

Final Drainage Report for Cordera Filing No. 3A & Master Development Drainage Plan Cordera Filing No. 3, Drainage Amendment

For: Cordera CN Future Filings; Kettle Creek Drainage Basin

10/22/2019

Prepared for:
City of Colorado Springs, Colorado
Engineering Development Review Division Team
30 South Nevada Avenue, Suite 401
Colorado Springs, CO 80903

High Valley Land Co., Inc.
1755 Telstar Drive, Suite 211
Colorado Springs, CO 80920

Prepared by:



2435 Research Parkway, Suite 300
Colorado Springs, CO 80920
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Engineer's Statement:

This report and plan for the drainage design of Cordera CN Future Filings as part of the Master Development Drainage Plan for Cordera Filing No. 3 was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

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10/22/2019

SEAL



Brady A. Shyrook
Registered Professional Engineer
State of Colorado
No. 38164

Date

Developer's Statement:

High Valley Land Co., Inc. hereby certifies that the drainage facilities for Cordera CN Future Filings as part of the Master Development Drainage Plan for Cordera Filing No. 3 shall be constructed according to the design presented in this report. I understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of Cordera CN Future Filings as part of the Master Development Drainage Plan for Cordera Filing No. 3, guarantee that final drainage design review will absolve High Valley Land Co., Inc. and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

High Valley Land Co., Inc.
Business Name

By: *[Handwritten signature]*
Steve Rossoll

Title: Director of Development

Address: 1755 Telstar Drive, Suite 211
Colorado Springs, CO 80920

City of Colorado Springs:

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

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10/31/2019

For the City Engineer

Date

Conditions:

Introduction

The purpose of this drainage amendment is to update the proposed on-site water quality facilities for the Cordera CN Future Filings as an amendment to the approved *Final Drainage Report for Cordera Filing No. 3A & Master Development Drainage Plan Cordera Filing No. 3, Pine Creek & Kettle Creek Drainage Basins*, approved October 2007, prepared by Matrix Design Group, Inc. (MDDP) due to final design considerations of the Cordera CN Filings. Existing regional Detention Facility “E” does not provide water quality for all of the upstream tributary areas.



Vicinity Map

Cordera CN Future Filings, In the City of Colorado Springs, County of El Paso, State of Colorado

Land Planning and Utilization

The Cordera CN Future Filings project is located on approximately 31.15 acres in northeastern Colorado Springs, is zoned commercial and is situated between three existing major roadways: Powers Boulevard, Old Ranch Road, and Cordera Crest Ave.

The property was previously studied and approved as part of the *Final Drainage Report for Cordera Filing No. 3A and Master Development Drainage Plan Cordera Filing No. 3, Pine Creek and Kettle Creek Drainage Basins*, Matrix Design Group, Inc. October 2007. At the time of the previous study, which was prior to the DCM update in May of 2014, on-site detention (the 5-year through the 100-year events) for individual lots within the proposed development (Sub-basin OK-7 of the **MDDP**) was accounted for inside Detention Facility "E" within the Bison Ridge development as part of the master planning process at the time. Water quality was to be provided by each development on-site with an additional 20% capacity due to accumulation of sediment. The zoning of the Cordera CN Future Filings being for commercial development (which typically has high associated impervious areas), this planned development needs to maximize the utilization of the available area by implementing underground water quality methods and facilities. A variance request is being submitted in association with this design.

The proposed Cordera CN Future Filings drain to the Kettle Creek Drainage Basin. Due to geographical constraints as outlined in the variance request, the Cordera CN Future Filings project area is proposing underground water quality facilities for the development of the internal parcels of the Cordera CN Future Filings that will treat developed runoff and release at the allowable release rates in conformance with the **MDDP**. Matrix is recommending this proposed drainage amendment for the Cordera CN Future Filings due to the revisions of the DCM update in May of 2014 and the hardship the site faces as outlined in the variance request for the CN1 Future Filings, the site is required to provide water quality for all developed acreages. The original master plan did not anticipate additional surface area for water quality ponds, and the loss of the commercial surface area imposes a disadvantage to the feasibility of the site development. The site is also geographically constrained between existing State Highway 21 (Powers Boulevard) and Old Ranch Road, making additional property for water quality unavailable. These underground facilities treat on-site runoff for water quality and release into a proposed storm system main that routes flows to the southwest where the Cordera CN Future Filings outfall to an existing 72-inch RCP that crosses beneath Powers Boulevard and ultimately conveys developed runoff to Detention Facility "E".

Conclusion

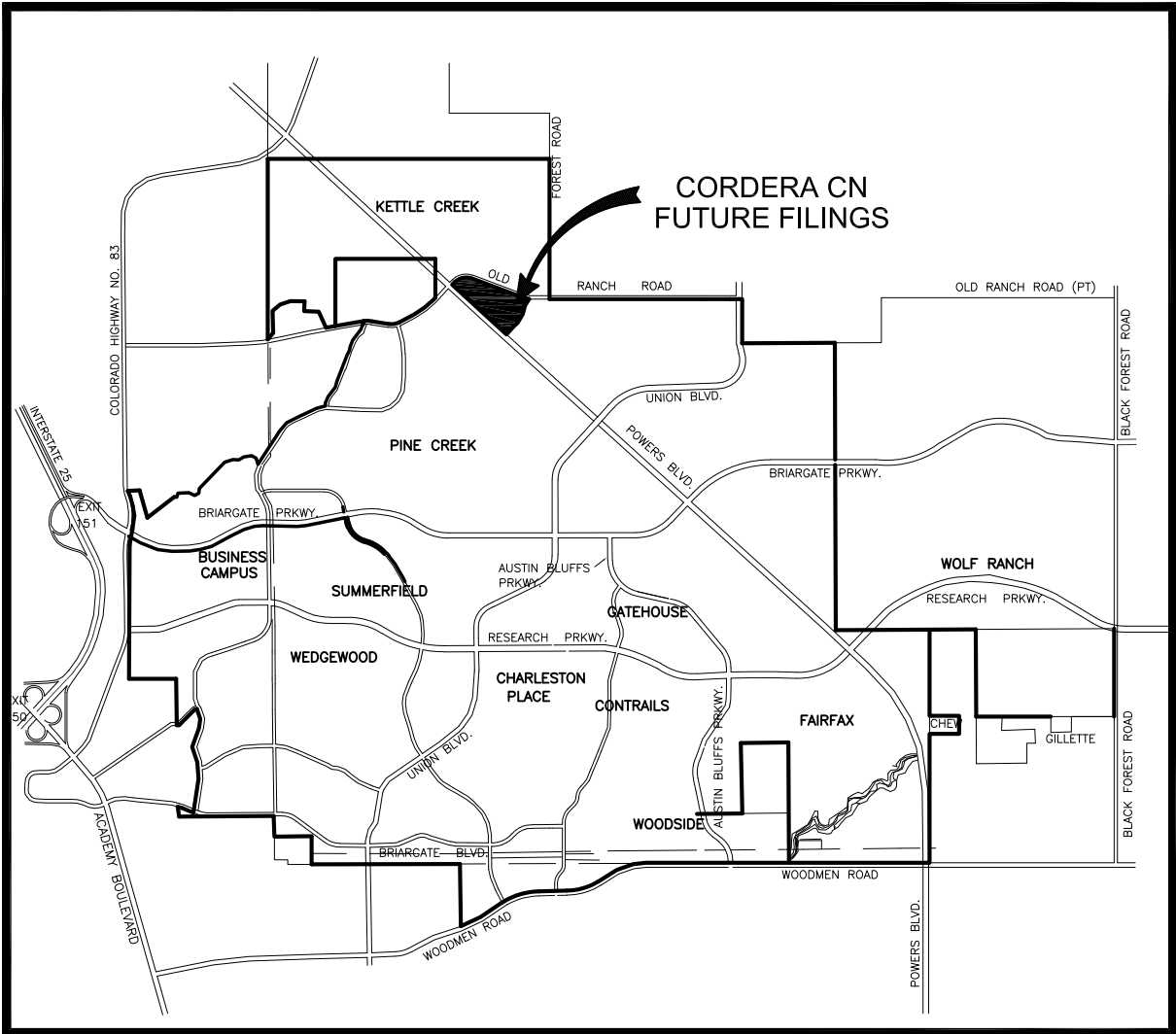
This amendment revises the approved *Final Drainage Report for Cordera Filing No. 3A & Master Development Drainage Plan Cordera Filing No. 3, Pine Creek & Kettle Creek Drainage Basins*, approved October 2007, prepared by Matrix Design Group, Inc. to include on-site below grade water quality facilities for each of the remaining undeveloped lots within the Cordera CN Future Filings. This will allow the development to better comply with the DCM (as updated in May 2014) by providing water quality treatment for each development. This will also help to ensure the future developed areas to be of a size more feasible for development in line with current zoning.

The changes reflected in this amendment have not impacted the general drainage patterns within the study area and area tributary to it and do not increase developed flows. The proposed underground water treatment facilities and associated piping will be privately owned and

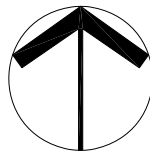
maintained by the developer. The integrity of the structures and associated pipes will not adversely affect the storm sewer system and these changes will not have an adverse impact on downstream facilities.

Appendix/Attachments

1. Vicinity Map
2. Variance Request for Cordera CN Future Filings for underground water quality
3. Excerpts from the *Final Drainage Report for Cordera Filing No. 3A and Master Development Drainage Plan Cordera Filing No. 3, Pine Creek and Kettle Creek Drainage Basins*, Matrix Design Group, Inc. October 2007
4. Excerpts from the *Kettle Creek Drainage Basin, Drainage Basin Planning Study and Master Development Drainage Plan*, J.R. Engineering, March 2003
5. Excerpts from the *Preliminary/Final Drainage Report for Bison Ridge at Kettle Creek Filing No. 1 and Preliminary Drainage Report for Bison Ridge at Kettle Creek Filing No. 2 and Bison Ridge at Kettle Creek Multi-Family and Commercial Sites*, J.R. Engineering, revised November 2003



VICINITY MAP



NORTH
N.T.S.



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719.575.0100



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Phone: 719.575.0100
Fax: 719.575.0208
matrixdesigngroup.com

Variance Request

Date: September 26, 2019

Applicant: High Valley Land Co.
Mr. Steve Rossoll
1755 Telstar Drive, Suite 211
Colorado Springs, CO 80920

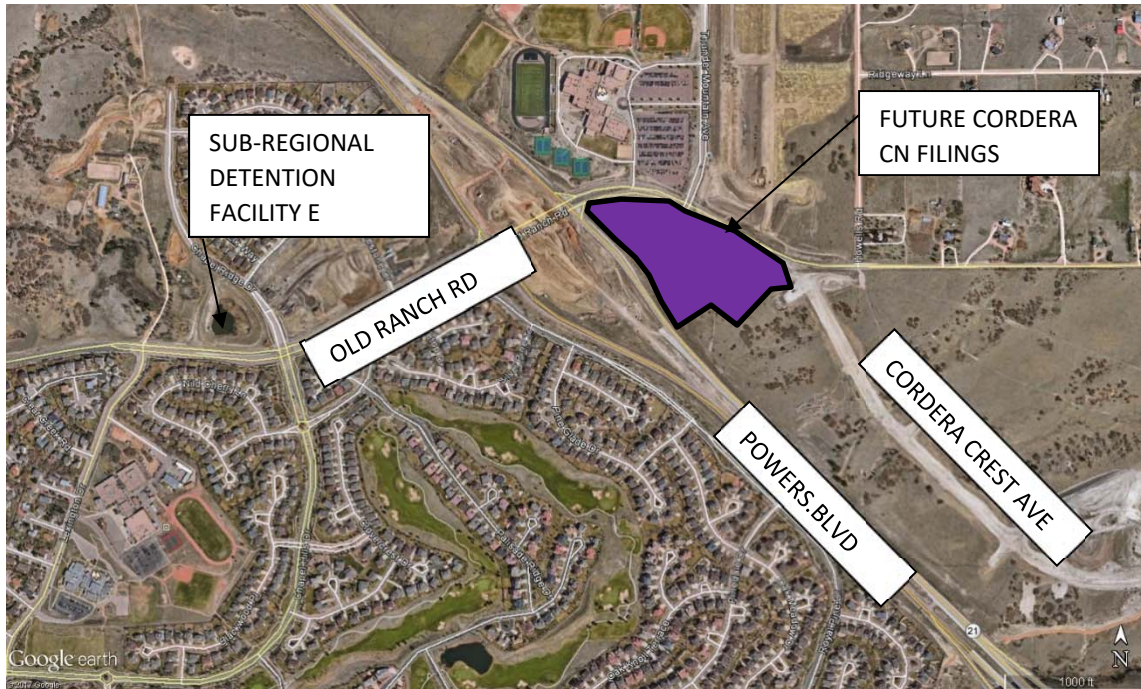
Engineer: Matrix Design Group, Inc.
Mr. Brady Shyrock, PE
2435 Research Parkway, Suite 300
Colorado Springs, CO 80920

Project: Cordera CN Future Filings
Colorado Springs, CO 80924

Request: Variance for underground water quality
Section 6.7, Chapter 3 of the City of Colorado Springs Drainage Criteria
Manual, Volume 1

Background: The Cordera CN Future Filings project is located on approximately 13.15 acres in northeastern Colorado Springs. The property is located east of Powers Boulevard and just south of Old Ranch Road. The property is also bounded by Cordera Crest Avenue to the east, (see vicinity map below). The proposed development is comprised of an approved commercial development within the Cordera Master Plan area with supporting infrastructure (private access drives, parking lots, underground stormwater quality facilities and site utilities). The historical and existing topography for the property slopes from the northeast to the southwest.

This proposed variance is to be applied to the previously approved *Final Drainage Report for Cordera Filing No. 3A and Master Development Drainage Plan Cordera Filing No. 3, Pine Creek and Kettle Creek Drainage Basins*, Matrix Design Group, Inc. October 2007.



Vicinity Map

Cordera CN Future Filings, In the City of Colorado Springs, County of El Paso, State of Colorado

The property was previously studied and approved as part of the *Final Drainage Report for Cordera Filing No. 3A and Master Development Drainage Plan Cordera Filing No. 3, Pine Creek and Kettle Creek Drainage Basins*, Matrix Design Group, Inc. October 2007. At the time of the previous study, detention for individual lots within the proposed development was not a requirement, as the 5-year through the 100-year events had been accounted for inside Detention Facility “E” within the Bison Ridge development as part of the master planning process at the time. The previous study did not specifically state that water quality for the associated sub-basin (OK-7) was required, but the adjacent areas were required to provide water quality in conformance with the Phase II requirements at the time. The site is geographically constrained between existing State Highway 21 (Powers Boulevard) Old Ranch Road, and Cordera Crest Avenue (see attached exhibit), making additional property (surface area as required by the DCM and UDFCD) for water quality unavailable. The original master plan did not anticipate additional surface area for water quality ponds, and the loss of the commercial surface area imposes a detriment to the viability of the site development. As part of this project, the Cordera CN Future Filings are proposing that each of the remaining undeveloped lots and the private drive (Blue Horizon View) utilize underground water quality facilities.

The project area is part of the Cordera Master Plan area, is zoned commercial and is situated between three existing major roadways: Powers Boulevard,

Old Ranch Road, and Cordera Crest Ave. The existing mini-storage facility has an underground water quality facility that provides water quality treatment and release at the allowable release rates in conformance with the *Cordera CN Filing No. 1, Lot 1 Drainage Addendum, Kettle Creek Drainage Basin*, Matrix Design Group, Inc. May 2018. This variance request is proposing that each of the remaining undeveloped lots and the private drive (Blue Horizon View) utilize underground water quality facilities in conformance with the same release rates as set forth within the *Cordera CN Filing No. 1, Lot 1 Drainage Addendum, Kettle Creek Drainage Basin*, Matrix Design Group, Inc. May 2018.

The proposed Cordera CN Future Filings are located within the Kettle Creek Drainage Basin. The area has been previously analyzed for detention requirements within Sub-Regional Detention Facility "E". Associated downstream infrastructure en route to Sub-Regional Detention Facility "E" has already been sized according to the *Final Drainage Report for Cordera Filing No. 3A and Master Development Drainage Plan Cordera Filing No. 3, Pine Creek and Kettle Creek Drainage Basins*, Matrix Design Group, Inc. October 2007.

Contributing Conditions:

Development for the site is constrained by a number of factors including:

- Existing zoning of the overall project area. Commercial sites typically have higher densities and require more hardscape surfaces to meet access and parking requirements, etc. in accordance with DCM drainage and grading criteria.
- Existing site topography (high slopes ranging from 9.7% to 13.8%) and historic drainage patterns (from northeast to southwest)
- Existing roadways adjacent to the site – Powers Boulevard to the west, Old Ranch Road to the north, and Cordera Crest Avenue to the east, and planned internal connection service drives from Blue Horizon View.
- Existing Utility Easements - 30' water main easement along the west and south side of the property where changes to grading and installation of detention and water quality features are prohibited.

Due to the above factors, there are no accommodations for several above grade water quality facilities. Therefore, forcing these facilities upon the already geographically constrained site creates additional burden and hardship (refer to attached map). Per the attached exhibit, by requiring above grade facilities for each of the future developments, the available surface area for development is reduced significantly, to an extent where

above grade water quality facilities fall in direct conflict with their associated developments.

The specified underground water quality facilities would be placed strategically with the associated developments and in line with the proposed storm main trunk infrastructure so as to maximize development while also providing the required water quality treatment in compliance with the DCM. The proposed water quality facilities will conform to the DCM criteria for water quality drain time of 40 hours. StormTech is an underground water quality system that utilizes polypropylene, open bottom chambers in order to detain storm water underground. The chambers are designed and 3rd party tested for an HS-20 or HL-93 live load - which allows the systems to be put under parking lots and roadways, maximizing the value of the development site. StormTech systems use isolator rows for TSS and TPH removal that many cities and municipalities along the front range consider adequate for water quality in lieu of pretreatment. The system can be fully maintained above ground, significantly reducing the life cycle costs of a typical underground detention system.

Justification: The site is encumbered by several constraints (noted above), which influence the proposed site layouts and grading of the overall Cordera CN Filings and conveyance of generated runoff for the site. 1.) The established elevations of surrounding roadways which drive the grading of the future parcels, 2.) horizontal limitations due to existing zoning and proximity to existing right-of-ways and existing utility easements, and 3.) water quality treatment for each of the lots will require more space than is available, given the constraints listed above. Therefore, adding treatment facilities conforming with City Standards as above grade facilities is not physically possible. We recommend approval of this variance request to allow below grade water quality facilities for the remaining undeveloped lots within the area described above.

In summary, downstream drainage facilities are presently constructed and designed to accommodate runoff released from the overall Cordera CN Filings. The *Cordera CN Filing No. 1, Lot 1 Drainage Addendum, Kettle Creek Drainage Basin*, Matrix Design Group, Inc. May 2018, has detailed and designed the proposed storm sewer system in conformance with allowable release rates per the approved the *Final Drainage Report for Cordera Filing No. 3A and Master Development Drainage Plan Cordera Filing No. 3, Pine Creek and Kettle Creek Drainage Basins*, Matrix Design Group, Inc. October 2007.

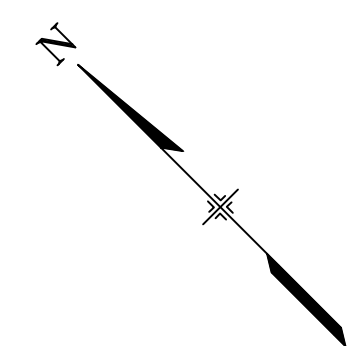
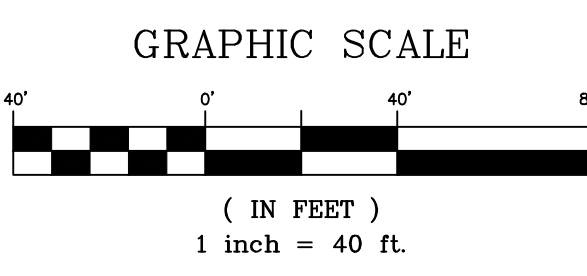
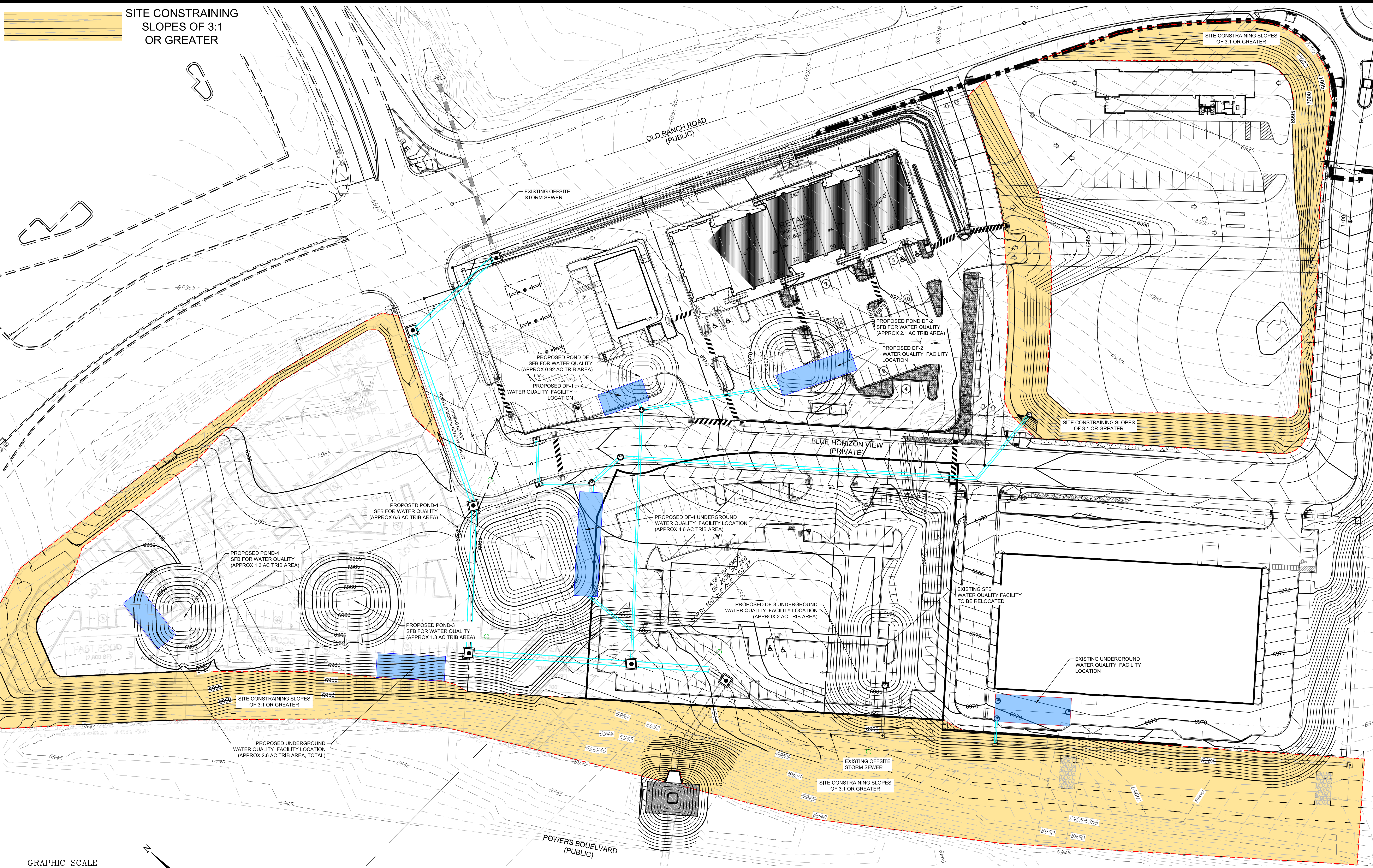
The proposed underground water treatment facilities and associated piping will be privately owned and maintained by each of the developers of the future parcels. Maintenance agreements will be required for each of the parcels containing one of the water quality facilities. The approval of this variance will not decrease water quality or increase peak flows in Fountain Creek.

Respectfully,



Brady A. Shyrock, PE

SITE CONSTRAINING SLOPES OF 3:1 OR GREATER



CORDERA CN1 SITE PLAN / DRAINAGE EXHIBIT



Design point K8 (design point K10 of the interim developed conditions) collects runoff from sub-basins KP-10 and KP-13 through KP-15 and design point K7; an area totaling 60.12 acres. Runoff rates of $Q(5) = 15.4$ cfs and $Q(100) = 89.8$ cfs are routed through a 30" RCP to design point K15.

Design point K15 (design point K11 of the interim developed conditions) collects runoff from sub-basins KP-16, KP-23 through KP-25, and KP-27 and design point K8; an area totaling 64.18 acres. Runoff rates of $Q(5) = 22.0$ cfs and $Q(100) = 101.8$ cfs are routed through a 42" RCP to design point K13.

Design point K13 (design point K13 of the interim developed conditions) collects runoff from design points K12 and K15; an area totaling 247.22 acres. Runoff rates of $Q(5) = 60.6$ cfs and $Q(100) = 316.0$ cfs are routed through a 66" RCP to Detention Pond DF-6.

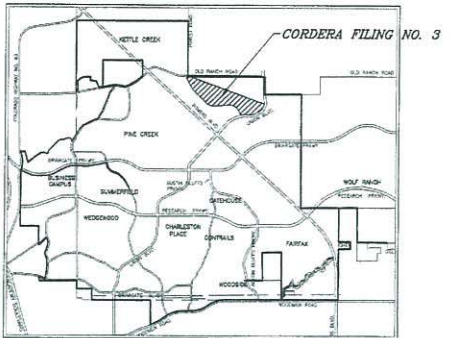
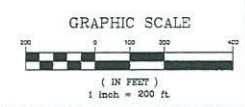
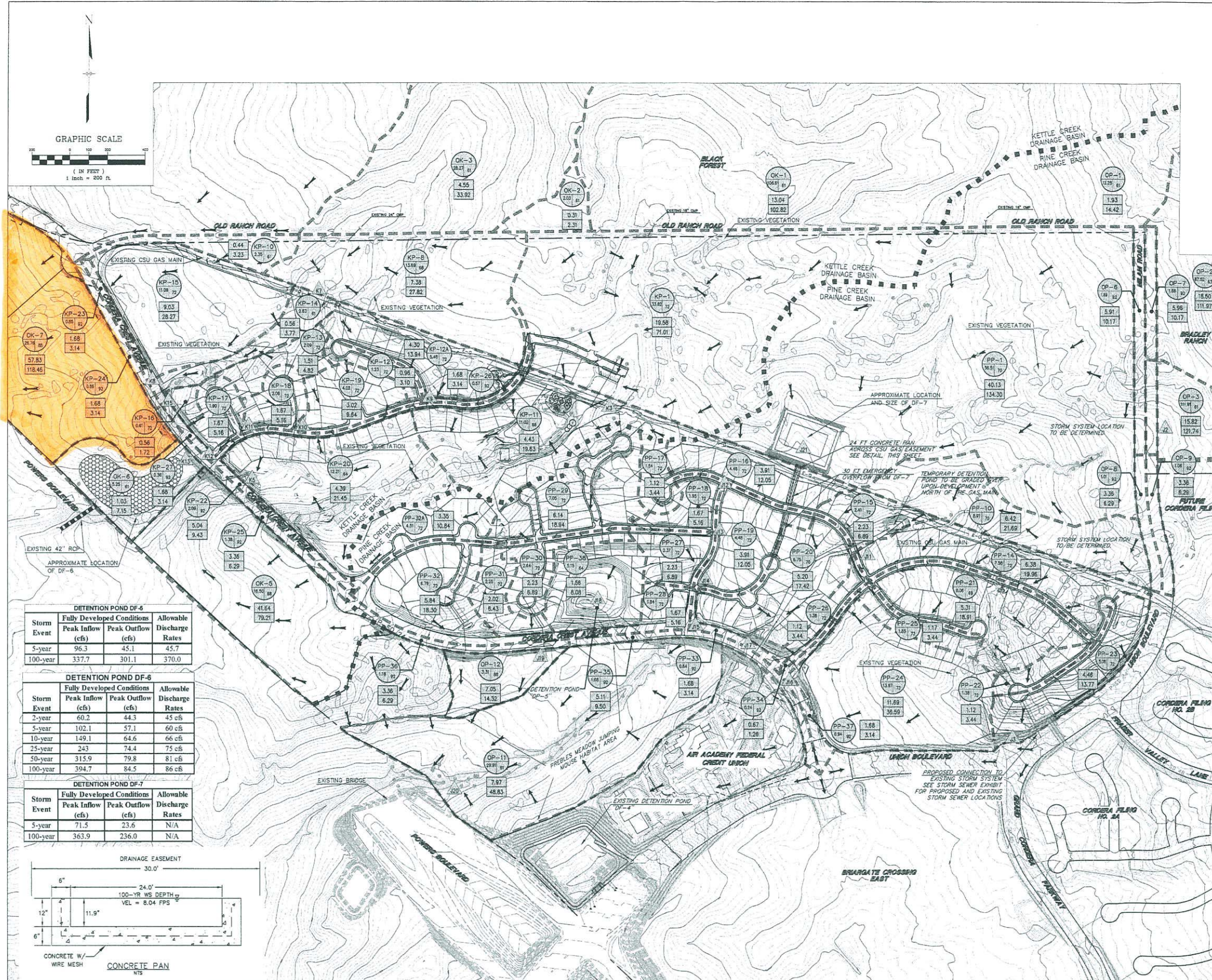
Sub-basin OK-5 consists of 16.50 acres of future commercial development located in the western portion of the site. The area generates runoff rates of $Q(5) = 41.6$ cfs and $Q(100) = 79.2$ cfs and are routed to detention pond DF-6.

Sub-basin OK-6 consists of 5.25 acres of dedicated open space where detention facility DF-6 is located. The area generates runoff rates of $Q(5) = 1.0$ cfs and $Q(100) = 7.2$ cfs that are collected by detention facility DF-6. Allowable discharge rates for this detention facility have been established by the Kettle Creek DBPS. The table below summarizes the flowrates discharged into Kettle Creek under fully developed conditions and the allowable discharge rates.

Table 4.5
Allowable and Proposed Discharge Rates for Detention Facility 6

Storm Event	Fully Developed Conditions		Allowable Discharge Rates
	Peak Inflow (cfs)	Peak Outflow (cfs)	
2-year	60.2 cfs	44.3 cfs	45 cfs
5-year	102.1 cfs	57.1 cfs	60 cfs
10-year	149.1 cfs	64.6 cfs	66 cfs
25-year	243.0 cfs	74.4 cfs	75 cfs
50-year	315.9 cfs	79.8 cfs	81 cfs
100-year	394.7 cfs	84.5 cfs	86 cfs

Sub-basin OK-7 consists of 26.76 acres of future commercial development located in the northwestern portion of the site. The area generates runoff rates of $Q(5) = 57.8$ cfs and $Q(100) = 118.5$ cfs that are routed to an existing 72" RCP located underneath Powers Boulevard. Sub-basin OK-7 is located within sub-basin D13 of the Kettle Creek DBPS (Fully Developed Condition Basin Map). Sub-basin D13 consisted of 42.9 acres that generated flowrates of $Q(5) = 115$ cfs and $Q(100) = 219$ cfs. To compare, OK-7 generates 2.16 cfs/acre and 4.43 cfs/acre for the minor and major storm events, while D13 generated 2.68 cfs/acre and 5.10 cfs/acre for the minor and major storm events. Once sub-basin OK-7 is developed, the development plan must comply with this drainage report or the cfs/acre per the Kettle Creek DBPS.



VICINITY MAP



PINE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
J1	(NOT USED)		
J2			
J3	5.58	17.21	OP2, OP3, OP6 OP7
J4	(NOT USED)		
J5	(NOT USED)		
J6	(NOT USED)		
J7	(NOT USED)		
J8	(NOT USED)		
J9	(NOT USED)		
J10	(NOT USED)		
J11			PP10, PP14, PP15, PP21, OP8, OP9
J12	24.20	238.64	PP16, PP17, DF7
J13	24.41	239.51	PP18, J12
J14	27.77	243.04	PP19, PP27, J13
J15	68.96	297.49	PP20, PP33, J14, J17
J16	14.82	44.05	PP24, PP25, PP26, PP34, PP37
J17	35.86	114.32	PP26, J11, J16
J18	94.91	331.27	PP28, PP31, PP35, PP36, J15, J19
J19	17.11	54.21	PP29, PP30, PP32, PP32A
J20	47.14	308.69	OP11, OP12, DF5
J21	71.54	363.88	OP1, PP1, J1

KETTLE CREEK SUMMARY TABLE

DESIGN POINT ID	Q(5) (CFS)	Q(100) (CFS)	SUB-BASINS
K1	(NOT USED)		
K2	(NOT USED)		
K3	22.84	152.01	KP1, OK1, OK2
K4	(NOT USED)		
K5	6.16	37.43	KP11, KP20
K6	(NOT USED)		
K7	9.91	58.27	KP8, OK3
K8	15.44	89.82	KP10, KP13, KP14, KP15, K7
K9	27.51	166.15	KP12, KP2A, KP26, K3
K10	29.91	172.76	KP19, K9
K11	30.89	175.16	KP18, K10
K12	39.48	216.68	KP17, KP22, K5, K11
K13	60.56	315.99	K12, K15
K14	(NOT USED)		
K15	22.04	101.78	KP16, KP23, KP24, KP25, KP27, K8

DETENTION POND DF-6

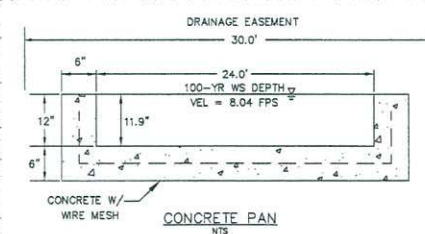
Storm Event	Fully Developed Conditions Peak Inflow (cfs)	Fully Developed Conditions Peak Outflow (cfs)	Allowable Discharge Rates
5-year	96.3	45.1	45.7
100-year	337.7	301.1	370.0

DETENTION POND DF-6

Storm Event	Fully Developed Conditions Peak Inflow (cfs)	Fully Developed Conditions Peak Outflow (cfs)	Allowable Discharge Rates
2-year	60.2	44.3	45 cfs
5-year	102.1	57.1	60 cfs
10-year	149.1	64.6	66 cfs
25-year	243	74.4	75 cfs
50-year	315.9	79.8	81 cfs
100-year	394.7	84.5	86 cfs

DETENTION POND DF-7

Storm Event	Fully Developed Conditions Peak Inflow (cfs)	Fully Developed Conditions Peak Outflow (cfs)	Allowable Discharge Rates
5-year	71.5	23.6	N/A
100-year	363.9	236.0	N/A



NO.	DATE	DESCRIPTION	BY
REVISIONS			
BENCHMARK DATA (ELEV.) (DATUM)			
(DESCRIPTION/LOCATION)			

NAME: S:\06104\070\Drawings\DR03-PP-Analysis.dwg
 PLOT DATE: Oct 11, 2007 9:30am
 PLOT BY: Matrix
 PLOT DATE: Oct 11, 2007 9:30am

Matrix Design Group, Inc.
 Integrated Design Solutions
 2435 Research Parkway, Suite 300
 Colorado Springs, CO 80920
 Phone 719-575-0100
 Fax 719-575-0208

CORDERA FILING NO. 3
 MASTER DEVELOPMENT DRAINAGE PLAN
 FULLY DEVELOPED DRAINAGE MAP

FOR AND ON BEHALF OF
 MATRIX DESIGN GROUP, INC.

DESIGNED BY: BAS	SCALE: 1" = 200'	DATE ISSUED: OCTOBER 2007	DP03
DRAWN BY: BAS	NO. REV: N/A	SHEET NO: 03	SHEETS: 03
CHECKED BY: NRT			

The regional detention alternatives presented herein only are considered for the purposes of attenuating developed flow rates. Consideration of regional detention alternatives will have significant environmental impacts as discussed in Section 5. Sub-regional detention alone will not reduce flow rates in Kettle Creek to historic levels, as past development in the upper portion of the basin is a contributing factor to the increased flows under existing conditions. Regional detention must be owned and maintained by a public entity, with ownership and maintenance responsibilities clearly defined to ensure the proper function of the facility in perpetuity.

6.3 Sub-Regional Detention

The anticipated approach is sub-regional detention with full spectrum detention and water quality treatment. Any future development in the Kettle Creek basin within the City of Colorado Springs shall have sub-regional detention for each development/phase. Detention facilities serving drainage basins between 20 and 130 acres are considered “sub-regional detention”. Sub-regional detention may be constructed by a public entity such as a municipality or special district to serve several landowners in the upstream watershed or by a single landowner. It may be possible for a single landowner to construct sub-regional detention if the upper part of the watershed is owned by others and if the necessary conditions are achieved. Sub-regional detention should be addressed in subsequent Master Development Drainage Plans (MDDP) for individual development projects. The ownership and maintenance of these ponds are anticipated to be public or quasi-public. In order to be considered for public maintenance the contributory area shall be in the range of 70-120 acres. **A conceptual map illustrating the locations of required sub-regional detention facilities is shown in Figure 6-1.**

6.3.1 Full Spectrum Detention

The full spectrum detention approach, as defined in Chapter 13 of the DCM, shall be implemented as the standard detention approach. Impervious surfaces associated with development increase peak flows, frequency of runoff and total volume of stormwater surface runoff when compared to pre-development conditions. This increase is most pronounced for the smaller, more frequent storms and can result in stream degradation and water quality impacts as well as flooding during large storm events.

In addition to detaining developed conditions stormwater discharge for flood control and for water quality considerations, it is also important to expand the focus to the range of flows responsible for transporting the most bedload in the receiving stream. This range depends on reach specific characteristics but is between the annual event and the 5-year event. Runoff events in this range can produce geomorphic changes in local receiving streams resulting in severe erosion, loss of riparian habitat, and water quality degradation.

Outflow hydrographs from traditional flood-control detention facilities tend to maintain flows near the maximum release rates for relatively long periods of time. This allows hydrographs released from multiple independent ponds to overlap and add to each other to generate flows exceeding pre-development conditions. Traditional flood-control detention concepts can result in an increase in total watershed discharges even if individual detention facilities each control peak discharges to pre-developed conditions. Full spectrum detention modeling reduces urban runoff peaks to levels similar to pre-development conditions for a wide range of storms over an entire watershed, even with multiple independent detention facilities. A result of full

spectrum detention is that discharges from storms smaller than approximately the 2-year event will be reduced to very low flows near or below the sediment carrying threshold value for downstream drainageways.

6.3.2 Water Quality

Each sub-regional detention pond shall detain flows not only for flood control, but also for water quality. The Water Quality Capture Volume (WQCV) is intended to capture most runoff events and reduce their pollutant load prior to discharging into drainageways. The size of this storage element depends primarily on the amount of tributary impervious area and can be reduced by implementing development practices that reduce the effective imperviousness, discussed in more detail below.

Future development in the basin shall consider other land planning and engineering design approaches to manage stormwater runoff and water quality. Low Impact Development (LID) is a comprehensive approach with the goal of mimicking the pre-development hydrologic regime. LID emphasizes conservation of natural features and use of engineered, on-site, small-scale hydrologic controls that infiltrate, filter, store, evaporate, and detain runoff close to its source. Portions of the site that aid in reducing the developed conditions discharge should be preserved, which may include mature trees, stream corridors, wetlands, and NRCS Type A/B soils with higher infiltration rates.

Minimizing Directly Connected Impervious Area (MDCIA) includes a variety of runoff reduction strategies based on reducing impervious areas and routing runoff from impervious surfaces over grassy areas to slow runoff and promote infiltration. MDCIA is a technique for reducing runoff peaks and volumes following urbanization. Paved areas can be reduced in extent to the minimum amount practical, and implement methods to route runoff over grassed areas rather than directly into storm sewer. When soils vary over the site, concentrate new impervious areas over NRCS Type C and D soils, while preserving NRCS Type A and B soils for landscape areas and other permeable surfaces. Increasing the number and lengths of flow paths will all reduce the impact of the development.

Volume reduction is a key hydrologic objective, as opposed to peak flow reduction being the only objective. Volume reduction is emphasized not only to reduce pollutant loading and peak flows, but also to move toward hydrologic regimes with flow durations and frequencies closer to the natural hydrologic regime.

6.4 Limited Channel Stabilization Alternative

Channel improvements may be necessary in the main study reach of Kettle Creek to limit erosion and deposition resulting from high velocities as determined in Section 4. However, grading and grade control structures may not be feasible in Kettle Creek due to the disturbance they would cause with the presence of the Preble’s meadow jumping mouse. Conceptual check structure placement is provided for reference, should grade control structures become an option in the future.

The locations of these conceptual check structures were determined by areas where mean channel velocities exceeded 5 feet per second for the 100-year event. Future grade between check structures was estimated to stabilize at approximately 0.20 percent. Check structure placement was shown to lower velocities above 5

LEGEND

- JOVENCHI-I LLC
- 260 EB LLC
- HIGH VALLEY LAND COMPANY INC
- KETTLE CREEK LLC & VENEZIA JOHN FAMILY TRUST
- ① ESTIMATED LOCATION OF PROPOSED SUBREGIONAL PONDS
- EXISTING LOCATION OF SUBREGIONAL PONDS
- KETTLE CREEK BASIN BOUNDARY

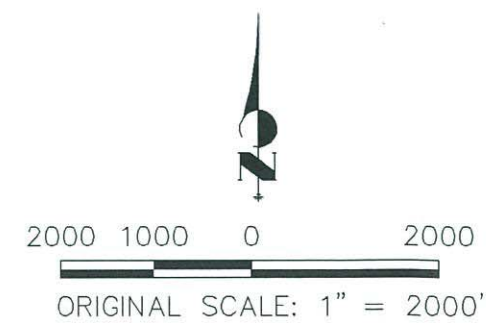
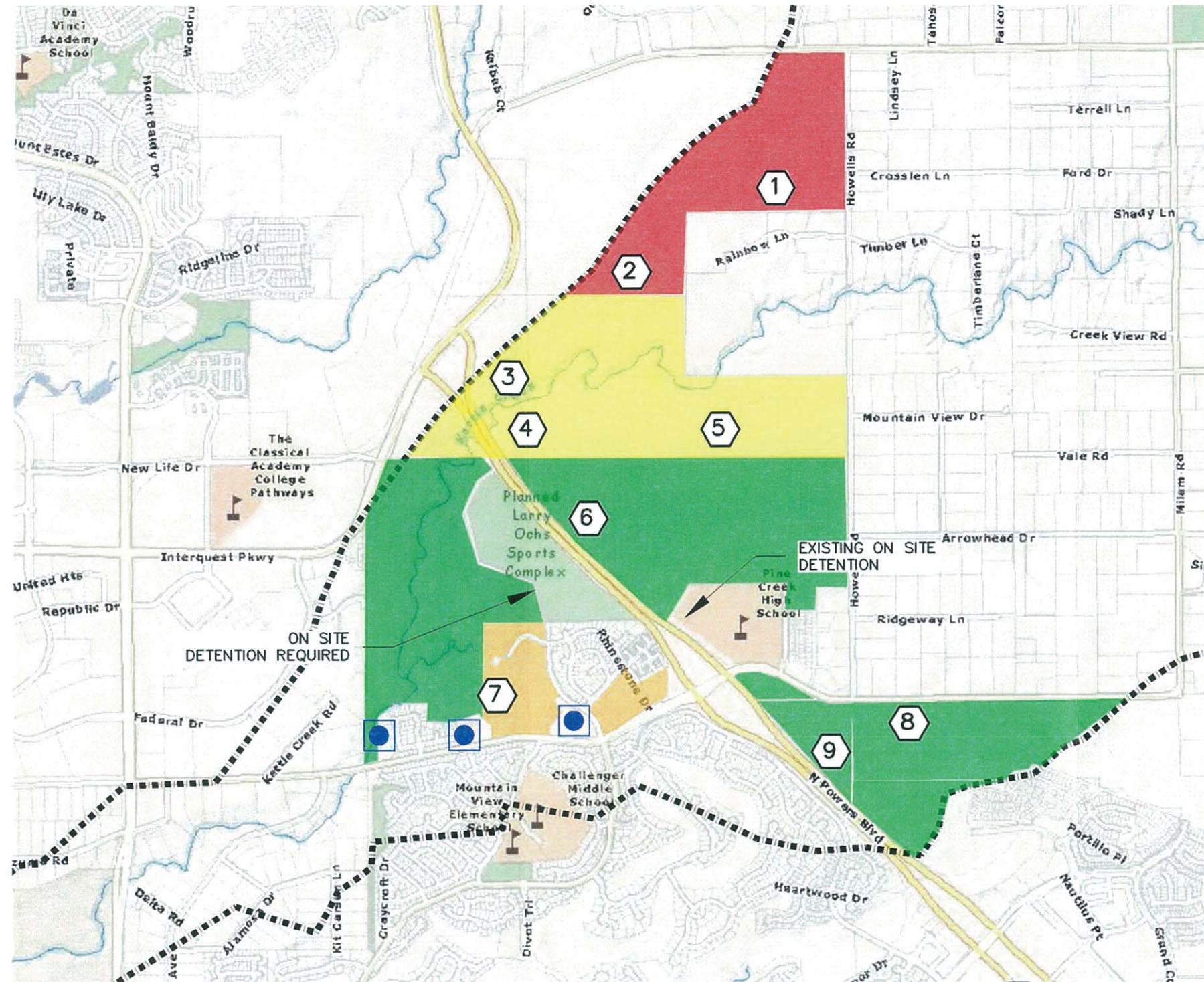


FIGURE 6-1
 SUBREGIONAL POND
 LOCATIONS
 KETTLE CREEK DBPS
 JOB NO. 25100.00
 MAY 2015

SOUTH TRIBUTARY

KETTLE CREEK DRAINAGE BASIN
 OLD RANCH ROAD TRIBUTARY
 MASTER DEVELOPMENT DRAINAGE PLAN
 FULLY DEVELOPED CONDITION BASIN MAP AND MASTER PLAN



KEYED NOTES

- ANALYSIS POINT D24 REPRESENTS A DIRECT ADDITION OF THE HYDROGRAPHS AT ANALYSIS POINT D23 AND THE OUTLET HYDROGRAPH FROM THE CREEK-SIDE ESTATES REGIONAL DETENTION FACILITY. IT DOES NOT REFLECT ANY OTHER FLOW IN KETTLE CREEK.
- NATURAL CHANNEL IS PROPOSED TO BE ELIMINATED IN THIS AREA. STORM WATER TO BE CONVEYED IN A PROPOSED STORM DRAIN.
- REMOVE EXISTING EMBANKMENT DOWN TO LEVEL OF PERMANENT POOL. PROTECT REMAINING EMBANKMENT IF PRUDENT TO DO SO IN ORDER TO PROTECT AGAINST EXCESSIVE EROSION.
- NATURAL CHANNEL PROPOSED TO REMAIN UNIMPROVED IN THIS AREA.
- DETENTION FACILITY OUTLET AND SPILLWAY ARE PROPOSED TO BE REVISED.

GENERAL NOTES:

- PROPOSED STORM DRAINS SHOWN ON THIS PLAN ARE ONLY INTENDED TO INDICATE GENERAL LOCATIONS AND APPROXIMATE SIZES OF FUTURE FACILITIES. ACTUAL STORM DRAIN SIZES AND LOCATIONS SHALL BE DETERMINED WITH MORE DETAILED ANALYSIS AT THE TIME OF DETAILED DESIGN OF THE FACILITIES. IT IS LIKELY THAT ADDITIONAL FACILITIES NOT SHOWN ON THIS PLAN WILL BE REQUIRED.
- PROPOSED DETENTION FACILITIES SHOWN ON THIS PLAN ARE ONLY INTENDED TO INDICATE GENERAL LOCATIONS AND LAND AREA REQUIRED FOR THESE FACILITIES. ACTUAL LOCATIONS AND LAND AREA REQUIRED SHALL BE DETERMINED AT THE TIME OF DETAILED DESIGN OF THE FACILITIES.
- EXCEPT AS OTHERWISE NOTED, THIS PLAN SHALL NOT MODIFY THE REQUIREMENTS OF PREVIOUSLY APPROVED MASTER DEVELOPMENT DRAINAGE PLANS AND FINAL DRAINAGE REPORTS.

SUB-BASIN DATA SUMMARY
 FULLY DEVELOPED CONDITION

SUB BASIN I.D.	AREA (acres)	PERCENT IMPERVIOUS	CN	LAG (hours)	Q5 (cfs)	Q100 (cfs)
D1	0.085	24.2	5.0	87.5	0.283	17.25
D2	0.027	38.2	10.0	89.0	0.225	20.72
D3	0.048	30.5	35.5	25.0	0.287	14.46
D4	0.048	30.5	35.5	25.0	0.287	14.46
D5	0.030	16.1	30.3	74.5	0.233	16.47
D6	0.039	16.1	30.3	74.5	0.233	16.47
D7	0.071	45.8	48.8	79.8	0.373	82.157
D8	0.062	39.5	72.3	82.2	0.311	111.208
D9	0.018	11.4	31.8	74.2	0.213	10.30
D10	0.027	17.2	8.3	88.0	0.307	7.29
D11	0.028	19.7	35.6	74.0	0.123	21.19
D12	0.021	33.3	34.8	74.6	0.220	10.91
D13	0.067	42.0	72.6	91.5	0.323	115.219
D14	0.023	16.4	32.7	78.2	0.137	14.117
D15	0.043	27.8	31.0	75.0	0.200	28.75
D16	0.062	39.5	21.0	72.5	0.197	31.98
D17	0.010	8.5	39.8	85.0	0.117	10.88
D17A	0.011	9.7	80.0	89.0	0.120	21.38
D18	0.064	41.0	30.0	76.3	0.226	35.16
D19	0.024	5.1	40.0	80.0	0.122	25.89
D20	0.030	18.9	80.4	86.5	0.108	82.107
D21	0.041	26.4	32.5	78.5	0.174	18.28
D22	0.037	23.7	40.9	78.5	0.156	31.81
D23	0.005	3.5	56.7	88.0	0.110	8.15
D24	0.035	16.1	26.7	77.5	0.151	18.48
D25	0.017	10.8	53.2	82.2	0.156	18.42
D26	0.033	20.9	30.0	75.5	0.145	24.66
D27	0.028	11.0	45.5	80.0	0.123	8.19
D28	0.004	2.8	48.8	84.0	0.137	8.16
D29	0.018	11.8	37.8	78.2	0.146	15.40
D30	0.017	11.0	28.5	74.0	0.123	11.32
D31	0.009	4.5	40.0	78.5	0.146	6.16
D32	0.006	3.7	5.0	68.0	0.114	3.9
D33	0.006	23.3	10.4	70.2	0.138	18.59
D34	0.039	24.7	38.5	77.0	0.159	30.86
D35	0.039	24.7	40.0	78.0	0.161	32.83
D36	0.024	15.2	19.5	72.0	0.237	10.34
D37	0.011	6.8	93.1	99.0	0.124	23.40
TOTAL	1.265	872.0				

ANALYSIS POINT DATA SUMMARY
 FULLY DEVELOPED CONDITION

ANALYSIS POINT	WATERSHED AREA (acres)	Q2 (cfs)	Q5 (cfs)	Q10 (cfs)	Q25 (cfs)	Q50 (cfs)	Q100 (cfs)	POINT DESCRIPTION
DFA	107.2	0.17	17	44	68	105	134	TOTAL FLOW
DFB	132.3	0.21	30	64	81	101	116	TOTAL FLOW
DFC	267.1	0.42	139	237	311	405	465	TOTAL FLOW
DFD	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFE	267.1	0.42	139	237	311	405	465	TOTAL FLOW
DFG	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFH	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFI	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFJ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFK	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFL	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFM	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFN	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFO	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFP	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFQ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFR	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFS	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFD	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFE	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFG	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFH	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFI	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFJ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFK	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFL	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFM	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFN	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFO	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFP	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFQ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFR	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFS	277.8	0.38	75	148	198	264	291	TOTAL FLOW
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DFE	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFG	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFH	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFI	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFJ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFK	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFL	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFM	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFN	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFO	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFP	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFQ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFR	277.8	0.38	75	148	198	264	291	TOTAL FLOW
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DFP	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFQ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFR	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFS	277.8	0.38	75	148	198	264	291	TOTAL FLOW
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DFG	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFH	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFI	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFJ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFK	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFL	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFM	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFN	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFO	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFP	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFQ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFR	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFS	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFD	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFE	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFG	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFH	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFI	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFJ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFK	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFL	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFM	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFN	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFO	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFP	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFQ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFR	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFS	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFD	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFE	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFG	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFH	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFI	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFJ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFK	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFL	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFM	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFN	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFO	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFP	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFQ	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFR	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFS	277.8	0.38	75	148	198	264	291	TOTAL FLOW
DFD	277.8	0.38	75	148	198	264	291	TOTAL FLOW

REGIONAL DETENTION FACILITY "E"
Stage Storage Discharge Data

Water Surface Elevation (Feet)	Cumulative Storage Volume (AC/FT)	Normal Outlet to Storm Drain Discharge (cfs)	Normal Outlet to Natural Channel Discharge (cfs)
22.5	0.0	0	0
23.0	0.1	0	0.7
24.0	0.7	0	1.2
26.0	2.8	18.0	1.8
28.0	5.1	32.5	2.2
30.0	7.8	42.3	2.6
32.0	10.8	50.2	5.4
33.0	12.5	53.7	17
34.0	14.2	57	41
35.0	16.0	60	81
36.0	18.0	63	138
37.0	19.8	66	170
38.0	22.0	69	240
39.0	24.1	71	364
40.0	26.4	74	456
41.0	28.8	76	556
42.0	31.2	79	671
43.0	33.8	81	796
44.0	36.4	83	933

Normal Outlet To Old Ranch Road Storm Drain

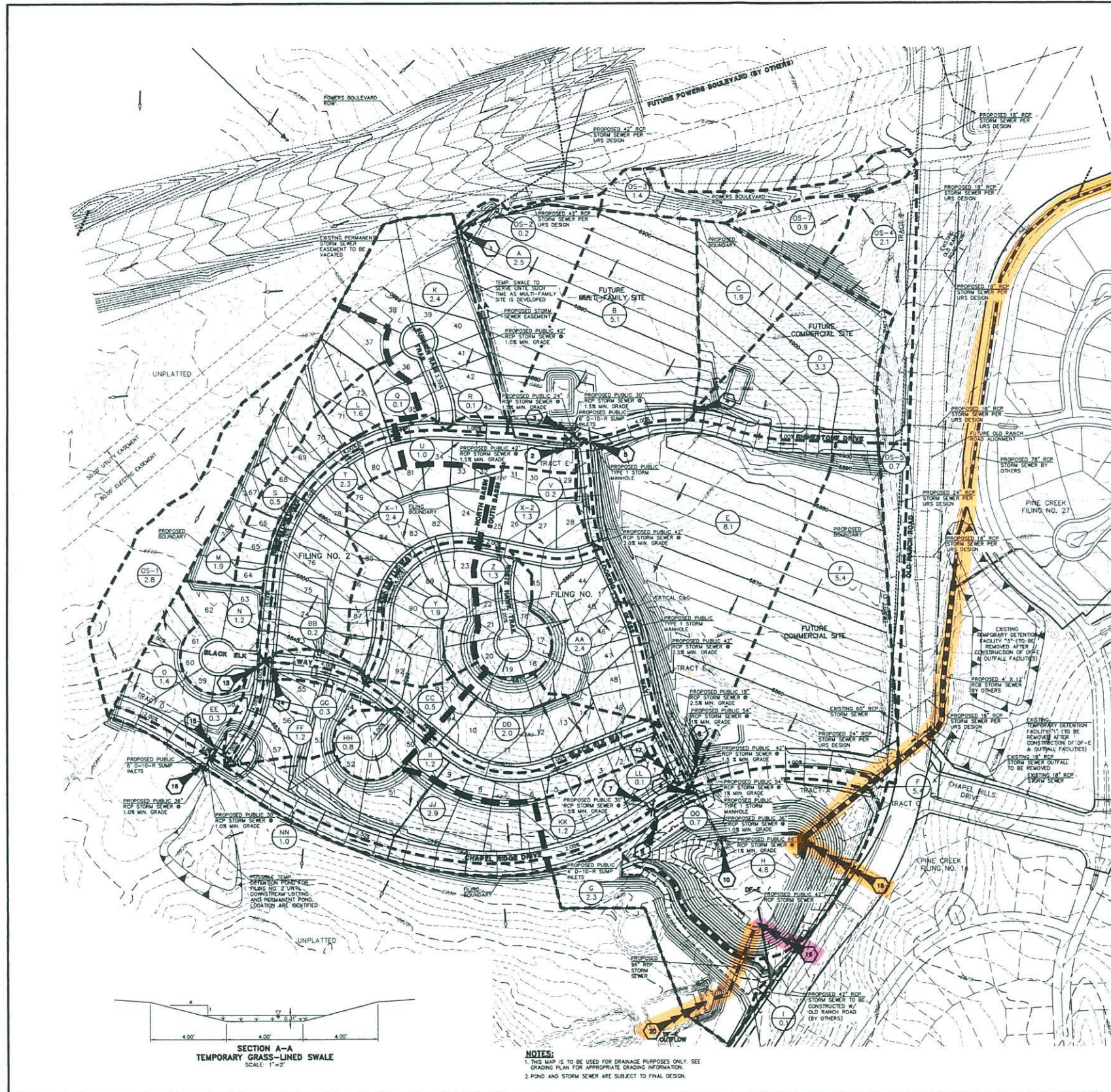
Outlet: 2.25' Diameter Vertical Orifice, Invert = 6824.0

Normal Outlet Staged To Natural Channel

Low Stage: 6" Diameter Vertical Orifice, Invert = 6822.25+/-

High Stage: 12" x 12' I.D. Reinforced Concrete Riser with 8' Diameter Outfall to the South Tributary Natural Channel, to Incorporate a 90° V-Notch Weir at Elevation 6831.0, Vertical at 6836.0 Forming a Broadcrested Weir to 6840.7, the Peak 100-year W.S.E.

In the emergency overflow condition the Q₁₀₀ inflow of 1078 cfs is planned to enter the 12' x 12' riser and outfall to the South Tributary through a proposed 8' diameter R.C.P.



REGIONAL DETENTION FACILITY "E"
STAGE STORAGE DISCHARGE DATA

WATER SURFACE ELEVATION (FEET)	CUMULATIVE STORAGE VOLUME (AC/FT)	NORMAL OUTLET TO STORM DRAIN DISCHARGE (CFS)	NORMAL OUTLET TO NATURAL CHANNEL DISCHARGE (CFS)
24.0	0.0	0	0
24.1	0.2	0	0
24.2	0.4	0	0
24.3	0.6	0	0
24.4	0.8	0	0
24.5	1.0	0	0
24.6	1.2	0	0
24.7	1.4	0	0
24.8	1.6	0	0
24.9	1.8	0	0
25.0	2.0	0	0
25.1	2.2	0	0
25.2	2.4	0	0
25.3	2.6	0	0
25.4	2.8	0	0
25.5	3.0	0	0
25.6	3.2	0	0
25.7	3.4	0	0
25.8	3.6	0	0
25.9	3.8	0	0
26.0	4.0	0	0
26.1	4.2	0	0
26.2	4.4	0	0
26.3	4.6	0	0
26.4	4.8	0	0
26.5	5.0	0	0
26.6	5.2	0	0
26.7	5.4	0	0
26.8	5.6	0	0
26.9	5.8	0	0
27.0	6.0	0	0
27.1	6.2	0	0
27.2	6.4	0	0
27.3	6.6	0	0
27.4	6.8	0	0
27.5	7.0	0	0
27.6	7.2	0	0
27.7	7.4	0	0
27.8	7.6	0	0
27.9	7.8	0	0
28.0	8.0	0	0
28.1	8.2	0	0
28.2	8.4	0	0
28.3	8.6	0	0
28.4	8.8	0	0
28.5	9.0	0	0
28.6	9.2	0	0
28.7	9.4	0	0
28.8	9.6	0	0
28.9	9.8	0	0
29.0	10.0	0	0
29.1	10.2	0	0
29.2	10.4	0	0
29.3	10.6	0	0
29.4	10.8	0	0
29.5	11.0	0	0
29.6	11.2	0	0
29.7	11.4	0	0
29.8	11.6	0	0
29.9	11.8	0	0
30.0	12.0	0	0
30.1	12.2	0	0
30.2	12.4	0	0
30.3	12.6	0	0
30.4	12.8	0	0
30.5	13.0	0	0
30.6	13.2	0	0
30.7	13.4	0	0
30.8	13.6	0	0
30.9	13.8	0	0
31.0	14.0	0	0
31.1	14.2	0	0
31.2	14.4	0	0
31.3	14.6	0	0
31.4	14.8	0	0
31.5	15.0	0	0
31.6	15.2	0	0
31.7	15.4	0	0
31.8	15.6	0	0
31.9	15.8	0	0
32.0	16.0	0	0
32.1	16.2	0	0
32.2	16.4	0	0
32.3	16.6	0	0
32.4	16.8	0	0
32.5	17.0	0	0
32.6	17.2	0	0
32.7	17.4	0	0
32.8	17.6	0	0
32.9	17.8	0	0
33.0	18.0	0	0
33.1	18.2	0	0
33.2	18.4	0	0
33.3	18.6	0	0
33.4	18.8	0	0
33.5	19.0	0	0
33.6	19.2	0	0
33.7	19.4	0	0
33.8	19.6	0	0
33.9	19.8	0	0
34.0	20.0	0	0
34.1	20.2	0	0
34.2	20.4	0	0
34.3	20.6	0	0
34.4	20.8	0	0
34.5	21.0	0	0
34.6	21.2	0	0
34.7	21.4	0	0
34.8	21.6	0	0
34.9	21.8	0	0
35.0	22.0	0	0
35.1	22.2	0	0
35.2	22.4	0	0
35.3	22.6	0	0
35.4	22.8	0	0
35.5	23.0	0	0
35.6	23.2	0	0
35.7	23.4	0	0
35.8	23.6	0	0
35.9	23.8	0	0
36.0	24.0	0	0
36.1	24.2	0	0
36.2	24.4	0	0
36.3	24.6	0	0
36.4	24.8	0	0
36.5	25.0	0	0
36.6	25.2	0	0
36.7	25.4	0	0
36.8	25.6	0	0
36.9	25.8	0	0
37.0	26.0	0	0
37.1	26.2	0	0
37.2	26.4	0	0
37.3	26.6	0	0
37.4	26.8	0	0
37.5	27.0	0	0
37.6	27.2	0	0
37.7	27.4	0	0
37.8	27.6	0	0
37.9	27.8	0	0
38.0	28.0	0	0
38.1	28.2	0	0
38.2	28.4	0	0
38.3	28.6	0	0
38.4	28.8	0	0
38.5	29.0	0	0
38.6	29.2	0	0
38.7	29.4	0	0
38.8	29.6	0	0
38.9	29.8	0	0
39.0	30.0	0	0
39.1	30.2	0	0
39.2	30.4	0	0
39.3	30.6	0	0
39.4	30.8	0	0
39.5	31.0	0	0
39.6	31.2	0	0
39.7	31.4	0	0
39.8	31.6	0	0
39.9	31.8	0	0
40.0	32.0	0	0
40.1	32.2	0	0
40.2	32.4	0	0
40.3	32.6	0	0
40.4	32.8	0	0
40.5	33.0	0	0
40.6	33.2	0	0
40.7	33.4	0	0
40.8	33.6	0	0
40.9	33.8	0	0
41.0	34.0	0	0
41.1	34.2	0	0
41.2	34.4	0	0
41.3	34.6	0	0
41.4	34.8	0	0
41.5	35.0	0	0
41.6	35.2	0	0
41.7	35.4	0	0
41.8	35.6	0	0
41.9	35.8	0	0
42.0	36.0	0	0
42.1	36.2	0	0
42.2	36.4	0	0
42.3	36.6	0	0
42.4	36.8	0	0
42.5	37.0	0	0
42.6	37.2	0	0
42.7	37.4	0	0
42.8	37.6	0	0
42.9	37.8	0	0
43.0	38.0	0	0
43.1	38.2	0	0
43.2	38.4	0	0
43.3	38.6	0	0
43.4	38.8	0	0
43.5	39.0	0	0
43.6	39.2	0	0
43.7	39.4	0	0
43.8	39.6	0	0
43.9	39.8	0	0
44.0	40.0	0	0

NORMAL OUTLET TO OLD RANCH ROAD STORM DRAIN
OUTLET: 2.25' DIAMETER VERTICAL ORIFICE, INVERT = 6824.0
NORMAL OUTLET STAGED TO NATURAL CHANNEL

LOW STAGE: 6" DIAMETER VERTICAL ORIFICE, INVERT = 6822.25
HIGH STAGE: 12" x 12" I.D. REINFORCED CONCRETE RISER WITH 8" DIAMETER OUTFALL TO THE SOUTH TRIBUTARY NATURAL CHANNEL TO INCORPORATE A 90° V-NOTCH MCR AT ELEVATION 6831.0, VERTICAL AT 6830.0 FORMING A BROADCASTED WEIR TO 6860.7, THE PEAK 100-YEAR W.S.E.

IN THE EMERGENCY OVERFLOW CONDITION THE 0100 INFLOW OF 1078 CFS IS PLANNED TO ENTER THE 12" x 12" RISER AND OUTFALL TO THE SOUTH TRIBUTARY THROUGH A PROPOSED 8" DIAMETER R.C.P.

HISTORIC CONDITION VERSUS DEVELOPED CONDITION FLOW COMPARISON
(FROM KETTLE CREEK DRAINAGE BASIN OLD RANCH TRIBUTARY DDPs/MDDP)

STORM FREQUENCY YEARS	ANALYSIS POINT "E"		
	AP-H9	AP-D12	NET DIFF
1	31	9	-22
2	109	77	-32
5	178	145	-33
10	232	202	-30
20	292	272	-20
50	382	362	-20
100	472	452	-20

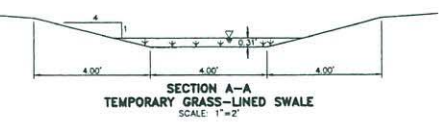
WHERE AP-H9 IS THE HISTORIC DISCHARGE TO THE CHANNEL DOWNSTREAM OF DF-E AND AP-D12 IS THE DEVELOPED DISCHARGE TO THE NATURAL CHANNEL FROM DF-E

LEGEND

DESCRIPTION	SYMBOL
EXISTING GROUND CONTOUR	--- (dashed line)
PROPOSED FINISHED CONTOUR	--- (solid line)
SUBDIVISION BOUNDARY	--- (dashed line)
LOT LINE	--- (dashed line)
BASEIN BOUNDARY	--- (dashed line)
AREA IN ACRES	(E) 8.1
PROPOSED STORM SEWER	--- (solid line)
EXISTING STORM SEWER	--- (dashed line)
STREET GRADE	--- (solid line)
EXISTING DRAINAGE ARROW	--- (arrow)

DESIGN POINT FLOW (CFS)

DESIGN POINT	FLOW (CFS)
1	Q ₁ = 25 CFS
2	Q ₂ = 55 CFS
3	Q ₃ = 2 CFS
4	Q ₄ = 4 CFS
5	Q ₅ = 21 CFS
6	Q ₆ = 48 CFS
7	Q ₇ = 22 CFS
8	Q ₈ = 40 CFS
9	Q ₉ = 142 CFS
10	Q ₁₀ = 56 CFS
11	Q ₁₁ = 103 CFS
12	Q ₁₂ = 18 CFS
13	Q ₁₃ = 41 CFS
14	Q ₁₄ = 3 CFS
15	Q ₁₅ = 5 CFS
16	Q ₁₆ = 126 CFS
17	Q ₁₇ = 223 CFS
18	Q ₁₈ = 129 CFS
19	Q ₁₉ = 223 CFS
20	Q ₂₀ = 6 CFS
21	Q ₂₁ = 12 CFS
22	Q ₂₂ = 14 CFS
23	Q ₂₃ = 28 CFS
24	Q ₂₄ = 54 CFS
25	Q ₂₅ = 5 CFS
26	Q ₂₆ = 9 CFS
27	Q ₂₇ = 14 CFS
28	Q ₂₈ = 26 CFS
29	Q ₂₉ = 337 CFS
30	Q ₃₀ = 863 CFS
31	Q ₃₁ = 470 CFS
32	Q ₃₂ = 1,079 CFS
33	Q ₃₃ = 137 CFS
34	Q ₃₄ = 600 CFS



NOTES:
1. THIS MAP IS TO BE USED FOR DRAINAGE PURPOSES ONLY. SEE GRADING PLAN FOR APPROPRIATE GRADING INFORMATION.
2. POND AND STORM SEWER ARE SUBJECT TO FINAL DESIGN.

UNPLATTED

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DATE: 11/26/03
BY: SM

REVISION: 1 REVISED PER UPDATED PIPE SIZING

H-SCALE: 1"=100'
N-SCALE: N/A
DATE: 10/14/02
DESIGNED BY: TEM
DRAWN BY: MLW
CHECKED BY:

BISON RIDGE AT KETTLE CREEK
PRELIMINARY/FINAL DRAINAGE REPORT
DRAINAGE MAP

SHEET 1 OF 1
JOB NO. 8906.00