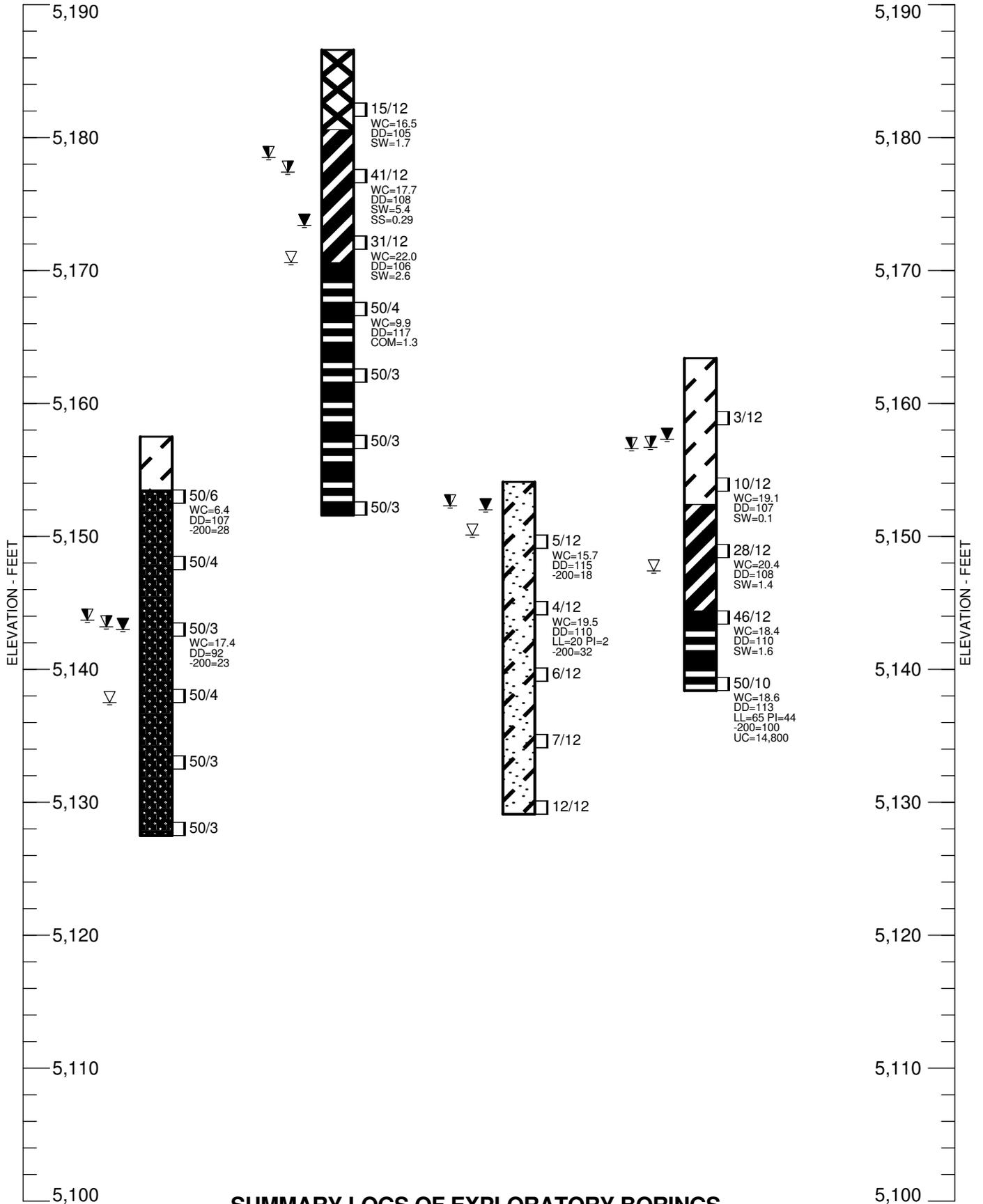
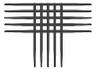
S:\PROJECTS\47900\DN47910.000\115.2. REPORTS\IR1\DN47910-115-R1-G.GPJ

TH-5  
EL. 5157.5

TH-6  
EL. 5186.6

TH-7  
EL. 5154.1

TH-8  
EL. 5163.4



**SUMMARY LOGS OF EXPLORATORY BORINGS**

HT FLATIRON LP  
FLATIRON MEADOWS SUBDIVISION, PHASE 6A  
PROJECT NO. DN47,910-115

FIG. A-2

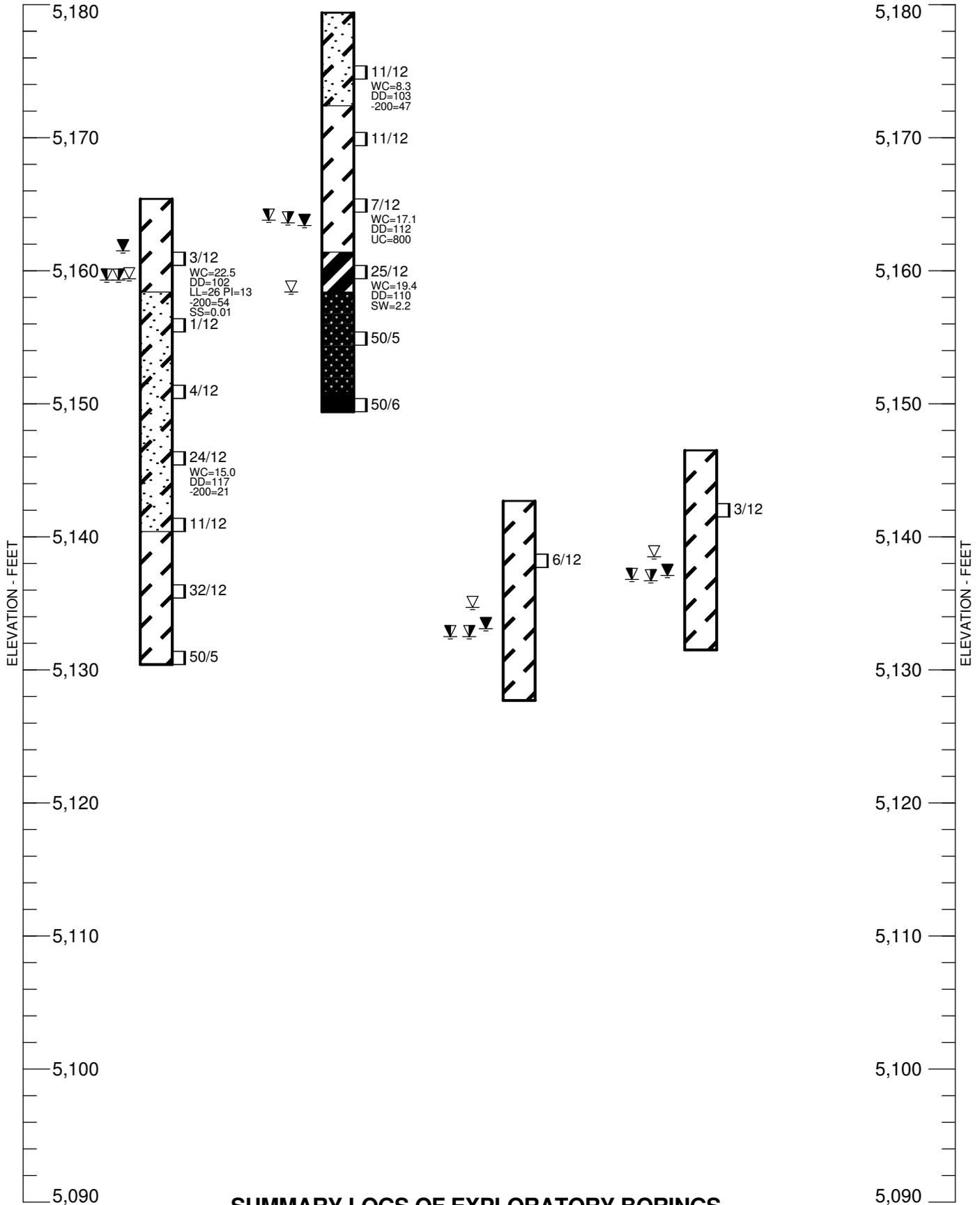
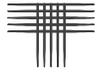
S:\PROJECTS\47900\DN47910.000\115.2. REPORTS\IR1\DN47910-115-R1-G.GPJ

TH-9  
EL. 5165.4

TH-10  
EL. 5179.4

TH-11  
EL. 5142.7

TH-12  
EL. 5146.5



### SUMMARY LOGS OF EXPLORATORY BORINGS

HT FLATIRON LP  
FLATIRON MEADOWS SUBDIVISION, PHASE 6A  
PROJECT NO. DN47,910-115

FIG. A-3

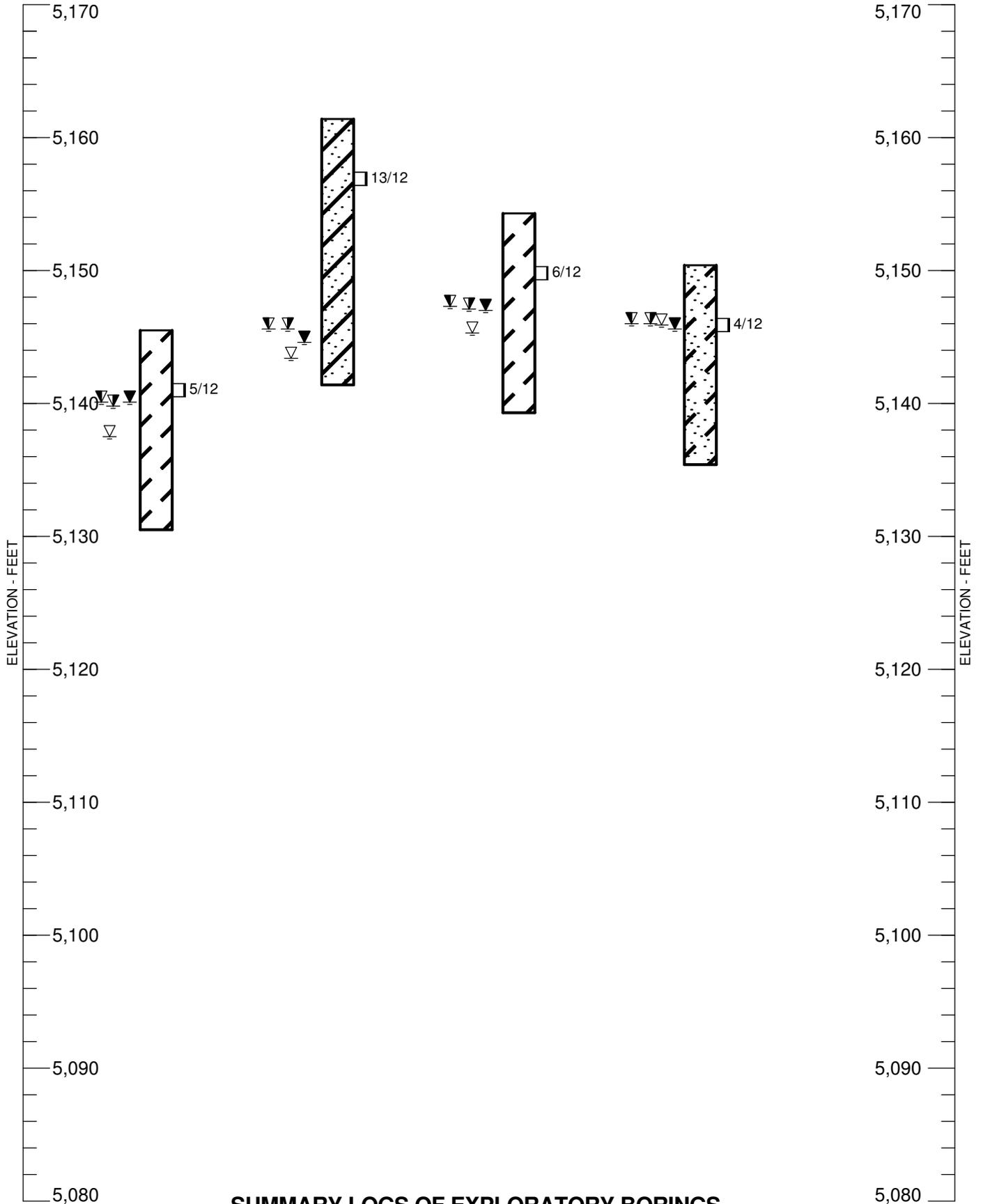
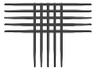
S:\PROJECTS\47900\DN47910.000\115.2. REPORTS\IR1\DN47910-115-R1-G.GPJ

TH-13  
EL. 5145.5

TH-14  
EL. 5161.4

TH-15  
EL. 5154.3

TH-16  
EL. 5150.4



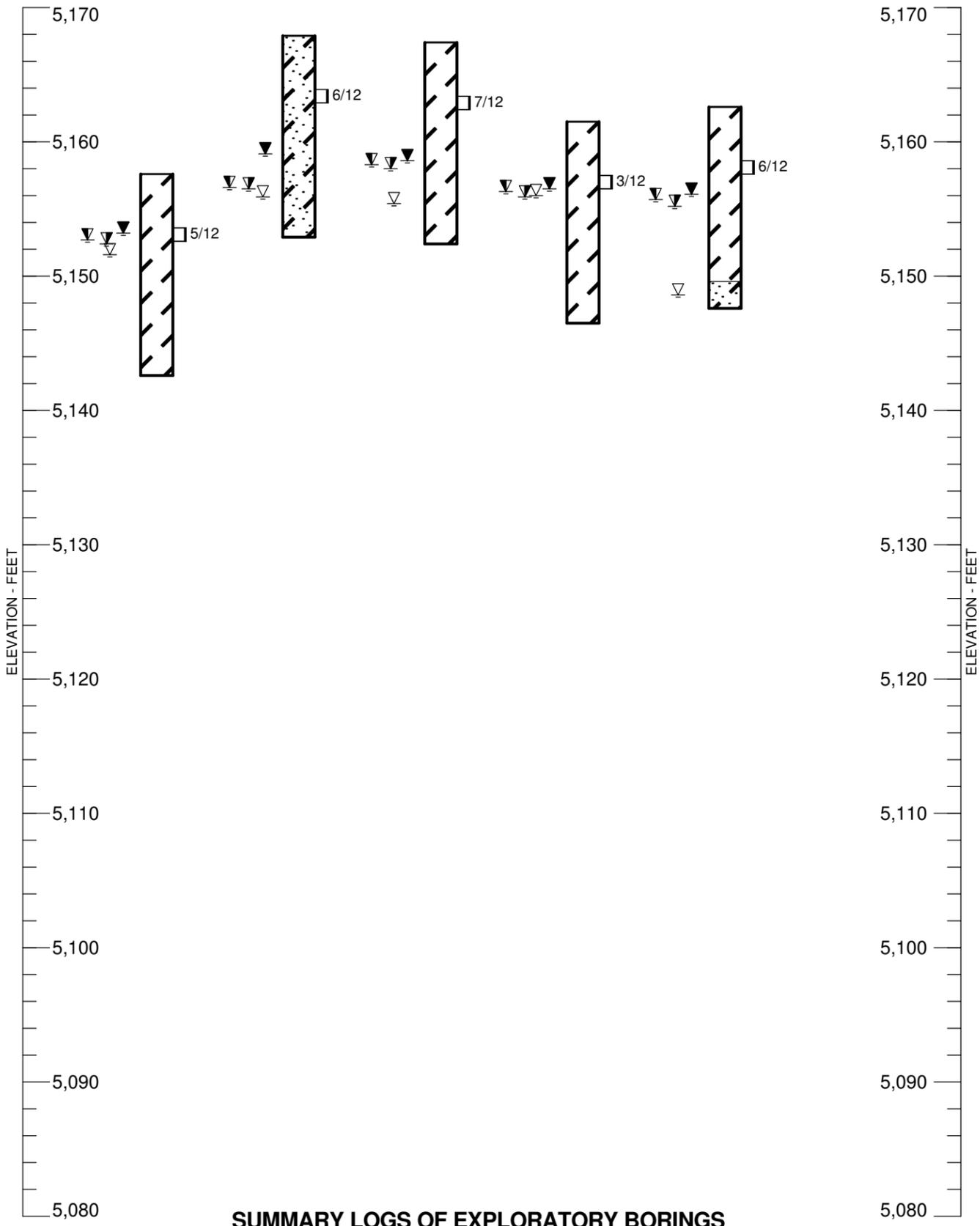
### SUMMARY LOGS OF EXPLORATORY BORINGS

HT FLATIRON LP  
FLATIRON MEADOWS SUBDIVISION, PHASE 6A  
PROJECT NO. DN47,910-115

FIG. A- 4



TH-17 EL. 5157.6    TH-18 EL. 5167.9    TH-19 EL. 5167.4    TH-20 EL. 5161.5    TH-21 EL. 5162.6



**LEGEND:**

- FILL, CLAY, SANDY, SILTY, VERY STIFF, MOIST, BROWN, GRAY, TAN, RUST.
- CLAY, SANDY TO VERY SANDY, SILTY, GRAVELLY AT DEPTH, SOFT TO VERY STIFF, MOIST TO VERY MOIST, BROWN, TAN, GRAY, WHITE (CL).
- SAND, SILTY TO VERY CLAYEY, VERY LOOSE TO DENSE, SLIGHTLY MOIST TO WET, BROWN, LIGHT BROWN, TAN (SM, SC).
- WEATHERED CLAYSTONE, MOIST, GRAY, RUST, OLIVE.
- BEDROCK, CLAYSTONE, SILTY, SILTSTONE LAYERS, HARD TO VERY HARD, SLIGHTLY MOIST TO MOIST, GRAY, RUST, BROWN, LIGHT GRAY, TAN.
- BEDROCK, SANDSTONE, SOME SILTSTONE, SILTY TO CLAYEY, CEMENTED ZONES, VERY HARD, MOIST TO VERY MOIST, LIGHT GRAY, RUST, GRAY, BROWN, TAN.
- DRIVE SAMPLE. THE SYMBOL 18/12 INDICATES 18 BLOWS OF AN AUTOMATIC 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH O.D. SAMPLER 12 INCHES.
- WATER LEVEL MEASURED AT TIME OF DRILLING.
- WATER LEVEL MEASURED AFTER DRILLING ON JUNE 23, 2015 (TH-1 THROUGH TH-10) OR SEPTEMBER 16, 2015 (TH-11 THROUGH TH-21).
- WATER LEVEL MEASURED AFTER DRILLING ON JULY 2, 2015 (TH-1 THROUGH TH-10) OR SEPTEMBER 23, 2015 (TH-11 THROUGH TH-21).
- WATER LEVEL MEASURED AFTER DRILLING ON JULY 9, 2015 (TH-1 THROUGH TH-10) OR OCTOBER 8, 2015 (TH-11 THROUGH TH-21).
- PRACTICAL DRILL REFUSAL.

**NOTES:**

1. THE BORINGS WERE DRILLED USING 4-INCH DIAMETER, CONTINUOUS-FLIGHT SOLID-STEM AUGER AND TRUCK-MOUNTED CME-45 AND CME-55 DRILL RIGS. TH-1 THROUGH TH-10 WERE DRILLED ON JUNE 11, 17 AND 22, 2015 AND TH-11 THROUGH TH-21 WERE DRILLED ON SEPTEMBER 14, 2015.
2. BORING LOCATIONS WERE STAKED AND ELEVATIONS WERE PROVIDED BY CALIBRE ENGINEERING.
3. WC - INDICATES MOISTURE CONTENT (%).  
 DD - INDICATES DRY DENSITY (PCF).  
 SW - INDICATES SWELL WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).  
 COM - INDICATES COMPRESSION WHEN WETTED UNDER APPROXIMATE OVERBURDEN PRESSURE (%).  
 LL - INDICATES LIQUID LIMIT.  
 PI - INDICATES PLASTICITY INDEX.  
 -200 - INDICATES PASSING NO. 200 SIEVE (%).  
 UC - INDICATES UNCONFINED COMPRESSIVE STRENGTH (psf).  
 SS - INDICATES WATER-SOLUBLE SULFATE CONTENT (%).
4. THESE LOGS ARE SUBJECT TO THE EXPLANATIONS, LIMITATIONS AND CONCLUSIONS CONTAINED IN THIS REPORT.

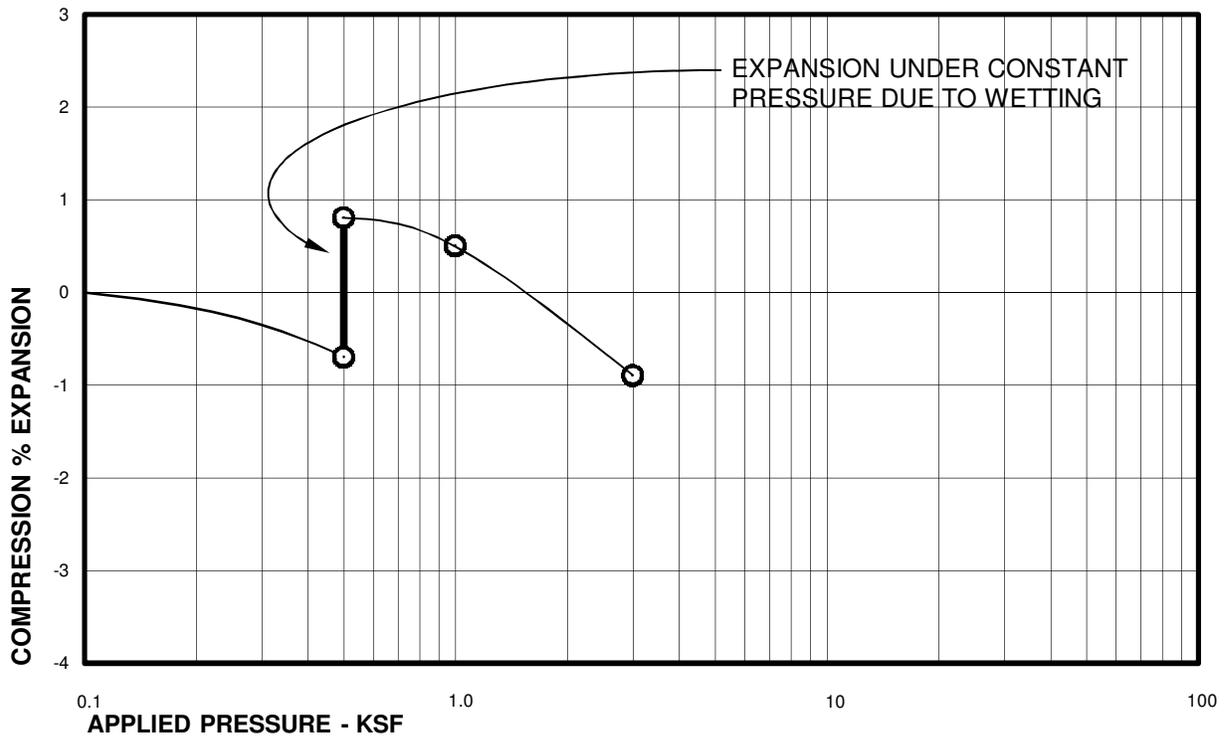
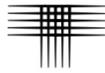
**SUMMARY LOGS OF EXPLORATORY BORINGS**

HT FLATIRON LP  
 FLATIRON MEADOWS SUBDIVISION, PHASE 6A  
 PROJECT NO. DN47,910-115

S:\PROJECTS\47900\DN47910\0001152 - REPORTS\RI\DN47910-115-R1-G.GPJ

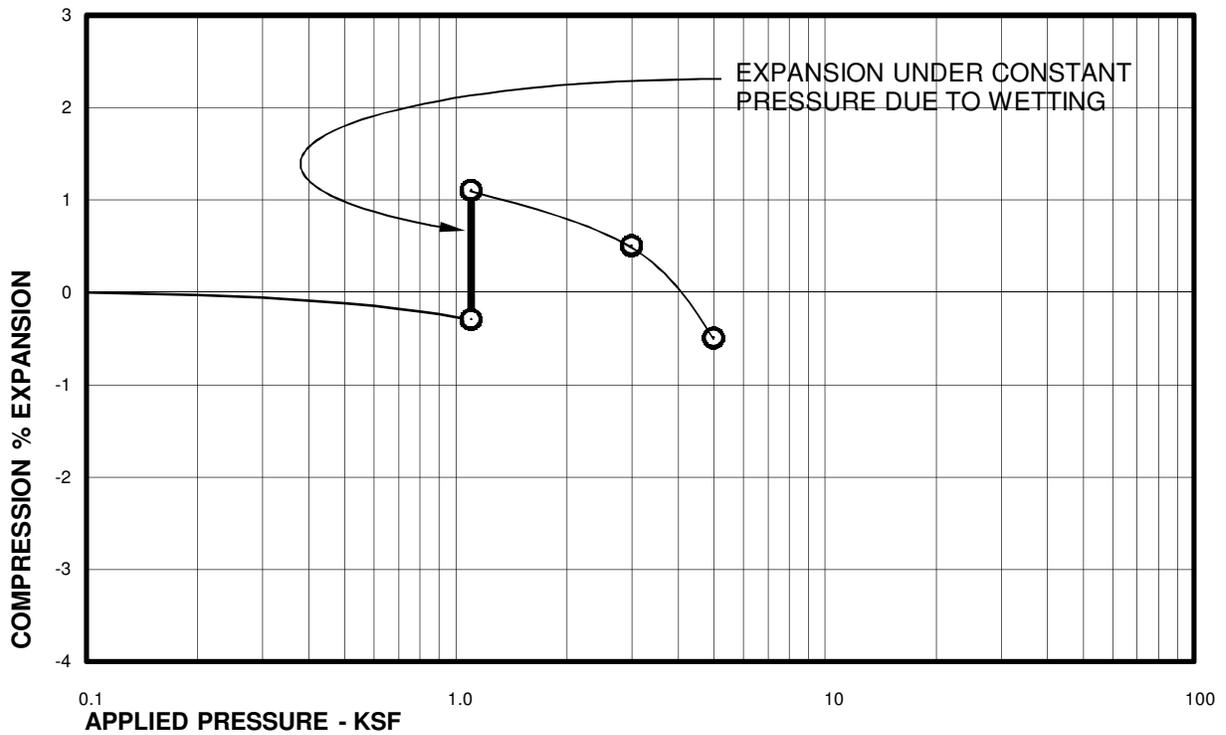


APPENDIX B  
LABORATORY TEST RESULTS  
TABLE B-I – SUMMARY OF LABORATORY TEST RESULTS



Sample of FILL, CLAY, SANDY  
From TH-1 AT 4 FEET

DRY UNIT WEIGHT= 112 PCF  
MOISTURE CONTENT= 16.8 %

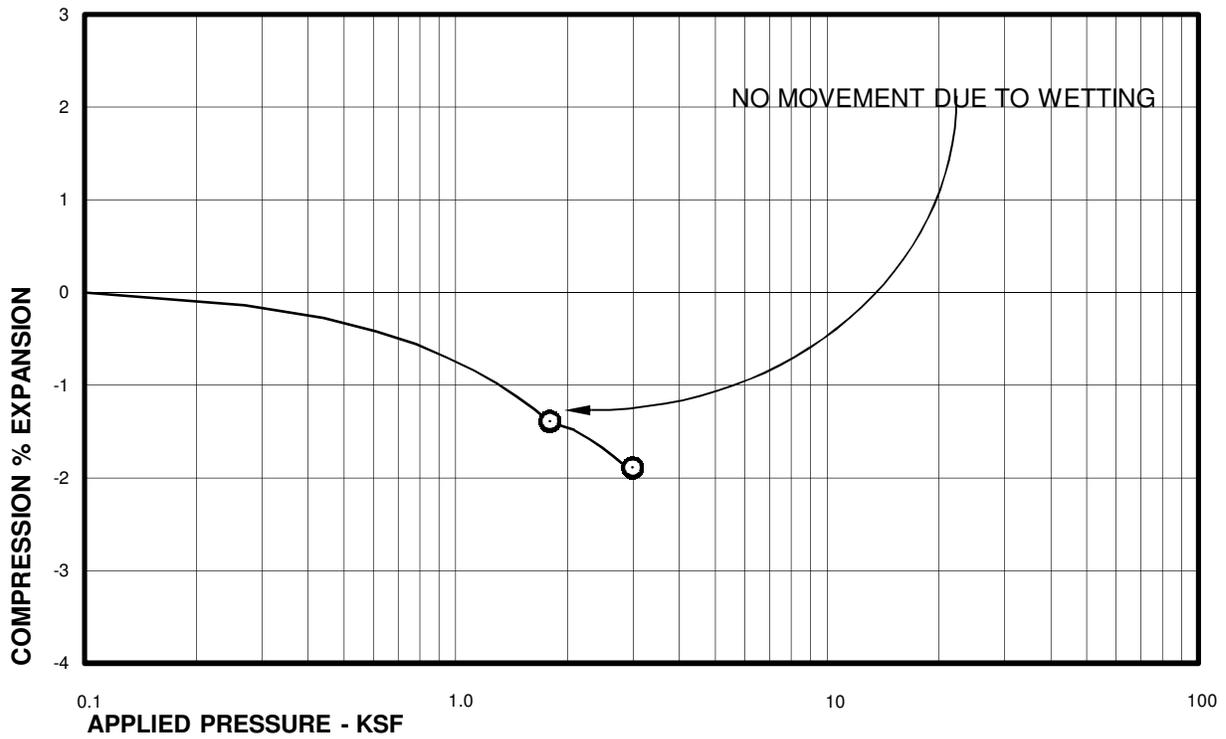
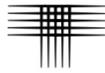


Sample of CLAY, SANDY (CL)  
From TH-1 AT 9 FEET

DRY UNIT WEIGHT= 113 PCF  
MOISTURE CONTENT= 8.2 %

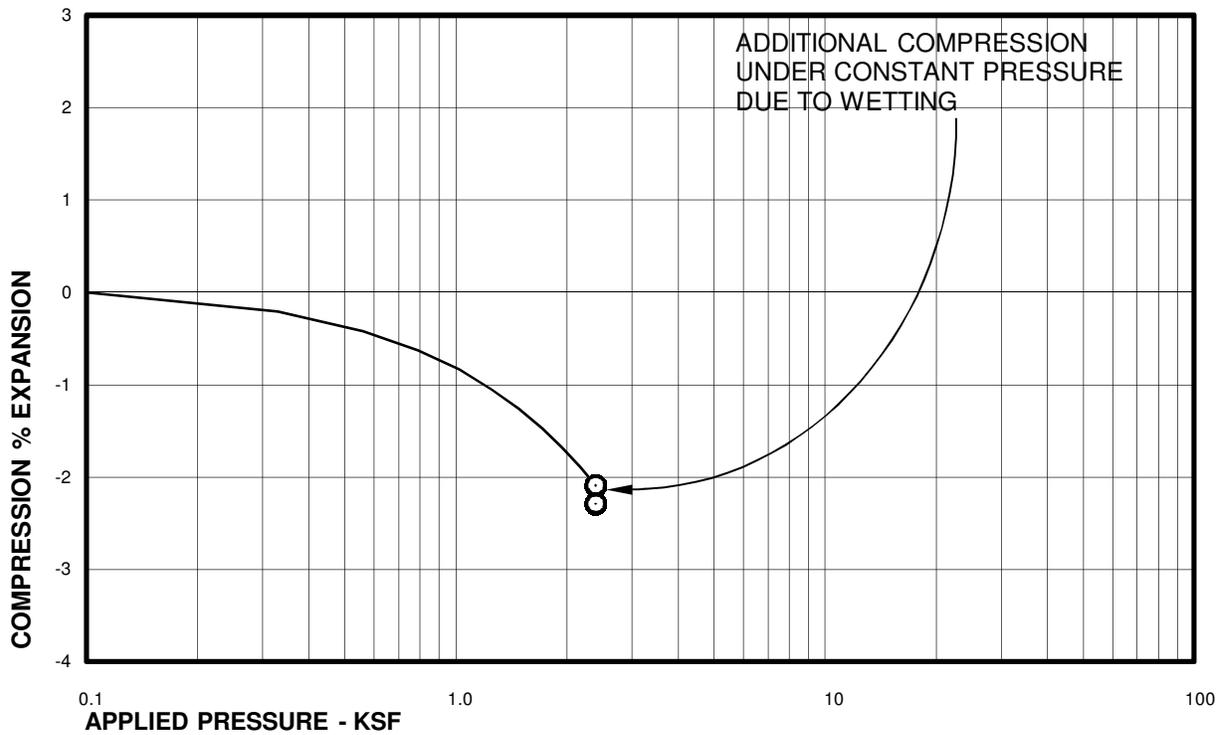
## Swell Consolidation Test Results

FIG. B-1



Sample of SAND, CLAYEY (SC)  
From TH-1 AT 14 FEET

DRY UNIT WEIGHT= 113 PCF  
MOISTURE CONTENT= 5.9 %

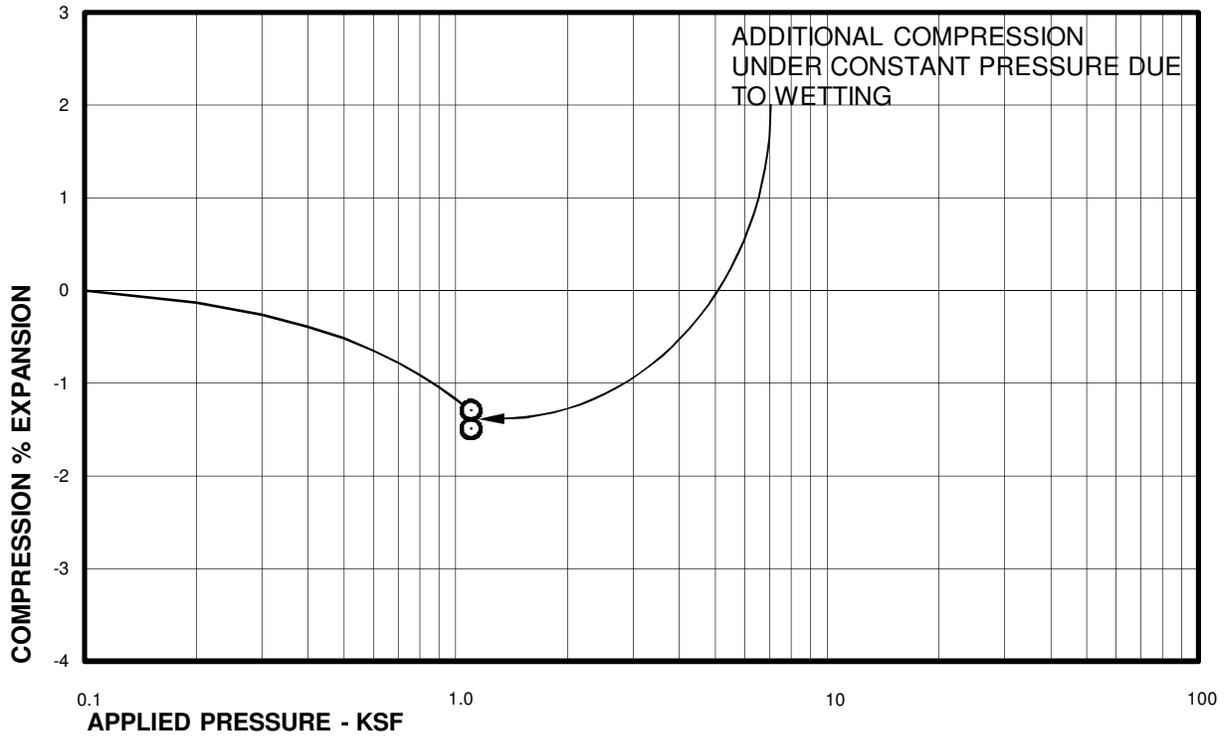


Sample of CLAY, SANDY (CL)  
From TH-1 AT 19 FEET

DRY UNIT WEIGHT= 111 PCF  
MOISTURE CONTENT= 12.3 %

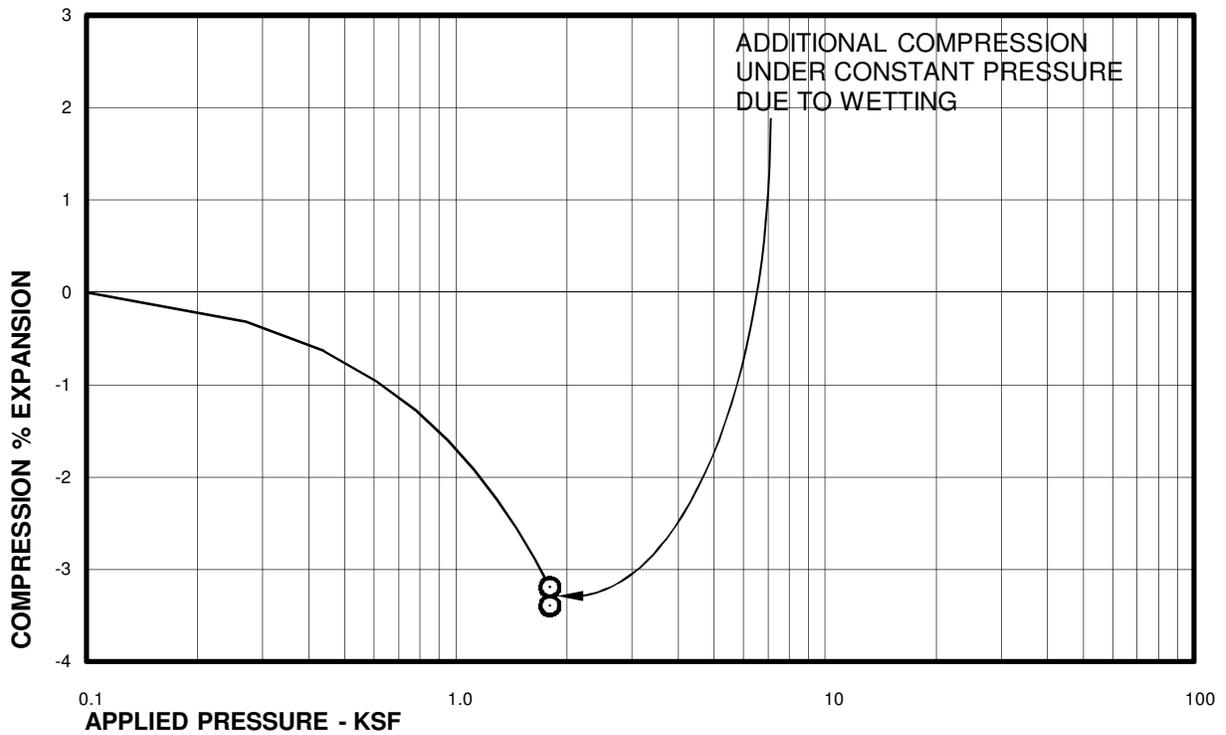
## Swell Consolidation Test Results

FIG. B-2



Sample of CLAY, SANDY (CL)  
From TH-4 AT 9 FEET

DRY UNIT WEIGHT= 115 PCF  
MOISTURE CONTENT= 13.9 %

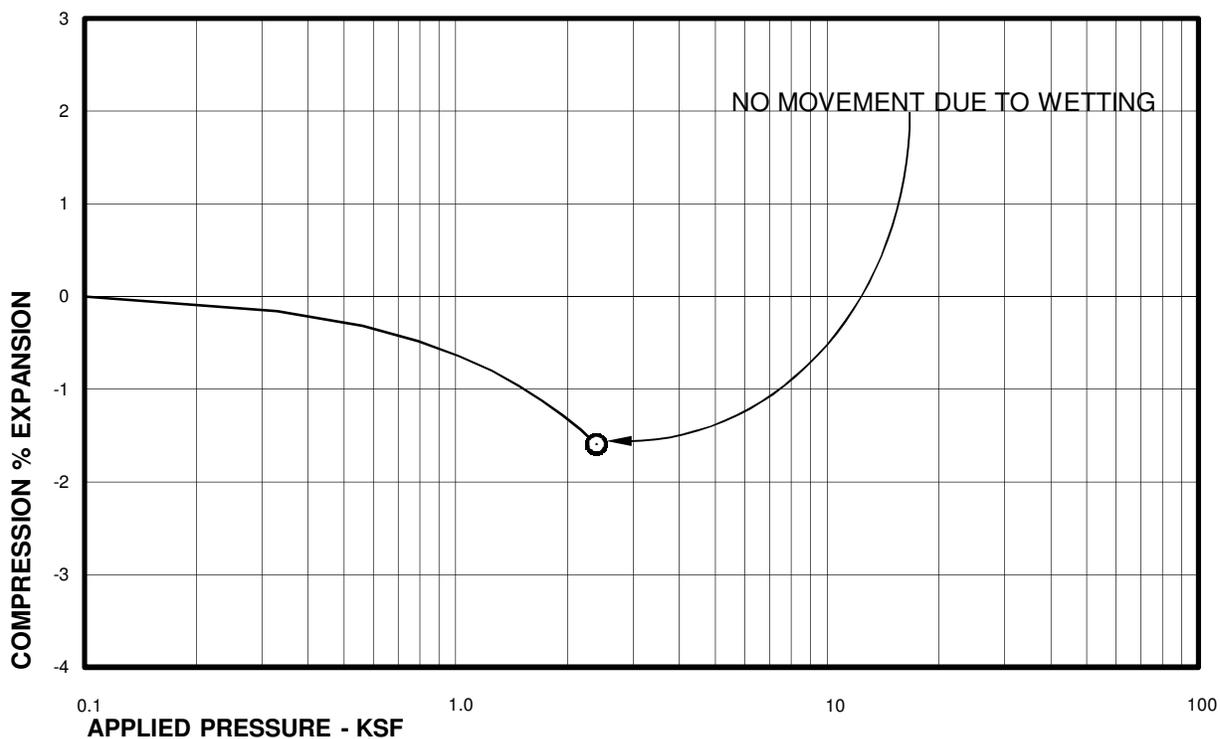
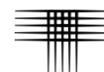


Sample of CLAY, SANDY (CL)  
From TH-4 AT 14 FEET

DRY UNIT WEIGHT= 108 PCF  
MOISTURE CONTENT= 19.3 %

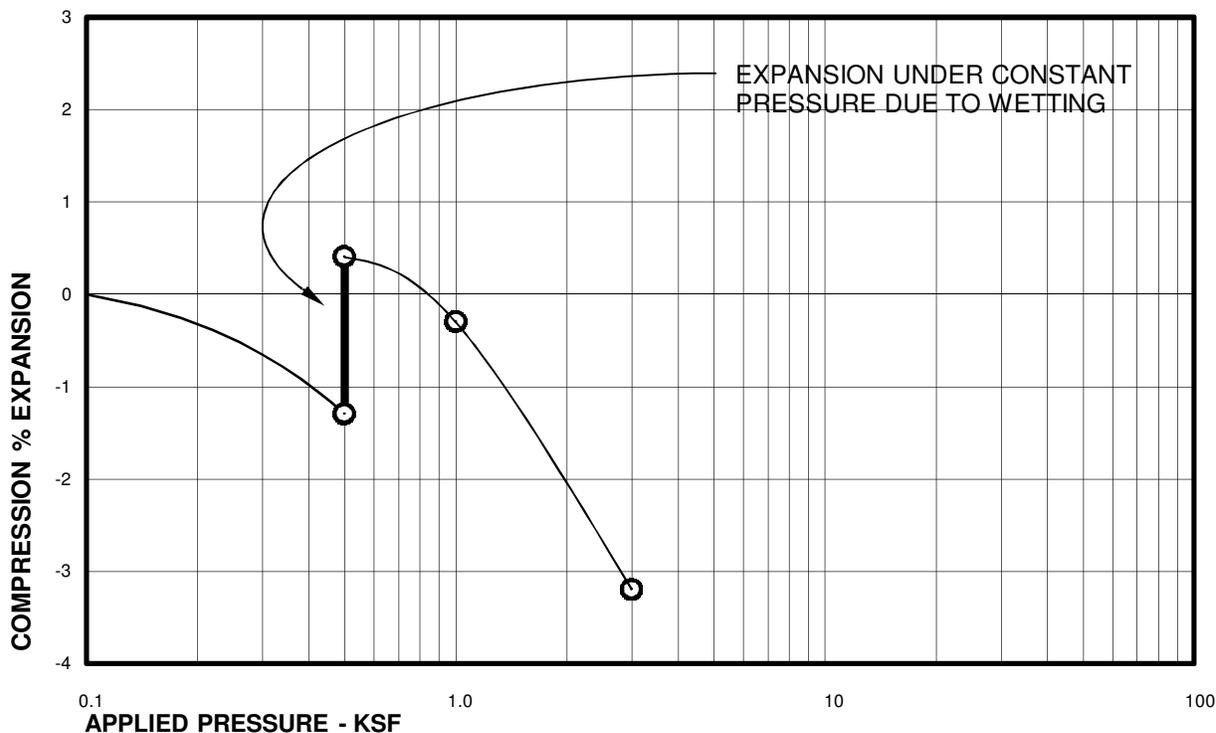
## Swell Consolidation Test Results

FIG. B-3



Sample of SANDSTONE  
From TH-4 AT 19 FEET

DRY UNIT WEIGHT= 104 PCF  
MOISTURE CONTENT= 19.6 %

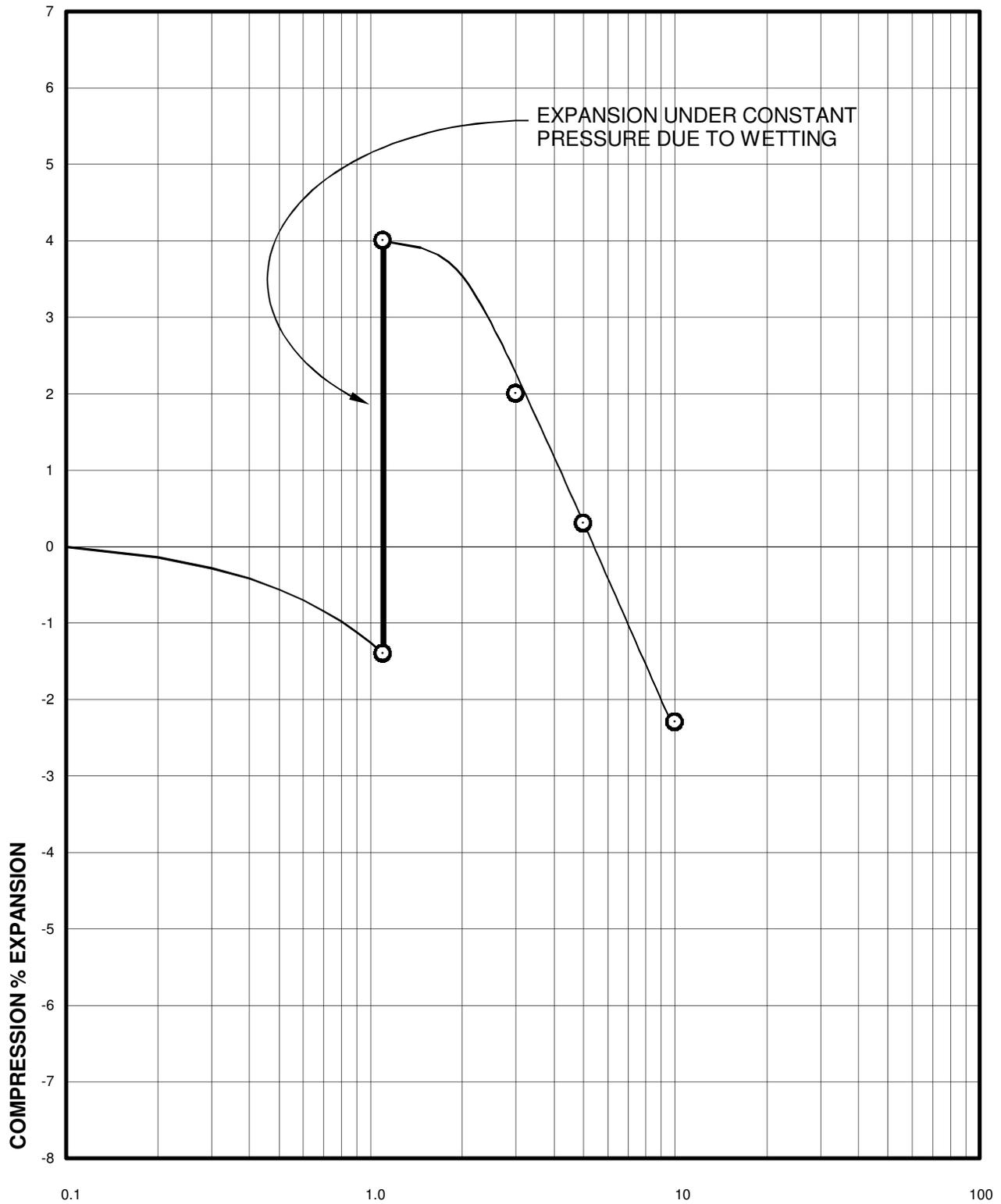
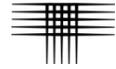


Sample of FILL, CLAY, SANDY  
From TH-6 AT 4 FEET

DRY UNIT WEIGHT= 105 PCF  
MOISTURE CONTENT= 16.5 %

## Swell Consolidation Test Results

FIG. B-4

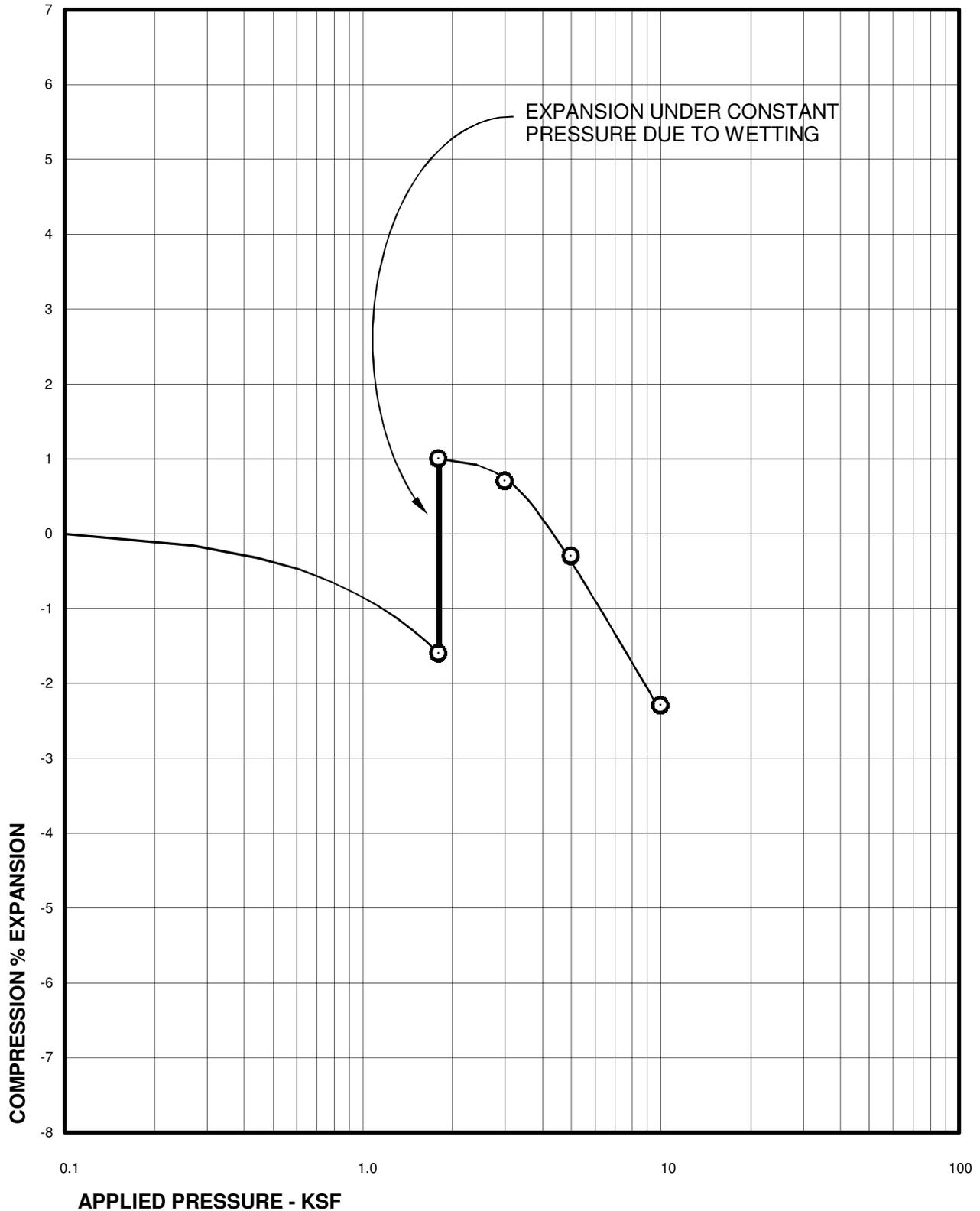


**APPLIED PRESSURE - KSF**  
Sample of WEATHERED CLAYSTONE  
From TH-6 AT 9 FEET

DRY UNIT WEIGHT= 108 PCF  
MOISTURE CONTENT= 17.7 %

# Swell Consolidation Test Results

FIG. B-5

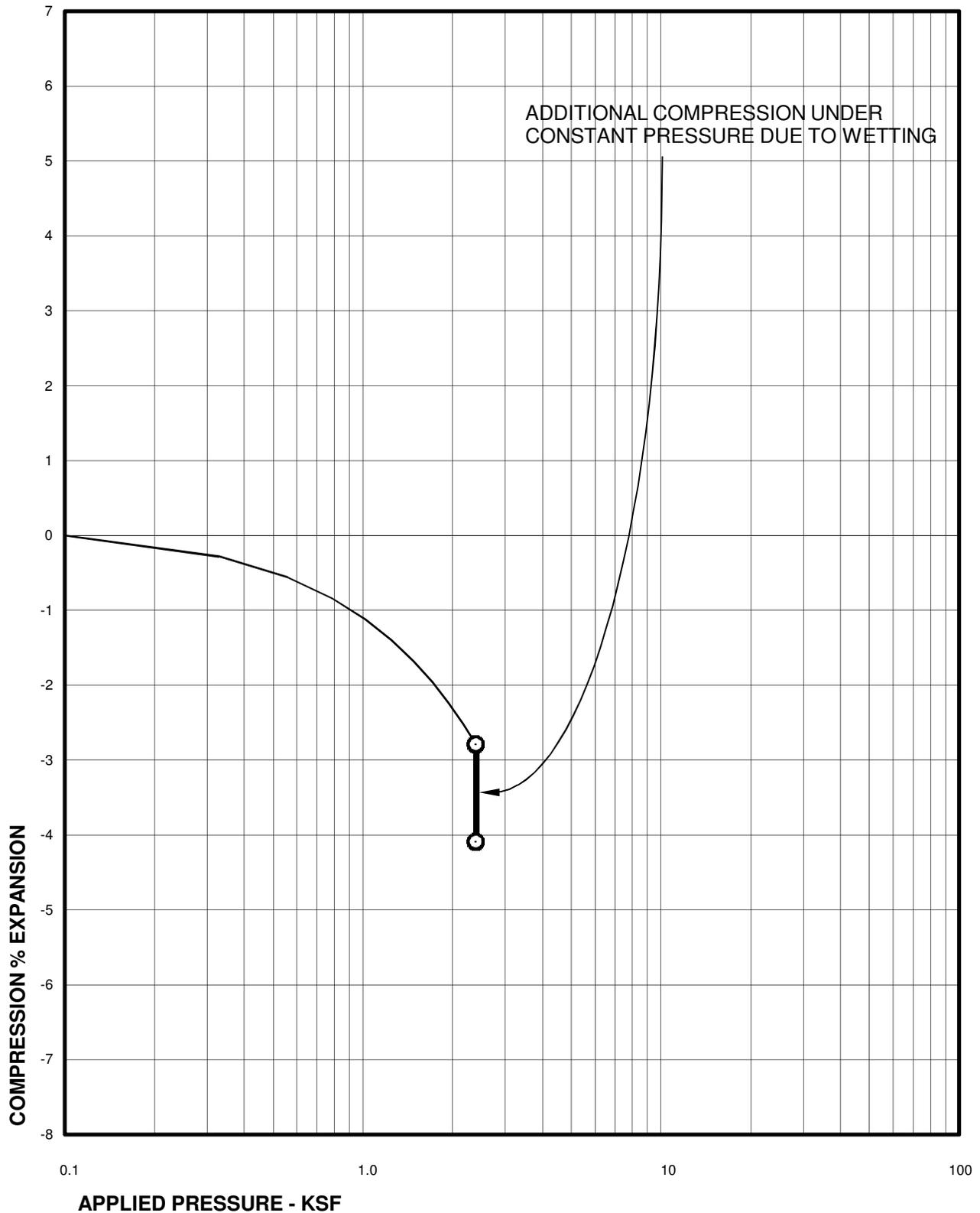
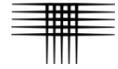


Sample of WEATHERED CLAYSTONE  
From TH-6 AT 14 FEET

DRY UNIT WEIGHT= 106 PCF  
MOISTURE CONTENT= 22.0 %

## Swell Consolidation Test Results

FIG. B-6

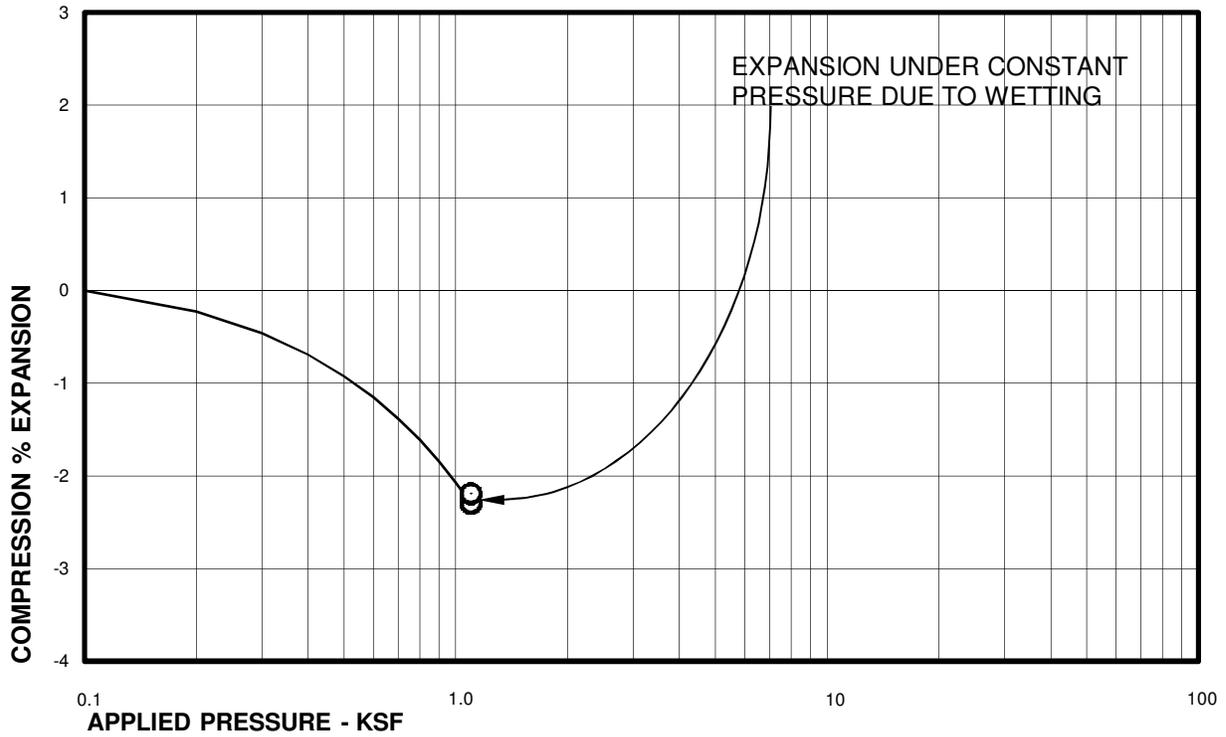
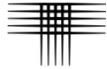


Sample of CLAYSTONE  
From TH-6 AT 19 FEET

DRY UNIT WEIGHT= 117 PCF  
MOISTURE CONTENT= 9.9 %

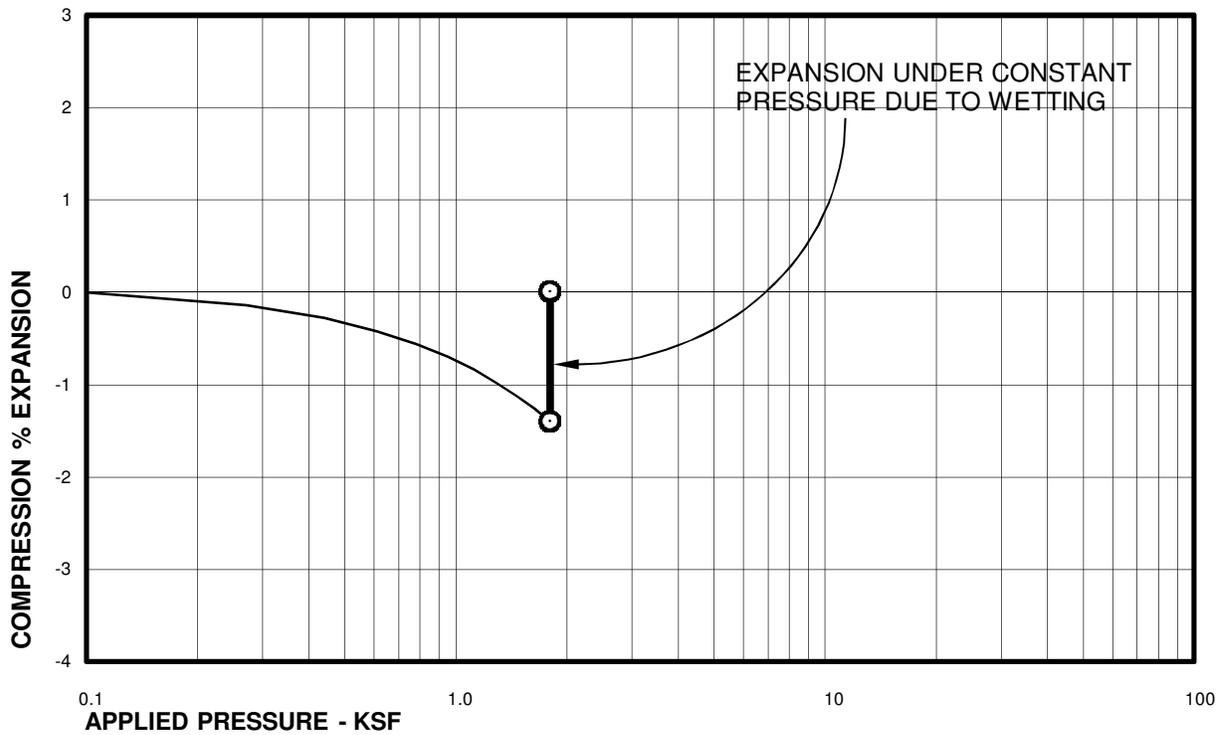
## Swell Consolidation Test Results

FIG. B-7



Sample of CLAY, SANDY (CL)  
From TH-8 AT 9 FEET

DRY UNIT WEIGHT= 107 PCF  
MOISTURE CONTENT= 19.1 %

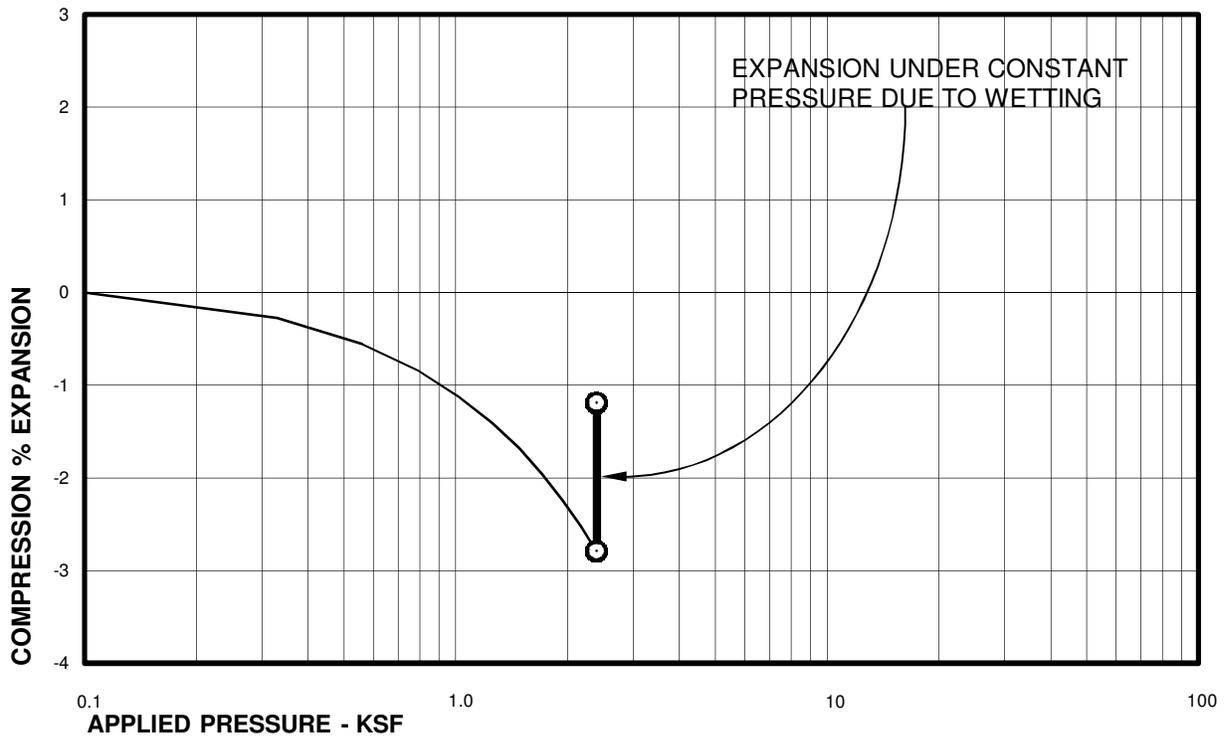
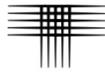


Sample of WEATHERED CLAYSTONE  
From TH-8 AT 14 FEET

DRY UNIT WEIGHT= 108 PCF  
MOISTURE CONTENT= 20.4 %

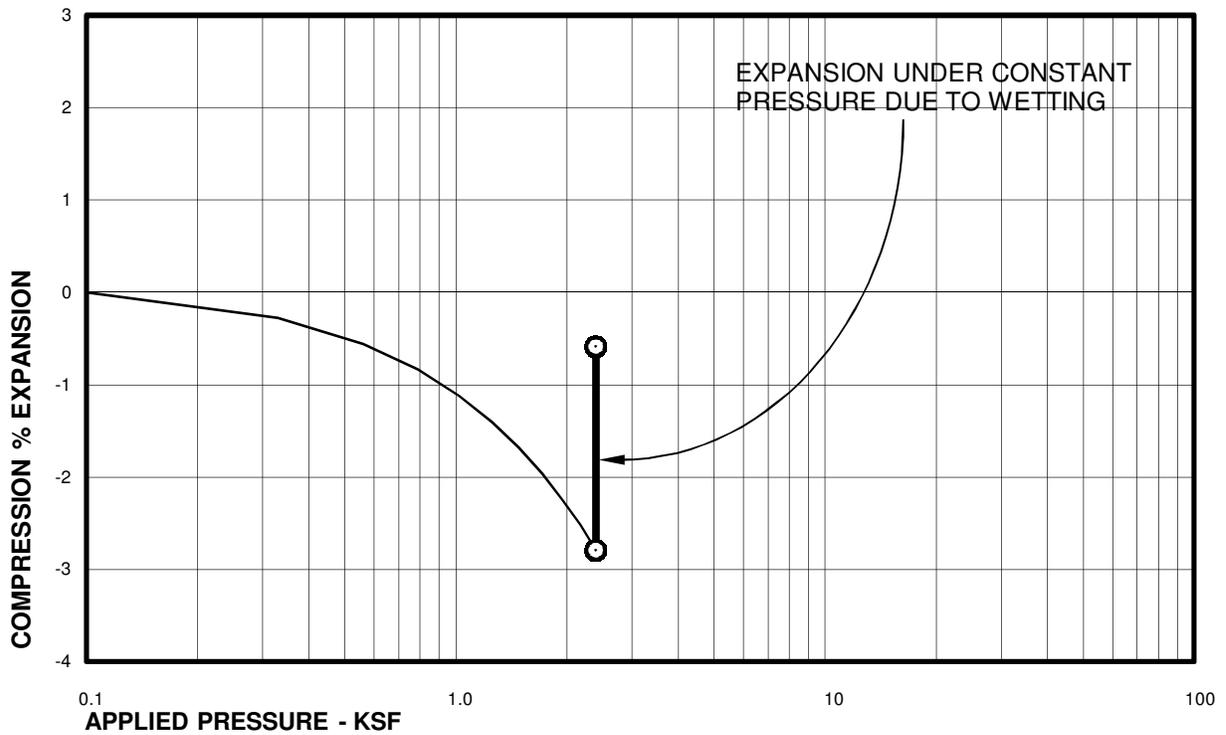
## Swell Consolidation Test Results

FIG. B-8



Sample of CLAYSTONE  
From TH-8 AT 19 FEET

DRY UNIT WEIGHT= 110 PCF  
MOISTURE CONTENT= 18.4 %

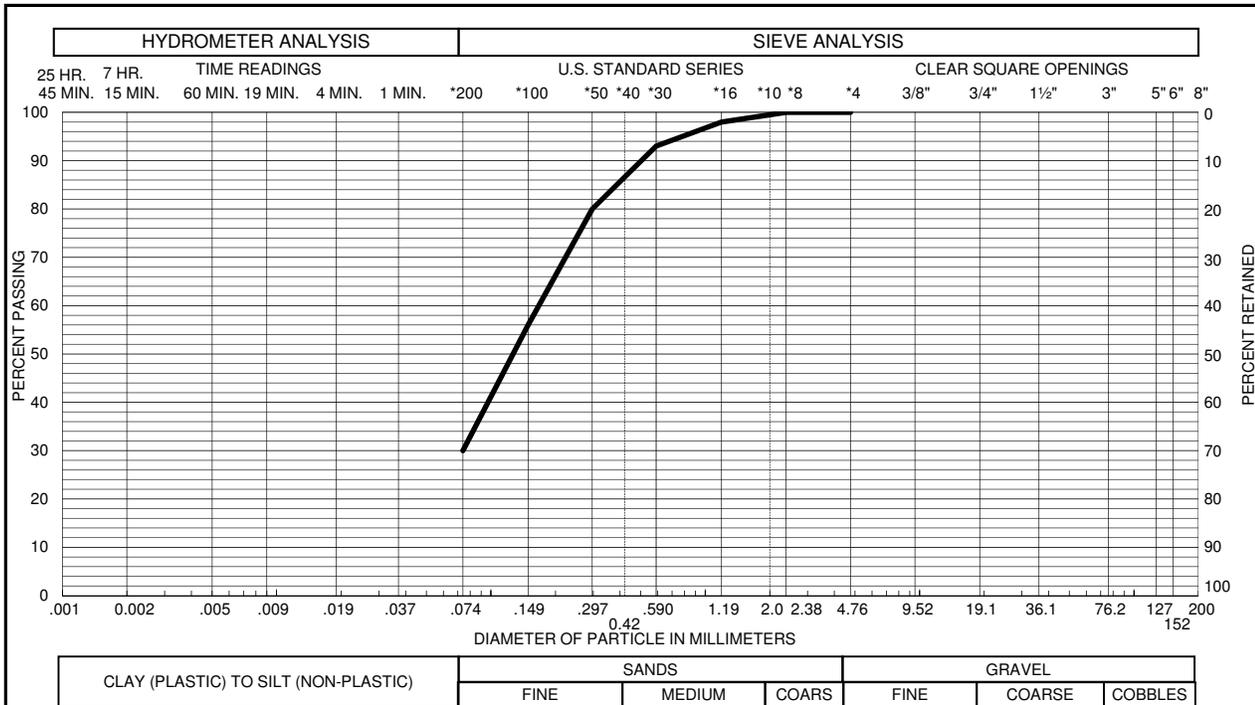
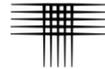


Sample of WEATHERED CLAYSTONE  
From TH-10 AT 19 FEET

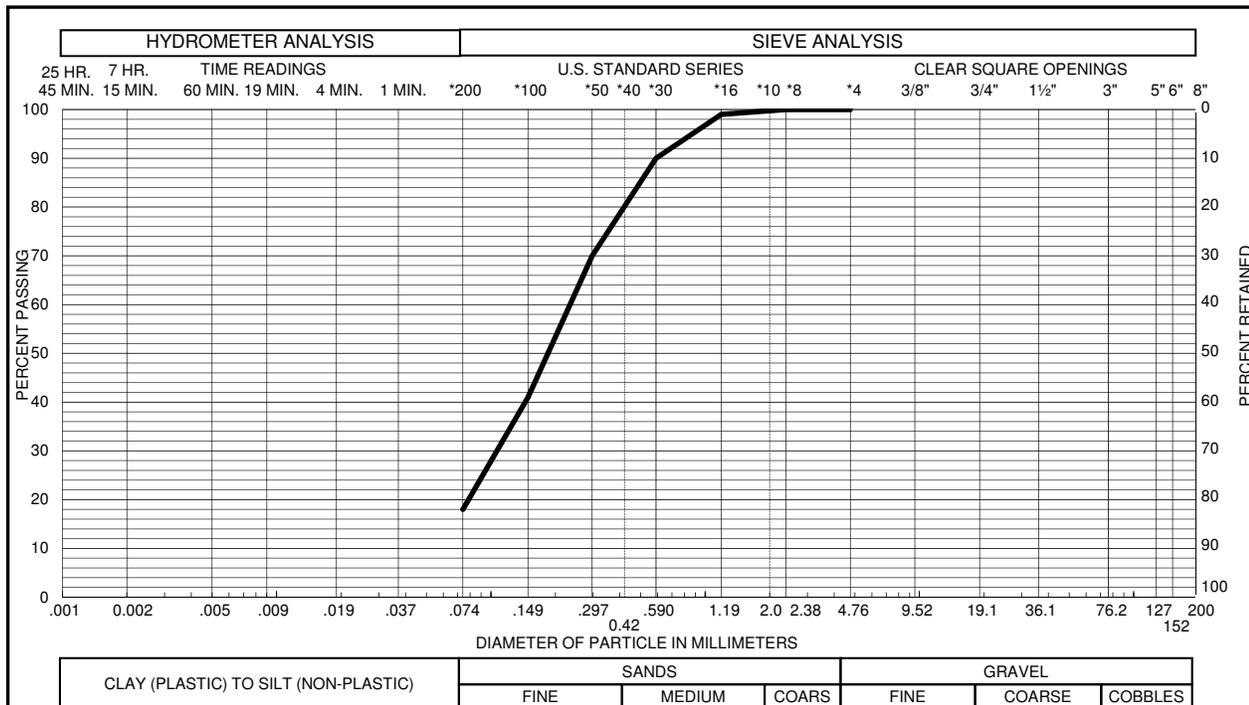
DRY UNIT WEIGHT= 110 PCF  
MOISTURE CONTENT= 19.4 %

## Swell Consolidation Test Results

FIG. B-9



Sample of SAND, SILTY, SL. CLAYEY (SC) GRAVEL 0 % SAND 70 %  
 From TH - 2 AT 9 FEET SILT & CLAY 30 % LIQUID LIMIT \_\_\_\_\_  
 PLASTICITY INDEX \_\_\_\_\_



Sample of SAND, SILTY (SM) GRAVEL 0 % SAND 82 %  
 From TH - 7 AT 4 FEET SILT & CLAY 18 % LIQUID LIMIT \_\_\_\_\_  
 PLASTICITY INDEX \_\_\_\_\_

## Gradation Test Results

TABLE B - I



SUMMARY OF LABORATORY TEST RESULTS

BORING	DEPTH (ft)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SWELL TEST DATA				ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (psf)	SOLUBLE SULFATE CONTENT (%)	PASSING NO. 200 SIEVE (%)	SOIL TYPE
				SWELL (%)	COMPRESSION (%)	APPLIED PRESSURE (psf)	SWELL PRESSURE (psf)	LIQUID LIMIT	PLASTICITY INDEX				
TH-1	4	16.8	112	1.5		500	2,500				0.35		FILL, CLAY, SANDY
TH-1	9	8.2	113	1.4		1,100	4,200						CLAY, SANDY (CL)
TH-1	14	5.9	113	0.0		1,800							SAND, CLAYEY (SC)
TH-1	19	12.3	111		0.2	2,400							CLAY, SANDY (CL)
TH-2	4	17.1	108					25	10			43	SAND, VERY CLAYEY (SC)
TH-2	9	16.5	114									30	SAND, SILTY, SL. CLAYEY (SC)
TH-2	19	16.3	118									41	SAND, CLAYEY (SC)
TH-3	4	6.2	114									30	SANDSTONE, SILTY, SL. CLAYEY
TH-3	14	9.2	119									30	SANDSTONE, SILTY, SL. CLAYEY
TH-4	9	13.9	115		0.2	1,100							CLAY, SANDY (CL)
TH-4	14	19.3	108		0.2	1,800							CLAY, SANDY (CL)
TH-4	19	19.6	104	0.0		2,400							SANDSTONE
TH-5	4	6.4	107									28	SANDSTONE, SILTY, SL. CLAYEY
TH-5	14	17.4	92									23	SANDSTONE, SILTY, SL. CLAYEY
TH-6	4	16.5	105	1.7		500	1,600						FILL, CLAY, SANDY
TH-6	9	17.7	108	5.4		1,100	7,800				0.29		WEATHERED CLAYSTONE
TH-6	14	22.0	106	2.6		1,800	6,800						WEATHERED CLAYSTONE
TH-6	19	9.9	117		1.3	2,400							CLAYSTONE
TH-7	4	15.7	115									18	SAND, SILTY (SM)
TH-7	9	19.5	110					20	2			32	SAND, SILTY, SL. CLAYEY (SC)
TH-8	9	19.1	107	0.1		1,100							CLAY, SANDY (CL)
TH-8	14	20.4	108	1.4		1,800							WEATHERED CLAYSTONE
TH-8	19	18.4	110	1.6		2,400							CLAYSTONE
TH-8	24	18.6	113					65	44	14,800		100	CLAYSTONE
TH-9	4	22.5	102					26	13		0.01	54	CLAY, VERY SANDY (CL)
TH-9	19	15.0	117									21	SAND, SILTY, SL. CLAYEY (SC)
TH-10	4	8.3	103									47	SAND, VERY CLAYEY (SC)
TH-10	14	17.1	112							800			CLAY, SANDY (CL)
TH-10	19	19.4	110	2.2		2,400							WEATHERED CLAYSTONE



## APPENDIX C

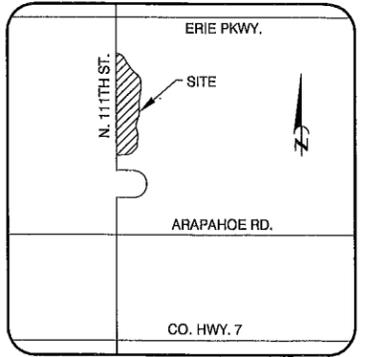
### Geotechnical Site Development Study for Planning Area C

Prepared by A.G. Wassenaar, Inc.

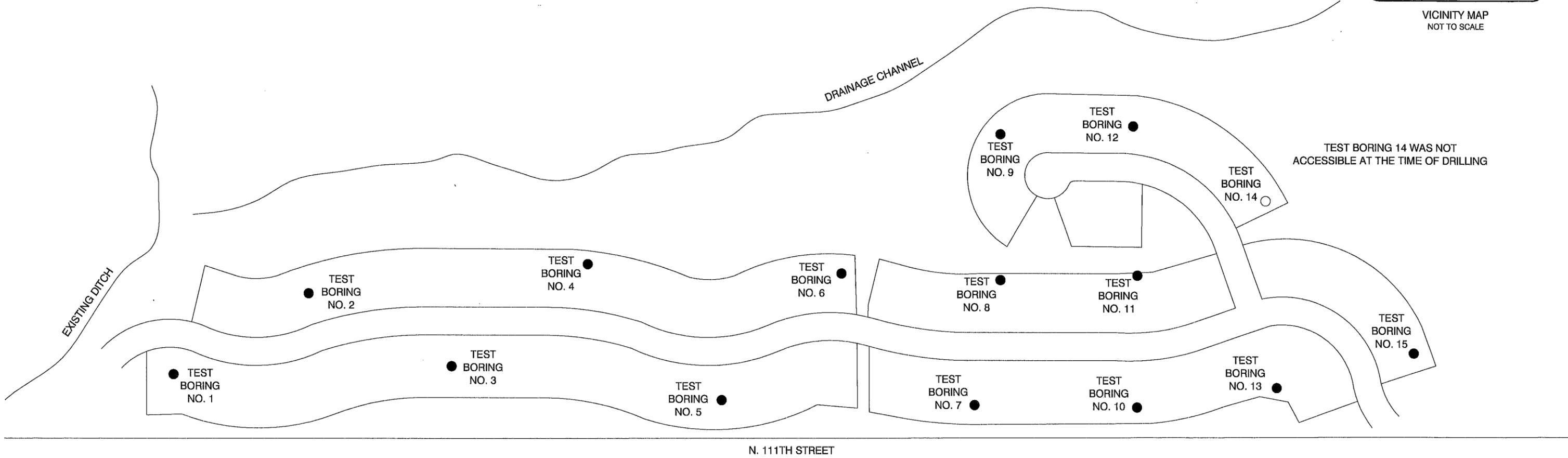
(AGW Project Number 133416; report dated November 12, 2013)

FLATIRON MEADOWS  
PHASE 6A

SCALE: 1" = 200'



VICINITY MAP  
NOT TO SCALE



NOTE: ALL LOCATIONS ARE APPROXIMATE

<b>A.G. Wassenaar</b> Geotechnical and Environmental Consultants <i>Inc.</i>	
SITE PLAN AND VICINITY MAP	PROJECT NO. 133416 FIGURE 1

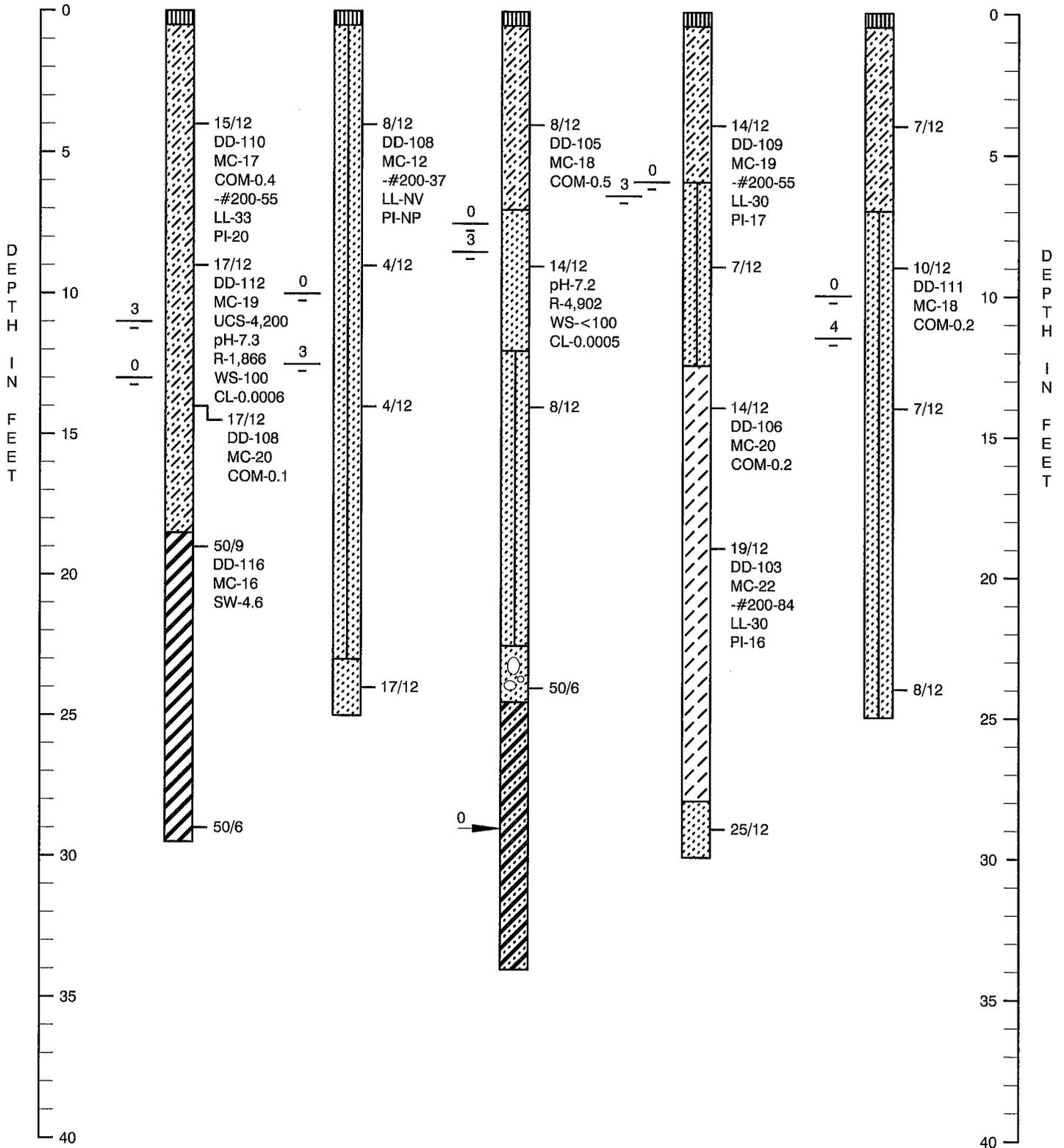
TEST BORING NO. 1  
ELEV. 5122

TEST BORING NO. 2  
ELEV. 5126

TEST BORING NO. 3  
ELEV. 5128

TEST BORING NO. 4  
ELEV. 5129

TEST BORING NO. 5  
ELEV. 5138



SEE FIGURE 4 FOR LEGEND AND NOTES TO EXPLORATORY BORINGS

EXPLORATORY BORING LOGS  
FIGURE 2

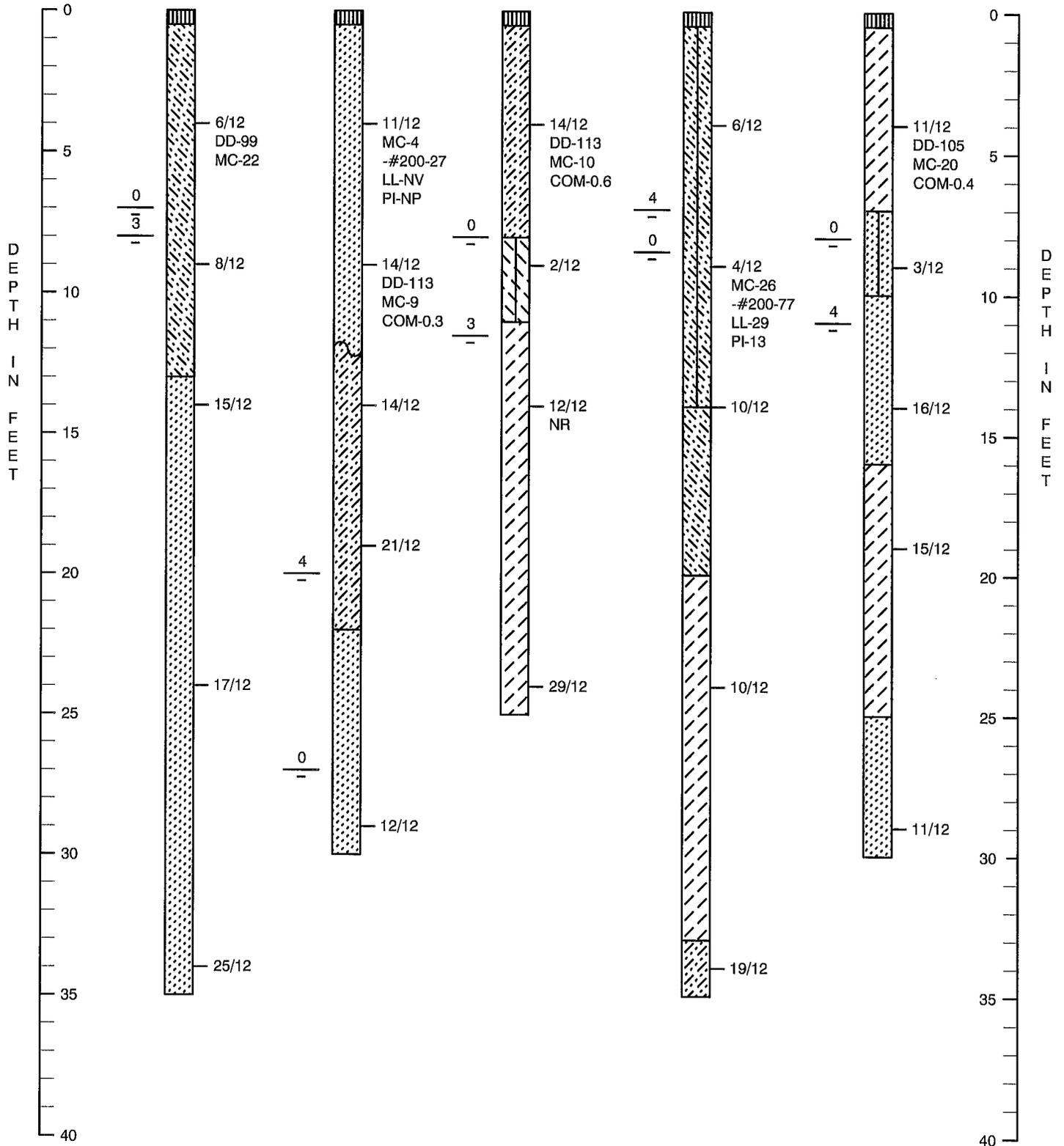
TEST BORING NO. 6  
ELEV. 5139

TEST BORING NO. 7  
ELEV. 5157

TEST BORING NO. 8  
ELEV. 5151

TEST BORING NO. 9  
ELEV. 5147

TEST BORING NO. 10  
ELEV. 5159



SEE FIGURE 4 FOR LEGEND AND NOTES TO EXPLORATORY BORINGS

EXPLORATORY BORING LOGS  
FIGURE 3

TEST BORING NO. 11  
ELEV. 5155

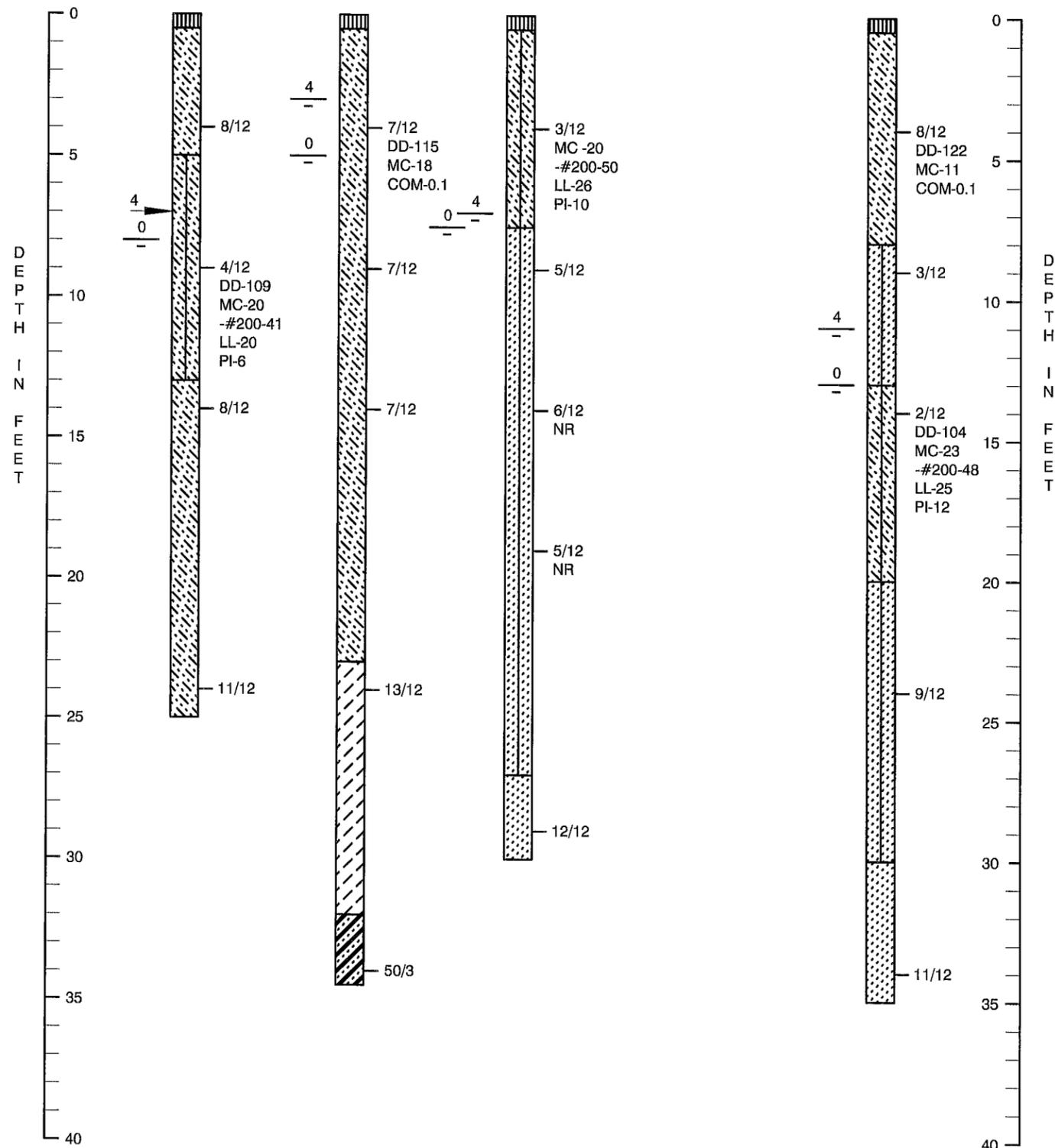
TEST BORING NO. 12  
ELEV. 5150

TEST BORING NO. 13  
ELEV. 5162

TEST BORING NO. 14  
ELEV. 5162

TEST BORING NO. 15  
ELEV. 5171

NOT ACCESSIBLE



LEGEND

- TOPSOIL, CLAY, SANDY, ORGANIC, MOIST, DARK BROWN
- CLAY, SOFT TO MEDIUM STIFF, SILTY, SANDY TO VERY SANDY, WITH SAND LENSES, MOIST TO VERY MOIST, BROWN (CL)
- CLAY, STIFF, SILTY, SANDY TO VERY SANDY, WITH SAND LENSES, MOIST TO VERY MOIST, BROWN (CL)
- SAND, VERY LOOSE TO LOOSE, SILTY TO VERY SILTY, MOIST TO WET, BROWN (SM)
- SAND, MEDIUM DENSE, SILTY, SCATTERED GRAVEL, MOIST TO WET, BROWN (SM)
- SAND, VERY CLAYEY TO CLAY, SANDY, VERY LOOSE / SOFT, MOIST TO VERY MOIST, SLIGHTLY CALCAREOUS, BROWN (SC, CL)
- SAND, VERY CLAYEY TO CLAY, SANDY, LOOSE / MEDIUM STIFF, MOIST TO VERY MOIST, SLIGHTLY CALCAREOUS, BROWN (SC, CL)
- SAND, VERY CLAYEY TO CLAY, SANDY, MEDIUM DENSE / STIFF, SLIGHTLY CALCAREOUS, MOIST TO WET, BROWN
- CLAYSTONE (BEDROCK), HARD TO VERY HARD, MOIST, OLIVE TO RUST BROWN TO GRAY
- SANDSTONE (BEDROCK), HARD TO VERY HARD, POORLY CEMENTED, SILTY, MOIST, BROWN TO GRAY
- 15/12 INDICATES THAT 15 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE A 2.5-INCH OUTSIDE DIAMETER SAMPLER 12 INCHES.
- 0 INDICATES THE DEPTH TO THE FREE WATER TABLE AND THE NUMBER OF DAYS AFTER DRILLING WHEN THE MEASUREMENT WAS TAKEN.
- INDICATES GRADUAL CHANGE IN MATERIAL. LOCATION OF EXACT CHANGE NOT IDENTIFIED.
- 0 INDICATES THE DEPTH AT WHICH THE TEST BORING CAVED AND THE NUMBER OF DAYS AFTER DRILLING WHEN THE MEASUREMENT WAS TAKEN.
- NR INDICATES NO SAMPLE RECOVERED
- DD INDICATES DRY DENSITY OF SAMPLE IN POUNDS PER CUBIC FOOT
- MC INDICATES MOISTURE CONTENT AS A PERCENTAGE OF DRY WEIGHT OF SOIL
- SW INDICATES PERCENT SWELL UNDER A SURCHARGE OF 1000 PSF UPON WETTING
- COM INDICATES PERCENT COMPRESSION UNDER A SURCHARGE OF 1000 PSF UPON WETTING
- #200 INDICATES PERCENT PASSING THE NO. 200 SIEVE
- LL INDICATES LIQUID LIMIT
- PI INDICATES PLASTICITY INDEX
- NP INDICATES NON-PLASTIC
- NV INDICATES NO VALUE
- UC INDICATES UNCONFINED COMPRESSIVE STRENGTH IN POUNDS PER SQUARE FOOT
- pH INDICATES ACIDITY OR ALKALINITY OF SAMPLE IN pH UNITS
- R INDICATES RESISTIVITY IN OHMS.CM
- WS INDICATES WATER SOLUBLE SULFATES IN PARTS PER MILLION
- CL INDICATES CHLORIDES IN PERCENT

NOTES

1. TEST BORINGS WERE DRILLED SEPTEMBER 26, 27 AND 30, 2013 WITH A 4-INCH DIAMETER, CONTINUOUS FLIGHT POWER AUGER.
2. LOCATIONS OF TEST BORINGS WERE STAKED BY OTHERS AT LOCATIONS CHOSEN BY THIS FIRM.
3. ELEVATIONS AND CUT/FILL DEPTHS WERE OBTAINED FROM STAKING PROVIDED BY OTHERS AND HAVE BEEN ROUNDED TO THE NEAREST FOOT.
4. THE HORIZONTAL LINES SHOWN ON THE LOGS ARE TO DIFFERENTIATE MATERIALS AND REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIALS. THE TRANSITIONS BETWEEN MATERIALS MAY BE GRADUAL.
5. DRILL LOGS SHOWN IN THIS REPORT ARE SUBJECT TO THE LIMITATIONS, EXPLANATIONS, AND CONCLUSIONS OF THIS REPORT.

**A.G. Wassenaar**  
Geotechnical and Environmental Consultants **Inc.**

EXPLORATORY  
BORING LOGS

PROJECT NO. 133416  
FIGURE 4



APPENDIX D  
GUIDELINE SITE GRADING SPECIFICATIONS  
Flatiron Meadows Subdivision, Phase 6A, Planning Areas A-H  
Erie, Colorado



## GUIDELINE SITE GRADING SPECIFICATIONS

Flatiron Meadows Subdivision, Phase 6A, Planning Areas A-H  
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 grade 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 substantially remove all debris, vegetation, organics and other deleterious materials before excavation or fill placement. 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

Debris, vegetation, organics and other deleterious materials shall be substantially 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 disced or bladed until it is free from large clods, brought to the proper moisture content (between 1 and 4 percent above optimum moisture content and within 2 percent of optimum for sands) and compacted to at least 95 percent of maximum dry density as determined in accordance with ASTM D 698.

### 5. FILL MATERIALS

Fill soils shall be substantially free from debris, vegetation, organics and other deleterious materials, and shall not contain rocks or lumps having a diameter greater than six (6) inches. Claystone bedrock should be broken down to three (3) inches or smaller in size. 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.

## 6. MOISTURE CONTENT

Fill material classifying as CH, CL and SC shall be moisture conditioned to between optimum moisture content and 3 percent above optimum. Granular soils classifying as 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 sheepfoot 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.



APPENDIX E  
GUIDELINE SITE GRADING SPECIFICATIONS  
(SUB-EXCAVATION)  
Flatiron Meadows Subdivision, Phase 6A, Planning Areas A-H  
Erie, Colorado



## GUIDELINE SITE GRADING SPECIFICATIONS (SUB-EXCAVATION)

Flatiron Meadows Subdivision, Phase 6A, Planning Areas A-H  
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 materials that may be placed outside of the development boundaries.

### 2. GENERAL

The Soils Engineer shall be the Owner's representative. The Soils Engineer shall observe fill materials, method of placement, moisture content and percent compaction, and shall provide written opinions 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 where the material will support structures of any kind.

### 4. SCARIFYING AREA TO BE FILLED

All topsoil and vegetable matter shall be removed from the ground surface where 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 that would prevent uniform compaction.

### 5. COMPACTING AREA TO BE FILLED

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, (1 to 4 percent above optimum) and compacted to not less than 95 percent of maximum density as determined in accordance with ASTM D 698.

### 6. FILL MATERIALS

Fill soils shall be free from vegetable matter or other deleterious substances, and shall not contain clay and claystone having a diameter greater than three (3) 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, SP, GP, GC and GM are acceptable. Concrete, asphalt, and other deleterious materials or debris shall not be used as fill.

## 7. MOISTURE CONTENT

Fill materials shall be moisture-conditioned to within limits of optimum moisture content specified in "Moisture Content and Density Criteria". Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas or imported to the site.

The Contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Soils Engineer, it is not possible to obtain uniform moisture content by adding water on the fill surface. The Contractor will be required to rake or disc the fill to provide uniform moisture content throughout the fill.

The application of water to embankment materials shall be made with any type of watering equipment that 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.

## 8. COMPACTION OF FILL MATERIALS

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 given in "Moisture Content and Density Criteria". Fill materials shall be placed such that the thickness of loose material does not exceed 8 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of suitable 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.

## 9. MOISTURE CONTENT AND DENSITY CRITERIA

Fill material shall be substantially compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698, AASHTO T 99) dry density at 1 to 4 percent above optimum moisture content. Additional criteria for acceptance are presented in DENSITY TESTS.



## 10. DENSITY TESTS

Field density tests shall be made by the Soils Engineer 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 the density or moisture content of any layer of fill or portion thereof not within specifications, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

Allowable ranges of moisture content and density given in MOISTURE CONTENT AND DENSITY CRITERIA are based on design considerations. The moisture shall be controlled by the Contractor so that moisture content of the compacted earth fill, as determined by tests performed by the Soils Engineer, shall be within the limits given. The Soils Engineer will inform the Contractor when the placement moisture is less than or exceeds the limits specified and the Contractor shall immediately make adjustments in procedures as necessary to maintain placement moisture content within the specified limits, to satisfy the following requirements.

### A. Moisture

1. The average moisture content of material tested each day shall not be less than 1.5 percent over optimum moisture content.
2. Material represented by samples tested having moisture lower than 1 percent over optimum will be rejected. Such rejected materials shall be reworked until moisture equal to or greater than 1 percent above optimum is achieved.

### B. Density

1. The average dry density of material tested each day shall not be less than 95 percent of standard Proctor maximum dry density (ASTM D 698).
2. No more than 10 percent of the material represented by the samples tested shall be at dry densities less than 95 percent of standard Proctor maximum dry density (ASTM D 698).
3. Material represented by samples tested having dry density less than 95 percent of standard Proctor maximum dry density (ASTM D 698) will be rejected. Such rejected materials shall be reworked until a dry density equal to or greater than 95 percent of standard Proctor maximum dry density (ASTM D 698) is obtained.



11. OBSERVATION AND TESTING OF FILL

Observation by the Soils Engineer shall be sufficient during the placement of fill and compaction operations so that they can declare the fill was placed in general conformance with specifications. All observations necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner.

12. 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 Engineer indicates the moisture content and density of previously placed materials are as specified.

13. REPORTING OF FIELD DENSITY TESTS

Density tests made by the Soils Engineer, 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.



# **ALDRIDGE TRANSPORTATION CONSULTANTS, LLC**

*Advanced Transportation Planning and Traffic Engineering*

John M.W. Aldridge, PE, PTOE, AICP  
Colorado Registered Professional Engineer

1082 Chimney Rock Road  
Highlands Ranch, CO 80126  
Fax: 303-703-9152  
Mobile: 303-594-4132  
Email: [john@atceng.com](mailto:john@atceng.com)

February 27, 2017

Brian Moss, P.E.  
Calibre Engineering Inc.  
9090 S. Ridgeline Blvd. Suite 105  
Highlands Ranch, CO 80129

Re: Planning Area H  
Flatiron Meadows, Erie

Dear Mr. Moss:

This letter provides an analysis and finding of compliance for Planning Area H in the Flatiron Meadows Subdivision. We have reviewed the site plan for compliance to the **Flatiron Meadows Traffic Impact Study** dated February 14, 2014 and the **111<sup>th</sup>/Arapahoe Intersection Warrant Study** dated August 10, 2016. Both studies were prepared by this firm and both considered the full development of Flatiron Meadows with approximately 824 homes.



The current site plan for Planning Area H (shown in color in the graphic to the left) proposes 120 duplexes. Access to the site will be from 111<sup>th</sup> St. only at two locations approximately 350 feet apart. 111<sup>th</sup> St. is a two-lane rural collector that is 32-foot-wide with 12-foot travel lanes and 4-foot bike lanes on each side. 111<sup>th</sup> St. currently carries less than 300 average daily traffic (ADT) in this section of the roadway. It is projected to carry 1,300 ADT in the 20-year design horizon.

111<sup>th</sup> St. connects to Erie Parkway on the north end. The intersection is two-way stop sign controlled. On the south end, it connects to Arapahoe Road and



ultimately to Baseline Road. Both intersections are traffic signal controlled. Erie Parkway currently carries approximately 10,000 ADT and Arapahoe Road carries approximately 13,000 ADT.

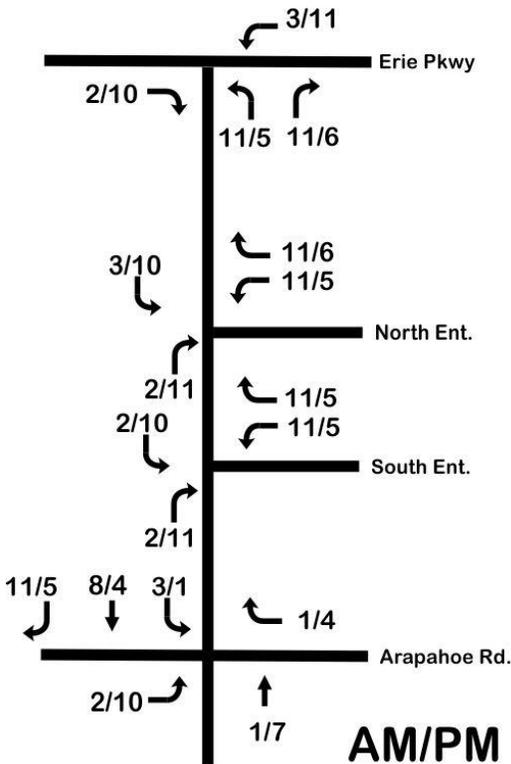
**TRIP GENERATION**

The following table presents the project area ADT and AM/PM peak hour trip generation. The rates and values are from the ITE Trip Generation Manual, 9<sup>th</sup> Edition.

Trip Generation Worksheet								
ITE CODE	LAND USE	UNIT	QUANTITY	ADT	AM		PM	
					IN	OUT	IN	OUT
230	Duplex	DU	120	5.81	0.07	0.37	0.35	0.17
				<b>697</b>	<b>9</b>	<b>44</b>	<b>42</b>	<b>21</b>
<b>Total Trips</b>				<b>697</b>	<b>9</b>	<b>44</b>	<b>42</b>	<b>21</b>

**TRIP DISTRIBUTION**

This analysis assumes that 50 percent will travel to/from the north to access northbound SH-287 and the town’s business district, schools, etc. The other 50 percent will to/from the south to access southbound SH-287, I-25, and points south including the City of Lafayette. The graphic shows the AM/PM trip assignment at Erie Parkway, Arapahoe Road, and the north and south entrances to Planning Area H.



**OPERATIONS ANALYSIS**

The level of service operations for the intersection of Erie Parkway/111<sup>th</sup> St. with the site generated traffic for the full development of Flatiron Meadows was analyzed in the **Flatiron Meadows Traffic Impact Study**. Per the study, the intersection was recently improved to include an approximately 100-foot exclusive left turn lane. The study concluded that traffic signal control was not warranted despite the LOS F rating for the minor street left turn out<sup>1</sup>.

A recent study of the 111<sup>th</sup> St./Arapahoe Road intersection was prepared in August 2016. The purpose of the study was to determine the impact of the full-build out of Flatiron Meadows (again including Planning Area H) on the traffic signal operations and whether geometric changes to the intersection’s configuration were necessary to accommodate the additional traffic. The study

concluded that the added traffic makes only minimal changes to the LOS in seconds of delay (the

<sup>1</sup> Considered normal for stop sign control in urban areas. Refer to page 19-40 in the 2010 HCM.



overall letter rating did not change) and that the intersection's existing configuration is adequate to handle the additional traffic.

The question of whether auxiliary left and right turn lanes at the north and south accesses to Planning Area H are necessary can be determined by the warrant thresholds in the State Highway Access Code. The Town of Erie defers to the Code for lane warrants. Per the Code, 111<sup>th</sup> St. would be considered an NR-C. The speed limit is posted at 40 mph. Under these conditions, a left turn lane is required with a turning volume of greater than 25 vehicles per hour. A right turn lane is required with a turning volume of greater than 50 vehicles per hour. The projected volumes do not warrant turn lanes at either intersection.

#### FINDINGS

Based on the data and analysis provided herein, it is my professional opinion that the traffic generated by Planning Area H can be easily accommodated by the existing adjacent streets and intersections without any changes to the existing geometry and traffic control. Moreover, auxiliary turn lanes at the north and south entrances to Planning Area H from 111<sup>th</sup> St. are not required by volume. We find that Planning Area H is compliant with the **Flatiron Meadows Traffic Impact Study** (February 2014) and the **111<sup>th</sup>/Arapahoe Road Intersection Warrant Study** (August 2016).

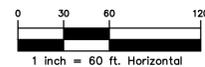
ATC appreciates the opportunity to be of service. Please call if you have any questions. We can be reached at 303-703-9112.

Respectfully submitted,

**Aldridge Transportation Consultants, LLC**

John M.W. Aldridge, P.E.  
Principal





**Calibre**

Calibre Engineering, Inc.  
9090 South Ridgeline Boulevard, Suite 105  
Highlands Ranch, CO 80129 (303) 730-0434  
www.calibre-engineering.com  
Construction Management Civil Engineering Surveying