



October 12, 2017

Andrea Mimnaugh  
Principal Planner  
**Community Development Department**  
2255 West Berry Avenue  
Littleton, CO 80120

**RE: Watson Lane Reserve, Use by Special Exception (Floodplain) – ENG17-0004**

Dear Andrea:

Urban Drainage reviewed the August, 2017 submittal of the above Use by Special Exception documents. They have requested that a “brief technical memo documenting the existing and proposed conditions of Drainageway D” be included with the next submittal. This letter is that requested technical memo.

The Watson Lane Reserve proposed project site is located at the southwest corner of the intersection of West Bowles Avenue and South Watson Lane. The site is adjacent to W. Bowles Avenue on the north, Brookhaven’s Tract E on the west, Drainageway D drainage channel which lies in Brookhaven’s Tract I on the south and S. Watson Lane on the east (see attached Vicinity map).

The property is comprised of approximately 4.08 acres of land. The site currently consists of existing buildings (which have been recently demolished), drives, fences, open space and trees. There is an existing abandoned irrigation ditch that runs through the southern part of the site. The site is relatively flat with slopes generally under 2%. Several areas of local ponding are present on the site.

Currently there are existing drainage conveyance paths adjacent to both S. Watson Lane and Brookhaven Lane, as well as a large regional drainage channel (Drainageway D) directly south of the property. Within Bowles Avenue on the north side of the project site, there is an existing storm pipe drainage system with an existing 5’ Type R inlet in the northwest corner of the site. The proposed project site itself is generally devoid of drainage facilities.

According to the Natural Resources Conservation Service, the soil of the site consists of Edgewater loam and is consistent with the characteristics of the Hydrologic Soil Group C (see the attached Web Soil Survey).

The proposed development consists of 6 single-family home lots along with supporting infrastructure. The existing R-E zoning of site is to be maintained.

The site is located on the Flood Insurance Rate Map (FIRM) number 08005C0432K dated December 17, 2010 (see attached Firmette). The northern half of the site is located within Flood Zone X, areas determined to be outside of the 0.2% (500-year) annual chance flood. However, the southern half of the site is located within the 1% annual chance (100-year) Flood Zone A Special Flood Hazard Area (no base elevations determined).

The Brookhaven's Tract E area adjacent to the western side of the site sheet flows to the east into the site. A portion of the W. Bowles Avenue right-of-way sheet flows south into the site. Currently, the majority of the S. Watson Lane right-of-way adjacent to the eastern side of the site sheet flows west towards the property line from the existing edge of the roadway. A shallow swale has been formed along the eastern property line to direct these runoff flows south toward the existing Drainageway D. This swale becomes more pronounced the closer it gets to the Drainageway D (see the attached Existing Conditions Drainage Map).

During the major storm events, as indicated on the FEMA Firm Map 08005C0432K, dated December 17, 2010, stormwater from the existing Drainageway D overtops the channel inundating approximately one-half of the project site. A CLOMR study (case no. 08-08-0842R) was prepared and approved by FEMA October 29, 2008. This study was performed to demonstrate that the previously proposed placement of fill throughout the proposed project site to a point above the 100-year water surface elevation would remove it from the 100-year floodplain. This study also demonstrated that the proposed revisions to the north side of Drainageway D would maintain the flood carrying capacity of the drainageway channel.

The CLOMR study determined that only 190 cfs of the 100-year flowrate of 288 cfs would pass through the culverts under Watson Lane with the remaining 98 cfs overtopping the roadway. However, it was identified that these overtopping flows would extend north along the west side of Watson Lane before spilling over the western edge of the asphalted roadway to the drainage channel on the eastern side of the roadway. Please see the attached Effective Floodplain and Post-Project Floodplain drawings from the CLOMR.

The proposed grading plan for this project site, filling to an extent that the CLOMR's Post Project 100-year floodplain limit (see the attached Post-Project Floodplain Exhibit) will be shifted away from the proposed home sites and into the Drainageway D channel in Brookhaven's Tract I, conforms to the proposed grading indicated in the CLOMR at the project boundaries, however, the interior grading is per the proposed site plan (see the attached Grading Plan).

The conceptual drainage plan for this project site is to convey the on-site storm runoff flows into grass lined drainage swales along the outside property lines and direct the flows south to



the Drainageway D channel, or north into the existing storm drain pipe system in Bowles Avenue, or east into Watson Lane (see the attached Proposed Conditions Drainage Map).

The runoff from the north and west sides of the project site (Basins A & B) will be captured in the proposed water quality drainage swale at the property boundary. The northern flows and the northwestern flows around the private property in the northwest corner (Basin A) will be piped north into the existing storm drain pipe system in Bowles Avenue while the remaining western flows (Basin B) will be directed south to Drainageway D. The flows are then piped into the Drainageway D channel under the maintenance access roadway on the downstream side of the box culvert under Brookhaven Lane. The proposed method of connection into the channel will be similar to the existing 12" RCP pipe with flap gate that is located just south of the Watson Lane culverts.

With the addition of mountable curb and gutter and a 5' meandering detached walk on the west side of Watson Lane, the grading will generally conform to the existing condition with further definition of the location of the existing swale at the property line. However, the eastern side of the project site will need to be filled to bring it 1' above the CLOMR defined 100-year water surface elevation of 5326.1 (revised to the NAVD 88 datum) per the approved CLOMR. There will be a proposed water quality drainage swale along the eastern boundary. Flows from Basins D, E, G, and H will be directed to the gutter pans of the private access roadway. Flows in excess of the water quality flows will be allowed to bypass the water quality drainage swales in Lots 4, 5 and 6 and flow into Watson Lane. Runoff from Basin F is directed into the water quality swale located in Lot 5.

The runoff from the south side (Basin I) will be captured in the proposed water quality drainage swale at the property line. Any flows that have been directed into the proposed water quality drainage swale at the eastern property line in Lot 6 will be directed south into Basin I. The water quality swale will have an underdrain and this underdrain is proposed to connect with the existing 12" RCP pipe that currently discharges into the Drainageway D channel through a flap gate that is located just south of the Watson Lane culverts (see attached photos). Since there is not a storm water discharge pipe planned for this drainage swale other than the underdrain, it is proposed that the minor and major storm event flows minus the water quality volumes will be discharged through a weir into the Watson lane ROW in the southeast corner of the site.

The northern side of the Drainageway D channel will be constructed with the improvements to the southern boundary. There will be a 10' wide concrete access roadway included as part of the construction. The northern side of the channel will be graded at 4:1 from the maintenance access roadway up into the site to an elevation approximately 1' above the CLOMR defined 100-year water surface elevation. This will channelize the 100-year flows

and remove a significant portion of the floodplain from the project site and relocate it into the designated Drainageway D channel.

As mentioned above, it is proposed that the grass lined drainage swales discussed above will act as the water quality feature for the proposed project. Since the slope of these swales are proposed to be less than 2%, underdrains will be incorporated into the swales to collect the infiltrate and pipe it to the proposed discharge points. Basins A and C will discharge into the proposed storm drain pipe in the northwest corner of the site. Basin B will discharge into the Drainageway D channel adjacent to the proposed storm pipe. Basins D through I will discharge into the existing 12" RCP pipe located in the southeastern corner of the site discharging directly into the Drainageway D channel. These drainage swales have been designed in accordance with UDFCD criteria, specifically Volume 3, Treatment BMP Fact Sheet T-2 for Grass Swales.

WRC Engineering, now RESPEC Consulting and Services, has been coordinated with to ensure that the intent of the approved CLOMR is followed with the development of this proposed project. During a meeting with City personnel August 8th to review the projects site drainage issues and discuss possible solutions, RESPEC was requested to submit to the City a revised CLOMR HEC-RAS model and results. The original model was revised to include the city's requested mountable curb and gutter on the west side of Watson Lane and the proposed cross-section for the Drainageway D channel. This proposed cross-section included the existing conditions of the south side, the existing concrete trickle channel, and on the north side the proposed 4:1 slope from the trickle channel up to the maintenance access roadway, the maintenance access roadway, and the proposed 4:1 slope up to the elevation indicated previously (see the attached Drainageway D Cross-Section plan sheet). The revised CLOMR HEC-RAS model results with a run date of August 24, 2017 determined that only 210 cfs of the 100-year flowrate of 288 cfs would pass through the culverts under Watson Lane with the remaining 78 cfs overtopping the roadway.

Attached is an exhibit that compares the HEC-RAS model results from the original CLOMR report to the recently revised HEC-RAS model results (see attached CLOMR HEC-RAS Model Results spreadsheet). CLOMR sections 275 and 280 were the only ones to be compared since they cross the project site. At a 100-year flow rate of 288 cfs, the velocity in the channel is approximately 1.1 fps faster, the depth is approximately 0.5' higher and the Froude number is approximately 0.1 higher between the corrected effective (existing condition) and the post project (proposed filling) HEC-RAS models. The respective values are approximately 0.6 fps higher, 1.1' higher and 0.07 higher between the post project (proposed filling) and the revised HECRAS (proposed grading condition) model results.

It should be noted that at CLOMR Sections 275 and 280 (within the southern limits of the project site), at a 100-year flow rate of 288 cfs, the flow velocity is less than 2.2 fps, the Froude Number less than 0.25, and the total depth over the existing concrete trickle channel is less



than 6-feet. When comparing this to a cross-section without the backwater effects from the Watson Lane culverts (see attached Channel Report), the flow velocity is less than 2.5 fps, the depth above the existing trickle channel is less than 4.7', and the Froude number is less than 0.3. Calculated Shear Stress values are all less than 0.2 lb/sq ft.

As mentioned previously, the CLOMR HEC-RAS model was revised to include the city's requested mountable curb and gutter on the western side of Watson Lane and the proposed cross-section for Drainageway D channel. When the results of this model at CLOMR section 275 are compared to the USDCM Volume 1 Table 8-3, Design Parameters for Naturalized Channels (see attached Channel Stability spreadsheet), the velocity, depth and shear stress values for the 100-year flow rate are all well below the maximums indicated in Table 8-3. The velocity, Froude number and shear stress all indicate that there will be no need for additional bank protection.

At this time, it is proposed that the disturbed areas associated with the Drainageway D channel are to be seeded with the seed mix per Table A-1 from the USDCM Volume 1, Appendix A, Seed Mix Tables (see attached Table). These disturbed areas are to be covered with straw coconut mix erosion control blankets to minimize erosion and promote the growth of the seed mix.

Sincerely,

**Phelps Engineering Services, Inc.**

A handwritten signature in black ink that reads "Frank Feero".

Frank Feero, P.E.  
*Senior Project Engineer*



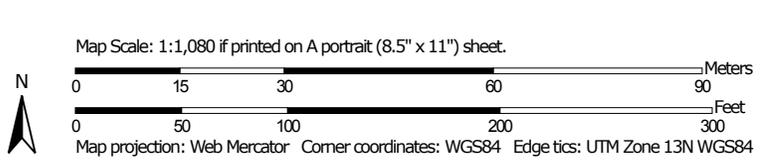
**VICINITY MAP**

SCALE 1"=500'

Hydrologic Soil Group—Arapahoe County, Colorado  
(Watson Lane Meadows)



Soil Map may not be valid at this scale.



Hydrologic Soil Group—Arapahoe County, Colorado  
(Watson Lane Meadows)

### MAP LEGEND

**Area of Interest (AOI)**

 Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

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

**Soil Rating Lines**

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

**Soil Rating Points**

-  A
-  A/D
-  B
-  B/D

-  C
-  C/D
-  D
-  Not rated or not available

**Water Features**

 Streams and Canals

**Transportation**

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

**Background**

 Aerial Photography

### MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service  
Web Soil Survey URL:  
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Arapahoe County, Colorado  
Survey Area Data: Version 12, Sep 22, 2016

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

Date(s) aerial images were photographed: Jun 10, 2014—Aug 21, 2014

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

## Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Arapahoe County, Colorado (CO005)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
EdB	Edgewater loam, 0 to 3 percent slopes	C	4.2	100.0%
NIB	Nunn loam, 1 to 3 percent slopes	C	0.0	0.0%
<b>Totals for Area of Interest</b>			<b>4.2</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:

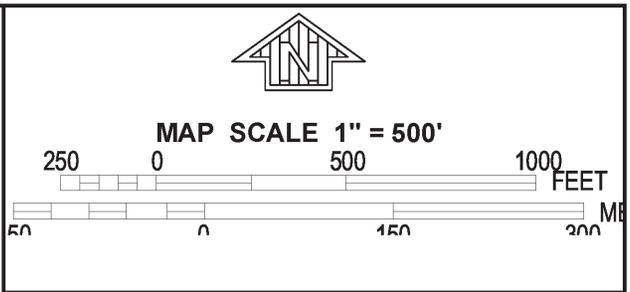
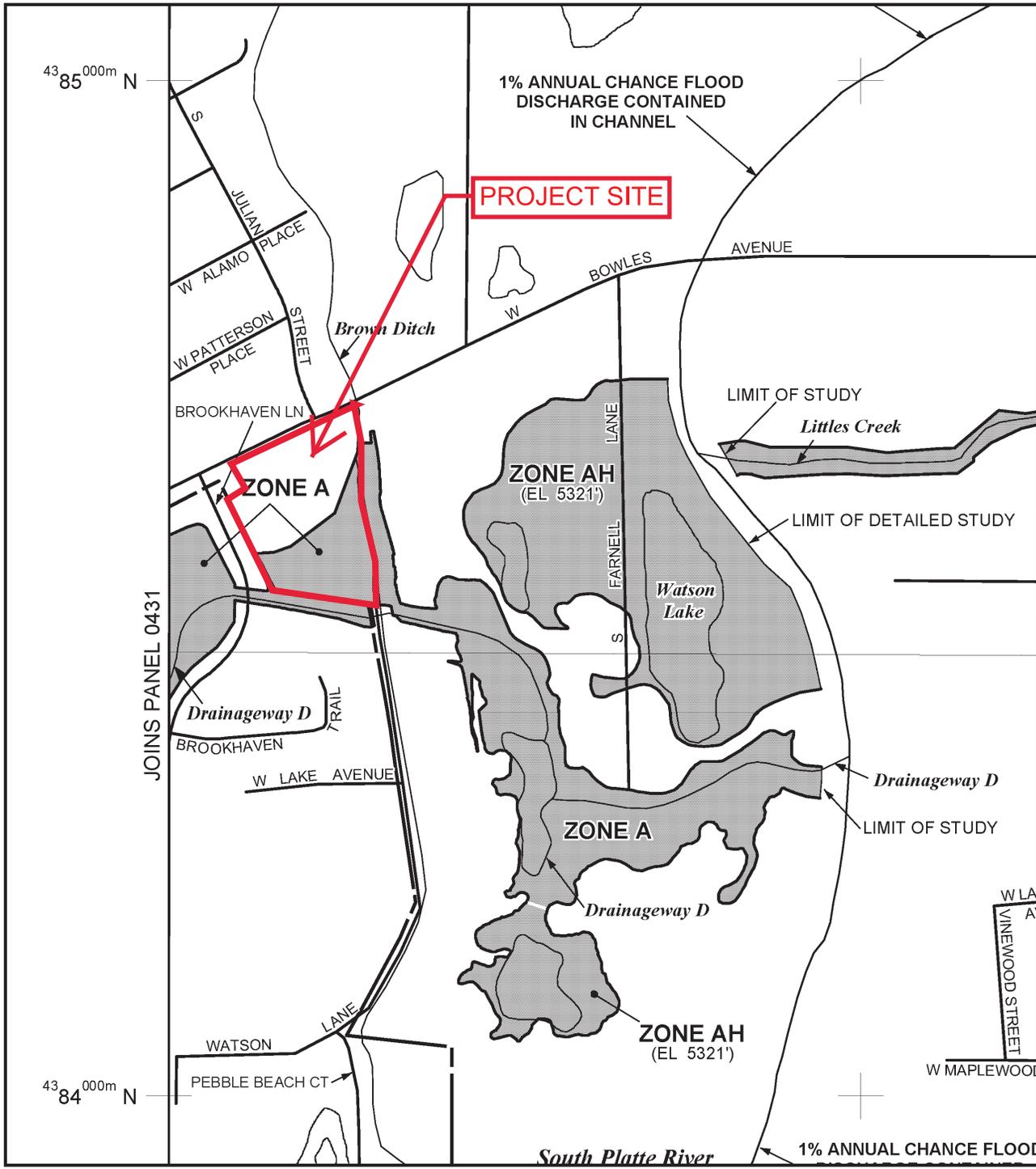
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

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.



NATIONAL FLOOD INSURANCE PROGRAM

**NFIP**

**PANEL 0432K**

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

**PANEL 432 OF 725**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ARAPAHOE COUNTY	080011	0432	K
COLUMBINE VALLEY, TOWN OF	080014	0432	K
ENGLEWOOD, CITY OF	085074	0432	K
LITTLETON, CITY OF	080017	0432	K

Notice: This map was reissued on November 6, 2015 to make a correction. This version replaces any previous versions. See the Notice-to-User Letter that accompanied this correction for details.

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**  
**08005C0432K**

**MAP REVISED**  
**DECEMBER 17, 2010**

  
**Federal Emergency Management Agency**

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

A long, narrow concrete channel or roadway runs through a grassy area, leading towards a building in the distance. The channel is flanked by grass and trees. In the background, a building with a yellow facade and a porch is visible through the trees. The sky is overcast.

LOOKING UPSTREAM FROM WATSON LANE TO BROOKHAVEN LANE, 10' WIDE CONCRETE MAINTENANCE ACCESS ROADWAY TO BE FORMALIZED IN LOCATION OF DIRT PATH, ADDITIONAL FILL OF 4'-5' WILL BE PLACED IN PROJECT SITE ON THE RIGHT AND THE SLOPE WILL BE GRADED AT 4:1 FROM THE MAINTENANCE ACCESS ROADWAY UP INTO THE SITE REACHING TO 1' ABOVE THE CLOMR 100-YR WATER SURFACE ELEVATION.



EXISTING 12" RCP PIPE OUTFALL INTO THE CHANNEL THAT WILL BE UTILIZED FOR THE PROPOSED WATER QUALITY SWALE UNDERDRAIN DISCHARGE, THE DIRT PATH WILL BE FORMALIZED INTO THE MAINTENANCE ACCESS ROADWAY AND THE SLOPE GRADED AT 4:1 WITH AN ADDITIONAL 4'-5' OF FILL PLACED ON THE PROJECT SITE BOUNDARY, LOOKING EAST INTO THE PROJECT SITE.



LOOKING DOWNSTREAM AT THE  
WATSON LANE CULVERTS,  
MAINTENANCE ACCESS ROADWAY WILL  
BE TO THE LEFT OF THE HEADWALL



BROOKHAVEN  
LANE

MAINTENANCE ACCESS ROADWAY  
TO PASS TO RIGHT OF THE EXISTING  
RIPRAP, LOOKING UPSTREAM



LOOKING UPSTREAM AT  
BROOKHAVEN LANE BOX  
CULVERT

### CLOMR HEC-RAS Model Results

	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	E.G. W.S. (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude #	Depth (ft)	Shear (lb/sq ft)
Revised HEC-RAS Model 8/24/2017	280	100-Year	288	5317.56	5323.34	5323.38	0.000395	2.11	174.96	65.67	0.23	5.78	0.14
	275	100-Year	288	5317.35	5323.29	5323.33	0.000378	2.17	176.10	62.15	0.23	5.94	0.14
Post Project 3/6/2008	280	100-Year	288	5318.3	5323.04	5323.11	0.000316	1.53	188.22	64.05	0.16	4.74	0.09
	275	100-Year	288	5318.3	5323.04	5323.07	0.000274	1.47	196.23	63.74	0.15	4.74	0.08
Corrected Effective 3/2/2008 *	280	100-Year	288	5318.7	5322.92	5322.92	0.000017	0.40	379.24	111.33	0.04	4.22	0.00
	275	100-Year	288	5318.3	5322.92	5322.92	0.000019	0.43	254.61	70.72	0.04	4.62	0.01
Duplicate Effective 12/7/2007 *	280	100-Year	288	5318.7	5323.09	5323.09	0.000071	0.80	252.09	74.90	0.08	4.39	0.02

\* Note: the velocity, flow area and top width are for the channel, not the overbank.

# Channel Report

## Drainageway D at CLOMR Sta 275

### User-defined

Invert Elev (ft) = 20.61  
 Slope (%) = 0.10  
 N-Value = 0.032

### Highlighted

Depth (ft) = 4.69  
 Q (cfs) = 288.00  
 Area (sqft) = 117.12  
 Velocity (ft/s) = 2.46  
 Wetted Perim (ft) = 52.89  
 Crit Depth, Yc (ft) = 3.10  
 Top Width (ft) = 50.87  
 EGL (ft) = 4.78

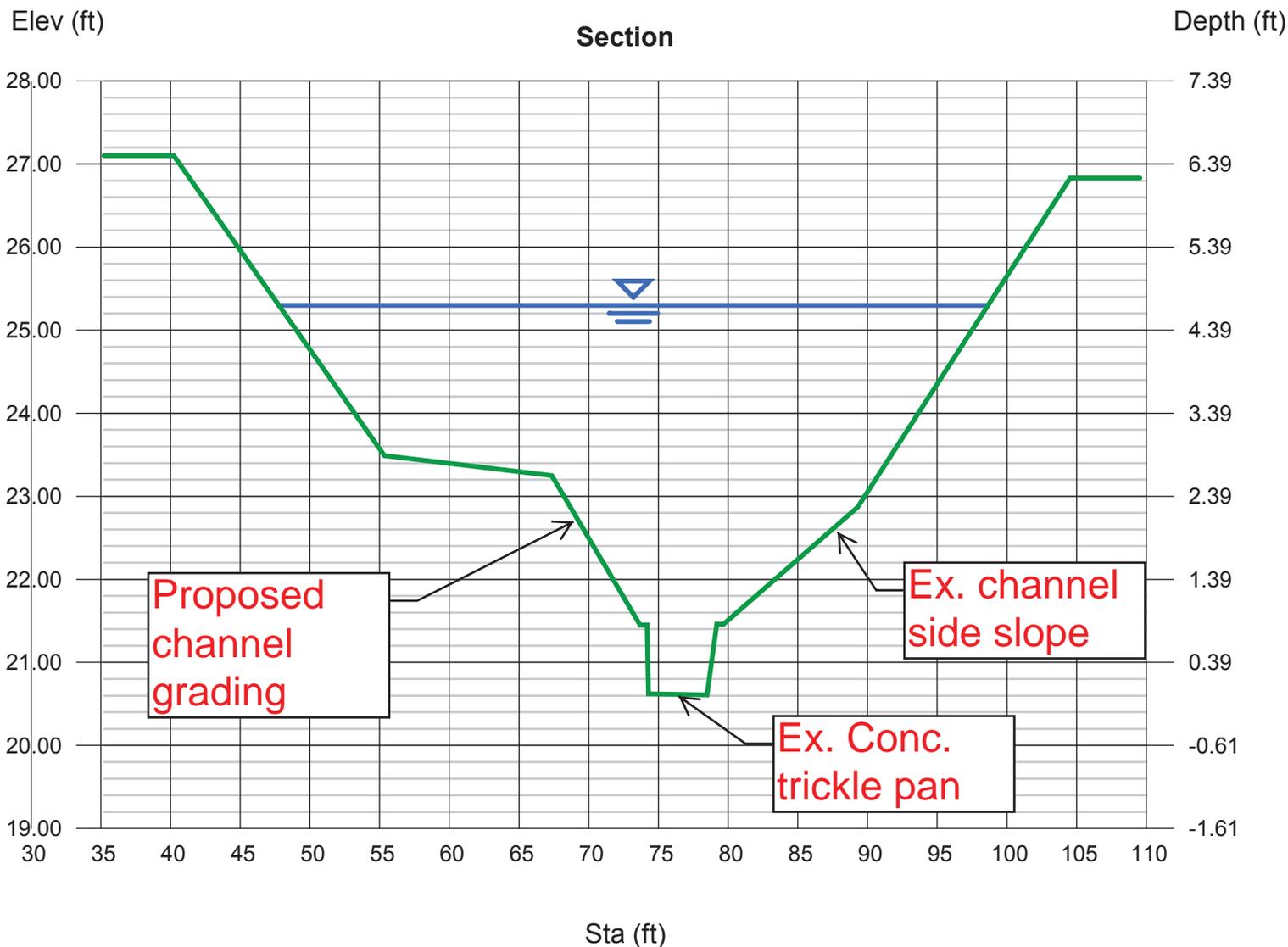
### Calculations

Compute by: Known Q  
 Known Q (cfs) = 288.00

### (Sta, El, n)-(Sta, El, n)...

(40.24, 27.10)-(55.35, 23.49, 0.035)-(67.35, 23.25, 0.035)-(73.68, 21.45, 0.035)-(74.18, 21.45, 0.013)-(74.28, 20.62, 0.013)-(78.48, 20.61, 0.013)  
 -(79.18, 21.46, 0.013)-(79.68, 21.46, 0.013)-(89.29, 22.87, 0.035)-(104.54, 26.83, 0.035)

Note: The flow depth and velocity does not include the backwater effect of the culverts under Watson Lane. The depth over the maintenance road is less than 2-ft (1.9-ft). The calculated Froude number is 0.29 and shear stress is 0.11 lb/sq ft.



## WATSON LANE RESERVE DRAINAGEWAY D CHANNEL STABILITY

**Subdivision** Watson Lane Reserve  
**Location** Littleton, Colorado

**Project Name:** Watson Lane Reserve  
**Project No.** 16165  
**Calculated By:** FGF  
**Checked By:** LEP  
**Date:** 10/12/2017

**Q100 = 288 cfs**

Slope %	Overall Depth ft	Overbank Depth ft	Velocity fps	Flow Area sq ft	Top Width ft	Shear Stress lbs/sf	Froude Number
0.01	5.94	3.06	2.17	176.10	62.15	0.14	0.23

Note: Values listed in table come from the 8/24/2017 revised CLOMR HEC-RAS model results at CLOMR Section 275. The model was revised to include the city's requested mountable curb and gutter on the west side of Watson Lane and the proposed grading for the north side of the Drainageway D channel.

Note: Per Urban Storm Drainage Criteria Manual Volume 1 Table 8-3, the maximum shear stress allowed is 1.2 lb/sf, maximum 100-yr velocity allowed is 7 fps, and a maximum 100-yr depth outside bank full channel allowed is 5 ft. The values shown in the table indicate that bank protection is not required.

## Appendix A. Seed Mix Tables

### Upland Native Seed Mixes (drill seed rates)

**Table A-1. Upland area seed mix – loamy to clay soils**

Common Name	Scientific Name	Growth Season	Growth Form	% Mix	Lb/ac (PLS <sup>1</sup> )
<b>Grasses</b>					
Blue grama	<i>Bouteloua gracilis</i>	Warm	Sod	25	1.8
Sand dropseed	<i>Sporobolus cryptandrus</i>	Warm	Bunch	20	0.2
Sideoats grama	<i>Bouteloua curtipendula</i>	Warm	Sod	20	6.3
Western wheatgrass	<i>Pascopyrum smithii</i>	Cool	Sod	15	8.2
Buffalograss	<i>Bouteloua dactyloides</i>	Warm	Sod	10	10.7
Inland saltgrass	<i>Distichlis spicata</i>	Warm	Sod	5	0.6
<b>Herbaceous/Wildflowers</b>					
Pasture sage	<i>Artemisia frigida</i>			1	0.01
Blanket flower	<i>Gaillardia aristata</i>			1	0.5
Prairie coneflower	<i>Ratibida columnifera</i>			1	0.1
Purple prairieclover	<i>Dalea (Petalostemum) purpurea</i>			1	0.3
Blue flax	<i>Linum lewisii</i>			1	0.4
<b>TOTAL PLS POUNDS/ACRE</b>				<b>100</b>	<b>29.11</b>

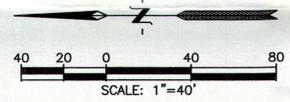
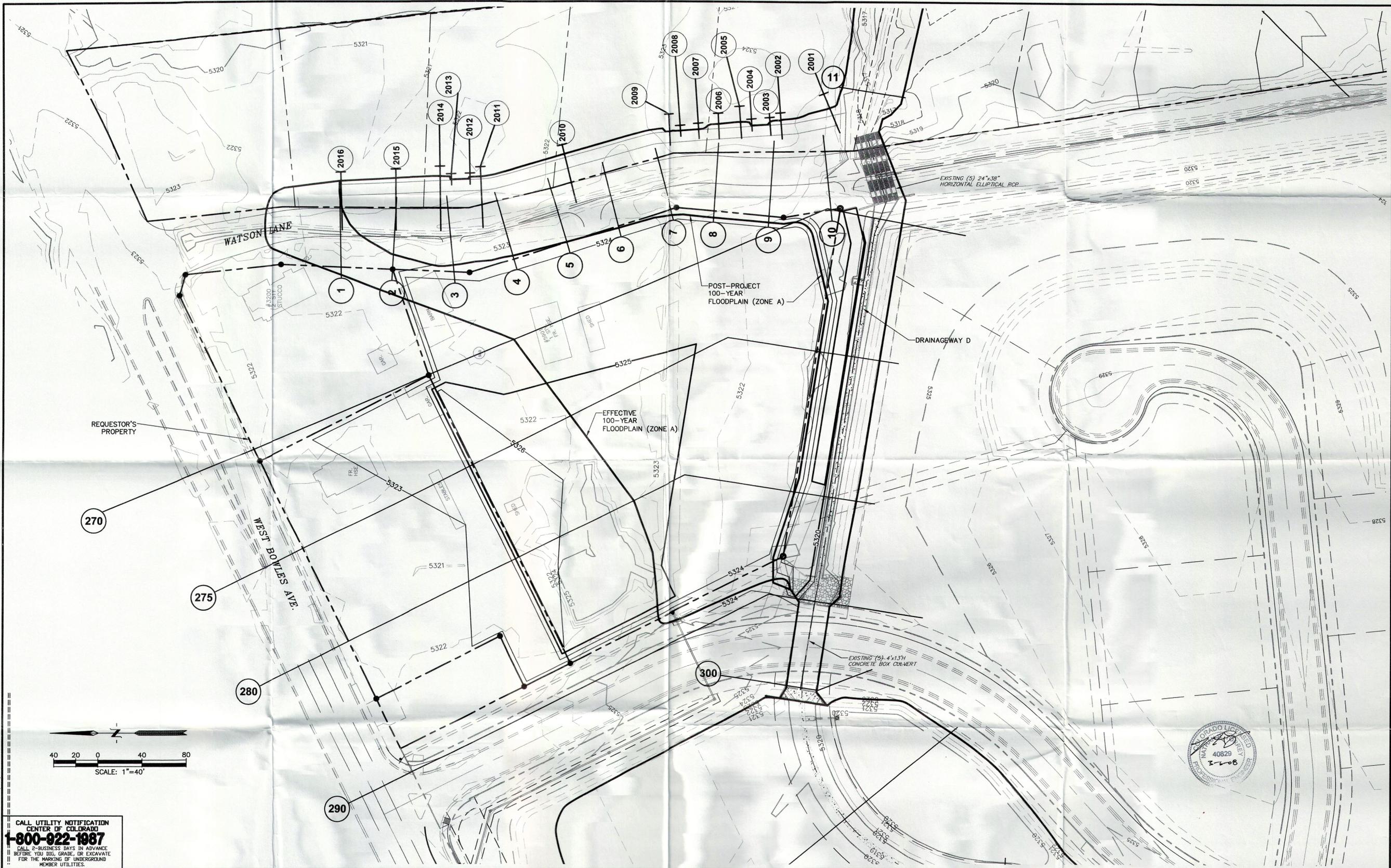
<sup>1</sup>PLS = Pure Live Seed – If broadcast seeding, double the rate

**Table A-2. Upland area seed mix – sandy soil**

Common Name	Scientific Name	Growth Season	Growth Form	% Mix	Lb/ac (PLS <sup>1</sup> )
<b>Grasses</b>					
Switchgrass	<i>Panicum virgatum</i>	Warm	Sod/Bunch	15	2.3
Prairie sandreed	<i>Calamovilfa longifolia</i>	Warm	Sod	10	2.2
Sideoats grama	<i>Bouteloua curtipendula</i>	Warm	Sod	10	3.1
Blue grama	<i>Bouteloua gracilis</i>	Warm	Sod	10	0.7
Indian ricegrass	<i>Oryzopsis hymenoides</i>	Cool	Bunch	10	4.3
Western wheatgrass	<i>Pascopyrum smithii</i>	Cool	Sod	10	5.5
Little bluestem	<i>Schizachyrium scoparium</i>	Warm	Bunch	10	2.3
Sand dropseed	<i>Sporobolus cryptandrus</i>	Warm	Bunch	10	0.1
Green needlegrass	<i>Stipa viridula</i>	Cool	Bunch	10	3.3
<b>Herbaceous/Wildflowers</b>					
Pasture sage	<i>Artemisia frigida</i>			1	0.1
Blanket flower	<i>Gaillardia aristata</i>			2	0.9
Tansy aster	<i>Maceranthera tanacetifolia</i>			2	0.2
<b>TOTAL PLS POUNDS/ACRE</b>				<b>100</b>	<b>25</b>

<sup>1</sup>PLS = Pure Live Seed – If broadcast seeding, double the rate





2191.DWG, 03/06/08 - PAH

CALL UTILITY NOTIFICATION  
CENTER OF COLORADO  
**1-800-822-1987**  
CALL 2-BUSINESS DAYS IN ADVANCE  
BEFORE YOU DIG, GRADE, OR EXCAVATE  
FOR THE MARKING OF UNDERGROUND  
MEMBER UTILITIES.

**WRC ENGINEERING, INC.**

950 SOUTH CHERRY STREET  
SUITE 404  
DENVER, COLORADO 80246  
PHONE NO: (303) 757-8513  
FAX NO: (303) 758-3208

NO.	BY	DATE	REVISION DESCRIPTION
DESIGNED	NRT		
DRAWN	PAH		
CHECKED			
DATE		03/06/08	
AS-BUILT			

**MR. GLEN CLAYTON**

**FLOODPLAIN ANALYSIS  
DRAINAGEWAY D**

**POST-PROJECT  
FLOODPLAIN**

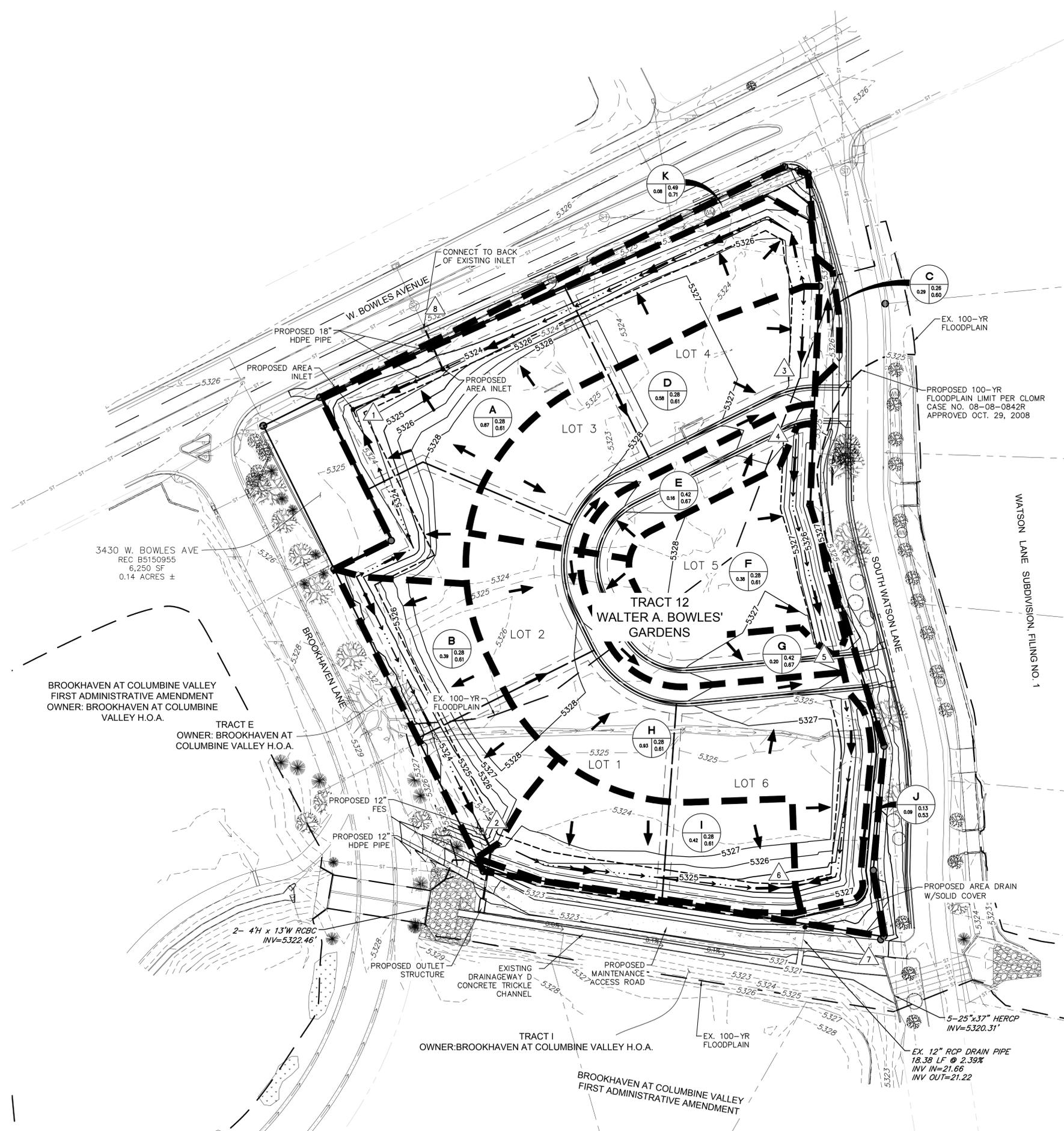
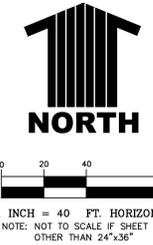
PROJECT NUMBER  
2191  
SHEET  
2 OF 2







Drawing name: S:\Entitlement Engineering\16165 - Clayton Farms Property\CAD\Sheets\IMPROVEMENT PLANS\12-13 Drainage Area map - Existing.dwg Proposed CP Sep 27, 2017 4:27pm by: SCampois



- LEGEND:**
- EXISTING BOUNDARY LINE
  - EXISTING CENTERLINE
  - EXISTING RIGHT-OF-WAY
  - EXISTING CONTOURS
  - PROPOSED CONTOURS
  - PROPOSED MOUNTABLE CURB
  - EXISTING STORM SEWER
  - EXISTING FENCE
  - BASIN BOUNDARY
  - BASIN IDENTIFICATION
  - DRAINAGE POINT
  - FLOW DIRECTION
  - PROPOSED SWALE W/ FLOW DIRECTION
  - PROPOSED UNDERDRAIN W/CLEANOUT
  - PROPOSED STORM PIPE W/AREA DRAIN
  - APPROXIMATE 100-YEAR FLOODPLAIN FROM THE NATIONAL FLOOD INSURANCE PROGRAM, FEMA FIRM NO. 08005C0432K, DECEMBER 17, 2010.
  - CLOMR POST-PROJECT FLOODPLAIN PER CLOMR CASE NO. 08-08-0842R, APPROVED OCTOBER 29, 2008

- NOTE:**
1. ALL GRADING CONTOUR ELEVATIONS ARE BASED ON NAVD88 VERTICAL DATUM
  2. EX. 100-YEAR FLOODPLAIN PER FEMA FIRM No. 08005C0432K, DATED DEC. 17, 2010.

**BENCHMARK**

A GPS DERIVED ELEVATION WAS ESTABLISHED AT AN ONSITE BENCHMARK 50 FEET WEST OF THE NORTHWEST CORNER OF TRACK 12 OF WALTER A. BOWLES GARDEN, BEING A NO. 5 REBAR WITH RED PLASTIC CAP, MARKED "COLO ENGN AND SURVEY, LS 26958". ELEVATION OF 5325.29 FEET (NAVD88 DATUM).

1 PER CITY COMMENTS	9/27/2017	JOA	BY
			DATE
			REVISIONS
			No.



SCALE: AS SHOWN
DESIGNED BY: FGF
DRAWN BY: JOA
CHECKED BY: LEP

**IMPROVEMENT PLANS  
PROPOSED CONDITIONS  
DRAINAGE MAP**

**WATSON LANE RESERVE  
WEST BOWLES AVE  
& SOUTH WATSON LANE**

DATE  
5/16/2017  
PROJECT NO.  
16165