# MASTER DEVELOPMENT
# DRAINAGE PLAN
# FOR
# JANE DAVIS RANCH SKETCH PLAN,
# EL PASO COUNTY, COLORADO

March 2024

Prepared For:

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PCD File No.: SKP232

**ENGINEER'S STATEMENT:**
The attached drainage plan was prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

_____ _____

Bryan T. Law, Colorado P.E. # 25043 Date
For and On Behalf of JR Engineering, LLC

**DEVELOPER'S STATEMENT:**
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: William Guman & Associates, Ltd.

By: _____
William Guman
Title: Owner
Address: 731 North Weber Street
Colorado Springs, CO 80903

**El Paso County:**
Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2 and Engineering Criteria Manual, as amended.

_____ _____

Joshua Palmer, P.E. Date
County Engineer/ ECM Administrator

Conditions:

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# PURPOSE

This document is the Master Development Drainage Plan (MDDP) for the proposed Jane Davis Ranch Sketch Plan. The purpose of this drainage plan is to:

1. Identify on-site and off-site drainage patterns.
2. Recommend preliminary stormwater facilities to collect and convey storm runoff from the proposed development to appropriate discharge and/or detention locations.
3. Recommend preliminary water quality and detention facilities to control discharge release rates to below historic rates.
4. Analyze drainage problems and alternate solutions. Analyze the ability of downstream drainage facilities to pass developed runoff from the proposed development.
5. Demonstrate compliance with drainage basin planning studies and master plans.

The drainage improvements proposed in this report are preliminary to support the in nature to support the Jane Davis Ranch Sketch Plan. Final Drainage Report with the development plan will be required as development and platting progresses.

# GENERAL LOCATION AND DESCRIPTION

## Location

The proposed Jane Davis Ranch development is located within the east half of the southeast quarter of Section 33 and the majority of Section 34, Township 12 South, Range 64 West of the Sixth Principal Meridian, El Paso County, Colorado. The site is bound by existing Elbert Road to the east, the north line of Section 34, Township 12 South, Range 64 West of the Sixth Principal Meridian to the north, about 630’ to the east of existing Stapleton Road to the east, and by the existing Judge Orr Road to the south. A vicinity map is presented in Appendix A.

## Description of Property

The proposed Jane Davis Ranch development contains approximately 395 acres and per the “Jane Davis Ranch Sketch Plan” will be comprised of 2.5-acre single-family lots, 5-acre single-family lots, commercial areas, neighborhood park areas, and detention pond areas. See Appendix E for the Jane Davis Ranch Sketch Plan. The site is currently unoccupied and undeveloped besides some existing dirt roads and buildings. The existing ground cover is sparse short and mixed grass prairie vegetation and natural drainageways.

Per a NRCS web soil survey of the area, the site is made up of Hydrologic Group A and D soils. Type A soils are typically deep well-drained to excessively drained sands that have a high infiltration rate when thoroughly wet. Type D soils are typically clays and soils with a high water table that have a very slow infiltration rate. Most of the developable area of the site has Type A soils. The Type D

soils are located mostly within the undevelopable floodplain area. A NRCS soil survey map is presented in Appendix A.

## Floodplain Statement

Based on the FEMA FIRM numbers 08041C0558G and 08041C0556G, both dated December 7, 2018, the site lies within Zone A, Zone AE, and Zone X. Zone A is defined as area within the Special Flood Hazard Area (SFHA) with no base flood elevations determined. Zone AE is defined as area within the SFHA with base flood elevations determined. Zone A is defined as area outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The floodplains throughout the site shall be considered no-build areas and all proposed development within the site will occur in Zone X. The FIRM panels are presented in Appendix A.

## Environmental

The "Wetland, Wildlife and Natural Features Report for Davis Subdivision in El Paso County, Colorado" by ECOS dated June 19, 2023 describes the existing environmental features of the site. No critical habitat, wildlife refuges, or hatcheries are found in the vicinity of the site. The site does have existing wetland and riparian habitats located within the drainageways. In compliance with the environmental report, these areas will not be impacted by development and will be left intact. Road corridors that must cut through these wetland and riparian areas shall be minimized and will be analyzed farther in the Final Drainage Report with the development plan. See Appendix E for excerpts of the afore mentioned environmental report.

# MAJOR DRAINAGE BASINS AND SUB-BASINS

## Major Basin Descriptions

The site lies within the Gieck Ranch Drainage Basin. As part of its drainage research, JR Engineering reviewed the following drainage studies, reports, and LOMRs:

- Gieck Ranch Drainage Basin Planning Study prepared by Drexel, Barrell & Co. in October, 2007 and revised in February 2010. (Not adopted by El Paso County as of July 2019)
- Santa Fe Springs – Haegler Ranch Drainage Basin Letter of Map Revision prepared by Tri-Core Engineering in June 2004

**Gieck Ranch Drainage Basin**

The "Gieck Ranch Drainage Basin Planning Study" has not been approved by El Paso County as of the date of this report. The Gieck Ranch Drainage Basin covers approximately 22 square miles beginning approximately 5 miles northeast of the Town of Falcon and extends approximately 15 miles to the southeast. The Gieck Ranch Drainage Bain is tributary to Black Squirrel Creek, which drains south to its confluence with the Arkansas River near Pueblo, Colorado. In general, the Gieck Ranch Drainage Basin flows from northwest to southeast across the proposed development. Within the Gieck Ranch DBPS, there are recommended drainage improvements including culverts, detention

ponds and drainage channel improvements. Excerpts of the Gieck Ranch DBPS are shown in Appendix E for information only.

As described within the Gieck Ranch DBPS, the drainage basin has been subdivided into six major drainage ways. The site is located adjacent to or within reaches of the Main Stem Channel (MS), Haegler Diversion (HD) tributary, and West Fork (WF) tributary. Approximately 1.4 square miles of the adjacent Haegler Ranch Basin is diverted into the Gieck Ranch Basin immediately upstream of the intersection of Judge Orr Road and Curtis Road. When Judge Orr Road was built, no culvert was constructed to convey the runoff from the north side of Judge Orr Road to the south. The runoff thus flows east along Judge Orr Road to the existing culvert (Structure #38) within the Gieck Ranch Basin. It was determined that this diversion will be maintained. The Gieck Ranch DBPS has recommended structures, detention ponds and drainage channel improvements. The drainage channel improvements are described as either vegetation augmentation or selective stabilization. With vegetation augmentation, native hydric species are used to augment the existing vegetation when stormwater runoff is first introduced. This allows the dry channel to transform to a wet channel without the loss of soils. Selective channel stabilization involves armoring the channel banks with riprap or other bioengineered stabilization measures. Additionally, grade control structures to prevent headcutting of the channel invert are required with selective stabilization. Developments in or around the drainageways are required to implement proper measures to maintain or create stable characteristics of the drainageway.

To the west of the Judge Orr Road and Stapleton Road intersection, the Haegler Diversion of Gieck Ranch Basin crosses onto the western side of the site. The reach upstream of the site is defined as HD-R4 and has a developed 100-year flow of 429 cfs. The DBPS recommends that the HD-R4 reach be improved by vegetation augmentation. The Haegler Diversion then continues flowing east within a parcel outside of this development scope until it once again crosses onto the site boundary at the reach defined as HD-R5. At this location, a 100-year flow of 468 cfs is anticipated in the developed condition. The DBPS recommends that the HD-R5 reach be improved by selective stabilization as well as several 4’ non-grouted riprap drop structures. The Haegler Diversion tributary then converges with the West Fork tributary of the Gieck Ranch Basin.

In the central area of the site, the West Fork of Gieck Ranch Basin crosses onto the site. The reach is defined as WF-R4d upstream of the site and has a developed 100-year flow of 242 cfs. The West Fork then continues flowing southeast along the WF-R5 reach with developed 100-year flow of 394 cfs and then the WF-R6 reach with developed 100-year flow of 698 cfs. Both the West Fork WF-R6 reach the Haegler Diversion reach DH-R5 converge to the north of the Judge Orr Road crossing. The DBPS recommends that the WF-R4d, WF-R5, and WF-R6 reaches all be improved by selective stabilization as well as several grade control structures. The DBPS also recommends that the WF-R6 reach be improved using a trapezoidal channel with a 50’ bottom width and 10:1 side slopes. The West Fork tributary then crosses Judge Orr Road via Structure #38. Structure #38 is an existing 67” x 95” CMP in good condition located at the Judge Orr Road at West Fork crossing. Per the DBPS the existing structure size is not adequate to pass the anticipated developed flow and the DBPS proposes

that 4 - 12’ x 5’ RCBC be installed. The DBPS also recommended a regional detention facility WF-SR1 be located to the north of Judge Orr Road. The pond characteristics are developed 100-year inflow of 951 cfs to the pond and 100-year flow of 753 cfs flowing out of the pond with a detention storage volume of 29 acre-feet. The DBPS states that the pond exceeds the contributing size area limitation for full-spectrum design and therefore, the water quality control volume will be provided. Flows from the proposed pond will then use either Structure #38 or Structure #39 to cross Judge Orr Road. Structure #39 is an existing 36” CMP in good condition located at Judge Orr Road to the east of Structure #38. Per the DBPS the existing structure size is adequate to pass the anticipated flow and the DBPS proposes that structure remains. The Gieck Ranch West Fork tributary is then off-site within the reach to the south of Judge Orr Road. This reach is defined as WF-R7a and has a developed 100-year flow of 753 cfs.

To the west of the existing Elbert Road, the Main Stem of Gieck Ranch Basin crosses onto the eastern side of the site. The reach upstream of the site is defined as MS-R7c and has a developed 100-year flow of 877 cfs. The DBPS recommends that the MS-R7c reach be improved by vegetation augmentation as well as several grade control structures. The Main Stem continues flowing southeast along the MS-R8a reach with developed 100-year flow of 896 cfs. The DBPS recommends that the MS-R8a reach be improved using a trapezoidal channel with a 50’ bottom width and 10:1 side slopes with vegetation augmentation. Also to the west of the existing Elbert Road the Main Stem Tributary #3 also crosses onto the site. The reach upstream of the site is defined as MST3-R1 and has a developed 100-year flow of 19 cfs. The DBPS recommends that the MST3-R1 reach be improved as needed. Downstream of this reach, the Main Stem Tributary #3 reach MST3-R1 and the Main Stem reach MS-R8a converge to the west of Structure #36. Structure #36 is an existing dual 48” CMP in good condition located at Elbert Road and Main Stem crossing. Per the DBPS the existing structure size is not adequate to pass the anticipated developed flow and the DBPS proposes that 3 – 12’ x 4’ RCBC be installed. Structure #37 is an existing 24” CMP in poor condition located along Elbert Road to the south of Structure #36. Per the DBPS the existing structure size is adequate to pass the anticipated flow and the DBPS proposes that the structure remains. The Gieck Ranch Main Stem channel is then off-site within the reach to the east of Elbert Road. This reach is defined as MS-R8b and has a developed 100-year flow of 896 cfs.

**Haegler Ranch Drainage Basin**

“The Santa Fe Springs – Haegler Ranch Drainage Basin LOMR” was executed on Haegler Ranch Tributary 2, 3, and 4. The LOMR revised the on-site effective flood zones from Zone A to Zone AE for the three drainageways. Upstream stretches of Tributary 3 are classified Zone A located on-site. See FIRM Panel 080059-0575G for limits of LOMR study and revised flood zones, presented in Appendix E.

The proposed development does not intend to change peak flows in the existing drainageways. Due to a proposed residential collector crossing the existing drainageway, it is anticipated that a LOMR will be required in the future to analyze the impacts in this area. Future reports will analyze the proposed Jane Davis Ranch drainage infrastructure and determine what is needed for the

development. Additionally, a hydraulic analysis of the drainageway will be provided at the subdivision stage of development with the Final Drainage Reports.

# JANE DAVIS RANCH BASINS AND SUB-BASINS

## Existing Sub-basin Drainage

The existing basin delineation for Jane Davis Ranch as shown on the map within Appendix F is as follows:

Basin OS1 is approximately 26.55 acres and is comprised of undeveloped areas to the west of the project site. Basin flow ($Q_5$=0 cfs, $Q_{100}$=13 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin EXA and follow the drainage patterns of that basin. The basin flows will combine at DP1.

Existing Basin EXA is approximately 19.37 acres and in the existing condition is comprised of undeveloped land and part of the FEMA floodplain. Basin flow ($Q_5$=0 cfs, $Q_{100}$=13 cfs) from this basin flows from northwest to southeast along Stapleton Road where the flows enter the existing drainage way at DP1 ($Q_5$= N/A, $Q_{100}$=429 cfs). These flows are from the reach HD-R4 within the "Gieck Ranch Drainage Basin Planning Study" by Drexel, Barrell & Co. dated October 2007. Flows then cross Stapleton Road using dual 4'x8.5' RCBC and continue flowing east within the existing drainageway.

Basin OS2 is approximately 11.56 acres and is comprised of undeveloped areas to the west of the project site. Basin flow ($Q_5$=0 cfs, $Q_{100}$=6 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin EXB and follow the drainage patterns of that basin. The basin flows will combine at DP2.

Existing Basin EXB is approximately 5.12 acres and in the existing condition is comprised of undeveloped land, an existing dirt road, and an existing building. Basin flow ($Q_5$=0 cfs, $Q_{100}$=3 cfs) from this basin flows from northwest to southeast to dual 24" RCP culverts at DP2 ($Q_5$=0 cfs, $Q_{100}$=9 cfs). The DP2 flows then cross Stapleton Road using the dual 24" RCP culverts and continue flowing east within the existing drainageway.

Basin OS3A is approximately 5.37 acres and is comprised of undeveloped areas to the west of the project site. Basin flow ($Q_5$=0 cfs, $Q_{100}$=2 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin EXC and follow the drainage patterns of that basin. The basin flows will combine at DP3.

Existing Basin EXC is approximately 54.95 acres and in the existing condition is comprised of undeveloped land and part of the FEMA floodplain. Basin flow ($Q_5$=1 cfs, $Q_{100}$=34 cfs) from this basin flows from west to east and northwest to southeast towards the existing drainageway at DP3

($Q_5$=N/A, $Q_{100}$=394 cfs). These flows are from the reach WF-R5 within the "Gieck Ranch Drainage Basin Planning Study" by Drexel, Barrell & Co. dated October 2007. The flows then continue flowing southeast within the existing drainageway.

Basin OS3B is approximately 20.89 acres and is comprised of undeveloped areas to the west of the project site. Basin flow ($Q_5$=0 cfs, $Q_{100}$=12 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin EXD and follow the drainage patterns of that basin. The basin flows will combine at DP4.

Existing Basin EXD is approximately 114.1 acres and in the existing condition is comprised of undeveloped land, part of the FEMA floodplain, existing dirt roads, and existing buildings. Basin flow ($Q_5$=1 cfs, $Q_{100}$=44 cfs) from this basin flows from northwest to southeast towards the existing drainageway at DP4 ($Q_5$=N/A, $Q_{100}$=753 cfs). These flows are from the reach WF-R7a within the "Gieck Ranch Drainage Basin Planning Study" by Drexel, Barrell & Co. dated October 2007. The flows then continue flowing southeast within the existing drainageway, Gieck Ranch West Tributary.

Basin OS3C is approximately 21.41 acres and is comprised of undeveloped areas to the northwest of the project site. Basin flow ($Q_5$=0 cfs, $Q_{100}$=9 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin EXE and follow the drainage patterns of that basin. The basin flows will combine at DP5.

Existing Basin EXE is approximately 105.2 acres and in the existing condition is comprised of undeveloped land and an existing dirt road. Basin flow ($Q_5$=1 cfs, $Q_{100}$=53 cfs) from this basin flows from northwest to southeast towards Elbert Road at DP5 ($Q_5$=1 cfs, $Q_{100}$=62 cfs). The flows then continue flowing east off-site across another property towards the existing drainageway.

Basin OS4 is approximately 60.07 acres and is comprised of undeveloped areas to the northwest of the project site. The northern basin line boundary was assumed and future further evaluation shall determine if more area is tributary to the basin from the north. Basin flow ($Q_5$=1 cfs, $Q_{100}$=33 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin EXF and follow the drainage patterns of that basin. The basin flows will combine at DP6.

Existing Basin EXF is approximately 37.91 acres and in the existing condition is comprised of undeveloped land. Basin flow ($Q_5$=0 cfs, $Q_{100}$=14 cfs) from this basin flows from west to east towards Elbert Road at DP6 ($Q_5$=1 cfs, $Q_{100}$=48 cfs). The flows then continue flowing east towards the existing drainageway.

Basin OS5 is approximately 16.65 acres and is comprised of undeveloped areas to the north of the project site. Basin flow ($Q_5$=0 cfs, $Q_{100}$=9 cfs) will follow the historic path overland from the north to the south where it will enter Basin EXG and follow the drainage patterns of that basin. The basin flows will combine at DP7.

Existing Basin EXG is approximately 16.19 acres and in the existing condition is comprised of undeveloped land, part of the FEMA floodplain, an existing dirt road, and an existing building. Basin flow ($Q_5$=0 cfs, $Q_{100}$=11 cfs) from this basin flows from northwest to southeast where flows enter the exiting drainageway at DP7 ($Q_5$=N/A, $Q_{100}$=896 cfs). These flows are from the reach MS-R8a within the "Gieck Ranch Drainage Basin Planning Study" by Drexel, Barrell & Co. dated October 2007. Flows then cross Elbert Road using dual 48" CMP culverts and continue flowing southeast within the existing drainageway.

Existing Basin EXH is approximately 44.49 acres and in the existing condition is comprised of undeveloped land, an existing dirt road, and an existing building. Basin flow ($Q_5$=0 cfs, $Q_{100}$=16 cfs) from this basin flows from north to south towards the intersection of Judge Orr Road and Elbert Road at DP8. The flows then continue flowing southeast towards the existing drainageway.

A summary of existing basin parameters is presented in Appendix B.

## Proposed Drainage Conveyance

In general, developed flows are collected in proposed roadside swales, which convey water to the proposed detention areas. Proposed rural minor collector roadways with 80' right-of-ways as well as rural local roadways with 60' right-of-ways are used throughout the site and are per the typical El Paso County section. Proposed swales will be designed per the typical county rural roadside ditch section and designed to ensure they are stable and have required capacity to satisfy criteria. A swale is considered stable with a velocity of 5 ft/s or less. To ensure capacity, swales will have a minimum of 1 ft. of freeboard over the water surface for flows anticipated in a 100-year storm event. The roadside swales shall comply with Table 6-1 of the EPC DCM Volume 1. In addition to the swales, a few proposed culverts also convey flows under proposed roadways. Culverts under paved roads will be sized to not overtop the roadways with flows from a 100-year storm event. The inlets and outlets of the proposed culverts will be protected with riprap to limit potential erosion. More detailed analysis shall be provided in the future Final Drainage Report with the development plan.

## Proposed Sub-basin Drainage

The proposed basin delineation for Jane Davis Ranch as shown on the map within Appendix F is as follows:

Basin OS1B is approximately 7.86 acres and is comprised of undeveloped areas to the west of the project site. This basin is off-site and therefore no work is proposed in this area. Flow will follow the historic path overland from the northwest to the southeast where it follows the rural local roadway to the south outfalling to the Haegler Ranch Tributary 2 floodplain at DP1 ($Q_5$=0 cfs, $Q_{100}$=4 cfs). Roadway flows will be excluded and treated in Basin A.

Basin OS1A is approximately 18.68 acres and is comprised of undeveloped areas to the west of the project site. This basin is off-site and therefore no work is proposed in this area. Flow will follow the

historic path overland from the northwest to the southeast where it will enter Basin A and follow the drainage patterns of that basin. The basin flows will combine at DP2.

Basin A is approximately 17.96 acres and in the proposed condition will be composed of a proposed rural local roadway, Parcel C, and part of Parcel B which both have a land use of large single-family lots. Runoff ($Q_5$=2 cfs, $Q_{100}$=14 cfs) from this basin will be collected in a proposed swale that runs north to south along existing Stapleton Road. Runoff from the local roadway will be captured and piped to the proposed swale and direct flows to Pond 1 at DP2 ($Q_5$=2 cfs, $Q_{100}$=27 cfs). The flows will be treated within the full-spectrum Extended Detention Basin (EDB) and then released to the existing drainageway within Basin B at DP3.

Basin B is approximately 1.48 acres and is the boundary of one of the existing floodplains that crosses the site. A proposed rural local roadway crosses the floodplain and is also the boundary of the basin. In the proposed condition, this basin will remain undeveloped as floodplains are no-build areas. The only proposed disturbances within this basin are channel improvements and drainage infrastructure to cross the roadways which will be further analyzed in detail with drainage reports submitted with the development plan. This in accordance with Section I.7.1.B.8 of the ECM Stormwater Quality Policy and Procedure. Basin flows ($Q_5$=0 cfs, $Q_{100}$=1 cfs) will follow the historic drainage pattern from west to east and flow to DP3 ($Q_5$=N/A, $Q_{100}$=429 cfs). These flows are from the reach HD-R4 within the "Gieck Ranch Drainage Basin Planning Study" by Drexel, Barrell & Co. dated October 2007. The flows then cross Stapleton Road using 4'x8.5' box culvert and continue flowing east within the existing drainage way. The flows then continue flowing east within the existing drainageway.

Basin OS2 is approximately 11.56 acres and is comprised of undeveloped areas to the west of the project site. This basin is off-site and therefore no work is proposed in this area. Runoff ($Q_5$=0 cfs, $Q_{100}$=6 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin C and follow the drainage patterns of that basin. The basin flows will combine at DP4.

Basin C is approximately 5.20 acres and in the proposed condition will be composed of a proposed rural local roadway, part of Parcel B, which has a land use of large single-family lots, and Parcel A which has a land use of commercial. Runoff ($Q_5$=5 cfs, $Q_{100}$=11 cfs) from this basin will be collected by a proposed swale running along Judge Orr Road. Runoff from the local roadway will be captured and piped to the proposed swale and direct flows to Pond 2 at DP4 ($Q_5$=5 cfs, $Q_{100}$=17 cfs). The flows will be treated within the full-spectrum EDB and then released to the existing drainageway within Basin B at DP3.

Basin D is approximately 25.91 acres and in the proposed condition will be composed of part of Parcel D, which has a land use of large single-family lots, and a proposed rural minor collector roadway. Runoff ($Q_5$=3 cfs, $Q_{100}$=15 cfs) from this basin will be collected in a proposed roadside swale that runs along the proposed minor collector. Runoff from both the north and south side of this collector shall be captured by the proposed swale and culvert that leads to Pond 3 at DP5 ($Q_5$=3 cfs,

Please identify whether the box culverts are anticipated to have capacity for this flow and/or if any improvements are needed at this crossing.

$Q_{100}$=15 cfs). The flows will be treated within the full-spectrum EDB and then released to the existing drainageway. The flows then continue flowing southeast within the existing drainage way to DP6 within Basin E2.

Basin E1 is approximately 9.11 acres and is the boundary of one of the existing floodplains that crosses the site. A proposed rural minor collector crosses the floodplain and is also the boundary of the basin. In the proposed condition, this basin will remain undeveloped as floodplains are no-build areas. The only proposed disturbances within this basin are channel improvements and drainage infrastructure to cross the roadways which will be further analyzed in detail with drainage reports submitted with the development plan. This in accordance with Section I.7.1.B.8 of the ECM Stormwater Quality Policy and Procedure. Basin flows ($Q_5$=3 cfs, $Q_{100}$=11 cfs) will follow the historic drainage pattern from northwest to southeast and flow to DP6 within Basin E2.

Basin E2 is approximately 1.17 acres and is the boundary of one of the existing floodplains that crosses the site. A proposed rural minor collector crosses the floodplain and is also the boundary of the basin. In the proposed condition, this basin will remain undeveloped as floodplains are no-build areas. The only proposed disturbances within this basin are channel improvements and drainage infrastructure to cross the roadways which will be further analyzed in detail with drainage reports submitted with the development plan. This in accordance with Section I.7.1.B.8 of the ECM Stormwater Quality Policy and Procedure. Basin flows ($Q_5$=1 cfs, $Q_{100}$=2 cfs) will follow the historic drainage pattern from northwest to southeast and flow to DP6 ($Q_5$=N/A, $Q_{100}$=394 cfs). These flows are from the reach WF-R5 within the “Gieck Ranch Drainage Basin Planning Study” by Drexel, Barrell & Co. dated October 2007. The flows then continue flowing southeast within the existing drainageway.

Basin OS3 is approximately 47.67 acres and is comprised of undeveloped areas to the northwest of the project site. This basin is off-site and therefore no work is proposed in this area. Runoff ($Q_5$=1 cfs, $Q_{100}$=33 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin F and follow the drainage patterns of that basin. The basin flows will combine at DP7.

Basin F is approximately 49.33 acres and in the proposed condition will be composed of part of Parcel M, which has a land use of large single-family lots, Parcel P that has a land use of neighborhood park, Parcel Q that has a land use of detention pond, and a proposed rural minor collector roadway. Runoff from this basin will be collected in a proposed roadside swale that runs along the proposed minor collector. Runoff from both the east and west side of this collector shall be captured by the proposed swale and culvert that leads to Pond 4 at DP7 ($Q_5$=4 cfs, $Q_{100}$=57 cfs). The flows will be treated within the full-spectrum EDB and then released to the existing drainageway. . The flows then continue flowing southeast within the existing drainage way to DP6 within Basin E2.

Basin OS4 is approximately 60.07 acres and is comprised of undeveloped areas to the northwest of the project site. This basin is off-site and therefore no work is proposed in this area. The northern

basin line boundary was assumed and future further evaluation shall determine if more area is tributary to the basin from the north. Runoff ($Q_5$=1 cfs, $Q_{100}$=33 cfs) will follow the historic path overland from the northwest to the southeast where it will enter Basin G and follow the drainage patterns of that basin. The basin flows will combine at DP8.

Basin G is approximately 53.91 acres and in the proposed condition will be composed of part of Parcel M, which has a land use of large single-family lots, part of Parcel N that has a land use of large single-family lots, Parcel S that has a land use of detention pond, and a proposed rural minor collector roadway. Runoff ($Q_5$=4 cfs, $Q_{100}$=32 cfs) from this basin will be collected in a proposed roadside swale that runs along the proposed minor collector. Runoff from both the north and south side of this collector shall be captured by the proposed swale and culvert that leads to Pond 5 at DP8 ($Q_5$=5 cfs, $Q_{100}$=65 cfs). The flows will be treated within the full-spectrum EDB and then released to the existing drainageway. The flows then continue flowing southeast within the existing drainage way to DP9 within Basin H.

Basin H is approximately 10.99 acres and is the boundary of one of the existing floodplains that crosses the site. In the proposed condition, this basin will remain undeveloped as floodplains are no-build areas. The only proposed disturbances within this basin are channel improvements which will be further analyzed in detail with drainage reports submitted with the development plan. This in accordance with Section I.7.1.B.8 of the ECM Stormwater Quality Policy and Procedure. Basin flows ($Q_5$=0 cfs, $Q_{100}$=4 cfs) will follow the historic drainage pattern from northwest to southeast and flow to DP9 ($Q_5$=N/A, $Q_{100}$=896 cfs). These flows are from the reach MS-R8a within the “Gieck Ranch Drainage Basin Planning Study” by Drexel, Barrell & Co. dated October 2007. The flows then continue flowing southeast within the existing drainageway and will cross the proposed triple 12’x4’ box culvert under Elbert Road.

Basin OS5 is approximately 16.65 acres and is comprised of undeveloped areas to the north of the project site. This basin is off-site and therefore no work is proposed in this area. Runoff ($Q_5$=0 cfs, $Q_{100}$=9 cfs) will follow the historic path overland from the north to the south where it will enter Basin I and follow the drainage patterns of that basin. The basin flows will combine at DP10.

Basin I is approximately 5.20 acres and in the proposed condition will be composed of part of Parcel N, which has a land use of large single-family lots. Runoff ($Q_5$=0 cfs, $Q_{100}$=4 cfs) from this basin will flow overland towards the existing drainageway at DP10. Runoff from this basin is comprised of only large single-family lots and does not include any proposed roadway flows. Flows will therefore follow the historic path to the existing Unnamed Tributary drainageway without a permanent stormwater quality measure and are excluded from water quality treatment. This in accordance with Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedure. The flows then continue flowing southeast within the existing drainage way to DP9 within Basin H.

Basin J is approximately 119.8 acres and in the proposed condition will be composed of Parcel L, J, F, H, and part of N which all have a land use of large single-family lots. Also within this basin is

Please provide reason for not providing detention. It appears that developed Flows from DP 12 are less than existing DP5 at this location. Please state that.

Parcel G, which has a land use of commercial, Parcel R that has a land use of detention pond, proposed rural minor collector roadways, and proposed rural local roadway. Runoff ($Q_5$=10 cfs, $Q_{100}$=60 cfs) from this basin will be collected in a proposed roadside swale that runs along the proposed residential collector. Runoff from all sides of the collectors shall be captured by the proposed swales and culverts that lead to Pond 6 at DP11. The flows will be treated within the full-spectrum EDB and then released to the existing drainageway. The flows then continue flowing southeast within the existing drainage way. The flows then continue flowing southeast within the existing drainage way to DP14 within Basin M1. A portion of this basin diverts flow from going east into the Main Stem tributary and goes south into the West Fork tributary, but since the two drainageways meet about a mile downstream, not large scale impacts are anticipated.

Basin K is approximately 29.86 acres and in the proposed condition will be composed of Parcel O and Parcel K which has a land use of large single-family lots. Runoff ($Q_5$=3 cfs, $Q_{100}$=24 cfs) from this basin will flow overland towards the existing drainageway at DP12. Runoff from this basin is comprised of only large single-family lots and does not include any proposed roadway flows. Flows will therefore follow the historic path to the existing Unnamed Tributary drainageway without a permanent stormwater quality measure and are excluded from water quality treatment. This in accordance with Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedure. The flows then continue flowing the historic drainage pattern to the Elbert Road site boundary.

Basin L is approximately 56.53 acres and in the proposed condition will be composed of Parcel I and Parcel E, which both have a land use of large single-family lots. Runoff ($Q_5$=4 cfs, $Q_{100}$=36 cfs) from this basin will flow overland towards the existing drainageway at DP13. Runoff from this basin is comprised of only large single-family lots and does not include any proposed roadway flows. Flows will therefore follow the historic path to the existing drainageway without a permanent stormwater quality measure and are excluded from water quality treatment. This in accordance with Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedure. The flows then continue flowing southeast within the existing drainage way to DP14 within Basin M1.

Basin M1 is approximately 10.55 acres and is the boundary of one of the existing floodplains that crosses the site. A proposed rural minor collector roadway crosses the floodplain and is also the boundary of the basin. In the proposed condition, this basin will remain undeveloped as floodplains are no-build areas. The only proposed disturbances within this basin are channel improvements and drainage infrastructure to cross the roadways which will be further analyzed in detail with drainage reports submitted with the development plan. This in accordance with Section I.7.1.B.8 of the ECM Stormwater Quality Policy and Procedure. Basin flows ($Q_5$=3 cfs, $Q_{100}$=10 cfs) will follow the historic drainage pattern from northwest to southeast to DP14 ($Q_5$=N/A, $Q_{100}$=753 cfs). These flows are from the reach WF-R5 within the "Gieck Ranch Drainage Basin Planning Study" by Drexel, Barrell & Co. dated October 2007. The flows then continue flowing southeast within the existing drainageway.

Per the drainage map it appears that this basins flow will be conveyed to the proposed culvert under the minor collector and then the detention pond in parcel R. The stated exclusion is water quality only therefore increased flows need to be mitigated. Please verify and revise accordingly.

Basin M2 is approximately 0.26 acres and is the boundary of one of the existing floodplains that crosses the site. A proposed rural minor collector roadway crosses the floodplain and is also the boundary of the basin. In the proposed condition, this basin will remain undeveloped as floodplains are no-build areas. The only proposed disturbances within this basin are channel improvements and drainage infrastructure to cross the roadways which will be further analyzed in detail with drainage reports submitted with the development plan. This in accordance with Section I.7.1.B.8 of the ECM Stormwater Quality Policy and Procedure. Basin flows ($Q_5$=0 cfs, $Q_{100}$=0 cfs) will follow the historic drainage pattern from northwest to southeast to DP14 within Basin M1.

A summary of proposed basin parameters is presented in Appendix B. See the table below for the water quality treatment summary table indicating which basins are treated and which are excluded.

**Table 1 –** Water Quality Treatment Summary Table

| PBMP Summary Table | | |
|---|---|---|
| Basins | Tributary Area (acres) | PBMP |
| A | 17.96 | POND 1 |
| B | 1.33 | EXCLUDED** |
| C | 5.20 | POND 2 |
| D | 26.15 | POND 3 |
| E1-E2 | 10.28 | EXCLUDED** |
| F | 49.33 | POND 4 |
| G | 53.91 | POND 5 |
| H | 10.99 | EXCLUDED** |
| I | 5.20 | EXCLUDED* |
| J | 119.80 | POND 6 |
| K | 29.86 | EXCLUDED* |
| L | 56.53 | EXCLUDED* |
| M1-M2 | 10.81 | EXCLUDED** |
| *EXCLUDED BASED ON LARGE-LOT SINGLE FAMILY SITE PER ECM APP. I.7.B.5<br>** EXCLUDED BASED ON STREAM STABILIZATION SITE PER ECM APP. I.7.B.8 | | |

# DRAINAGE DESIGN CRITERIA

## Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the “City of Colorado Spring/El Paso County Drainage Criteria Manual” Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the “Urban Storm Drainage Criteria Manual” Volumes 1 - 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the “Colorado Springs Drainage Criteria Manual (CCSDCM)”, dated May 2014, as adopted by El Paso County, as well as the July 2019 El Paso County Engineering Criteria Manual update.

## Hydrologic Criteria

All hydrologic data was obtained from the “El Paso Drainage Criteria Manual" Volumes 1 and 2, and the “Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual” Volumes 1, 2, and 3. On-site flows were determined based on the 5-year (minor) storm event and the 100-year (major) storm event. Rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Figure 6-5 of the City of Colorado Springs DCM. Runoff was calculated using CUHP Version 2.0.0, developed by Urban Drainage and Flood Control District. The model utilizes the raingage classified as “a design storm by temporal distribution of one-hour rain depths with area correction factors”. The following Colorado Springs rainfall depths were utilized in the model: 1.50 inches for 1-hour 5-year depth and 2.52 inches for 1-hour 100-year depth. The CUHP calculations and SWMM model are presented in Appendix B.

Mile High Flood District’s MHFD-Detention, Version 4.06 workbook was used for preliminary pond sizing. Required detention volumes were designed per USDCM and CCS/EPCDCM. Preliminary pond sizing spreadsheets are presented in Appendix D.

## Hydraulic Criteria

For the purposes of the Jane Davis Ranch Sketch Plan, no hydraulic analysis was performed. In reports submitted with the development plan, proposed culverts and roadside ditches shall be designed to conform to requirements set in the EPC DCM.

# DRAINAGE FACILITY DESIGN

## General Concept

The proposed stormwater conveyance system was designed to convey the developed Jane Davis Ranch flows to one of six full-spectrum EDBs via roadside ditches and roadway culverts. Pond 1 is located within Parcel B, which has a large lot single-family land use, and will detain the developed flows on-site. Pond 2 is located within Parcel A, which has a commercial land use, and will detain the developed flows on-site. Pond 3 is located within Parcel D, which has a large lot single-family land use, and will detain the developed flows on-site. Pond 4 is located within Parcel Q, which has a detention pond land use, and will detain the developed flows within this parcel. Pond 5 is located in Parcel S, which has a detention pond land use, and will detain the developed flows within this parcel. Pond 6 is located within Parcel R, which has a detention pond land use, and will detain the developed flows within this parcel. All proposed full-spectrum EDBs will be designed to release flows at less than historic to minimize adverse impacts downstream. Due to this, there are no drainage problems anticipated downstream of the Jane Davis Ranch development. The EDBs will outfall at various points of the existing drainageway and all proposed work shall stay out of the floodplain. Only stream stabilization activities shall occur in the floodplain.

The “Soil and Geology Study: Davis Subdivision” prepared by Rocky Mountain Group showed some bore test results with groundwater located within 10 feet of the surface. The test borings taken were

not located in the immediate vicinity of the proposed full-spectrum EDBs, but final pond locations may have some risk for shallow groundwater. When the final pond locations are determined with future analysis within the drainage reports submitted for development plans, additional test bore holes may be required. If shallow groundwater is an issue for any of the full-spectrum EDBs, mitigation options such as clay or geomembrane layers shall be defined in the future drainage reports.

## Four Step Process to Minimize Adverse Impacts of Urbanization

In accordance with the El Paso County Drainage Criteria Manual, Volume 2 this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes; stabilizing drainageways, treating the water quality capture volume (WQCV), and consider the need for Industrial Commercial BMP's.

Step 1, Reducing Runoff Volumes: The development of the project site is proposed as mixed commercial and large-lot single family residential (2.5 ac. min.) with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roadways will utilize roadside ditches further disconnecting impervious areas. These practices will also allow for increased infiltration and reduce runoff volume.

Step 2, Stabilize Drainageways: This site will utilize roadside ditches with culvert crossings throughout the site. These roadside ditches will then direct the on-site development flows to the multiple detention ponds within the project that will be designed to release at or below historic rates in the natural channels. The natural channels will be stabilized in reaches with high velocity by the use of drop structures incorporated at each roadway culvert crossing and isolated grade control structures where warranted per the Gieck Ranch DBPS. Based upon the proposed reduction in released flows compared to the pre-developed flows, no impact to downstream drainageways is anticipated.

Step 3, Provide WQCV: Runoff from this development will be treated through capture and slow release of the WQCV in multiple permanent detention basins that will be designed per current El Paso County drainage criteria. In accordance with Section I.7.1.B.5 of the ECM Stormwater Quality Policy and Procedure, developed basins with large lot single-family sites with a maximum of 10% impervious area shall be allowed to release runoff without a downstream permanent stormwater quality measure. In accordance with Section I.7.1.B.8, sites with constructing activity that is for the purpose of stream stabilization are also excluded from having a downstream permanent stormwater quality measure. See highlighted areas in the drainage map presented in Appendix F. Outlet structure release rates will be limited to less than historic rates to minimize adverse impacts to downstream stormwater facilities. Complete pond and outlet structure designs will be provided with the Final Drainage Report. Preliminary pond design parameters are presented in Appendix D.

Step 4, Consider the need for Industrial and Commercial BMP's: Some areas within the development propose commercial uses. A site specific storm water quality and erosion control plan

and narrative will be prepared for each future Filing. Site specific temporary source control BMPs as well as permanent BMP's will be detailed in this plan and narrative to protect receiving waters.

### Channel Analysis and Design

Detailed channel analysis and design will be provided with the development plan. Due to proposed rural local roadways crossing the existing Gieck Ranch Tributary drainageway in three locations, it is anticipated that a LOMR will be required in the future to analyze the impacts in this area. The design of the required drainage infrastructure will be defined at that time. Additionally, improvements to the existing drainageway include but are not limited to adjacent reach selective stabilization as stated in the environmental study and the Gieck Ranch DBPS.

## SUMMARY

The proposed development remains consistent with pre-development drainage conditions with the construction of the recommended drainage improvements, including ditches, culverts, detention ponds and drainage channel improvements. The proposed development will not adversely affect the offsite major drainageways or surrounding development. This report meets the latest El Paso County Drainage Criteria requirements for this site.

# REFERENCES:


1. City of Colorado Springs Drainage Criteria Manual Volume 1, City of Colorado Springs, CO, May 2014.

2. Urban Storm Drainage Criteria Manual, Urban Drainage and Flood Control District, Latest Revision.

3. Jane Davis Ranch Sketch Plan, William Guman & Associates, Ltd., April 2023.

4. Wetland, Wildlife and Natural Features Report for Davis Subdivision in El Paso County, Colorado, ECOS, June 2023.

5. Gieck Ranch Drainage Basin Planning Study, Drexel, Barrell & Co., October 2007 and revised in February 2010.

6. Letter of Map Revision Determination Document, Federal Emergency Management Agency, Febuary 16, 2005.

7. Soil and Geology Study: Davis Subdivision, Rocky Mountain Group, April 2023.

# APPENDIX A

# FIGURES AND EXHIBITS

N

2000 1000 0 2000

ORIGINAL SCALE: 1" = 2000'

VICINITY MAP
DAVIS RANCH
JOB NO. 25274.00
06/29/2023
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

# NOTES TO USERS

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Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

**Base Map** information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

**El Paso County Vertical Datum Offset Table**

| Flooding Source | Vertical Datum Offset (ft) |
|---|---|
| REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION | |

**Panel Location Map**

This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 64 WEST, AND TOWNSHIP 13 SOUTH, RANGE 64 WEST.

# LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

| | |
|---|---|
| **ZONE X** | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. |

OTHER AREAS

| | |
|---|---|
| **ZONE X** | Areas determined to be outside the 0.2% annual chance floodplain. |
| **ZONE D** | Areas in which flood hazards are undetermined, but possible. |

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

| | |
|---|---|
| | Floodplain boundary |
| | Floodway boundary |
| | Zone D Boundary |
| | CBRS and OPA boundary |
| | Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities. |
| 513 | Base Flood Elevation line and value; elevation in feet* |
| (EL 987) | Base Flood Elevation value where uniform within zone; elevation in feet* |

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

| | |
|---|---|
| A — A | Cross section line |
| 23 - - - - 23 | Transect line |
| 97° 07' 30.00"<br>32° 22' 30.00" | Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) |
| $^{4275000m}$N | 1000-meter Universal Transverse Mercator grid ticks, zone 13 |
| 6000000 FT | 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection |
| DX5510 × | Bench mark (see explanation in Notes to Users section of this FIRM panel) |
| ● M1.5 | River Mile |

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
**MARCH 17, 1997**

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
**DECEMBER 7, 2018** - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

**MAP SCALE 1" = 500'**

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

**PANEL 0558G**

# FIRM
## FLOOD INSURANCE RATE MAP
## EL PASO COUNTY, COLORADO
### AND INCORPORATED AREAS

**PANEL 558 OF 1300**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| EL PASO COUNTY | 080059 | 0558 | G |

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**
**08041C0558G**

**MAP REVISED**
**DECEMBER 7, 2018**

Federal Emergency Management Agency

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**Corporate limits** shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

**El Paso County Vertical Datum Offset Table**

| Flooding Source | Vertical Datum Offset (ft) |
|---|---|
| REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION | |

**Panel Location Map**

This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 64 WEST.

# LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| **ZONE A** | No Base Flood Elevations determined. |
| **ZONE AE** | Base Flood Elevations determined. |
| **ZONE AH** | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| **ZONE AO** | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| **ZONE AR** | Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| **ZONE A99** | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| **ZONE V** | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| **ZONE VE** | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

| | |
|---|---|
| **ZONE X** | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. |

OTHER AREAS

| | |
|---|---|
| **ZONE X** | Areas determined to be outside the 0.2% annual chance floodplain. |
| **ZONE D** | Areas in which flood hazards are undetermined, but possible. |

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

| | |
|---|---|
| | Floodplain boundary |
| | Floodway boundary |
| | Zone D Boundary |
| | CBRS and OPA boundary |
| | Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities. |
| 513 | Base Flood Elevation line and value; elevation in feet* |
| (EL 987) | Base Flood Elevation value where uniform within zone; elevation in feet* |

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

| | |
|---|---|
| A — A | Cross section line |
| 23 - - - - 23 | Transect line |
| 97° 07' 30.00"<br>32° 22' 30.00" | Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) |
| $^{42}75^{000m}$N | 1000-meter Universal Transverse Mercator grid ticks, zone 13 |
| 6000000 FT | 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection |
| DX5510 × | Bench mark (see explanation in Notes to Users section of this FIRM panel) |
| • M1.5 | River Mile |

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
**MARCH 17, 1997**

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
**DECEMBER 7, 2018** - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

**MAP SCALE 1" = 500'**

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

**PANEL 0556G**

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM

## FLOOD INSURANCE RATE MAP

## EL PASO COUNTY, COLORADO

AND INCORPORATED AREAS

**PANEL 556 OF 1300**

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

| COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| EL PASO COUNTY | 080059 | 0556 | G |

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**
**08041C0556G**

**MAP REVISED**
**DECEMBER 7, 2018**

Federal Emergency Management Agency

Hydrologic Soil Group—El Paso County Area, Colorado
(Davis Ranch)

Map Scale: 1:15,000 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 200 400 800 1200

Feet: 0 500 1000 2000 3000

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

## MAP LEGEND

**Area of Interest (AOI)**

Area of Interest (AOI)

**Soils**

**Soil Rating Polygons**

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

**Soil Rating Lines**

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

**Soil Rating Points**

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

**Water Features**

Streams and Canals

**Transportation**

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

**Background**

Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Sep 11, 2018—Oct 20, 2018

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

| Map unit symbol | Map unit name | Rating | Acres in AOI | Percent of AOI |
|---|---|---|---|---|
| 8 | Blakeland loamy sand, 1 to 9 percent slopes | A | 178.5 | 20.3% |
| 19 | Columbine gravelly sandy loam, 0 to 3 percent slopes | A | 606.1 | 69.1% |
| 29 | Fluvaquentic Haplaquolls, nearly level | D | 93.2 | 10.6% |
| **Totals for Area of Interest** | | | **877.8** | **100.0%** |

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff: None Specified*

*Tie-break Rule:* Higher

# APPENDIX B

# HYDROLOGIC CALCULATIONS

# EXISTING COMPOSITE % IMPERVIOUS/C VALUE CALCULATIONS

Subdivision: Jane Davis Ranch-Sketch Plan
Location: El Paso County

Project Name: Jane Davis Ranch
Project No.: 25274.00
Calculated By: GAG
Checked By:
Date: 3/13/24

| Basin ID | Total Area (ac) | Hardscape (100% Impervious) | | | | Undeveloped (2% Impervious) | | | | Basin Total Weighted C | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $C_5$ | $C_{100}$ | Area (ac) | Weighted % Imp. | $C_5$ | $C_{100}$ | Area (ac) | Weighted % Imp. | $C_5$ | $C_{100}$ | |
| | | | | | | | | | | | | |
| EXA | 19.37 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 19.37 | 2.0% | 0.08 | 0.35 | 2.0% |
| EXB | 5.12 | 0.90 | 0.96 | 0.12 | 2.3% | 0.08 | 0.35 | 5.00 | 2.0% | 0.10 | 0.36 | 4.3% |
| EXC | 54.95 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 54.95 | 2.0% | 0.08 | 0.35 | 2.0% |
| EXD | 114.1 | 0.90 | 0.96 | 0.17 | 0.1% | 0.08 | 0.35 | 113.95 | 2.0% | 0.08 | 0.35 | 2.1% |
| EXE | 105.2 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 105.18 | 2.0% | 0.08 | 0.35 | 2.0% |
| EXF | 37.91 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 37.91 | 2.0% | 0.08 | 0.35 | 2.0% |
| EXG | 16.19 | 0.90 | 0.96 | 0.07 | 0.4% | 0.08 | 0.35 | 16.12 | 2.0% | 0.08 | 0.35 | 2.4% |
| EXH | 44.49 | 0.90 | 0.96 | 0.16 | 0.4% | 0.08 | 0.35 | 44.33 | 2.0% | 0.08 | 0.35 | 2.4% |
| OS1 | 26.55 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 26.55 | 2.0% | 0.08 | 0.35 | 2.0% |
| OS2 | 11.56 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 11.56 | 2.0% | 0.08 | 0.35 | 2.0% |
| OS3A | 5.37 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 5.37 | 2.0% | 0.08 | 0.35 | 2.0% |
| OS3B | 20.89 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 20.89 | 2.0% | 0.08 | 0.35 | 2.0% |
| OS3C | 21.41 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 21.41 | 2.0% | 0.08 | 0.35 | 2.0% |
| OS4 | 60.07 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 60.07 | 2.0% | 0.08 | 0.35 | 2.0% |
| OS5 | 16.65 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 16.65 | 2.0% | 0.08 | 0.35 | 2.0% |
| | | | | | | | | | | | | |
| Total On-Site | 397.33 | | | | | | | | | | | 2.1% |

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| EXA | | 5 YR DESIGN STORM | 0.041 | 0.171 | 0.292 | 0.019 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| EXB | | 5 YR DESIGN STORM | 0.008 | 0.088 | 0.130 | 0.023 | 4.3 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.09 | 0.04 | 2.73 |
| EXC | | 5 YR DESIGN STORM | 0.086 | 0.186 | 0.359 | 0.024 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| EXD | | 5 YR DESIGN STORM | 0.178 | 0.455 | 0.848 | 0.021 | 2.1 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.30 |
| EXE | | 5 YR DESIGN STORM | 0.164 | 0.273 | 0.680 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| EXF | | 5 YR DESIGN STORM | 0.059 | 0.287 | 0.476 | 0.021 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| EXG | | 5 YR DESIGN STORM | 0.025 | 0.091 | 0.182 | 0.023 | 2.4 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.05 | 0.02 | 1.49 |
| EXH | | 5 YR DESIGN STORM | 0.070 | 0.301 | 0.615 | 0.023 | 2.4 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.05 | 0.02 | 1.49 |
| OS1 | | 5 YR DESIGN STORM | 0.030 | 0.077 | 0.260 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS2 | | 5 YR DESIGN STORM | 0.018 | 0.116 | 0.198 | 0.028 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS3A | | 5 YR DESIGN STORM | 0.008 | 0.072 | 0.197 | 0.023 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.00 | 0.02 | 1.22 |
| OS3B | | 5 YR DESIGN STORM | 0.033 | 0.085 | 0.304 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS3C | | 5 YR DESIGN STORM | 0.033 | 0.171 | 0.363 | 0.021 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS4 | | 5 YR DESIGN STORM | 0.094 | 0.236 | 0.420 | 0.027 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS5 | | 5 YR DESIGN STORM | 0.026 | 0.098 | 0.246 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |

**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)**

| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| EXA | 5-year | 0.158 | 0.113 | 40.3 | 3.80 | 21.0 | 2.69 | 6.3 | 31 | 96,377 | 0.01 | 1,065 | 35.0 | 0 | 1,065 | 0.01 |
| EXB | 5-year | 0.153 | 0.052 | 39.7 | 1.89 | 20.7 | 1.34 | 3.2 | 6 | 18,586 | 0.03 | 474 | 32.0 | 0 | 474 | 0.03 |
| EXC | 5-year | 0.158 | 0.157 | 31.5 | 4.10 | 16.4 | 2.90 | 6.8 | 82 | 199,469 | 0.01 | 2,203 | 34.0 | 1 | 2,203 | 0.02 |
| EXD | 5-year | 0.158 | 0.218 | 54.5 | 9.42 | 28.4 | 6.66 | 15.7 | 98 | 414,183 | 0.01 | 4,820 | 43.0 | 1 | 4,820 | 0.01 |
| EXE | 5-year | 0.158 | 0.210 | 40.2 | 6.79 | 20.9 | 4.80 | 11.3 | 123 | 381,876 | 0.01 | 4,218 | 39.0 | 1 | 4,219 | 0.01 |
| EXF | 5-year | 0.158 | 0.133 | 54.4 | 5.84 | 28.3 | 4.13 | 9.7 | 33 | 137,613 | 0.01 | 1,520 | 38.0 | 0 | 1,520 | 0.01 |
| EXG | 5-year | 0.157 | 0.090 | 28.3 | 2.26 | 14.7 | 1.59 | 3.8 | 27 | 58,770 | 0.01 | 789 | 32.0 | 0 | 789 | 0.02 |
| EXH | 5-year | 0.157 | 0.142 | 57.2 | 6.54 | 29.8 | 4.62 | 10.9 | 36 | 161,499 | 0.01 | 2,169 | 39.0 | 0 | 2,169 | 0.01 |
| OS1 | 5-year | 0.158 | 0.098 | 29.6 | 2.53 | 15.4 | 1.79 | 4.2 | 31 | 70,313 | 0.01 | 777 | 32.0 | 0 | 777 | 0.02 |
| OS2 | 5-year | 0.158 | 0.078 | 36.8 | 2.50 | 19.2 | 1.77 | 4.2 | 15 | 41,963 | 0.01 | 464 | 33.0 | 0 | 464 | 0.01 |
| OS3A | 5-year | 0.158 | 0.055 | 43.2 | 2.13 | 22.5 | 1.50 | 3.5 | 6 | 19,493 | 0.01 | 204 | 32.0 | 0 | 204 | 0.01 |
| OS3B | 5-year | 0.158 | 0.102 | 32.4 | 2.83 | 16.8 | 2.00 | 4.7 | 30 | 75,831 | 0.01 | 838 | 33.0 | 0 | 838 | 0.01 |
| OS3C | 5-year | 0.158 | 0.103 | 48.2 | 4.10 | 25.0 | 2.90 | 6.8 | 21 | 77,718 | 0.01 | 859 | 35.0 | 0 | 858 | 0.01 |
| OS4 | 5-year | 0.158 | 0.163 | 35.7 | 4.77 | 18.5 | 3.37 | 8.0 | 79 | 218,054 | 0.01 | 2,409 | 36.0 | 1 | 2,409 | 0.01 |
| OS5 | 5-year | 0.158 | 0.092 | 34.6 | 2.73 | 18.0 | 1.93 | 4.6 | 23 | 60,440 | 0.01 | 668 | 33.0 | 0 | 668 | 0.01 |

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| EXA | | 100 YR DESIGN STORM | 0.041 | 0.171 | 0.292 | 0.019 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| EXB | | 100 YR DESIGN STORM | 0.008 | 0.088 | 0.130 | 0.023 | 4.3 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.09 | 0.04 | 3.30 |
| EXC | | 100 YR DESIGN STORM | 0.086 | 0.186 | 0.359 | 0.024 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| EXD | | 100 YR DESIGN STORM | 0.178 | 0.455 | 0.848 | 0.021 | 2.1 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.59 |
| EXE | | 100 YR DESIGN STORM | 0.164 | 0.273 | 0.680 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| EXF | | 100 YR DESIGN STORM | 0.059 | 0.287 | 0.476 | 0.021 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| EXG | | 100 YR DESIGN STORM | 0.025 | 0.091 | 0.182 | 0.023 | 2.4 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.05 | 0.02 | 1.82 |
| EXH | | 100 YR DESIGN STORM | 0.070 | 0.301 | 0.615 | 0.023 | 2.4 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.05 | 0.02 | 1.82 |
| OS1 | | 100 YR DESIGN STORM | 0.030 | 0.077 | 0.260 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS2 | | 100 YR DESIGN STORM | 0.018 | 0.116 | 0.198 | 0.028 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS3A | | 100 YR DESIGN STORM | 0.008 | 0.072 | 0.197 | 0.023 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.00 | 0.02 | 1.50 |
| OS3B | | 100 YR DESIGN STORM | 0.033 | 0.085 | 0.304 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS3C | | 100 YR DESIGN STORM | 0.033 | 0.171 | 0.363 | 0.021 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS4 | | 100 YR DESIGN STORM | 0.094 | 0.236 | 0.420 | 0.027 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS5 | | 100 YR DESIGN STORM | 0.026 | 0.098 | 0.246 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |

**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)**

| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| EXA | 100-year | 0.157 | 0.112 | 40.3 | 3.78 | 21.0 | 2.67 | 6.3 | 31 | 96,377 | 0.47 | 44,883 | 44.0 | 13 | 44,883 | 0.49 |
| EXB | 100-year | 0.151 | 0.051 | 39.7 | 1.87 | 20.6 | 1.32 | 3.1 | 6 | 18,586 | 0.51 | 9,406 | 42.0 | 3 | 9,406 | 0.53 |
| EXC | 100-year | 0.157 | 0.156 | 31.5 | 4.08 | 16.4 | 2.88 | 6.8 | 82 | 199,469 | 0.47 | 92,892 | 43.0 | 34 | 92,887 | 0.62 |
| EXD | 100-year | 0.157 | 0.216 | 54.5 | 9.36 | 28.3 | 6.61 | 15.6 | 98 | 414,183 | 0.47 | 193,603 | 52.0 | 44 | 193,601 | 0.38 |
| EXE | 100-year | 0.157 | 0.209 | 40.2 | 6.75 | 20.9 | 4.77 | 11.3 | 123 | 381,876 | 0.47 | 177,840 | 47.0 | 53 | 177,842 | 0.50 |
| EXF | 100-year | 0.157 | 0.132 | 54.3 | 5.81 | 28.3 | 4.10 | 9.7 | 33 | 137,613 | 0.47 | 64,086 | 48.0 | 14 | 64,086 | 0.38 |
| EXG | 100-year | 0.156 | 0.089 | 28.3 | 2.24 | 14.7 | 1.58 | 3.7 | 27 | 58,770 | 0.47 | 27,777 | 41.0 | 11 | 27,775 | 0.67 |
| EXH | 100-year | 0.156 | 0.141 | 57.2 | 6.49 | 29.7 | 4.59 | 10.8 | 36 | 161,499 | 0.47 | 76,332 | 49.0 | 16 | 76,331 | 0.37 |
| OS1 | 100-year | 0.157 | 0.098 | 29.6 | 2.51 | 15.4 | 1.78 | 4.2 | 31 | 70,313 | 0.47 | 32,745 | 41.0 | 13 | 32,746 | 0.65 |
| OS2 | 100-year | 0.157 | 0.077 | 36.8 | 2.49 | 19.2 | 1.76 | 4.1 | 15 | 41,963 | 0.47 | 19,542 | 42.0 | 6 | 19,543 | 0.53 |
| OS3A | 100-year | 0.157 | 0.055 | 43.2 | 2.12 | 22.5 | 1.50 | 3.5 | 6 | 19,493 | 0.47 | 9,071 | 42.0 | 2 | 9,070 | 0.46 |
| OS3B | 100-year | 0.157 | 0.101 | 32.4 | 2.81 | 16.8 | 1.98 | 4.7 | 30 | 75,831 | 0.47 | 35,314 | 42.0 | 12 | 35,312 | 0.60 |
| OS3C | 100-year | 0.157 | 0.102 | 48.1 | 4.07 | 25.0 | 2.88 | 6.8 | 21 | 77,718 | 0.47 | 36,193 | 46.0 | 9 | 36,191 | 0.42 |
| OS4 | 100-year | 0.157 | 0.162 | 35.7 | 4.75 | 18.5 | 3.35 | 7.9 | 79 | 218,054 | 0.47 | 101,548 | 44.0 | 33 | 101,543 | 0.56 |
| OS5 | 100-year | 0.157 | 0.091 | 34.6 | 2.72 | 18.0 | 1.92 | 4.5 | 23 | 60,440 | 0.47 | 28,147 | 42.0 | 9 | 28,146 | 0.56 |

# PROPOSED COMPOSITE % IMPERVIOUS/C VALUE CALCULATIONS

Subdivision: Jane Davis Ranch-Sketch Plan
Location: El Paso County

Project Name: Jane Davis Ranch
Project No.: 25274.00
Calculated By: GAG
Checked By:
Date: 3/13/24

| Basin ID | Total Area (ac) | Hardscape (100% Impervious) | | | | Undeveloped (2% Impervious) | | | | Single-Family (2.5-5 acre) (0% Impervious) | | | | Commercial (95% Impervious) | | | | Park (7% Impervious) | | | | Basin Total Weighted C | | Basins Total Weighted % Imp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $C_5$ | $C_{100}$ | Area (ac) | Weighted % Imp. | $C_5$ | $C_{100}$ | Area (ac) | Weighted % Imp. | $C_5$ | $C_{100}$ | Area (ac) | Weighted % Imp. | $C_5$ | $C_{100}$ | Area (ac) | Weighted % Imp. | $C_5$ | $C_{100}$ | Area (ac) | Weighted % Imp. | $C_5$ | $C_{100}$ | |
| A | 17.96 | 0.90 | 0.96 | 0.58 | 3.2% | 0.08 | 0.35 | 0.51 | 0.1% | 0.16 | 0.41 | 16.87 | 9.4% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.18 | 0.43 | 12.7% |
| B | 1.33 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 1.33 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| C | 5.20 | 0.90 | 0.96 | 0.41 | 7.9% | 0.08 | 0.35 | 0.36 | 0.1% | 0.16 | 0.41 | 1.30 | 2.5% | 0.81 | 0.88 | 3.13 | 57.2% | 0.12 | 0.39 | 0.00 | 0.0% | 0.60 | 0.73 | 67.7% |
| D | 26.15 | 0.90 | 0.96 | 1.93 | 7.4% | 0.08 | 0.35 | 2.36 | 0.2% | 0.16 | 0.41 | 21.86 | 8.4% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.21 | 0.45 | 15.9% |
| E1 | 9.11 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 9.11 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| E2 | 1.17 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 1.17 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| F | 49.33 | 0.90 | 0.96 | 2.16 | 4.4% | 0.08 | 0.35 | 2.64 | 0.1% | 0.16 | 0.41 | 38.09 | 7.7% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 6.44 | 0.9% | 0.18 | 0.43 | 13.1% |
| G | 53.91 | 0.90 | 0.96 | 1.67 | 3.1% | 0.08 | 0.35 | 2.04 | 0.1% | 0.16 | 0.41 | 50.20 | 9.3% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.18 | 0.42 | 12.5% |
| H | 10.99 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 10.99 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| I | 5.20 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 0.00 | 0.0% | 0.16 | 0.41 | 5.20 | 10.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.16 | 0.41 | 10.0% |
| J | 119.8 | 0.90 | 0.96 | 5.70 | 4.8% | 0.08 | 0.35 | 6.42 | 0.1% | 0.16 | 0.41 | 105.63 | 8.8% | 0.81 | 0.88 | 2.05 | 1.6% | 0.12 | 0.39 | 0.00 | 0.0% | 0.20 | 0.44 | 15.3% |
| K | 29.86 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 0.00 | 0.0% | 0.16 | 0.41 | 29.86 | 10.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.16 | 0.41 | 10.0% |
| L | 56.53 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 0.00 | 0.0% | 0.16 | 0.41 | 56.53 | 10.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.16 | 0.41 | 10.0% |
| M1 | 10.55 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 10.55 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| M2 | 0.26 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 0.26 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| OS1A | 18.68 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 18.68 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| OS1B | 7.86 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 7.86 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| OS2 | 11.56 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 11.56 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| OS3 | 47.67 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 47.67 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| OS4 | 60.07 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 60.07 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| OS5 | 16.65 | 0.90 | 0.96 | 0.00 | 0.0% | 0.08 | 0.35 | 16.65 | 2.0% | 0.16 | 0.41 | 0.00 | 0.0% | 0.81 | 0.88 | 0.00 | 0.0% | 0.12 | 0.39 | 0.00 | 0.0% | 0.08 | 0.35 | 2.0% |
| Total On-Site | 397.4 | | | | | | | | | | | | | | | | | | | | | | | 12.9% |
| Total Pond 1 (Basin OS1B & A) | 36.64 | | | | | | | | | | | | | | | | | | | | | | | 7.2% |
| Total Pond 2 (Basin OS2 & B) | 16.76 | | | | | | | | | | | | | | | | | | | | | | | 22.4% |
| Total Pond 3 (Basin D) | 26.15 | | | | | | | | | | | | | | | | | | | | | | | 15.9% |
| Total Pond 4 (Basin OS3 & F) | 97.00 | | | | | | | | | | | | | | | | | | | | | | | 7.7% |
| Total Pond 5 (Basin OS4 & G) | 114.0 | | | | | | | | | | | | | | | | | | | | | | | 7.0% |
| Total Pond 6 (Basin J) | 119.8 | | | | | | | | | | | | | | | | | | | | | | | 15.3% |

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| A | | 5 YR DESIGN STORM | 0.028 | 0.066 | 0.313 | 0.020 | 12.7 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.25 | 0.11 | 8.97 |
| B | | 5 YR DESIGN STORM | 0.002 | 0.043 | 0.114 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.00 | 0.02 | 1.22 |
| C | | 5 YR DESIGN STORM | 0.008 | 0.114 | 0.210 | 0.020 | 67.7 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.92 | 0.29 | 65.04 |
| D | | 5 YR DESIGN STORM | 0.041 | 0.214 | 0.373 | 0.020 | 15.9 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.32 | 0.12 | 11.77 |
| E1 | | 5 YR DESIGN STORM | 0.014 | 0.117 | 0.197 | 0.020 | 2.0 | 0.40 | 0.10 | 3.00 | 0.50 | 0.0018 | 0.00 | 0.04 | 0.02 | 1.66 |
| E2 | | 5 YR DESIGN STORM | 0.002 | 0.031 | 0.046 | 0.020 | 2.0 | 0.40 | 0.10 | 3.00 | 0.50 | 0.0018 | 0.00 | 0.00 | 0.02 | 1.66 |
| F | | 5 YR DESIGN STORM | 0.077 | 0.277 | 0.639 | 0.020 | 13.1 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.26 | 0.11 | 9.31 |
| G | | 5 YR DESIGN STORM | 0.084 | 0.265 | 0.486 | 0.020 | 12.5 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.25 | 0.11 | 8.80 |
| H | | 5 YR DESIGN STORM | 0.017 | 0.116 | 0.319 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| I | | 5 YR DESIGN STORM | 0.008 | 0.051 | 0.132 | 0.020 | 10.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.20 | 0.10 | 6.71 |
| J | | 5 YR DESIGN STORM | 0.187 | 0.466 | 1.057 | 0.020 | 15.3 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.31 | 0.12 | 11.23 |
| K | | 5 YR DESIGN STORM | 0.047 | 0.120 | 0.235 | 0.020 | 10.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.20 | 0.10 | 6.71 |
| L | | 5 YR DESIGN STORM | 0.088 | 0.226 | 0.424 | 0.020 | 10.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.20 | 0.10 | 6.71 |
| M1 | | 5 YR DESIGN STORM | 0.016 | 0.168 | 0.259 | 0.020 | 2.0 | 0.40 | 0.10 | 3.00 | 0.50 | 0.0018 | 0.00 | 0.04 | 0.02 | 1.66 |
| M2 | | 5 YR DESIGN STORM | 0.000 | 0.027 | 0.036 | 0.020 | 0.0 | 0.40 | 0.10 | 3.00 | 0.50 | 0.0018 | 0.00 | 0.00 | 0.02 | 0.00 |
| OS1A | | 5 YR DESIGN STORM | 0.029 | 0.096 | 0.190 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS1B | | 5 YR DESIGN STORM | 0.012 | 0.072 | 0.160 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.00 | 0.02 | 1.22 |
| OS2 | | 5 YR DESIGN STORM | 0.018 | 0.116 | 0.198 | 0.028 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS3 | | 5 YR DESIGN STORM | 0.074 | 0.107 | 0.385 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS4 | | 5 YR DESIGN STORM | 0.094 | 0.236 | 0.420 | 0.027 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |
| OS5 | | 5 YR DESIGN STORM | 0.026 | 0.098 | 0.246 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.24 |

**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)**

| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| A | 5-year | 0.130 | 0.079 | 30.5 | 2.16 | 15.9 | 1.52 | 3.6 | 28 | 65,195 | 0.10 | 6,466 | 32.0 | 2 | 6,465 | 0.11 |
| B | 5-year | 0.158 | 0.029 | 50.0 | 1.43 | 26.0 | 1.01 | 2.4 | 1 | 4,828 | 0.01 | 50 | 31.0 | 0 | 50 | 0.01 |
| C | 5-year | 0.082 | 0.069 | 23.5 | 1.56 | 12.2 | 1.10 | 2.6 | 10 | 18,876 | 0.98 | 18,557 | 31.0 | 5 | 18,555 | 0.96 |
| D | 5-year | 0.123 | 0.090 | 48.5 | 3.66 | 25.2 | 2.59 | 6.1 | 25 | 94,925 | 0.14 | 13,054 | 37.0 | 3 | 13,054 | 0.10 |
| E1 | 5-year | 0.157 | 0.069 | 44.5 | 2.67 | 23.1 | 1.88 | 4.4 | 10 | 33,069 | 0.36 | 11,961 | 41.0 | 3 | 11,961 | 0.32 |
| E2 | 5-year | 0.157 | 0.028 | 29.7 | 0.93 | 15.4 | 0.65 | 1.5 | 2 | 4,247 | 0.36 | 1,536 | 35.0 | 1 | 1,535 | 0.44 |
| F | 5-year | 0.128 | 0.124 | 54.2 | 5.45 | 28.2 | 3.85 | 9.1 | 43 | 179,068 | 0.10 | 18,581 | 40.0 | 3 | 18,581 | 0.07 |
| G | 5-year | 0.130 | 0.131 | 44.7 | 4.79 | 23.3 | 3.38 | 8.0 | 56 | 195,693 | 0.10 | 18,962 | 37.0 | 4 | 18,961 | 0.08 |
| H | 5-year | 0.158 | 0.076 | 51.2 | 3.29 | 26.6 | 2.33 | 5.5 | 10 | 39,894 | 0.01 | 441 | 34.0 | 0 | 441 | 0.01 |
| I | 5-year | 0.138 | 0.048 | 31.3 | 1.45 | 16.3 | 1.03 | 2.4 | 8 | 18,876 | 0.07 | 1,316 | 31.0 | 0 | 1,316 | 0.08 |
| J | 5-year | 0.124 | 0.180 | 58.7 | 8.41 | 30.5 | 5.94 | 14.0 | 96 | 434,874 | 0.13 | 56,548 | 44.0 | 10 | 56,548 | 0.08 |
| K | 5-year | 0.138 | 0.105 | 28.4 | 2.59 | 14.8 | 1.83 | 4.3 | 49 | 108,392 | 0.07 | 7,557 | 33.0 | 3 | 7,557 | 0.09 |
| L | 5-year | 0.138 | 0.140 | 38.3 | 4.43 | 19.9 | 3.13 | 7.4 | 69 | 205,204 | 0.07 | 14,308 | 36.0 | 4 | 14,307 | 0.07 |
| M1 | 5-year | 0.157 | 0.074 | 56.4 | 3.51 | 29.3 | 2.48 | 5.8 | 9 | 38,297 | 0.36 | 13,852 | 44.0 | 3 | 13,852 | 0.26 |
| M2 | 5-year | 0.163 | 0.015 | 48.6 | 0.84 | 25.3 | 0.59 | 1.4 | 0 | 944 | 0.33 | 315 | 40.0 | 0 | 314 | 0.27 |
| OS1A | 5-year | 0.158 | 0.097 | 28.7 | 2.43 | 14.9 | 1.72 | 4.1 | 30 | 67,808 | 0.01 | 749 | 32.0 | 0 | 749 | 0.02 |
| OS1B | 5-year | 0.158 | 0.065 | 34.1 | 2.01 | 17.7 | 1.42 | 3.4 | 11 | 28,532 | 0.01 | 298 | 32.0 | 0 | 298 | 0.01 |
| OS2 | 5-year | 0.158 | 0.078 | 36.8 | 2.50 | 19.2 | 1.77 | 4.2 | 15 | 41,963 | 0.01 | 464 | 33.0 | 0 | 464 | 0.01 |
| OS3 | 5-year | 0.158 | 0.147 | 27.9 | 3.46 | 14.5 | 2.44 | 5.8 | 80 | 173,042 | 0.01 | 1,912 | 33.0 | 1 | 1,911 | 0.02 |
| OS4 | 5-year | 0.158 | 0.163 | 35.7 | 4.77 | 18.5 | 3.37 | 8.0 | 79 | 218,054 | 0.01 | 2,409 | 36.0 | 1 | 2,409 | 0.01 |
| OS5 | 5-year | 0.158 | 0.092 | 34.6 | 2.73 | 18.0 | 1.93 | 4.6 | 23 | 60,440 | 0.01 | 668 | 33.0 | 0 | 668 | 0.01 |

**Summary of CUHP Input Parameters (Version 2.0.1)**

| | | | | | | | | Depression Storage | | Horton's Infiltration Parameters | | | DCIA Level and Fractions | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | SWMM Node/ID | Raingage Name/ID | Area (sq.mi.) | Dist. to Centroid (miles) | Length (miles) | Slope (ft./ft.) | Percent Imperv. | Pervious (inches) | Imperv. (inches) | Initial Rate (in./hr.) | Final Rate (in.hr.) | Decay Coeff. (1/sec.) | DCIA Level | Dir. Con'ct Imperv. Fraction | Receiv. Perv. Fraction | Percent Eff. Imperv. |
| A | | 100 YR DESIGN STORM | 0.028 | 0.066 | 0.313 | 0.020 | 12.7 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.25 | 0.11 | 10.32 |
| B | | 100 YR DESIGN STORM | 0.002 | 0.043 | 0.114 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.00 | 0.02 | 1.50 |
| C | | 100 YR DESIGN STORM | 0.008 | 0.114 | 0.210 | 0.020 | 67.7 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.92 | 0.29 | 66.04 |
| D | | 100 YR DESIGN STORM | 0.041 | 0.214 | 0.373 | 0.020 | 15.9 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.32 | 0.12 | 13.25 |
| E1 | | 100 YR DESIGN STORM | 0.014 | 0.117 | 0.197 | 0.020 | 2.0 | 0.40 | 0.10 | 3.00 | 0.50 | 0.0018 | 0.00 | 0.04 | 0.02 | 1.79 |
| E2 | | 100 YR DESIGN STORM | 0.002 | 0.031 | 0.046 | 0.020 | 2.0 | 0.40 | 0.10 | 3.00 | 0.50 | 0.0018 | 0.00 | 0.00 | 0.02 | 1.79 |
| F | | 100 YR DESIGN STORM | 0.077 | 0.277 | 0.639 | 0.020 | 13.1 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.26 | 0.11 | 10.68 |
| G | | 100 YR DESIGN STORM | 0.084 | 0.265 | 0.486 | 0.020 | 12.5 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.25 | 0.11 | 10.14 |
| H | | 100 YR DESIGN STORM | 0.017 | 0.116 | 0.319 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| I | | 100 YR DESIGN STORM | 0.008 | 0.051 | 0.132 | 0.020 | 10.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.20 | 0.10 | 7.92 |
| J | | 100 YR DESIGN STORM | 0.187 | 0.466 | 1.057 | 0.020 | 15.3 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.31 | 0.12 | 12.70 |
| K | | 100 YR DESIGN STORM | 0.047 | 0.120 | 0.235 | 0.020 | 10.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.20 | 0.10 | 7.92 |
| L | | 100 YR DESIGN STORM | 0.088 | 0.226 | 0.424 | 0.020 | 10.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.20 | 0.10 | 7.92 |
| M1 | | 100 YR DESIGN STORM | 0.016 | 0.168 | 0.259 | 0.020 | 2.0 | 0.40 | 0.10 | 3.00 | 0.50 | 0.0018 | 0.00 | 0.04 | 0.02 | 1.79 |
| M2 | | 100 YR DESIGN STORM | 0.000 | 0.027 | 0.036 | 0.020 | 0.0 | 0.40 | 0.10 | 3.00 | 0.50 | 0.0018 | 0.00 | 0.00 | 0.02 | 0.00 |
| OS1A | | 100 YR DESIGN STORM | 0.029 | 0.096 | 0.190 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS1B | | 100 YR DESIGN STORM | 0.012 | 0.072 | 0.160 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.00 | 0.02 | 1.50 |
| OS2 | | 100 YR DESIGN STORM | 0.018 | 0.116 | 0.198 | 0.028 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS3 | | 100 YR DESIGN STORM | 0.074 | 0.107 | 0.385 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS4 | | 100 YR DESIGN STORM | 0.094 | 0.236 | 0.420 | 0.027 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |
| OS5 | | 100 YR DESIGN STORM | 0.026 | 0.098 | 0.246 | 0.020 | 2.0 | 0.40 | 0.10 | 5.00 | 1.00 | 0.0007 | 0.00 | 0.04 | 0.02 | 1.51 |

**Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)**

| | | Unit Hydrograph Parameters and Results | | | | | | | | | Excess Precip. | | Storm Hydrograph | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Catchment Name/ID | User Comment for Catchment | CT | Cp | W50 (min.) | W50 Before Peak | W75 (min.) | W75 Before Peak | Time to Peak (min.) | Peak (cfs) | Volume (c.f) | Excess (inches) | Excess (c.f.) | Time to Peak (min.) | Peak Flow (cfs) | Total Volume (c.f.) | Runoff per Unit Area (cfs/acre) |
| A | 100-year | 0.125 | 0.077 | 30.3 | 2.09 | 15.7 | 1.48 | 3.5 | 28 | 65,195 | 0.66 | 43,298 | 41.0 | 14 | 43,292 | 0.80 |
| B | 100-year | 0.157 | 0.029 | 50.0 | 1.42 | 26.0 | 1.00 | 2.4 | 1 | 4,828 | 0.47 | 2,247 | 45.0 | 1 | 2,247 | 0.40 |
| C | 100-year | 0.081 | 0.070 | 23.3 | 1.55 | 12.1 | 1.09 | 2.6 | 10 | 18,876 | 1.91 | 36,130 | 38.0 | 11 | 36,126 | 2.03 |
| D | 100-year | 0.120 | 0.089 | 48.0 | 3.59 | 25.0 | 2.54 | 6.0 | 26 | 94,925 | 0.73 | 69,245 | 46.0 | 15 | 69,246 | 0.59 |
| E1 | 100-year | 0.156 | 0.069 | 44.5 | 2.66 | 23.1 | 1.88 | 4.4 | 10 | 33,069 | 1.49 | 49,258 | 48.0 | 11 | 49,258 | 1.16 |
| E2 | 100-year | 0.156 | 0.027 | 29.7 | 0.92 | 15.4 | 0.65 | 1.5 | 2 | 4,247 | 1.49 | 6,326 | 41.0 | 2 | 6,323 | 1.53 |
| F | 100-year | 0.125 | 0.121 | 53.8 | 5.30 | 28.0 | 3.75 | 8.8 | 43 | 179,068 | 0.67 | 120,363 | 49.0 | 25 | 120,360 | 0.51 |
| G | 100-year | 0.126 | 0.127 | 44.4 | 4.62 | 23.1 | 3.27 | 7.7 | 57 | 195,693 | 0.66 | 129,182 | 46.0 | 32 | 129,182 | 0.59 |
| H | 100-year | 0.157 | 0.076 | 51.2 | 3.27 | 26.6 | 2.31 | 5.5 | 10 | 39,894 | 0.47 | 18,578 | 46.0 | 4 | 18,578 | 0.40 |
| I | 100-year | 0.134 | 0.047 | 31.2 | 1.42 | 16.2 | 1.00 | 2.4 | 8 | 18,876 | 0.61 | 11,530 | 41.0 | 4 | 11,531 | 0.74 |
| J | 100-year | 0.121 | 0.178 | 58.2 | 8.25 | 30.3 | 5.83 | 13.7 | 96 | 434,874 | 0.72 | 311,829 | 52.0 | 60 | 311,822 | 0.50 |
| K | 100-year | 0.134 | 0.102 | 28.3 | 2.52 | 14.7 | 1.78 | 4.2 | 50 | 108,392 | 0.61 | 66,209 | 41.0 | 24 | 66,209 | 0.80 |
| L | 100-year | 0.134 | 0.136 | 38.2 | 4.29 | 19.9 | 3.03 | 7.2 | 69 | 205,204 | 0.61 | 125,345 | 45.0 | 36 | 125,339 | 0.63 |
| M1 | 100-year | 0.156 | 0.074 | 56.4 | 3.50 | 29.3 | 2.47 | 5.8 | 9 | 38,297 | 1.49 | 57,044 | 53.0 | 10 | 57,044 | 0.98 |
| M2 | 100-year | 0.163 | 0.015 | 48.6 | 0.84 | 25.3 | 0.59 | 1.4 | 0 | 944 | 1.44 | 1,357 | 49.0 | 0 | 1,357 | 1.05 |
| OS1A | 100-year | 0.157 | 0.096 | 28.7 | 2.42 | 14.9 | 1.71 | 4.0 | 30 | 67,808 | 0.47 | 31,578 | 41.0 | 12 | 31,579 | 0.66 |
| OS1B | 100-year | 0.157 | 0.065 | 34.0 | 2.00 | 17.7 | 1.41 | 3.3 | 11 | 28,532 | 0.47 | 13,277 | 41.0 | 4 | 13,276 | 0.57 |
| OS2 | 100-year | 0.157 | 0.077 | 36.8 | 2.49 | 19.2 | 1.76 | 4.1 | 15 | 41,963 | 0.47 | 19,542 | 42.0 | 6 | 19,543 | 0.53 |
| OS3 | 100-year | 0.157 | 0.146 | 27.9 | 3.44 | 14.5 | 2.43 | 5.7 | 80 | 173,042 | 0.47 | 80,586 | 42.0 | 33 | 80,583 | 0.68 |
| OS4 | 100-year | 0.157 | 0.162 | 35.7 | 4.75 | 18.5 | 3.35 | 7.9 | 79 | 218,054 | 0.47 | 101,548 | 44.0 | 33 | 101,543 | 0.56 |
| OS5 | 100-year | 0.157 | 0.091 | 34.6 | 2.72 | 18.0 | 1.92 | 4.5 | 23 | 60,440 | 0.47 | 28,147 | 42.0 | 9 | 28,146 | 0.56 |

# APPENDIX C

# HYDRAULIC CALCULATIONS

# (N/A)

# APPENDIX D

# WATER QUALITY AND DETENTION CALCULATIONS

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.06 (July 2022)*

Project: Jane Davis Ranch

Basin ID: Pond 1

**Example Zone Configuration (Retention Pond)**

Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 37.00 | acres |
| Watershed Length = | 2,920 | ft |
| Watershed Length to Centroid = | 1,460 | ft |
| Watershed Slope = | 0.020 | ft/ft |
| Watershed Imperviousness = | 7.50% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.161 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.188 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.091 | acre-feet | 1.19 | inches |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.161 | acre-feet | 1.50 | inches |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.220 | acre-feet | 1.75 | inches |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.695 | acre-feet | 2.00 | inches |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 1.188 | acre-feet | 2.25 | inches |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 1.877 | acre-feet | 2.52 | inches |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 3.423 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.111 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.154 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.205 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.283 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 0.408 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 0.730 | acre-feet | | |

Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.161 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.027 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.542 | acre-feet |
| Total Detention Basin Volume = | 0.730 | acre-feet |
| Initial Surcharge Volume (ISV) = | 21 | $ft^3$ |
| Initial Surcharge Depth (ISD) = | 0.33 | ft |
| Total Available Detention Depth ($H_{total}$) = | 4.00 | ft |
| Depth of Trickle Channel ($H_{TC}$) = | 0.50 | ft |
| Slope of Trickle Channel ($S_{TC}$) = | 0.010 | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | 4 | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | 2 | |
| Initial Surcharge Area ($A_{ISV}$) = | 64 | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | 8.0 | ft |
| Surcharge Volume Width ($W_{ISV}$) = | 8.0 | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | 1.46 | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | 159.8 | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | 81.0 | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | 12,943 | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | 6,772 | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | 1.71 | ft |
| Length of Main Basin ($L_{MAIN}$) = | 173.5 | ft |
| Width of Main Basin ($W_{MAIN}$) = | 94.7 | ft |
| Area of Main Basin ($A_{MAIN}$) = | 16,424 | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | 25,050 | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | 0.732 | acre-feet |

Depth Increment = 0.25 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| Top of Micropool | 0.00 | | 8.0 | 8.0 | 64 | | 0.001 | | |
| ISV | 0.33 | | 8.0 | 8.0 | 64 | | 0.001 | 21 | 0.000 |
| | 0.50 | | 8.0 | 8.0 | 64 | | 0.001 | 32 | 0.001 |
| | 0.75 | | 8.0 | 8.0 | 64 | | 0.001 | 48 | 0.001 |
| | 1.00 | | 25.7 | 16.5 | 423 | | 0.010 | 90 | 0.002 |
| | 1.25 | | 51.7 | 29.0 | 1,497 | | 0.034 | 317 | 0.007 |
| | 1.50 | | 77.7 | 41.5 | 3,222 | | 0.074 | 893 | 0.020 |
| | 1.75 | | 103.7 | 54.0 | 5,596 | | 0.128 | 1,981 | 0.045 |
| | 2.00 | | 129.7 | 66.5 | 8,620 | | 0.198 | 3,745 | 0.086 |
| | 2.25 | | 155.7 | 79.0 | 12,295 | | 0.282 | 6,346 | 0.146 |
| Floor | 2.29 | | 159.8 | 81.0 | 12,943 | | 0.297 | 6,851 | 0.157 |
| Zone 1 (WQCV) | 2.31 | | 160.0 | 81.1 | 12,981 | | 0.298 | 7,110 | 0.163 |
| Zone 2 (EURV) | 2.40 | | 160.7 | 81.9 | 13,156 | | 0.302 | 8,286 | 0.190 |
| | 2.50 | | 161.5 | 82.7 | 13,350 | | 0.306 | 9,611 | 0.221 |
| | 2.75 | | 163.5 | 84.7 | 13,843 | | 0.318 | 13,010 | 0.299 |
| | 3.00 | | 165.5 | 86.7 | 14,343 | | 0.329 | 16,533 | 0.380 |
| | 3.25 | | 167.5 | 88.7 | 14,851 | | 0.341 | 20,182 | 0.463 |
| | 3.50 | | 169.5 | 90.7 | 15,368 | | 0.353 | 23,959 | 0.550 |
| | 3.75 | | 171.5 | 92.7 | 15,892 | | 0.365 | 27,867 | 0.640 |
| Zone 3 (100-year) | 4.00 | | 173.5 | 94.7 | 16,424 | | 0.377 | 31,906 | 0.732 |
| | 4.25 | | 175.5 | 96.7 | 16,965 | | 0.389 | 36,080 | 0.828 |
| | 4.50 | | 177.5 | 98.7 | 17,513 | | 0.402 | 40,389 | 0.927 |
| | 4.75 | | 179.5 | 100.7 | 18,069 | | 0.415 | 44,837 | 1.029 |
| | 5.00 | | 181.5 | 102.7 | 18,634 | | 0.428 | 49,424 | 1.135 |
| | 5.25 | | 183.5 | 104.7 | 19,206 | | 0.441 | 54,154 | 1.243 |
| | 5.50 | | 185.5 | 106.7 | 19,786 | | 0.454 | 59,028 | 1.355 |
| | 5.75 | | 187.5 | 108.7 | 20,375 | | 0.468 | 64,048 | 1.470 |
| | 6.00 | | 189.5 | 110.7 | 20,971 | | 0.481 | 69,216 | 1.589 |

340
255
170
85
0
Length, Width (ft.)
84000
63000
42000
21000
0
Area (sq.ft.)
0.00
6.00
12.00
18.00
24.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

1.940
1.455
0.970
0.485
0.000
Area (acres)
21.560
16.170
10.780
5.390
0.000
Volume (ac-ft)
0.00
6.00
12.00
18.00
24.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.06 (July 2022)*

Project: Jane Davis Ranch

Basin ID: Pond 2

**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 17.00 | acres |
| Watershed Length = | 1,455 | ft |
| Watershed Length to Centroid = | 730 | ft |
| Watershed Slope = | 0.019 | ft/ft |
| Watershed Imperviousness = | 22.50% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.178 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.353 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.230 | acre-feet | 1.19 | inches |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.327 | acre-feet | 1.50 | inches |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.415 | acre-feet | 1.75 | inches |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.683 | acre-feet | 2.00 | inches |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 0.937 | acre-feet | 2.25 | inches |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 1.281 | acre-feet | 2.52 | inches |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 2.031 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.219 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.294 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.373 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.480 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 0.570 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 0.737 | acre-feet | | |

## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.178 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.175 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.385 | acre-feet |
| Total Detention Basin Volume = | 0.737 | acre-feet |
| Initial Surcharge Volume (ISV) = | 23 | $ft^3$ |
| Initial Surcharge Depth (ISD) = | 0.33 | ft |
| Total Available Detention Depth ($H_{total}$) = | 4.00 | ft |
| Depth of Trickle Channel ($H_{TC}$) = | 0.50 | ft |
| Slope of Trickle Channel ($S_{TC}$) = | 0.010 | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | 4 | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | 2 | |
| Initial Surcharge Area ($A_{ISV}$) = | 70 | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | 8.4 | ft |
| Surcharge Volume Width ($W_{ISV}$) = | 8.4 | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | 1.46 | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | 160.2 | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | 81.4 | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | 13,042 | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | 6,848 | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | 1.71 | ft |
| Length of Main Basin ($L_{MAIN}$) = | 173.9 | ft |
| Width of Main Basin ($W_{MAIN}$) = | 95.1 | ft |
| Area of Main Basin ($A_{MAIN}$) = | 16,535 | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | 25,230 | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | 0.738 | acre-feet |

Depth Increment = 0.25 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| Top of Micropool | 0.00 | | 8.4 | 8.4 | 70 | | 0.002 | | |
| ISV | 0.33 | | 8.4 | 8.4 | 70 | | 0.002 | 23 | 0.001 |
| | 0.50 | | 8.4 | 8.4 | 70 | | 0.002 | 35 | 0.001 |
| | 0.75 | | 8.4 | 8.4 | 70 | | 0.002 | 53 | 0.001 |
| | 1.00 | | 26.1 | 16.9 | 441 | | 0.010 | 98 | 0.002 |
| | 1.25 | | 52.1 | 29.4 | 1,531 | | 0.035 | 331 | 0.008 |
| | 1.50 | | 78.1 | 41.9 | 3,271 | | 0.075 | 917 | 0.021 |
| | 1.75 | | 104.1 | 54.4 | 5,661 | | 0.130 | 2,020 | 0.046 |
| | 2.00 | | 130.1 | 66.9 | 8,701 | | 0.200 | 3,802 | 0.087 |
| | 2.25 | | 156.1 | 79.4 | 12,392 | | 0.284 | 6,425 | 0.147 |
| Floor | 2.29 | | 160.2 | 81.4 | 13,042 | | 0.299 | 6,934 | 0.159 |
| Zone 1 (WQCV) | 2.36 | | 160.8 | 82.0 | 13,178 | | 0.303 | 7,851 | 0.180 |
| | 2.50 | | 161.9 | 83.1 | 13,451 | | 0.309 | 9,715 | 0.223 |
| | 2.75 | | 163.9 | 85.1 | 13,945 | | 0.320 | 13,140 | 0.302 |
| Zone 2 (EURV) | 2.91 | | 165.2 | 86.4 | 14,265 | | 0.327 | 15,396 | 0.353 |
| | 3.00 | | 165.9 | 87.1 | 14,447 | | 0.332 | 16,689 | 0.383 |
| | 3.25 | | 167.9 | 89.1 | 14,957 | | 0.343 | 20,364 | 0.467 |
| | 3.50 | | 169.9 | 91.1 | 15,475 | | 0.355 | 24,168 | 0.555 |
| | 3.75 | | 171.9 | 93.1 | 16,001 | | 0.367 | 28,102 | 0.645 |
| Zone 3 (100-year) | 4.00 | | 173.9 | 95.1 | 16,535 | | 0.380 | 32,169 | 0.738 |
| | 4.25 | | 175.9 | 97.1 | 17,077 | | 0.392 | 36,370 | 0.835 |
| | 4.50 | | 177.9 | 99.1 | 17,627 | | 0.405 | 40,708 | 0.935 |
| | 4.75 | | 179.9 | 101.1 | 18,185 | | 0.417 | 45,184 | 1.037 |
| | 5.00 | | 181.9 | 103.1 | 18,751 | | 0.430 | 49,801 | 1.143 |
| | 5.25 | | 183.9 | 105.1 | 19,325 | | 0.444 | 54,560 | 1.253 |
| | 5.50 | | 185.9 | 107.1 | 19,907 | | 0.457 | 59,464 | 1.365 |
| | 5.75 | | 187.9 | 109.1 | 20,497 | | 0.471 | 64,514 | 1.481 |
| | 6.00 | | 189.9 | 111.1 | 21,095 | | 0.484 | 69,713 | 1.600 |

340
255
170
85
0
Length, Width (ft.)
84000
63000
42000
21000
0
Area (sq.ft.)
0.00
6.00
12.00
18.00
24.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

1.940
1.455
0.970
0.485
0.000
Area (acres)
21.660
16.245
10.830
5.415
0.000
Volume (ac-ft)
0.00
6.00
12.00
18.00
24.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.06 (July 2022)*

Project: Jane Davis Ranch

Basin ID: Pond 3

**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 26.50 | acres |
| Watershed Length = | 2,250 | ft |
| Watershed Length to Centroid = | 1,240 | ft |
| Watershed Slope = | 0.025 | ft/ft |
| Watershed Imperviousness = | 16.00% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.217 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.355 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.211 | acre-feet | 1.19 | inches |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.316 | acre-feet | 1.50 | inches |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.412 | acre-feet | 1.75 | inches |
| 25-yr Runoff Volume (P1 = 2 in.) = | 0.803 | acre-feet | 2.00 | inches |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 1.181 | acre-feet | 2.25 | inches |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 1.702 | acre-feet | 2.52 | inches |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 2.844 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.217 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.295 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.379 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.499 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 0.619 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 0.872 | acre-feet | | |

## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.217 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.139 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 0.517 | acre-feet |
| Total Detention Basin Volume = | 0.872 | acre-feet |
| Initial Surcharge Volume (ISV) = | 28 | $ft^3$ |
| Initial Surcharge Depth (ISD) = | 0.33 | ft |
| Total Available Detention Depth ($H_{total}$) = | 5.00 | ft |
| Depth of Trickle Channel ($H_{TC}$) = | 0.50 | ft |
| Slope of Trickle Channel ($S_{TC}$) = | 0.010 | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | 4 | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | 2 | |
| Initial Surcharge Area ($A_{ISV}$) = | 86 | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | 9.3 | ft |
| Surcharge Volume Width ($W_{ISV}$) = | 9.3 | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | 1.16 | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | 129.9 | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | 67.3 | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | 8,737 | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | 3,746 | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | 3.01 | ft |
| Length of Main Basin ($L_{MAIN}$) = | 154.0 | ft |
| Width of Main Basin ($W_{MAIN}$) = | 91.3 | ft |
| Area of Main Basin ($A_{MAIN}$) = | 14,065 | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | 34,000 | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | 0.868 | acre-feet |

Depth Increment = 0.25 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| Top of Micropool | 0.00 | | 9.3 | 9.3 | 86 | | 0.002 | | |
| ISV | 0.33 | | 9.3 | 9.3 | 86 | | 0.002 | 28 | 0.001 |
| | 0.50 | | 9.3 | 9.3 | 86 | | 0.002 | 43 | 0.001 |
| | 0.75 | | 9.3 | 9.3 | 86 | | 0.002 | 64 | 0.001 |
| | 1.00 | | 26.9 | 17.8 | 478 | | 0.011 | 115 | 0.003 |
| | 1.25 | | 52.9 | 30.3 | 1,602 | | 0.037 | 361 | 0.008 |
| | 1.50 | | 78.9 | 42.8 | 3,376 | | 0.077 | 970 | 0.022 |
| | 1.75 | | 104.9 | 55.3 | 5,799 | | 0.133 | 2,103 | 0.048 |
| Floor | 1.99 | | 129.9 | 67.3 | 8,737 | | 0.201 | 3,836 | 0.088 |
| | 2.00 | | 130.0 | 67.3 | 8,753 | | 0.201 | 3,923 | 0.090 |
| | 2.25 | | 132.0 | 69.3 | 9,152 | | 0.210 | 6,161 | 0.141 |
| | 2.50 | | 134.0 | 71.3 | 9,558 | | 0.219 | 8,500 | 0.195 |
| Zone 1 (WQCV) | 2.60 | | 134.8 | 72.1 | 9,723 | | 0.223 | 9,464 | 0.217 |
| | 2.75 | | 136.0 | 73.3 | 9,973 | | 0.229 | 10,941 | 0.251 |
| | 3.00 | | 138.0 | 75.3 | 10,396 | | 0.239 | 13,487 | 0.310 |
| Zone 2 (EURV) | 3.19 | | 139.5 | 76.9 | 10,722 | | 0.246 | 15,493 | 0.356 |
| | 3.25 | | 140.0 | 77.3 | 10,826 | | 0.249 | 16,139 | 0.371 |
| | 3.50 | | 142.0 | 79.3 | 11,265 | | 0.259 | 18,900 | 0.434 |
| | 3.75 | | 144.0 | 81.3 | 11,711 | | 0.269 | 21,772 | 0.500 |
| | 4.00 | | 146.0 | 83.3 | 12,166 | | 0.279 | 24,757 | 0.568 |
| | 4.25 | | 148.0 | 85.3 | 12,629 | | 0.290 | 27,856 | 0.639 |
| | 4.50 | | 150.0 | 87.3 | 13,099 | | 0.301 | 31,072 | 0.713 |
| | 4.75 | | 152.0 | 89.3 | 13,578 | | 0.312 | 34,406 | 0.790 |
| | 5.00 | | 154.0 | 91.3 | 14,065 | | 0.323 | 37,862 | 0.869 |
| Zone 3 (100-year) | 5.01 | | 154.1 | 91.4 | 14,084 | | 0.323 | 38,002 | 0.872 |
| | 5.25 | | 156.0 | 93.3 | 14,559 | | 0.334 | 41,439 | 0.951 |
| | 5.50 | | 158.0 | 95.3 | 15,062 | | 0.346 | 45,142 | 1.036 |
| | 5.75 | | 160.0 | 97.3 | 15,573 | | 0.357 | 48,971 | 1.124 |
| | 6.00 | | 162.0 | 99.3 | 16,091 | | 0.369 | 52,929 | 1.215 |
| | 6.25 | | 164.0 | 101.3 | 16,618 | | 0.381 | 57,017 | 1.309 |
| | 6.50 | | 166.0 | 103.3 | 17,153 | | 0.394 | 61,238 | 1.406 |
| | 6.75 | | 168.0 | 105.3 | 17,695 | | 0.406 | 65,594 | 1.506 |
| | 7.00 | | 170.0 | 107.3 | 18,246 | | 0.419 | 70,087 | 1.609 |

320
240
160
80
0
Length, Width (ft.)
72400
54300
36200
18100
0
Area (sq.ft.)
0.00
6.00
12.00
18.00
24.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

1.660
1.245
0.830
0.415
0.000
Area (acres)
17.660
13.245
8.830
4.415
0.000
Volume (ac-ft)
0.00
6.00
12.00
18.00
24.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.06 (July 2022)*

Project: Jane Davis Ranch

Basin ID: Pond 4

**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 97.50 | acres |
| Watershed Length = | 4,885 | ft |
| Watershed Length to Centroid = | 2,450 | ft |
| Watershed Slope = | 0.020 | ft/ft |
| Watershed Imperviousness = | 8.00% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.449 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.538 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.261 | acre-feet | 1.19 | inches |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.458 | acre-feet | 1.50 | inches |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.623 | acre-feet | 1.75 | inches |
| 25-yr Runoff Volume (P1 = 2 in.) = | 1.887 | acre-feet | 2.00 | inches |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 3.192 | acre-feet | 2.25 | inches |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 5.017 | acre-feet | 2.52 | inches |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 9.098 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.319 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.441 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.587 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.805 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 1.142 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 1.999 | acre-feet | | |

## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.449 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.089 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 1.460 | acre-feet |
| Total Detention Basin Volume = | 1.999 | acre-feet |
| Initial Surcharge Volume (ISV) = | 59 | $ft^3$ |
| Initial Surcharge Depth (ISD) = | 0.33 | ft |
| Total Available Detention Depth ($H_{total}$) = | 5.00 | ft |
| Depth of Trickle Channel ($H_{TC}$) = | 0.50 | ft |
| Slope of Trickle Channel ($S_{TC}$) = | 0.010 | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | 4 | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | 2 | |
| Initial Surcharge Area ($A_{ISV}$) = | 178 | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | 13.3 | ft |
| Surcharge Volume Width ($W_{ISV}$) = | 13.3 | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | 2.17 | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | 239.0 | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | 121.8 | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | 29,120 | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | 22,838 | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | 2.00 | ft |
| Length of Main Basin ($L_{MAIN}$) = | 255.0 | ft |
| Width of Main Basin ($W_{MAIN}$) = | 137.8 | ft |
| Area of Main Basin ($A_{MAIN}$) = | 35,149 | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | 64,174 | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | 2.001 | acre-feet |

Depth Increment = 0.25 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| Top of Micropool | 0.00 | | 13.3 | 13.3 | 178 | | 0.004 | | |
| ISV | 0.33 | | 13.3 | 13.3 | 178 | | 0.004 | 59 | 0.001 |
| | 0.50 | | 13.3 | 13.3 | 178 | | 0.004 | 89 | 0.002 |
| | 0.75 | | 13.3 | 13.3 | 178 | | 0.004 | 133 | 0.003 |
| | 1.00 | | 31.0 | 21.8 | 677 | | 0.016 | 216 | 0.005 |
| | 1.25 | | 57.0 | 34.3 | 1,957 | | 0.045 | 532 | 0.012 |
| | 1.50 | | 83.0 | 46.8 | 3,888 | | 0.089 | 1,249 | 0.029 |
| | 1.75 | | 109.0 | 59.3 | 6,468 | | 0.148 | 2,530 | 0.058 |
| | 2.00 | | 135.0 | 71.8 | 9,698 | | 0.223 | 4,537 | 0.104 |
| | 2.25 | | 161.0 | 84.3 | 13,579 | | 0.312 | 7,433 | 0.171 |
| | 2.50 | | 187.0 | 96.8 | 18,109 | | 0.416 | 11,381 | 0.261 |
| | 2.75 | | 213.0 | 109.3 | 23,289 | | 0.535 | 16,542 | 0.380 |
| Zone 1 (WQCV) | 2.88 | | 226.5 | 115.8 | 26,240 | | 0.602 | 19,759 | 0.454 |
| Floor | 3.00 | | 239.0 | 121.8 | 29,120 | | 0.668 | 23,079 | 0.530 |
| Zone 2 (EURV) | 3.02 | | 239.2 | 122.0 | 29,177 | | 0.670 | 23,662 | 0.543 |
| | 3.25 | | 241.0 | 123.8 | 29,845 | | 0.685 | 30,450 | 0.699 |
| | 3.50 | | 243.0 | 125.8 | 30,579 | | 0.702 | 38,003 | 0.872 |
| | 3.75 | | 245.0 | 127.8 | 31,321 | | 0.719 | 45,740 | 1.050 |
| | 4.00 | | 247.0 | 129.8 | 32,070 | | 0.736 | 53,664 | 1.232 |
| | 4.25 | | 249.0 | 131.8 | 32,828 | | 0.754 | 61,776 | 1.418 |
| | 4.50 | | 251.0 | 133.8 | 33,594 | | 0.771 | 70,078 | 1.609 |
| | 4.75 | | 253.0 | 135.8 | 34,367 | | 0.789 | 78,573 | 1.804 |
| Zone 3 (100-year) | 5.00 | | 255.0 | 137.8 | 35,149 | | 0.807 | 87,263 | 2.003 |
| | 5.25 | | 257.0 | 139.8 | 35,939 | | 0.825 | 96,149 | 2.207 |
| | 5.50 | | 259.0 | 141.8 | 36,737 | | 0.843 | 105,233 | 2.416 |
| | 5.75 | | 261.0 | 143.8 | 37,542 | | 0.862 | 114,518 | 2.629 |
| | 6.00 | | 263.0 | 145.8 | 38,356 | | 0.881 | 124,005 | 2.847 |
| | 6.25 | | 265.0 | 147.8 | 39,178 | | 0.899 | 133,696 | 3.069 |
| | 6.50 | | 267.0 | 149.8 | 40,007 | | 0.918 | 143,594 | 3.296 |
| | 6.75 | | 269.0 | 151.8 | 40,845 | | 0.938 | 153,701 | 3.528 |
| | 7.00 | | 271.0 | 153.8 | 41,691 | | 0.957 | 164,017 | 3.765 |

420
315
210
105
0
Length, Width (ft.)
118000
88500
59000
29500
0
Area (sq.ft.)
0.00
6.00
12.00
18.00
24.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

2.720
2.040
1.360
0.680
0.000
Area (acres)
33.720
25.290
16.860
8.430
0.000
Volume (ac-ft)
0.00
6.00
12.00
18.00
24.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.06 (July 2022)*

Project: Jane Davis Ranch

Basin ID: Pond 5

**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 114.00 | acres |
| Watershed Length = | 4,575 | ft |
| Watershed Length to Centroid = | 2,300 | ft |
| Watershed Slope = | 0.025 | ft/ft |
| Watershed Imperviousness = | 7.00% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.466 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 0.531 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.257 | acre-feet | 1.19 | inches |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 0.457 | acre-feet | 1.50 | inches |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 0.625 | acre-feet | 1.75 | inches |
| 25-yr Runoff Volume (P1 = 2 in.) = | 2.072 | acre-feet | 2.00 | inches |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 3.585 | acre-feet | 2.25 | inches |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 5.694 | acre-feet | 2.52 | inches |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 10.445 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.313 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 0.434 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 0.580 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 0.804 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 1.179 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 2.162 | acre-feet | | |

## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.466 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.064 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 1.631 | acre-feet |
| Total Detention Basin Volume = | 2.162 | acre-feet |
| Initial Surcharge Volume (ISV) = | 61 | $ft^3$ |
| Initial Surcharge Depth (ISD) = | 0.33 | ft |
| Total Available Detention Depth ($H_{total}$) = | 5.00 | ft |
| Depth of Trickle Channel ($H_{TC}$) = | 0.50 | ft |
| Slope of Trickle Channel ($S_{TC}$) = | 0.010 | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | 4 | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | 2 | |
| Initial Surcharge Area ($A_{ISV}$) = | 185 | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | 13.6 | ft |
| Surcharge Volume Width ($W_{ISV}$) = | 13.6 | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | 2.32 | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | 254.9 | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | 129.6 | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | 33,028 | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | 27,594 | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | 1.85 | ft |
| Length of Main Basin ($L_{MAIN}$) = | 269.7 | ft |
| Width of Main Basin ($W_{MAIN}$) = | 144.4 | ft |
| Area of Main Basin ($A_{MAIN}$) = | 38,937 | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | 66,493 | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | 2.163 | acre-feet |

Depth Increment = 0.25 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| Top of Micropool | 0.00 | | 13.6 | 13.6 | 185 | | 0.004 | | |
| ISV | 0.33 | | 13.6 | 13.6 | 185 | | 0.004 | 61 | 0.001 |
| | 0.50 | | 13.6 | 13.6 | 185 | | 0.004 | 92 | 0.002 |
| | 0.75 | | 13.6 | 13.6 | 185 | | 0.004 | 138 | 0.003 |
| | 1.00 | | 31.3 | 22.1 | 691 | | 0.016 | 223 | 0.005 |
| | 1.25 | | 57.3 | 34.6 | 1,981 | | 0.045 | 544 | 0.012 |
| | 1.50 | | 83.3 | 47.1 | 3,921 | | 0.090 | 1,268 | 0.029 |
| | 1.75 | | 109.3 | 59.6 | 6,511 | | 0.149 | 2,558 | 0.059 |
| | 2.00 | | 135.3 | 72.1 | 9,751 | | 0.224 | 4,578 | 0.105 |
| | 2.25 | | 161.3 | 84.6 | 13,641 | | 0.313 | 7,488 | 0.172 |
| | 2.50 | | 187.3 | 97.1 | 18,182 | | 0.417 | 11,453 | 0.263 |
| | 2.75 | | 213.3 | 109.6 | 23,372 | | 0.537 | 16,633 | 0.382 |
| Zone 1 (WQCV) | 2.90 | | 228.9 | 117.1 | 26,798 | | 0.615 | 20,393 | 0.468 |
| Zone 2 (EURV) | 3.00 | | 239.3 | 122.1 | 29,212 | | 0.671 | 23,193 | 0.532 |
| Floor | 3.15 | | 254.9 | 129.6 | 33,028 | | 0.758 | 27,858 | 0.640 |
| | 3.25 | | 255.7 | 130.4 | 33,336 | | 0.765 | 31,176 | 0.716 |
| | 3.50 | | 257.7 | 132.4 | 34,112 | | 0.783 | 39,607 | 0.909 |
| | 3.75 | | 259.7 | 134.4 | 34,896 | | 0.801 | 48,233 | 1.107 |
| | 4.00 | | 261.7 | 136.4 | 35,689 | | 0.819 | 57,056 | 1.310 |
| | 4.25 | | 263.7 | 138.4 | 36,489 | | 0.838 | 66,078 | 1.517 |
| | 4.50 | | 265.7 | 140.4 | 37,297 | | 0.856 | 75,301 | 1.729 |
| | 4.75 | | 267.7 | 142.4 | 38,113 | | 0.875 | 84,727 | 1.945 |
| Zone 3 (100-year) | 5.00 | | 269.7 | 144.4 | 38,937 | | 0.894 | 94,358 | 2.166 |
| | 5.25 | | 271.7 | 146.4 | 39,769 | | 0.913 | 104,196 | 2.392 |
| | 5.50 | | 273.7 | 148.4 | 40,609 | | 0.932 | 114,243 | 2.623 |
| | 5.75 | | 275.7 | 150.4 | 41,457 | | 0.952 | 124,501 | 2.858 |
| | 6.00 | | 277.7 | 152.4 | 42,313 | | 0.971 | 134,972 | 3.099 |
| | 6.25 | | 279.7 | 154.4 | 43,178 | | 0.991 | 145,658 | 3.344 |
| | 6.50 | | 281.7 | 156.4 | 44,050 | | 1.011 | 156,562 | 3.594 |
| | 6.75 | | 283.7 | 158.4 | 44,930 | | 1.031 | 167,684 | 3.849 |
| | 7.00 | | 285.7 | 160.4 | 45,818 | | 1.052 | 179,027 | 4.110 |

440
330
220
110
0
Length, Width (ft.)
125200
93900
62600
31300
0
Area (sq.ft.)
0.00
6.00
12.00
18.00
24.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

2.880
2.160
1.440
0.720
0.000
Area (acres)
36.240
27.180
18.120
9.060
0.000
Volume (ac-ft)
0.00
6.00
12.00
18.00
24.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

# DETENTION BASIN STAGE-STORAGE TABLE BUILDER

*MHFD-Detention, Version 4.06 (July 2022)*

Project: Jane Davis Ranch

Basin ID: Pond 6

**Example Zone Configuration (Retention Pond)**

## Watershed Information

| | | |
|---|---|---|
| Selected BMP Type = | EDB | |
| Watershed Area = | 120.00 | acres |
| Watershed Length = | 5,580 | ft |
| Watershed Length to Centroid = | 2,460 | ft |
| Watershed Slope = | 0.020 | ft/ft |
| Watershed Imperviousness = | 15.50% | percent |
| Percentage Hydrologic Soil Group A = | 100.0% | percent |
| Percentage Hydrologic Soil Group B = | 0.0% | percent |
| Percentage Hydrologic Soil Groups C/D = | 0.0% | percent |
| Target WQCV Drain Time = | 40.0 | hours |
| Location for 1-hr Rainfall Depths = | User Input | |

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

| | | | Optional User Overrides | |
|---|---|---|---|---|
| Water Quality Capture Volume (WQCV) = | 0.957 | acre-feet | | acre-feet |
| Excess Urban Runoff Volume (EURV) = | 1.545 | acre-feet | | acre-feet |
| 2-yr Runoff Volume (P1 = 1.19 in.) = | 0.911 | acre-feet | 1.19 | inches |
| 5-yr Runoff Volume (P1 = 1.5 in.) = | 1.372 | acre-feet | 1.50 | inches |
| 10-yr Runoff Volume (P1 = 1.75 in.) = | 1.788 | acre-feet | 1.75 | inches |
| 25-yr Runoff Volume (P1 = 2 in.) = | 3.554 | acre-feet | 2.00 | inches |
| 50-yr Runoff Volume (P1 = 2.25 in.) = | 5.260 | acre-feet | 2.25 | inches |
| 100-yr Runoff Volume (P1 = 2.52 in.) = | 7.614 | acre-feet | 2.52 | inches |
| 500-yr Runoff Volume (P1 = 3.14 in.) = | 12.783 | acre-feet | | inches |
| Approximate 2-yr Detention Volume = | 0.944 | acre-feet | | |
| Approximate 5-yr Detention Volume = | 1.281 | acre-feet | | |
| Approximate 10-yr Detention Volume = | 1.651 | acre-feet | | |
| Approximate 25-yr Detention Volume = | 2.175 | acre-feet | | |
| Approximate 50-yr Detention Volume = | 2.710 | acre-feet | | |
| Approximate 100-yr Detention Volume = | 3.854 | acre-feet | | |

## Define Zones and Basin Geometry

| | | |
|---|---|---|
| Zone 1 Volume (WQCV) = | 0.957 | acre-feet |
| Zone 2 Volume (EURV - Zone 1) = | 0.588 | acre-feet |
| Zone 3 Volume (100-year - Zones 1 & 2) = | 2.309 | acre-feet |
| Total Detention Basin Volume = | 3.854 | acre-feet |
| Initial Surcharge Volume (ISV) = | 125 | $ft^3$ |
| Initial Surcharge Depth (ISD) = | 0.33 | ft |
| Total Available Detention Depth ($H_{total}$) = | 6.00 | ft |
| Depth of Trickle Channel ($H_{TC}$) = | 0.50 | ft |
| Slope of Trickle Channel ($S_{TC}$) = | 0.010 | ft/ft |
| Slopes of Main Basin Sides ($S_{main}$) = | 4 | H:V |
| Basin Length-to-Width Ratio ($R_{L/W}$) = | 2 | |
| Initial Surcharge Area ($A_{ISV}$) = | 379 | $ft^2$ |
| Surcharge Volume Length ($L_{ISV}$) = | 19.5 | ft |
| Surcharge Volume Width ($W_{ISV}$) = | 19.5 | ft |
| Depth of Basin Floor ($H_{FLOOR}$) = | 2.64 | ft |
| Length of Basin Floor ($L_{FLOOR}$) = | 294.0 | ft |
| Width of Basin Floor ($W_{FLOOR}$) = | 151.5 | ft |
| Area of Basin Floor ($A_{FLOOR}$) = | 44,535 | $ft^2$ |
| Volume of Basin Floor ($V_{FLOOR}$) = | 43,140 | $ft^3$ |
| Depth of Main Basin ($H_{MAIN}$) = | 2.53 | ft |
| Length of Main Basin ($L_{MAIN}$) = | 314.3 | ft |
| Width of Main Basin ($W_{MAIN}$) = | 171.7 | ft |
| Area of Main Basin ($A_{MAIN}$) = | 53,962 | $ft^2$ |
| Volume of Main Basin ($V_{MAIN}$) = | 124,408 | $ft^3$ |
| Calculated Total Basin Volume ($V_{total}$) = | 3.854 | acre-feet |

Depth Increment = 0.25 ft

| Stage - Storage Description | Stage (ft) | Optional Override Stage (ft) | Length (ft) | Width (ft) | Area ($ft^2$) | Optional Override Area ($ft^2$) | Area (acre) | Volume ($ft^3$) | Volume (ac-ft) |
|---|---|---|---|---|---|---|---|---|---|
| Top of Micropool | 0.00 | | 19.5 | 19.5 | 379 | | 0.009 | | |
| ISV | 0.33 | | 19.5 | 19.5 | 379 | | 0.009 | 125 | 0.003 |
| | 0.50 | | 19.5 | 19.5 | 379 | | 0.009 | 189 | 0.004 |
| | 0.75 | | 19.5 | 19.5 | 379 | | 0.009 | 284 | 0.007 |
| | 1.00 | | 37.1 | 28.0 | 1,039 | | 0.024 | 431 | 0.010 |
| | 1.25 | | 63.1 | 40.5 | 2,555 | | 0.059 | 867 | 0.020 |
| | 1.50 | | 89.1 | 53.0 | 4,722 | | 0.108 | 1,763 | 0.040 |
| | 1.75 | | 115.1 | 65.5 | 7,538 | | 0.173 | 3,282 | 0.075 |
| | 2.00 | | 141.1 | 78.0 | 11,005 | | 0.253 | 5,586 | 0.128 |
| | 2.25 | | 167.1 | 90.5 | 15,121 | | 0.347 | 8,838 | 0.203 |
| | 2.50 | | 193.1 | 103.0 | 19,888 | | 0.457 | 13,201 | 0.303 |
| | 2.75 | | 219.1 | 115.5 | 25,304 | | 0.581 | 18,836 | 0.432 |
| | 3.00 | | 245.1 | 128.0 | 31,371 | | 0.720 | 25,907 | 0.595 |
| | 3.25 | | 271.1 | 140.5 | 38,087 | | 0.874 | 34,576 | 0.794 |
| Zone 1 (WQCV) | 3.43 | | 289.9 | 149.5 | 43,326 | | 0.995 | 41,898 | 0.962 |
| Floor | 3.47 | | 294.0 | 151.5 | 44,535 | | 1.022 | 43,655 | 1.002 |
| | 3.50 | | 294.3 | 151.7 | 44,642 | | 1.025 | 44,993 | 1.033 |
| | 3.75 | | 296.3 | 153.7 | 45,538 | | 1.045 | 56,265 | 1.292 |
| Zone 2 (EURV) | 4.00 | | 298.3 | 155.7 | 46,442 | | 1.066 | 67,763 | 1.556 |
| | 4.25 | | 300.3 | 157.7 | 47,354 | | 1.087 | 79,487 | 1.825 |
| | 4.50 | | 302.3 | 159.7 | 48,274 | | 1.108 | 91,440 | 2.099 |
| | 4.75 | | 304.3 | 161.7 | 49,202 | | 1.130 | 103,625 | 2.379 |
| | 5.00 | | 306.3 | 163.7 | 50,138 | | 1.151 | 116,042 | 2.664 |
| | 5.25 | | 308.3 | 165.7 | 51,082 | | 1.173 | 128,695 | 2.954 |
| | 5.50 | | 310.3 | 167.7 | 52,034 | | 1.195 | 141,584 | 3.250 |
| | 5.75 | | 312.3 | 169.7 | 52,994 | | 1.217 | 154,712 | 3.552 |
| Zone 3 (100-year) | 6.00 | | 314.3 | 171.7 | 53,962 | | 1.239 | 168,081 | 3.859 |
| | 6.25 | | 316.3 | 173.7 | 54,938 | | 1.261 | 181,694 | 4.171 |
| | 6.50 | | 318.3 | 175.7 | 55,922 | | 1.284 | 195,551 | 4.489 |
| | 6.75 | | 320.3 | 177.7 | 56,914 | | 1.307 | 209,655 | 4.813 |
| | 7.00 | | 322.3 | 179.7 | 57,914 | | 1.330 | 224,009 | 5.143 |
| | 7.25 | | 324.3 | 181.7 | 58,922 | | 1.353 | 238,613 | 5.478 |
| | 7.50 | | 326.3 | 183.7 | 59,938 | | 1.376 | 253,470 | 5.819 |
| | 7.75 | | 328.3 | 185.7 | 60,962 | | 1.399 | 268,582 | 6.166 |
| | 8.00 | | 330.3 | 187.7 | 61,993 | | 1.423 | 283,952 | 6.519 |

460
345
230
115
0
Length, Width (ft.)
144800
108600
72400
36200
0
Area (sq.ft.)
0.00
6.00
12.00
18.00
24.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

3.340
2.505
1.670
0.835
0.000
Area (acres)
43.480
32.610
21.740
10.870
0.000
Volume (ac-ft)
0.00
6.00
12.00
18.00
24.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

# APPENDIX E

# REFERENCE MATERIALS

# Wetland, Wildlife and Natural Features Report
# for
# Davis Subdivision in El Paso County, Colorado

June 19, 2023

**Prepared for:**

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Project Number: 2022-22-1

drainages flow from the area and can form wide wet meadows of up to 40 acres in size. These many drainages and wet meadows support a mosaic of wetland plants and communities including Baltic rush (*Juncus balticus* var. *montanus*), Nebraska sedge (*Carex nebrascensis*), clustered sedge (*C. praegracilis*), woolly sedge (*C. pellita*), Crawe sedge (*C. crawei*), three-square bulrush (*Scirpus pungens*), saltgrass (*Distichlis spicata*) and the European pasture grass redtop (*Agrostis gigantea*). These communities can form monotypic stands or intermingle with adjacent types.

No Critical Habitat, Wildlife Refuges, or Hatcheries are present in the vicinity of the Site according to the USFWS IPaC Trust Resources Report in Appendix B (USFWS, 2023a).

### 3.1 Topography / Natural Landform

The topography of the Site trends from the northwest to the southeast and is formed by three gentle ridges along the southwest, central and northeast portions of the Site, which form natural drainage depressions in the southwest, south-central and northeast portions of the Site. It ranges from a high elevation of approximately 6,818 feet above mean sea level (AMSL) along the northwest edge of the Site to a low elevation of approximately 6,720 feet AMSL in the southeastern corner of the Site.

### 3.2 Soils

ECOS utilized the USDA, Natural Resource Conservation Service (NRCS) Web Soil Survey (USDA, NRCS, 2023) to determine the types of soils present and if hydric soils are present within the Site, as this data assist in informing the presence/absence of potential wetland habitat regulated under the Clean Water Act. The soil data were also utilized to supplement the field observations of vegetation, as the USDA provides a correlation of native vegetation species by soil types. Please refer to the Custom Soil Resource Report for the Site in Appendix A.

The Site is comprised of the following soil types:

<u>Map Unit Symbol & Name</u>

- 8 – Blakeland loamy sand, 1 to 9 percent slopes;
- 19 - Columbine gravelly sandy loam, 0 to 3 percent slopes; and
- 29 - Fluvaquentic Haploquolls, nearly level.

Pursuant to the Custom Soil Resource Report:

- The Blakeland loamy sand is not hydric; however, the 1% inclusion of Pleasant soil is hydric;
- The Columbine gravelly sandy loam is not hydric; however, the 1% inclusion of Fluvaquentic Haplaquolls and 1% inclusion of Pleasant soils are both hydric; and
- The Fluvaquentic Haplaquolls is hydric and the 1% inclusion of Haplaquolls soil is hydric as well.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS, 1994) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in *Field Indicators of Hydric Soils in the United States* (USDA, NRCS, 2010).

## 3.3 Vegetation Communities

### 3.3.1 Short- and Mixed-grass Prairie

The vegetation within the Site is primarily comprised of herbaceous short-grass prairie species with herbaceous wetland vegetation in the drainages and ephemeral swales flowing through the Site. Given the limited presence of certain mid-grass prairie species mixed throughout the shortgrass prairie, we have referred to the vegetation community as “short and mixed grass prairie”. Refer to Figure 4, Vegetation Community Map. The dominant prairie grass species is blue grama (*Bouteloua gracilis*), with occasional little bluestem (*Schizachyrium scoparium*) and western wheatgrass (*Pascopyrum smithii*). The other most common associative prairie species are prairie aster (*Machaeranthera tenacetifolia*), smooth brome (*Bromus inermis*), fringed sage (*Artemisia frigida*), yucca (*Yucca spp.*) and prickly pear cactus (*Opuntia* sp.). Other species include Wood’s rose (Rosa woodsii), false indigo bush (*Amorpha fruticosa*), sticky geranium (*Geranium viscosissimum*), and yarrow (Achillea millefolium). The Site is moderately grazed and there are scattered weeds, including Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), Scotch thistle (*Onopordum acanthium*), common mullein (*Verbascum thapsus*), horseweed (*Conyza canadensis*) and field bindweed (*Convolvulus arvensis*).

### 3.3.2 Wetland

Hydrophytic vegetation (wetland vegetation) is present within the northeastern, south-central, and southwest ephemeral drainages where saturated (hydric) soils are present. Dominant wetland vegetation includes Baltic rush (*Juncus balticus*), Nebraska sedge (*Carex nebrascensis*), clustered field sedged (*C. praegracilis*), saltgrass (*Distichlis spicata*), and spikerush (*Eleocharis palustris*). Dispersed sandbar willow (*Salix exigua*) is present in the northeastern ephemeral drainages. Other hydrophytic species present include water mint (*Mentha aquatica*), narrowleaf cattail (*Typha angustifolia*), and Rocky Mountain iris (*Iris missouriensis*). Refer to Figure 4, Vegetation Community Map and Figure 5, NWI Map.

### 3.3.2 Riparian

Riparian habitat within the Site is comprised of more robust short-grass prairie where moist, mesic soils are present adjacent to wetlands (described above) and small pockets of open water that were excavated for stock ponds (refer to Figures 4 and 6). Trees and shrubs are primarily absent, with the exception of narrowleaf and Plains cottonwood (*Populus angustifolia and deltoides*) and sandbar willow dispersed throughout the Site but mostly in the northeastern drainages. Refer to Figure 4, Vegetation Community Map and Figure 6. CNHP Riparian Habitat Map.

### 3.3.2 Residential Landscape

A large grove of Chinese elm (*Ulmus parvifolia*) was planted around the Davis Ranch (Gieck Ranch on USGS mapping) in the central portion of Section 34. This stand of elm serves as an excellent wind break, as well as good habitat for wildlife, including numerous bird cavities. Other common “landscape” trees such as pine, oak, and fruit trees are present in the residential areas. Refer to Figure 4, Vegetation Community Map.

Refer to Appendix B – Photo Location Map and Representative Photos of the vegetation communities found on the Site.

Source: Google Earth Aerial Image, 10/31/2022 & Ecosystem Services, LLC Site Assessment, 5/23/2023

Source: Colorado Natural Heritage Program (CNHP) Wetland Mapper

Source: Google Earth Aerial Image, 10/31/2023 & Ecosystem Services, LLC Wetland Delineation, 5/23/2023

### 3.7 Wildlife

The stated purpose and intent of the "El Paso County Development Standards" wildlife section is to ensure that proposed development is reviewed with consideration of the impacts to wildlife and wildlife habitat, and to implement the provisions of the Master Plan (El Paso County, 2021). The two primary vegetation types within the Site are herbaceous prairie and wetlands. ECOS has determined that the wildlife impact potential for development of this singular Site is expected to be moderate to low, as the Site currently provides poor to moderate habitat for wildlife. Taken in a regional watershed or larger landscape context, as more and more prairie is developed over time impacts to wildlife are expected to be moderate to high as wildlife run out of space and habitat.

The Site provides habitat for prairie species such as pronghorn (*Antilocapra americana*), black-tailed prairie dog (*Cynomys ludovicianus*), thirteen-lined ground squirrel (*Ictidomys tridecemlineatus*), voles (*Microtus spp.*) and jackrabbit (*Lepus townsendii*). The Site also provides foraging and breeding habitat for predators such as coyote (*Canis latrans*), fox (*Vulpes vulpes*), badger (*Meles meles*), and occasional bobcat (*Lynx rufus*). The Site also provides good habitat for reptiles and moderate habitat for amphibians such as Woodhouse toad (*Anaxyrus woodhousii*), leopard frog (*Lithobates pipiens*), and garter snake (*Thamnophis spp.).*

The USFWS IPaC Trust Resources Report (USFWS, 2023a) (Appendix C) reports that bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), and ferruginous hawk (*Buteo regalis*) may utilize the area. The Site provides limited tree nesting habitat for raptors; however, ferruginous hawks may also use ground nests.

The Site contains no Critical Habitat, Wildlife Refuges, or Hatcheries according to the USFWS IPaC Trust Resources Report (USFWS, 2023a) (Appendix C).

The project proposes to develop most of the prairie, however, the drainages and grassland immediately adjacent to them within the floodplain would be preserved as Open Space. A noxious weed management plan will be implemented per State and County requirements to improve wildlife habitat, and a native plant re-vegetation plan for the Open Space is recommended to provide additional benefit to wildlife habitat.

## 4.0 FEDERAL LISTED SPECIES

A number of species that occur in El Paso County are listed as threatened and endangered (T&E) by the USFWS under the Endangered Species Act (ESA) (USFWS 2023). ECOS compiled the data regarding T&E species for the Site in Table 3 based on the Site-specific, USFWS IPaC Trust Resources Report we ran for the Project (Appendix C) and our onsite assessment. ECOS has provided our professional opinion regarding the probability that these species may occur within the Site and their probability of being impacted by the Project.

The likelihood that the Project would impact any of the species listed below is insignificant to none. Most are not expected to occur in the project area and no downstream impacts are expected. The USFWS also states that there is no Critical Habitat for T&E species in the Site locations.

| **TABLE 3 - FEDERAL LISTED SPECIES POTENTIALLY IMPACTED BY THE PROJECT** | | | |
|---|---|---|---|
| **Species** | **Status** | **Habitat Requirements and Presence** | **Probability of Impact by Project** |
| **FISH** | | | |
| Greenback cutthroat trout (*Oncorhynchus clarki stomias*) | Threatened | Cold, clear, gravely headwater streams and mountain lakes that provide an abundant food supply of insects. | None. Suitable habitat does not exist on the Site. |
| Pallid sturgeon (*Scaphirhynchus albus*) | Endangered | Water-related activities/use in the N. Platte, S. Platte and Laramie River Basins may affect listed species in Nebraska. | None. The proposed project will not affect any of the listed river basins. |
| **BIRDS** | | | |
| Eastern Black Rail (*Laterallus jamaicensis ssp. Jamaicensis*) | Threatened | Habitat includes tidally or non-tidally influenced marshes which range in salinity from salt to brackish to fresh. It requires dense overhead perennial herbaceous cover with underlying soils that are moist to saturated (occasionally dry) interspersed with or adjacent to very shallow water (typically ≤ 3 cm). Eastern black rails depend on this dense cover throughout their life cycle and it is their primary strategy to avoid predation. | Insignificant. Suitable, dense, overhead, perennial, herbaceous cover and shallow water are minimal and dispersed in the discontinuous wetland habitat on the Site. |

## 5.0 RAPTORS AND MIGRATORY BIRDS

Raptors and most birds are protected by the Colorado Nongame Wildlife Regulations, as well as by the federal Migratory Bird Treaty Act. Additionally, eagles are protected by the Bald and Golden Eagle Protection Act (BGEPA).

### 5.1 COGCC Database

ECOS utilized the Colorado Oil and Gas Conservation Commissions (COGCC) GIS Online data (https://cogccmap.state.co.us/cogcc_gis_online/) (COGCC, 2023) to screen the Site for potential raptor nests. No raptor nests have been mapped within one mile of the Site (COGCC, 202). The closest raptor nests to the Site are Golden Eagle and Ferruginous hawk active nests located 3.22 miles east of the eastern edge of the Site and a Golden Eagle active nest located 7.02 miles southwest of the southwest corner of the Site.

### 5.2 USFWS IPaC Data

The USFWS IPaC data for the Site indicates the probability of the presence of five bird species (refer to Appendix C) in the vicinity of the Site. The birds listed by IPaC are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in the Project location. The 1988 amendment to the Fish and Wildlife Conservation Act mandates the USFWS to “identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA. "Birds of Conservation Concern 2021 (BCC 2021)" is the most recent effort to carry out this mandate. The birds listed by IPaC include:

- Bald Eagle (*Haliaeetus leucocephalus*) - This is not a BCC in this area but warrants attention because of the BGEPA.
- Ferruginous Hawk (*Buteo regalis*) - This is a BCC only in particular Bird Conservation Regions (BCRs) including Colorado. Per the USFWS Environmental Conservation Online System data (USFWS 2023b) (https://ecos.fws.gov/ecp/species/6038), ideal habitat for Ferruginous Hawks is grassland and shrub-steppe habitat including pastures, hayland, and cropland. Their nests can be found in trees and large shrubs and on roofs, utility structures, and artificial platforms, or near the ground on river cutbanks, or less frequently other ground locations such as rockpiles and riverbed mounds. ECOS has observed their nests open prairie habitat in this vicinity.
- Golden Eagle (Aquila chrysaetos) - This is not a BCC but warrants attention because of the BGEPA
- Lesser Yellowlegs (*Tringa flavipes*) - This is a BCC throughout its range in the continental USA and Alaska. Per the USFWS Per the USFWS Environmental Conservation Online System data (USFWS 2023b) (https://ecos.fws.gov/ecp/species/9679) the Site does not comprise suitable habitat for this species. However, they may pass through the Project vicinity in the 2nd, 3rd, and 4th week of April.

- Pinyon Jay (*Gymnorhinus cyanocephalus*) - This is a BCC throughout its range in the continental USA and Alaska. Per the USFWS Environmental Conservation Online System data (USFWS 2023b) (https://ecos.fws.gov/ecp/species/9420) the Site does not comprise suitable habitat for this species. As their name implies, they can be found in pinyon-juniper woodland, sagebrush, scrub oak, and chaparral communities, and sometimes in pine forests. Given that Colorado is within its large Western U.S. range, this broad-brush range includes the Project vicinity, but the probability of its presence in said vicinity is limited to the 1st week in October.

### 5.3 Field Assessment

Two occupied Redtail hawk nests were identified in the northeastern corner of the Site. One occupied magpie nest was identified in the central portion of the Site. Two large prairie dog colonies that provide potential habitat for Burrowing owl (Athene cunicularia) are present in the south-central and southwestern portions of the Site. Numerous tree cavities were identified in live and dead trees throughout the Site, especially in the forested area around the Davis ranch. One nest was being used by a redtail hawk and one unoccupied raptor nest (likely Redtail hawk or Great Horned owl) was identified immediately south of the south Site boundary near Judge Orr Road. Numerous songbirds were detected using the Cornell Lab Merlin bird identification application, including yellow oriole (*Icterus nigrogularis*), red-wing blackbird (*Agelaius phoeniceus*), grackle (*Quiscalus spp.*), flicker (*Colaptes spp.*), meadowlark (*Sturnella neglecta*), Say's phoebe (*Sayornis saya*), western kingbird (*Tyrannus verticalis*), eastern kingbird (*Tyrannus tyrannus*), northern mocking bird (*Mimus polyglottos*), western wood-pewee (*Contopus sordidulus*), house wren (*Troglodytes aedon*) and house sparrow (*Passer domesticus*). The prairie, riparian corridors, and wetland habitat may also provide nesting and foraging habitat for many other migratory birds. Please refer to Figure 8, Raptor Habitat Survey Map.

Source: Google Earth Aerial Image, 10/31/2023 & Ecosystem Services, LLC MBTA Survey, 5/23/2023

## 6.0 SUMMARY OF IMPACTS & RECOMMENDATIONS

### 6.1 Vegetation

The vegetation within the Site is primarily comprised of herbaceous shortgrass prairie species. Given the presence of certain midgrass and tallgrass prairie and non-native species mixed throughout the shortgrass prairie, we have referred to the vegetation community as “short and mixed grass prairie”. Wetland vegetation is comprised primarily of emergent, herbaceous, hydrophytic species in the ephemeral drainages and swales. Riparian habitat within the Site is comprised of upland grassland, herbaceous wetland, and small pockets of shallow open water (refer to Figure 6). Trees and shrubs are primarily absent, with the exception of dispersed individual narrowleaf and Plains cottonwood (*Populus angustifolia and deltoides*) and small patches of sandbar willow (*Salix exigua*) in the northeastern drainages. Refer to Figure 4, Vegetation Map.

The short and mixed grass prairie will be the primary vegetation/habitat type impacted by the proposed development. The proposed residential parcels are all planned to be low-density so that could provide ample opportunity to preserve high quality, native habitat within private lots if building envelopes/disturbance footprints are limited. Small neighborhood parks developed for tot-lots, field sports, etc. are not valuable open space for wildlife. If however they are designed to preserve some native habitat they can provide limited natural open space functions for smaller wildlife and birds. The two Commercial parcels and the internal road system are anticipated to have maximum impact on short and mixed grass prairie (e.g., 100% of the area beneath their footprint). The three Detention Ponds will result in the loss/impact primarily of short and mixed grass prairie, with minor impacts to wetland habitat resulting from stormwater outfalls into the creek systems. These impacts could be temporary and mitigated if prairie, riparian, and wetland habitat are restored after construction.

In addition to preserving the highest value existing native vegetation on public and private open space, in order to reduce overall direct impacts from the development, proposed landscaping (private and public) should consist of native prairie species from the same ecosystem that provide food and cover for wildlife. High, solid fences if proposed are a major impediment and impact wildlife movement through the landscape. Short, permeable and unbarbed wildlife-friendly fences that allow large and small species to move freely are recommended wherever fences are desired which will allow future residents to enjoy wildlife experiences in their everyday lives.

Over 80 percent of all wildlife species use riparian areas during some part of their life cycle. As such, floodplains, riparian areas including wetlands that together form linear natural corridors (i.e., greenways) should not be impacted by development and left intact. If necessary, road, trail, and utility corridors (i.e., crossings) that must cut through riparian areas should be avoided or minimized to only a few locations where the riparian corridors (and wetlands) are the narrowest or absent. Any proposed crossings should be designed perpendicular

to greenways. Greenways are ideal locations for trails that run parallel with the floodplain/riparian corridor to provide future neighborhood residents with positive natural outdoor and wildlife experiences such as bird watching (i.e., ecological benefits). The layout of the development at a sketch plan level is nebulous regarding the avoidance and minimization of impacts to greenways. During more detailed preliminary and final design, all man-made structures, including detention ponds should avoid impacting riparian areas and wetlands. Detention/water quality ponds, where required should be located adjacent to riparian areas and vegetated to the maximum extent possible utilizing native riparian and wetland vegetation in the pond bottoms; upland grasses, shrubs, and trees along side-slopes, spillways, and run-downs to expand riparian habitat for wildlife. Outfall structures from detention ponds with scour aprons are typically designed to extend into and impact wetlands and stream beds. These impacts can be mitigated by locating the outfall outside of riparian and/or wetland habitat and then creating a riparian/wetland swale that extends to the receiving stream.

Ground disturbance/removal of vegetation and exposure of soil instigates the invasion and colonization of common and noxious weeds, one of the most detrimental processes to the quality of any kind of habitat if left unchecked. As such, minimization of ground-disturbing activities that compact or remove native vegetation during construction is recommended. Thereafter, control of common, noxious weeds and non-native species in all areas (existing or landscaped) should be a priority during and after construction and as part of the long-term private residence and HOA maintenance of the Site. If native vegetation is preserved and weeds are managed, the loss of the existing habitat is minimized.

Overall impacts to vegetation communities that provide habitat for wildlife can be offset/mitigated by the thoughtful design; restrictions that minimize impacts to prairie through the employment of building envelopes; implementation of native planting and seeding requirements on private and public land; ongoing weed management; and long-term preservation of large, contiguous open space and greenways that limit crossings and fragmentation.

### 6.3 Wetland Habitat and Waters of the U.S.

There are five WOTUS features on the Site including the Northeast drainage (North and South branches); South-central drainage (North and South branches) and the Southwest drainage. The downstream end of the South-Central drainage collects water from the Southwest drainage and combines to form a very significant expanse of wetland along the entire north edge of Judge Orr Road. ECOS delineated the boundaries of these WOTUS features pursuant to the current USACE methodology to assist the planning and design Team in Site planning. The Sketch Plan does not reflect the locations of these delineated WOTUS features as it was prepared prior to the delineation. Therefore, during the final Site Plan design, the Project Team will incorporate avoidance and minimization of WOTUS impacts to the extent possible to meet the Least Environmentally Damaging and Practicable Alternative (LEDPA) requirements of Section 404(b)(1) of the Clean Water Act (CWA).

# GIECK RANCH
# DRAINAGE BASIN PLANNING STUDY
# El Paso County, Colorado

## Volume 1 – Final Report

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# I. Project Description, Location and Drainage

## A. Basin Description and Location

Figure 1.0 shows the location of the Gieck Ranch Drainage Basin. The basin covers a total area of 22.05 square miles within unincorporated El Paso County. The basin begins approximately five miles northeast of the Town of Falcon in El Paso County at an elevation of approximately 7,300 feet above mean sea level (msl). From this point, drainage from the basin travels approximately 15 miles to the southeast. An aerial photograph of the basin is included as Figure 1.1 which is located in Volume 2 of this report. The minimum elevation within the basin is approximately 6,100 feet above msl. Channel slope varies considerably across the basin with average channel slopes ranging from 0.5% to 5%. In general, steeper slopes are located at the northern reaches of the basin, while the flatter slopes are located at the southern reaches. The Gieck Ranch Drainage Basin is tributary to Black Squirrel Creek which drains south to its confluence with the Arkansas River near the city of Pueblo, Colorado. The area encompassing the basin is characterized by rolling range land typically associated with Colorado's semi-arid climates. Existing vegetative cover in undeveloped areas is considered fair for the purposes of this report.

While developing this Drainage Basin Planning Study it was determined that a portion of the adjacent Haegler Ranch Basin, approximately 1.4 square miles, is diverted into the Gieck Ranch Basin as shown in Figure 1.0. This diversion occurs just east and immediately upstream of the intersection of Judge Orr Road and Curtis Road. The diversion exists because no culvert was constructed to convey the runoff from the north side of Judge Orr Road to the south side when the road was originally built. Instead, runoff flows east along the northern edge of the road to a culvert located within the Gieck Basin. This condition has existed since the construction of Judge Orr Road. A stakeholder's meeting was held April, 2005 to discuss the impacts of maintaining the diversion or removing it and restoring historic flows. It was decided to maintain the diversion as is, Documentation and correspondence related to the diversion can be found in Section 1 of the Technical Addenda. In addition to the diversion, while delineating the drainage basins using LIDAR based topography, it was determined that there is an additional 1.35 square miles of area in the southeast section that drains into the Gieck Ranch Basin that was previously thought to drain into adjacent basins. The total square miles of drainage area for the Gieck Ranch Basin (22.05) includes the 1.4 square miles of drainage area diverted from the Haegler Ranch Basin and the 1.35 square miles of additional drainage area in the southeast section of the basin.

The drainage basin has been subdivided into six major sub-watersheds or drainageways. These include the Main Stem Channel (MS) and five main tributaries, the Haegler Diversion (HD), West Fork (WF), East Fork (EF), South Fork (SF), and Southeast Fork (SE). These major drainageways were determined as those existing drainageways that carry runoff from at least 100 to 160 acres. Figure 2.0 shows the locations of the six main drainageways.

There are several open water storage areas that exist within the basin. They appear to be remnants of former irrigation structures and/or stock watering ponds. They do not appear to be constructed for the purposes of flood control. For modeling purposes they were not evaluated as effective storage. Additionally, remnants of several irrigation facilities associated with former ranch lands can be found within the drainage basin. It is not apparent whether or not these irrigation structures are still used. There do not appear to be any active irrigation ditches within the basin.

## B. Climate and Flood History

The region surrounding the City of Falcon is generally classified as semi-arid, with annual precipitation in the range of 14 to 16 inches. The bulk of the precipitation is received during the spring and summer months in the form of thundershowers. Most of the flood-producing storms in El Paso County occur during the summer months when thunderstorms are most intense. Available flood history for El Paso County is almost exclusively concerned with the aspects of flooding on Fountain Creek or Monument Creek urbanized areas, so there is no history of flooding in the Gieck Ranch Basin listed in the El Paso County Flood Insurance Study. However, significant flooding events resulting in damage to roadways and drainage structures have been documented in nearby basins, such as that which occurred in the Haegler Basin in 1995. This indicates that flooding and related damage within the Gieck Ranch Drainage Basin and its tributaries is possible in the future.

## III. Hydrology

### A. Introduction

This section summarizes the hydrologic analysis of the Gieck Ranch Drainage Basin. Both existing conditions and future development were considered in the development of peak discharge rates and runoff volumes for the 2-, 5-, 10- and 100-year storm events. The following sections describe the data, methodologies, assumptions, and calculation methods used.

### B. Hydrologic Modeling

A hydrologic model was utilized to simulate stormwater runoff in the Gieck Ranch Basin. The model was developed using the U. S. Army Corps of Engineers' HEC-HMS hydrologic modeling program, version 3.3. The use of this model is made in compliance with the El Paso County Drainage Criteria Manual (DCM).

Delineation of the Gieck Ranch Basin and its sub-basins was performed using the El Paso County 2002 LIDAR Terrain Points data set. This data set shows the bare earth and canopy LIDAR points that were flown for a set section during April and May of 2002. The horizontal datum used for the data set is the North American Datum of 1983 and the vertical datum used is NAVD 88. The grid coordinate system used is the Colorado State Plane Coordinate System, Zone 502. The geographic locations have an absolute horizontal accuracy of 15 cm (approximately 0.5 feet) and an absolute vertical accuracy of 30 cm (approximately 1.0 feet). Additional metadata information for the data set is provided in Section 2 of the Technical Addenda.

The LIDAR data was processed using ArcGIS 9.1 computer software to create 2-foot contour intervals over the entire basin. The LIDAR data is considered by the El Paso County IT Department to be limited in it's accuracy for creating 5 foot contours. The 2 foot contours used throughout this study were accepted because significant 2 foot contour mapping had been done from another source and was available to confirm the reliability of the LIDAR based 2-foot contours. The topographic mapping was supplemented with field observations and measurements to assist in delineating sub-basins. The Gieck Ranch Basin was initially subdivided into six major watersheds or drainageways associated with the main stem channel and its' five major tributaries. Minor tributaries to these major drainageways were also identified to further delineate sub-basins. A total of 91 sub-basins ranging in size from 19 to 365 acres were delineated. The sub-basins are labeled in reference to its' associated drainageway or tributary as follows:

| Drainageway/Tributary | Basins |
|---|---|
| Main Stem | MS-B1 through MS-B35 |
| Main Stem Tributary #1 | MST1-B1 |
| Main Stem Tributary #2 | MST2-B1 through MST2-B3 |
| Main Stem Tributary #3 | MST3-B1 through MST3-B2 |
| Main Stem Tributary #4 | MST4-B1 through MST4-B2 |
| Main Stem Tributary #5 | MST5-B1 through MST5-B2 |
| Haegler Diversion | HD-B1 through HD-B6 |
| West Fork | WF-B1 through WF-B11 |
| West Fork Tributary #1 | WFT1-B1 through WFT1-B2 |
| East Fork | EF-B1 through EF-B8 |
| East Fork Tributary #1 | EFT1-B1 through EFT1-B4 |
| South Fork | SF-B1 through SF-B7 |
| South Fork Tributary #1 | SFT1-B1 |
| Southeast Fork | SE-B1 through SE-B7 |

Figures 6.1, 6.2 and 6.3, located in Volume 2 of this report, show the contour intervals and the sub-basin delineations for the existing and future conditions models.

### C. Time of Concentration Calculations

The topographic mapping was also used to determine the longest flow path within each basin, establish elevations at the beginning and end of flow paths, and determine channel geometry within reaches. This information was used to assist in computing the time of concentration of each sub-basin and ultimately the lag time used in the hydrology model. The time of concentration was determined using the methods presented in the SCS procedure in the Technical Release Manual titled Urban Hydrology for Small Watersheds, 2nd Edition, revised June 1986 (herein referred to as TR-55) and is calculated as the sum of the sheet flow, shallow concentrated flow, and open channel flow. For the existing conditions

Table 2.0: Summary of Existing Conditions Basin Data

| Basin ID | Basin Area (acres) | Basin Area (sq. miles) | Basin CCN | tlag (mins) | Average % Imp. Area | Impervious Acres |
|---|---|---|---|---|---|---|
| MS-B1 | 174.5 | 0.2727 | 74 | 20 | 1.3% | 2.3 |
| MS-B2 | 52.6 | 0.0821 | 73 | 34 | 0.0% | 0.0 |
| MS-B3 | 121.5 | 0.1898 | 72 | 32 | 0.2% | 0.3 |
| MS-B4 | 114.7 | 0.1792 | 69 | 91 | 0.1% | 0.2 |
| MS-B5 | 205.7 | 0.3214 | 64 | 43 | 0.0% | 0.0 |
| MS-B6 | 110.0 | 0.1720 | 59 | 103 | 0.2% | 0.2 |
| MS-B7 | 29.2 | 0.0456 | 58 | 51 | 0.5% | 0.1 |
| MS-B8 | 100.6 | 0.1571 | 58 | 129 | 0.6% | 0.6 |
| MS-B9 | 139.7 | 0.2183 | 58 | 179 | 0.2% | 0.3 |
| MS-B10 | 115.0 | 0.1797 | 58 | 157 | 0.5% | 0.5 |
| MS-B11 | 316.1 | 0.4939 | 66 | 69 | 1.1% | 3.4 |
| MS-B12 | 291.1 | 0.4548 | 59 | 285 | 0.3% | 0.8 |
| MS-B13 | 90.6 | 0.1415 | 60 | 72 | 0.1% | 0.1 |
| MS-B14 | 61.9 | 0.0966 | 60 | 38 | 0.1% | 0.0 |
| MS-B15 | 140.0 | 0.2187 | 70 | 81 | 0.3% | 0.5 |
| MS-B16 | 150.7 | 0.2354 | 59 | 76 | 0.1% | 0.2 |
| MS-B17 | 202.0 | 0.3156 | 58 | 185 | 0.1% | 0.2 |
| MS-B18 | 132.7 | 0.2073 | 60 | 79 | 0.0% | 0.0 |
| MS-B19 | 54.1 | 0.0845 | 62 | 65 | 0.1% | 0.1 |
| MS-B20 | 82.7 | 0.1292 | 64 | 61 | 0.5% | 0.4 |
| MS-B21 | 246.4 | 0.3850 | 63 | 164 | 0.8% | 1.9 |
| MS-B22 | 212.0 | 0.3312 | 62 | 81 | 0.7% | 1.4 |
| MS-B23 | 207.2 | 0.3237 | 58 | 167 | 0.0% | 0.1 |
| MS-B24 | 292.8 | 0.4576 | 58 | 72 | 0.1% | 0.2 |
| MS-B25 | 331.3 | 0.5176 | 65 | 73 | 0.1% | 0.3 |
| MS-B26 | 118.4 | 0.1850 | 61 | 83 | 0.1% | 0.2 |
| MS-B27 | 344.8 | 0.5388 | 65 | 128 | 0.0% | 0.1 |
| MS-B28 | 59.1 | 0.0924 | 68 | 52 | 0.3% | 0.2 |
| MS-B29 | 198.9 | 0.3108 | 62 | 83 | 1.1% | 2.1 |
| MS-B30 | 48.3 | 0.0754 | 69 | 78 | 1.8% | 0.9 |
| MS-B31 | 192.0 | 0.2999 | 61 | 240 | 1.4% | 2.6 |
| MS-B32 | 87.7 | 0.1371 | 64 | 81 | 0.3% | 0.2 |
| MS-B33 | 93.6 | 0.1462 | 68 | 57 | 1.3% | 1.2 |
| MS-B34 | 44.5 | 0.0696 | 74 | 61 | 1.9% | 0.9 |
| MS-B35 | 75.6 | 0.1181 | 67 | 48 | 1.1% | 0.9 |
| MST1-B1 | 156.3 | 0.2442 | 70 | 58 | 0.6% | 1.0 |
| MST2-B1 | 132.8 | 0.2076 | 73 | 43 | 0.2% | 0.3 |
| MST2-B2 | 262.9 | 0.4108 | 70 | 44 | 0.0% | 0.1 |
| MST2-B3 | 213.1 | 0.3329 | 58 | 118 | 0.1% | 0.2 |
| MST3-B1 | 75.7 | 0.1183 | 58 | 124 | 0.0% | 0.0 |
| MST3-B2 | 178.2 | 0.2784 | 59 | 179 | 1.3% | 2.2 |
| MST4-B1 | 274.0 | 0.4281 | 64 | 70 | 0.5% | 1.3 |
| MST4-B2 | 116.9 | 0.1827 | 69 | 53 | 0.0% | 0.0 |
| MST5-B1 | 165.0 | 0.2578 | 64 | 51 | 0.0% | 0.0 |
| MST5-B2 | 225.4 | 0.3522 | 61 | 138 | 0.0% | 0.1 |
| HD-B1 | 264.3 | 0.4129 | 73 | 50 | 0.0% | 0.1 |

Table 2.0: Summary of Existing Conditions Basin Data (continued):

| Basin ID | Basin Area (acres) | Basin Area (sq. miles) | Basin CCN | tlag (mins) | Average % Imp. Area | Impervious Acres |
|---|---|---|---|---|---|---|
| HD-B2 | 261.3 | 0.4082 | 70 | 48 | 0.1% | 0.1 |
| HD-B3 | 101.0 | 0.1578 | 64 | 48 | 0.3% | 0.3 |
| HD-B4 | 117.9 | 0.1843 | 61 | 65 | 1.5% | 1.7 |
| HD-B5 | 100.7 | 0.1573 | 62 | 165 | 10.8% | 10.9 |
| HD-B6 | 165.1 | 0.2580 | 64 | 71 | 0.5% | 0.9 |
| WF-B1 | 115.1 | 0.1799 | 72 | 54 | 0.0% | 0.0 |
| WF-B2 | 77.6 | 0.1212 | 67 | 38 | 0.0% | 0.0 |
| WF-B3 | 18.6 | 0.0291 | 73 | 24 | 0.0% | 0.0 |
| WF-B4 | 61.7 | 0.0964 | 66 | 32 | 1.1% | 0.7 |
| WF-B5 | 101.8 | 0.1590 | 68 | 37 | 2.0% | 2.0 |
| WF-B6 | 188.8 | 0.2950 | 63 | 81 | 3.8% | 7.2 |
| WF-B7 | 59.9 | 0.0935 | 61 | 142 | 1.3% | 0.8 |
| WF-B8 | 116.5 | 0.1820 | 61 | 71 | 0.0% | 0.0 |
| WF-B9 | 209.2 | 0.3268 | 68 | 66 | 0.1% | 0.2 |
| WF-B10 | 74.0 | 0.1156 | 62 | 200 | 1.5% | 1.1 |
| WF-B11 | 365.2 | 0.5707 | 64 | 56 | 0.1% | 0.3 |
| WFT1-B1 | 196.5 | 0.3071 | 65 | 87 | 1.2% | 2.4 |
| WFT1-B2 | 167.1 | 0.2610 | 66 | 86 | 16.1% | 26.9 |
| EF-B1 | 68.8 | 0.1076 | 73 | 20 | 0.0% | 0.0 |
| EF-B2 | 79.9 | 0.1248 | 73 | 26 | 0.0% | 0.0 |
| EF-B3 | 210.5 | 0.3289 | 73 | 26 | 0.0% | 0.0 |
| EF-B4 | 351.9 | 0.5498 | 73 | 34 | 0.0% | 0.2 |
| EF-B5 | 85.1 | 0.1329 | 73 | 42 | 0.1% | 0.1 |
| EF-B6 | 25.5 | 0.0398 | 58 | 61 | 0.3% | 0.1 |
| EF-B7 | 70.9 | 0.1107 | 58 | 66 | 0.3% | 0.2 |
| EF-B8 | 115.7 | 0.1807 | 58 | 119 | 0.7% | 0.8 |
| EFT1-B1 | 64.2 | 0.1004 | 73 | 27 | 0.0% | 0.0 |
| EFT1-B2 | 80.7 | 0.1261 | 68 | 28 | 0.0% | 0.0 |
| EFT1-B3 | 253.0 | 0.3953 | 67 | 70 | 0.1% | 0.2 |
| EFT1-B4 | 30.0 | 0.0470 | 59 | 74 | 0.3% | 0.1 |
| SF-B1 | 127.7 | 0.1995 | 64 | 55 | 0.5% | 0.7 |
| SF-B2 | 223.9 | 0.3498 | 70 | 61 | 0.0% | 0.0 |
| SF-B3 | 76.9 | 0.1202 | 70 | 60 | 0.0% | 0.0 |
| SF-B4 | 181.4 | 0.2835 | 67 | 109 | 0.1% | 0.2 |
| SF-B5 | 241.1 | 0.3767 | 67 | 101 | 0.0% | 0.1 |
| SF-B6 | 89.8 | 0.1403 | 72 | 48 | 0.1% | 0.1 |
| SF-B7 | 140.7 | 0.2199 | 69 | 67 | 0.1% | 0.2 |
| SFT1-B1 | 233.4 | 0.3647 | 69 | 74 | 0.0% | 0.0 |
| SE-B1 | 297.5 | 0.4649 | 73 | 39 | 0.8% | 2.5 |
| SE-B2 | 325.5 | 0.5087 | 72 | 94 | 0.0% | 0.1 |
| SE-B3 | 47.4 | 0.0741 | 72 | 102 | 2.0% | 0.9 |
| SE-B4 | 152.3 | 0.2380 | 73 | 68 | 0.1% | 0.2 |
| SE-B5 | 317.7 | 0.4964 | 71 | 204 | 0.4% | 1.2 |
| SE-B6 | 167.3 | 0.2614 | 73 | 99 | 3.6% | 6.0 |
| SE-B7 | 252.2 | 0.3940 | 63 | 83 | 0.8% | 2.0 |
| Totals | 14111 | 22.05 | 66 | | 0.7% | 100 |

Table 3.0: Summary of Future Conditions Basin Data

| Basin ID | Basin Area (acres) | Basin Area (sq. miles) | Basin CCN | tlag (mins) | Average % Imp. Area | Impervious Acres |
|---|---|---|---|---|---|---|
| MS-B1 | 174.5 | 0.2727 | 75 | 16 | 6.7% | 11.7 |
| MS-B2 | 52.6 | 0.0821 | 78 | 25 | 19.4% | 10.2 |
| MS-B3 | 121.5 | 0.1898 | 76 | 27 | 15.3% | 18.6 |
| MS-B4 | 114.7 | 0.1792 | 74 | 37 | 15.1% | 17.3 |
| MS-B5 | 207.4 | 0.3240 | 72 | 19 | 24.1% | 50.1 |
| MS-B6 | 110.0 | 0.1720 | 61 | 82 | 5.7% | 6.2 |
| MS-B7 | 29.2 | 0.0456 | 60 | 38 | 5.3% | 1.6 |
| MS-B8 | 100.6 | 0.1571 | 58 | 129 | 0.6% | 0.6 |
| MS-B9 | 139.7 | 0.2183 | 58 | 179 | 0.2% | 0.3 |
| MS-B10 | 115.0 | 0.1797 | 58 | 157 | 0.5% | 0.5 |
| MS-B11 | 316.1 | 0.4939 | 72 | 27 | 16.1% | 51.0 |
| MS-B12 | 291.2 | 0.4550 | 68 | 52 | 21.8% | 63.5 |
| MS-B13 | 90.6 | 0.1415 | 71 | 27 | 28.5% | 25.8 |
| MS-B14 | 61.9 | 0.0967 | 80 | 14 | 49.9% | 30.9 |
| MS-B15 | 140.0 | 0.2187 | 74 | 60 | 12.6% | 17.6 |
| MS-B16 | 150.7 | 0.2354 | 60 | 63 | 0.9% | 1.3 |
| MS-B17 | 202.0 | 0.3156 | 63 | 56 | 10.6% | 21.4 |
| MS-B18 | 132.7 | 0.2073 | 70 | 24 | 21.4% | 28.4 |
| MS-B19 | 54.1 | 0.0845 | 75 | 22 | 25.4% | 13.7 |
| MS-B20 | 82.7 | 0.1292 | 64 | 61 | 1.4% | 1.2 |
| MS-B21 | 246.4 | 0.3850 | 63 | 164 | 0.8% | 1.9 |
| MS-B22 | 212.0 | 0.3312 | 62 | 81 | 0.7% | 1.4 |
| MS-B23 | 207.2 | 0.3237 | 58 | 167 | 0.0% | 0.1 |
| MS-B24 | 292.8 | 0.4576 | 58 | 72 | 0.1% | 0.2 |
| MS-B25 | 331.3 | 0.5176 | 65 | 73 | 0.1% | 0.3 |
| MS-B26 | 118.4 | 0.1850 | 61 | 79 | 0.1% | 0.2 |
| MS-B27 | 344.8 | 0.5388 | 65 | 128 | 0.0% | 0.1 |
| MS-B28 | 59.1 | 0.0924 | 68 | 52 | 0.3% | 0.2 |
| MS-B29 | 198.9 | 0.3108 | 63 | 78 | 1.7% | 3.5 |
| MS-B30 | 48.3 | 0.0754 | 69 | 78 | 1.8% | 0.9 |
| MS-B31 | 192.0 | 0.2999 | 61 | 240 | 1.4% | 2.6 |
| MS-B32 | 87.7 | 0.1371 | 64 | 81 | 0.3% | 0.2 |
| MS-B33 | 93.6 | 0.1462 | 68 | 57 | 1.3% | 1.2 |
| MS-B34 | 44.5 | 0.0696 | 74 | 61 | 1.9% | 0.9 |
| MS-B35 | 75.6 | 0.1181 | 67 | 48 | 1.1% | 0.9 |
| MST1-B1 | 156.3 | 0.2442 | 73 | 37 | 11.9% | 18.6 |
| MST2-B1 | 132.8 | 0.2076 | 76 | 22 | 11.7% | 15.6 |
| MST2-B2 | 261.3 | 0.4082 | 73 | 27 | 11.9% | 31.0 |
| MST2-B3 | 213.1 | 0.3329 | 58 | 97 | 1.0% | 2.0 |
| MST3-B1 | 80.0 | 0.1249 | 59 | 79 | 1.6% | 1.3 |
| MST3-B2 | 173.9 | 0.2718 | 59 | 179 | 1.3% | 2.2 |
| MST4-B1 | 274.0 | 0.4281 | 75 | 23 | 28.3% | 77.5 |
| MST4-B2 | 116.9 | 0.1827 | 73 | 29 | 13.2% | 15.4 |
| MST5-B1 | 165.0 | 0.2578 | 77 | 22 | 37.6% | 62.1 |
| MST5-B2 | 225.4 | 0.3522 | 69 | 60 | 17.5% | 39.5 |
| HD-B1 | 264.3 | 0.4129 | 75 | 23 | 29.6% | 78.2 |

Table 3.0: Summary of Future Conditions Basin Data (continued):

| Basin ID | Basin Area (acres) | Basin Area (sq. miles) | Basin CCN | tlag (mins) | Average % Imp. Area | Impervious Acres |
|---|---|---|---|---|---|---|
| HD-B2 | 261.3 | 0.4082 | 79 | 17 | 45.6% | 119.1 |
| HD-B3 | 101.0 | 0.1578 | 68 | 27 | 12.0% | 12.1 |
| HD-B4 | 117.9 | 0.1843 | 64 | 41 | 11.0% | 12.9 |
| HD-B5 | 100.7 | 0.1573 | 64 | 73 | 14.2% | 14.3 |
| HD-B6 | 165.1 | 0.2580 | 66 | 41 | 6.1% | 10.1 |
| WF-B1 | 115.1 | 0.1799 | 74 | 26 | 26.7% | 30.7 |
| WF-B2 | 77.6 | 0.1212 | 81 | 16 | 47.2% | 36.6 |
| WF-B3 | 14.4 | 0.0224 | 82 | 13 | 36.6% | 5.3 |
| WF-B4 | 61.7 | 0.0964 | 69 | 20 | 12.0% | 7.4 |
| WF-B5 | 101.8 | 0.1590 | 71 | 29 | 11.8% | 12.0 |
| WF-B6 | 188.8 | 0.2950 | 63 | 76 | 3.8% | 7.2 |
| WF-B7 | 59.9 | 0.0935 | 61 | 122 | 1.3% | 0.8 |
| WF-B8 | 116.5 | 0.1820 | 62 | 67 | 2.7% | 3.1 |
| WF-B9 | 209.2 | 0.3268 | 82 | 27 | 40.8% | 85.3 |
| WF-B10 | 74.0 | 0.1156 | 79 | 28 | 48.7% | 36.0 |
| WF-B11 | 365.2 | 0.5707 | 78 | 27 | 37.6% | 137.4 |
| WFT1-B1 | 200.8 | 0.3137 | 69 | 36 | 11.8% | 23.7 |
| WFT1-B2 | 167.1 | 0.2610 | 66 | 48 | 16.1% | 26.9 |
| EF-B1 | 70.5 | 0.1102 | 76 | 15 | 11.3% | 8.0 |
| EF-B2 | 79.9 | 0.1248 | 73 | 26 | 0.0% | 0.0 |
| EF-B3 | 210.5 | 0.3289 | 73 | 26 | 0.0% | 0.0 |
| EF-B4 | 351.9 | 0.5498 | 73 | 34 | 0.0% | 0.2 |
| EF-B5 | 85.1 | 0.1329 | 73 | 42 | 0.1% | 0.1 |
| EF-B6 | 25.5 | 0.0398 | 58 | 61 | 0.3% | 0.1 |
| EF-B7 | 70.9 | 0.1107 | 58 | 66 | 0.3% | 0.2 |
| EF-B8 | 115.7 | 0.1807 | 58 | 119 | 0.7% | 0.8 |
| EFT1-B1 | 62.6 | 0.0978 | 76 | 20 | 11.9% | 7.5 |
| EFT1-B2 | 80.7 | 0.1261 | 68 | 28 | 0.0% | 0.0 |
| EFT1-B3 | 253.0 | 0.3953 | 67 | 70 | 0.1% | 0.2 |
| EFT1-B4 | 30.0 | 0.0470 | 59 | 74 | 0.3% | 0.1 |
| SF-B1 | 127.7 | 0.1995 | 64 | 53 | 1.4% | 1.8 |
| SF-B2 | 223.9 | 0.3498 | 70 | 61 | 0.0% | 0.0 |
| SF-B3 | 76.9 | 0.1202 | 70 | 60 | 0.0% | 0.0 |
| SF-B4 | 181.4 | 0.2835 | 67 | 109 | 0.1% | 0.2 |
| SF-B5 | 241.1 | 0.3767 | 67 | 101 | 0.0% | 0.1 |
| SF-B6 | 89.8 | 0.1403 | 72 | 55 | 0.1% | 0.1 |
| SF-B7 | 140.7 | 0.2199 | 69 | 67 | 0.1% | 0.2 |
| SFT1-B1 | 233.4 | 0.3647 | 69 | 73 | 0.0% | 0.0 |
| SE-B1 | 297.5 | 0.4649 | 73 | 39 | 0.8% | 2.5 |
| SE-B2 | 325.5 | 0.5087 | 72 | 94 | 0.0% | 0.1 |
| SE-B3 | 47.4 | 0.0741 | 72 | 102 | 2.0% | 0.9 |
| SE-B4 | 152.3 | 0.2380 | 73 | 68 | 0.1% | 0.2 |
| SE-B5 | 317.7 | 0.4964 | 71 | 204 | 0.4% | 1.2 |
| SE-B6 | 167.3 | 0.2614 | 73 | 99 | 3.6% | 6.0 |
| SE-B7 | 252.2 | 0.3940 | 63 | 85 | 0.8% | 2.0 |
| Totals | 14111 | 22.05 | 69 | | 9.5% | 1343 |

Table 4.0: Existing Conditions Channel Reach Data

| Reach ID | Reach Length R (ft) | Reach Slope (%) | Mannings n value | Reach Side Slope (h/v) | Bottom Width B (ft) |
|---|---|---|---|---|---|
| MS-R1 | 2400 | 1.67% | 0.05 | 7 | 20 |
| MS-R2 | 1800 | 2.22% | 0.05 | 5 | 15 |
| MS-R3 | 1270 | 2.05% | 0.07 | 10 | 50 |
| MS-R4 | 2900 | 1.79% | 0.07 | 10 | 25 |
| MS-R5 | 6040 | 1.79% | 0.05 | 8 | 20 |
| MS-R6 | 1050 | 1.24% | 0.07 | 15 | 20 |
| MS-R7 | 6190 | 1.86% | 0.05 | 6 | 25 |
| MS-R8 | 1870 | 1.60% | 0.07 | 15 | 20 |
| MS-R9 | 450 | 2.67% | 0.07 | 20 | 40 |
| MS-R10 | 1580 | 1.71% | 0.07 | 50 | 65 |
| MS-R11 | 5400 | 1.48% | 0.07 | 15 | 45 |
| MS-R12 | 570 | 1.05% | 0.05 | 4 | 30 |
| MS-R13 | 3110 | 1.09% | 0.05 | 6 | 40 |
| MS-R14 | 7160 | 1.12% | 0.05 | 7 | 25 |
| MS-R15 | 3400 | 1.03% | 0.05 | 6 | 45 |
| MS-R16 | 2400 | 1.13% | 0.05 | 6 | 30 |
| MS-R17 | 630 | 0.79% | 0.05 | 7 | 25 |
| MS-R18 | 5140 | 0.88% | 0.05 | 5 | 25 |
| MS-R18A | 3456 | 1.59% | 0.07 | 60 | 80 |
| MS-R19 | 1640 | 0.91% | 0.05 | 8 | 30 |
| MS-R20 | 2670 | 1.01% | 0.07 | 15 | 50 |
| MS-R21 | 5760 | 1.04% | 0.05 | 8 | 40 |
| MS-R22 | 3410 | 1.17% | 0.07 | 10 | 25 |
| MS-R23 | 3240 | 0.93% | 0.05 | 8 | 15 |
| MS-R24 | 1660 | 1.02% | 0.07 | 40 | 30 |
| MS-R25 | 3930 | 1.07% | 0.07 | 10 | 15 |
| MS-R26 | 760 | 0.66% | 0.07 | 12 | 25 |
| MS-R27 | 1570 | 1.59% | 0.07 | 12 | 25 |
| MS-R28 | 3730 | 0.88% | 0.07 | 15 | 60 |
| MS-R29 | 580 | 0.86% | 0.07 | 25 | 40 |
| MS-R30 | 2220 | 1.13% | 0.07 | 100 | 80 |
| MST2-R1 | 4010 | 2.00% | 0.07 | 12 | 25 |
| MST2-R2 | 6450 | 1.94% | 0.07 | 10 | 25 |
| MST3-R1 | 5970 | 1.76% | 0.07 | 60 | 70 |
| MST4-R1 | 3390 | 1.30% | 0.07 | 25 | 45 |
| MST5-R1 | 7230 | 1.08% | 0.05 | 6 | 30 |
| HD-R1 | 2900 | 2.07% | 0.07 | 40 | 60 |
| HD-R2 | 2650 | 2.08% | 0.07 | 20 | 30 |
| HD-R3 | 2460 | 1.22% | 0.05 | 8 | 20 |
| HD-R4 | 5920 | 1.52% | 0.07 | 50 | 80 |
| HD-R5 | 3730 | 1.61% | 0.05 | 9 | 10 |
| WF-R1 | 2210 | 1.72% | 0.07 | 15 | 25 |
| WF-R2 | 2200 | 2.27% | 0.07 | 40 | 50 |
| WF-R3 | 3200 | 1.69% | 0.05 | 6 | 15 |
| WF-R4 | 6270 | 1.82% | 0.07 | 15 | 30 |
| WF-R5 | 1130 | 1.24% | 0.07 | 10 | 30 |
| WF-R6 | 1060 | 1.42% | 0.07 | 20 | 25 |

Table 4.0: Existing Conditions Channel Reach Data (continued):

| Reach ID | Reach Length R (ft) | Reach Slope (%) | Mannings n value | Reach Side Slope (h/v) | Bottom Width B (ft) |
|---|---|---|---|---|---|
| WF-R7 | 3600 | 1.19% | 0.07 | 15 | 35 |
| WF-R8 | 5900 | 1.24% | 0.05 | 8 | 25 |
| WFT1-R1 | 6040 | 1.84% | 0.07 | 15 | 45 |
| EF-R1 | 2660 | 2.26% | 0.05 | 8 | 20 |
| EF-R2 | 2510 | 2.19% | 0.05 | 7 | 30 |
| EF-R3 | 4770 | 1.47% | 0.05 | 7 | 20 |
| EF-R4 | 1130 | 1.42% | 0.05 | 7 | 30 |
| EF-R5 | 2160 | 1.76% | 0.05 | 4 | 10 |
| EF-R6 | 1440 | 1.25% | 0.05 | 7 | 15 |
| EF-R7 | 5330 | 1.31% | 0.05 | 6 | 15 |
| EFT1-R1 | 3230 | 2.11% | 0.07 | 15 | 30 |
| EFT1-R2 | 6820 | 1.64% | 0.07 | 25 | 35 |
| EFT1-R3 | 2260 | 1.99% | 0.07 | 10 | 25 |
| SF-R1 | 6120 | 1.27% | 0.07 | 70 | 50 |
| SF-R2 | 3840 | 1.17% | 0.07 | 30 | 35 |
| SF-R3 | 2740 | 0.95% | 0.05 | 7 | 60 |
| SF-R4 | 1560 | 0.51% | 0.07 | 10 | 40 |
| SF-R5 | 2720 | 0.81% | 0.07 | 12 | 30 |
| SF-R6 | 4450 | 0.94% | 0.07 | 20 | 30 |
| SE-R1 | 5690 | 1.05% | 0.07 | 60 | 60 |
| SE-R2 | 3010 | 1.10% | 0.07 | 50 | 120 |
| SE-R3 | 6750 | 0.81% | 0.07 | 75 | 100 |
| SET1-R1 | 5580 | 0.99% | 0.07 | 80 | 80 |
| SET1-R2 | 3650 | 0.96% | 0.07 | 100 | 30 |

Table 5.0: Future Conditions Channel Reach Data

| Reach ID | Reach Length R (ft) | Reach Slope (%) | Mannings n value | Reach Side Slope (h/v) | Bottom Width B (ft) |
|---|---|---|---|---|---|
| MS-R1 | 2400 | 1.67% | 0.05 | 8 | 20 |
| MS-R2 | 1800 | 2.22% | 0.05 | 8 | 20 |
| MS-R3 | 1270 | 2.05% | 0.05 | 8 | 20 |
| MS-R4 | 2900 | 1.79% | 0.05 | 4 | 15 |
| MS-R5 | 6040 | 1.79% | 0.05 | 8 | 20 |
| MS-R6 | 1050 | 1.24% | 0.05 | 8 | 20 |
| MS-R7 | 6190 | 1.86% | 0.05 | 6 | 25 |
| MS-R8 | 1870 | 1.60% | 0.07 | 15 | 20 |
| MS-R9 | 450 | 2.67% | 0.07 | 20 | 40 |
| MS-R10 | 1580 | 1.71% | 0.07 | 50 | 65 |
| MS-R11 | 5400 | 1.48% | 0.05 | 4 | 15 |
| MS-R12 | 570 | 1.05% | 0.05 | 4 | 15 |
| MS-R13 | 3110 | 1.09% | 0.05 | 4 | 15 |
| MS-R14 | 7160 | 1.12% | 0.05 | 8 | 20 |
| MS-R15 | 3400 | 1.03% | 0.05 | 8 | 20 |
| MS-R16 | 2400 | 1.13% | 0.05 | 4 | 15 |
| MS-R17 | 630 | 0.79% | 0.05 | 4 | 15 |
| MS-R18 | 5140 | 0.88% | 0.05 | 5 | 25 |
| MS-R18A | 3456 | 1.59% | 0.07 | 80 | 60 |
| MS-R19 | 1640 | 0.91% | 0.05 | 8 | 30 |
| MS-R20 | 2670 | 1.01% | 0.07 | 15 | 50 |
| MS-R21 | 5760 | 1.04% | 0.05 | 8 | 40 |
| MS-R22 | 3410 | 1.17% | 0.07 | 10 | 25 |
| MS-R23 | 3240 | 0.93% | 0.05 | 8 | 15 |
| MS-R24 | 1660 | 1.02% | 0.07 | 40 | 30 |
| MS-R25 | 3930 | 1.07% | 0.07 | 10 | 15 |
| MS-R26 | 760 | 0.66% | 0.07 | 12 | 25 |
| MS-R27 | 1570 | 1.59% | 0.07 | 12 | 25 |
| MS-R28 | 3730 | 0.88% | 0.07 | 15 | 60 |
| MS-R29 | 580 | 0.86% | 0.07 | 25 | 40 |
| MS-R30 | 2220 | 1.13% | 0.05 | 8 | 20 |
| MST2-R1 | 4010 | 2.00% | 0.05 | 8 | 20 |
| MST2-R2 | 6450 | 1.94% | 0.05 | 8 | 20 |
| MST3-R1 | 5970 | 1.76% | 0.07 | 60 | 70 |
| MST4-R1 | 3390 | 1.30% | 0.05 | 8 | 20 |
| MST5-R1 | 7230 | 1.08% | 0.05 | 4 | 15 |
| HD-R1 | 2900 | 2.07% | 0.05 | 4 | 15 |
| HD-R2 | 2650 | 2.08% | 0.05 | 8 | 20 |
| HD-R3 | 2460 | 1.22% | 0.05 | 8 | 20 |
| HD-R4 | 5920 | 1.52% | 0.05 | 8 | 20 |
| HD-R5 | 3730 | 1.61% | 0.05 | 4 | 15 |
| WF-R1 | 2210 | 1.72% | 0.05 | 4 | 15 |
| WF-R2 | 2200 | 2.27% | 0.05 | 8 | 20 |
| WF-R3 | 3200 | 1.69% | 0.05 | 8 | 20 |
| WF-R4 | 6270 | 1.82% | 0.07 | 15 | 30 |
| WF-R5 | 1130 | 1.24% | 0.07 | 10 | 30 |
| WF-R6 | 1060 | 1.42% | 0.05 | 8 | 20 |

Table 5.0: Future Conditions Channel Reach Data (continued):

| Reach ID | Reach Length R (ft) | Reach Slope (%) | Mannings n value | Reach Side Slope (h/v) | Bottom Width B (ft) |
|---|---|---|---|---|---|
| WF-R7 | 3600 | 1.19% | 0.05 | 4 | 15 |
| WF-R8 | 5900 | 1.24% | 0.05 | 4 | 15 |
| WFT1-R1 | 6040 | 1.84% | 0.05 | 8 | 20 |
| EF-R1 | 2660 | 2.26% | 0.05 | 8 | 20 |
| EF-R2 | 2510 | 2.19% | 0.05 | 7 | 30 |
| EF-R3 | 4770 | 1.47% | 0.05 | 7 | 20 |
| EF-R4 | 1130 | 1.42% | 0.05 | 7 | 30 |
| EF-R5 | 2160 | 1.76% | 0.05 | 4 | 10 |
| EF-R6 | 1440 | 1.25% | 0.05 | 7 | 15 |
| EF-R7 | 5330 | 1.31% | 0.05 | 6 | 15 |
| EFT1-R1 | 3230 | 2.11% | 0.07 | 15 | 30 |
| EFT1-R2 | 6820 | 1.64% | 0.07 | 25 | 35 |
| EFT1-R3 | 2260 | 1.99% | 0.07 | 10 | 25 |
| SF-R1 | 6120 | 1.27% | 0.07 | 70 | 50 |
| SF-R2 | 3840 | 1.17% | 0.07 | 30 | 35 |
| SF-R3 | 2740 | 0.95% | 0.05 | 7 | 60 |
| SF-R4 | 1560 | 0.51% | 0.07 | 10 | 40 |
| SF-R5 | 2720 | 0.81% | 0.07 | 12 | 30 |
| SF-R6 | 4450 | 0.94% | 0.07 | 20 | 30 |
| SE-R1 | 5690 | 1.05% | 0.07 | 60 | 60 |
| SE-R2 | 3010 | 1.10% | 0.07 | 50 | 120 |
| SE-R3 | 6750 | 0.81% | 0.07 | 75 | 100 |
| SET1-R1 | 5580 | 0.99% | 0.07 | 80 | 80 |
| SET1-R2 | 3650 | 0.96% | 0.07 | 100 | 30 |

Table 6.2: Summary of Flows at Selected Design Points – 5-year Storm Event

| Design Point ID | Design Point Location | Hydrologic Element | Accumulative Area ($mi^2$) | Existing Peak Flow (cfs) | Future Peak Flow (cfs) | % Difference Peak Flow | Existing Volume (ac-ft) | Future Volume (ac-ft) | % Difference Volume |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Haegler Diversion at Eastonville Road | HD-J2 | 0.8 | 122 | 359 | 195% | 26 | 38 | 43% |
| 2 | West Fork at Eastonville Road | WF-J1 | 0.3 | 39 | 130 | 235% | 10 | 16 | 59% |
| 3 | Main Channel at Eastonville Road | MS-J4 | 1.3 | 214 | 389 | 82% | 37 | 50 | 33% |
| 4 | Haegler Diversion at Highway 24 | HD-J4 | 1.3 | 137 | 396 | 189% | 31 | 45 | 43% |
| 5 | West Fork at Highway 24 | WF-J3 | 0.4 | 52 | 186 | 258% | 16 | 23 | 47% |
| 6 | Main Channel at Highway 24 | MS-J6 | 2.5 | 262 | 591 | 126% | 62 | 78 | 27% |
| 7 | East Fork at Highway 24 | EF-J4 | 1.2 | 292 | 334 | 14% | 44 | 45 | 2% |
| 8 | Main Channel at Elbert Road | MS-J7 | 3.0 | 262 | 590 | 126% | 68 | 84 | 25% |
| 9 | East Fork at Elbert Road | EF-J6 | 2.1 | 307 | 344 | 12% | 62 | 64 | 4% |
| 10 | West Fork at Judge Orr Road | WF-J6 | 1.5 | 241 | 634 | 163% | 72 | 101 | 40% |
| 11 | Confluence of East Fork and Main Channel | MS-J9 | 5.7 | 456 | 934 | 105% | 134 | 153 | 14% |
| 12 | Main Channel at Judge Orr Road | MS-J11 | 6.7 | 482 | 997 | 107% | 150 | 187 | 25% |
| 13 | Confluence of West Fork and Main Channel | MS-J12 | 11.2 | 615 | 1780 | 189% | 240 | 346 | 44% |
| 14 | Main Channel at Falcon Highway | MS-J16 | 13.4 | 662 | 1907 | 188% | 271 | 412 | 52% |
| 15 | Main Channel at Peyton Highway | MS-J19 | 15.1 | 683 | 1906 | 179% | 285 | 428 | 50% |
| 16 | Main Channel at Jones Road | MS-J20 | 15.6 | 688 | 1913 | 178% | 291 | 440 | 51% |
| 17 | South Fork at Jones Road | SF-J4 | 1.3 | 117 | 117 | 0% | 41 | 41 | 0% |
| 18 | Confluence of South Fork and Main Channel | MS-J22 | 17.9 | 764 | 1989 | 161% | 341 | 494 | 45% |
| 19 | Southeast Fork at McDaniels Road | SE-J3 | 2.4 | 157 | 153 | -2% | 69 | 69 | 0% |
| 20 | Main Channel at McDaniels Road | MS-J29 | 19.6 | 790 | 1985 | 151% | 355 | 521 | 47% |
| 21 | Total Combined Outfall | SE-J3 plus MS-J29 | 22.0 | 909 | 2071 | 128% | 424 | 590 | 39% |

The 5-year storm event future undetained peak flow is estimated to increase by 128% over the existing peak flow while the future volume of runoff is estimated to increase by 39%.

Table 6.4: Summary of Flows at Selected Design Points – 100-year Storm Event

| Design Point ID | Design Point Location | Hydrologic Element | Accumulative Area ($mi^2$) | Existing Peak Flow (cfs) | Future Peak Flow (cfs) | % Difference Peak Flow | Existing Volume (ac-ft) | Future Volume (ac-ft) | % Difference Volume |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Haegler Diversion at Eastonville Road | HD-J2 | 0.8 | 431 | 1060 | 146% | 77 | 96 | 25% |
| 2 | West Fork at Eastonville Road | WF-J1 | 0.3 | 146 | 389 | 166% | 29 | 39 | 33% |
| 3 | Main Channel at Eastonville Road | MS-J4 | 1.3 | 730 | 1233 | 69% | 112 | 135 | 20% |
| 4 | Haegler Diversion at Highway 24 | HD-J4 | 1.3 | 521 | 1223 | 135% | 97 | 121 | 24% |
| 5 | West Fork at Highway 24 | WF-J3 | 0.4 | 224 | 605 | 170% | 49 | 62 | 26% |
| 6 | Main Channel at Highway 24 | MS-J6 | 2.5 | 997 | 1896 | 90% | 194 | 225 | 16% |
| 7 | East Fork at Highway 24 | EF-J4 | 1.2 | 1054 | 1113 | 6% | 124 | 126 | 1% |
| 8 | Main Channel at Elbert Road | MS-J7 | 3.0 | 1010 | 1896 | 88% | 220 | 253 | 15% |
| 9 | East Fork at Elbert Road | EF-J6 | 2.1 | 1120 | 1172 | 5% | 183 | 187 | 2% |
| 10 | West Fork at Judge Orr Road | WF-J6 | 1.5 | 1017 | 2213 | 117% | 244 | 291 | 19% |
| 11 | Confluence of East Fork and Main Channel | MS-J9 | 5.7 | 1817 | 3068 | 69% | 429 | 467 | 9% |
| 12 | Main Channel at Judge Orr Road | MS-J11 | 6.7 | 1968 | 3383 | 72% | 487 | 564 | 16% |
| 13 | Confluence of West Fork and Main Channel | MS-J12 | 11.2 | 2732 | 6104 | 123% | 805 | 993 | 23% |
| 14 | Main Channel at Falcon Highway | MS-J16 | 13.4 | 3045 | 6784 | 123% | 936 | 1191 | 27% |
| 15 | Main Channel at Peyton Highway | MS-J19 | 15.1 | 3200 | 6946 | 117% | 1012 | 1269 | 25% |
| 16 | Main Channel at Jones Road | MS-J20 | 15.6 | 3250 | 7056 | 117% | 1040 | 1308 | 26% |
| 17 | South Fork at Jones Road | SF-J4 | 1.3 | 454 | 454 | 0% | 133 | 133 | 0% |
| 18 | Confluence of South Fork and Main Channel | MS-J22 | 17.9 | 3650 | 7392 | 103% | 1210 | 1489 | 23% |
| 19 | Southeast Fork at McDaniels Road | SE-J3 | 2.4 | 547 | 546 | 0% | 210 | 210 | 0% |
| 20 | Main Channel at McDaniels Road | MS-J29 | 19.6 | 3791 | 7525 | 99% | 1293 | 1597 | 23% |
| 21 | Total Combined Outfall | SE-J3 plus MS-J29 | 22.0 | 4326 | 7687 | 78% | 1503 | 1807 | 20% |

The 100-year storm event future undetained peak flow is estimated to increase by 78% over the existing peak flow while the future volume of runoff is estimated to increase by 20%.

During the hydrologic analysis it was observed that the Black Squirrel Creek lies very close to the eastern boundary of the Gieck Ranch Basin from Falcon Highway downstream to Log Road. It is possible that flow from Black Squirrel Creek could spill into the Gieck Ranch Basin during extreme storm events. The flows in Black Squirrel Creek in this area are expected to be more than 5,000 cfs for the 100-year event. If the Black Squirrel Creek were to overflow its' banks and flow into the Gieck Ranch Basin it could increase the flows shown in the above tables. Possible improvements to address this potential problem include channel improvements to increase the Black Squirrel Creek conveyance in this area or constructing berms on the east bank to prevent overflow.

## IV. Hydraulic Analysis

### A. Introduction

This section summarizes the hydraulic analysis of the Gieck Ranch Drainage Basin. Included in this section are an inventory of existing drainageway structures and a summary of structure deficiencies, a description of the USACE HEC-RAS model, the 100-year existing conditions floodplain delineation with comparison to regulatory floodplains and a discussion of the 100-year future conditions floodplain. The floodplain information contained in this report is intended for the identification and mitigation of flood prone areas within the studied reach. It should only be used as a planning tool, and is not intended to replace the information presented in the El Paso County Flood Insurance Studies.

### B. Hydraulic Structure Inventory and Evaluation

All of the existing drainage structures within the basin were identified and evaluated based on size, type, and general condition. The locations of the existing structures are identified in Figures 6.1, 6.2 and 6.3 which are located in Volume 2 of this report. The hydraulic capacity of existing culverts and bridges was estimated using either the CulvertMaster computer program by Haested Methods or the USACE HEC-RAS model. The hydraulic capacity of road crossings was based on the allowable cross flow defined in Table 6.1 of the Colorado Springs/El Paso County DCM for the functional classifications of the existing roadways identified in the El Paso County DOT 2030 Major Transportation Corridors Plan. A summary of the inventory and hydraulic capacity analysis is presented in Table 8.0 and the detailed analysis is provided in Section 12 of the Technical Addenda. During evaluation of the structures it was determined that El Paso County is not responsible for the maintenance and/or replacement for some structures, such as bridges and culverts under Highway 24. While these structures are included in the inventory tables, they were not evaluated for hydraulic capacity as indicated in Table 8.0.

In general, culverts inventoried for this study were found to have little capacity during the 100-year storm event before flood flows would overtop the road. Many were partially clogged with debris and/or sediment. A few were completely buried, possibly from roadside maintenance grading, and were not found. In general, most of the existing bridge crossings were found to have adequate capacity during the 100-year storm event.

The diversion channel that conveys water from the Haegler Diversion drainageway to the West Fork drainageway north of Judge Orr Road was also evaluated for capacity. It was found to be inadequate to convey the existing 100-year flow.

### C. Irrigation Structures

There are no irrigation canals located within the basin. The basin does have a number of stock watering ponds that have been constructed over time by local ranchers. These structures are meant to detain water during the spring runoff and during infrequent thunderstorms that occur over the basin. It is assumed that the structures will be removed as the basin develops or will be overwhelmed during a major storm event. Therefore, they were not evaluated as effective storage areas in the hydraulic analysis.

### D. Hydraulic Model

Water surface elevations for the Gieck Ranch Drainage Basin were modeled using the U.S. Army Corps of Engineers direct-step-backwater computer model HEC-RAS version 4.0, dated May 2005. Water surface elevations were determined for the major stream reaches of the Gieck Ranch Drainage Basin identified in Figure 8.1 located in Volume 2 of this report. These stream reaches were first defined based on the ARC Hydro 1.1 GIS extension applied to the surface grid generated from the LIDAR terrain points within the ARCVIEW GIS 9.1 environment. Adjustments were made to stream reaches based on structure locations, El Paso County DOT review comments, and field investigations. The final stream delineations used in the HEC-RAS model closely match the reach delineations used in the HEC-HMS hydrologic model and follow the same naming convention with the one exception that some of the major drainageways have been further sub-divided within the HEC-RAS model as upper/middle/lower or North 1 (N1), North 2 (N2), South 1 (S1), South 2 (S2), etc., as shown on Figure 8.1.

Table 8.0: Structure Inventory and Evaluation Summary

| Structure ID | Location | Type | Existing Condition | Percent of 100-year Flow Passing* | Adequate** Y/N? | Proposed Structure |
|---|---|---|---|---|---|---|
| 1 | Eastonville Road southeast of structure 2 | 18" CMP | Good | 13% | N | 2 - 6' x 3' CBC |
| 2 | Eastonville Road at Haegler Diversion | 18" CMP | Good | 3% | N | 1 - 12' x 5' CBC |
| 3 | Eastonville Road northeast of structure 2 | 18" CMP | Good | 67% | N | 2 - 24" RCP |
| 4 | Eastonville Road at West Fork | 36" CMP | Good | 24% | N | 48" x 76" ERCP |
| 5 | Eastonville Road northeast of structure 4 | 30" CMP | Fair | 81% | N | 2 - 30" CMP |
| 6 | Eastonville Road northeast of structure 5 | 18" CMP | Poor | 100% | Y | --- |
| 7 | Eastonville Road northeast of structure 6 | 18" CMP | Good | 100% | Y | --- |
| 8 | Eastonville Road northeast of structure 7 | 18" CMP | Good | 93% | N | 19" x 30" ERCP |
| 9 | Eastonville Road at Main Channel | 24" CMP | Fair | 2% | N | 2 - 10' x 5' CBC |
| 10 | Eastonville Road at Main Channel - East Tributary | 19" x 28" CMP | Good | 4% | N | 1 - 12' x 5' CBC |
| 11 | Eastonville Road northeast of structure 10 | 18" CMP | Good | 100% | Y | --- |
| 12 | Eastonville Road northeast of structure 11 | 24" x 35" CMP | Good | 89% | Y | --- |
| 13 | Eastonville Road at headwaters of East Fork | 30" CMP | Good | 24% | N | 43" x 68" ERCP |
| 14 | Upstream of Hwy 24 at Haegler Diversion | 2 - 36" CMP | Good | 22% | N | 2 - 8' x 4' CBC |
| 15 | Hwy 24 at Haegler Diversion | 4' x 4' CBC | Good | 34% | N.E. | --- |
| 16 | Upstream of Hwy 24 northeast of structure 14 | 18" CI | Good | 100% | N | 24" CMP |
| 17 | Hwy 24 northeast of structure 15 | 24" RCP | Good | 100% | N.E. | --- |
| 18 | Upstream of Hwy 24 at West Fork | Bridge | Good | 100% | Y | --- |
| 19 | Hwy 24 at West Fork | Bridge | Good | 100% | N.E. | --- |
| 20 | Upstream of Hwy 24 northeast of structure 18 | 36" CMP | Good | 72% | Y | --- |
| 21 | Hwy 24 northeast of structure 19 | 24" CMP | Poor | 34% | N.E. | --- |
| 22 | Upstream of Hwy 24 at Main Channel | Bridge | Good | 100% | Y | --- |
| 23 | Hwy 24 at Main Channel | Bridge | Good | 100% | N.E. | --- |
| 24 | Upstream of Hwy 24 northeast of structure 22 | 24" CMP | Unknown | 100% | Y | --- |
| 25 | Hwy 24 northeast of structure 23 | 24" CMP | Unknown | 100% | N.E. | --- |
| 26 | Upstream of Hwy 24 northeast of structure 24 | 24" CMP | Unknown | 100% | Y | --- |
| 27 | Hwy 24 northeast of structure 25 | 24" CMP | Fair | 100% | N.E. | --- |
| 28 | Hwy 24 northeast of structure 27 | 24" CMP | Poor | 99% | N.E. | --- |
| 29 | Upstream of Hwy 24 at East Fork - West Tributary | 24" CMP | Fair | 6% | N | 1 - 12' x 4' CBC |
| 30 | Hwy 24 at East Fork - West Tributary | 24" CMP | Good | 9% | N.E. | --- |
| 31 | Upstream of Hwy 24 at East Fork - East Tributary | Bridge | Good | 100% | Y | --- |
| 32 | Hwy 24 at East Fork - East Tributary | Bridge | Good | 100% | N.E. | --- |
| 33 | Curtis Road south of Hwy 24 | 15" CMP | Good | 6% | N | 36" CMP |
| 34 | Elbert Road at East Fork | Bridge | Good | 39% | N | 50' Span |

Table 8.0: Structure Inventory and Evaluation Summary (Cont.)

| | | | | | | |
|---|---|---|---|---|---|---|
| 35 | Elbert Road south of structure 34 | 24" CMP | Good | 100% | Y | --- |
| 36 | Elbert Road at Main Channel | 2 - 48" CMP | Good | 19% | N | 3 - 12' x 4' CBC |
| 37 | Elbert Road south of structure 36 | 24" CMP | Poor | 55% | Y | --- |
| 38 | Judge Orr Road at West Fork | 67" x 95" CMP | Good | 20% | N | 4 - 12' x 5' CBC |
| 39 | Judge Orr Road east of structure 38 | 36" CMP | Good | 100% | Y | --- |
| 40 | Judge Orr Road west of structure 41 | 24" CMP | Poor | 90% | Y | --- |
| 41 | Judge Orr Road at Main Channel | Bridge | Good | 100% | Y | --- |
| 42 | Falcon Hwy at Main Channel | Bridge | Good | 57% | N | 85' Span |
| 43 | Peyton Road at headwaters of South Fork | 24" CMP | Fair | 75% | Y | --- |
| 44 | Peyton Road at Main Channel | 4 - 24" RCP | Good | 2% | N | 5 - 12' x 7' CBC |
| 45 | Peyton Road south of structure 44 | 36" CMP | Poor | 100% | Y | --- |
| 46 | Peyton Road south of structure 45 | 24" CMP | Good | 100% | Y | --- |
| 47 | East Garrett Road west of structure 48 | 24" CMP | Poor | 100% | Y | --- |
| 48 | East Garrett Road at South Fork | 48" CMP | Good | 14% | N | 2 - 5' x 4' CBC |
| 49 | J.D. Johnson Road at South Fork | 4 - 42" RCP | Good | 63% | N | 2 - 12' x 4' CBC |
| 50 | J.D. Johnson Road south of structure 49 | 30" CMP | Fair | 56% | N | 36" CMP |
| 51 | J.D. Johnson Road south of structure 50 | 30" CMP | Fair | 100% | Y | --- |
| 52 | Jones Road at Main Channel | 60" CMP | Fair | 4% | N | 6 - 12' x 7' CBC |
| 53 | J.D. Johnson Road at Jones Road | 30" CMP | Fair | 55% | Y | --- |
| 54 | Jones Road east of J.D. Johnson Road | 30" CMP | Good | 73% | Y | --- |
| 55 | Jones Road at South Fork | 36" CMP | Good | 6% | N | 2 - 7' x 5' CBC |
| 56 | Jones Road east of structure 55 | 30" CMP | Fair | 67% | Y | --- |
| 57 | J.D. Johnson Road at Main Channel US of structure 58 | 3 - 60" RCP | Good | 14% | N | 85' Span |
| 58 | J.D. Johnson Road at Main Channel | 30" CMP | Good | 1% | N | 120' Span |
| 59 | J.D. Johnson Road and Log Road | 24" CMP | Fair | 23% | N | 2 - 6' x 3' CBC |
| 60 | Main Channel at private driveway | 48" CMP (est.) | Unknown | 2% | N.E. | --- |
| 61 | Log Road at Main Channel | Bridge | Good | 36% | N | 120' Span |
| 62 | McDaniel Road at Main Channel | 30" x 48" Oval CMP | Good | 1% | N | 120' Span |
| 63 | Log Road and McDaniels Road | 24" CMP | Good | 2% | N | 5 - 6' x 3' CBC |

* Road over-topping not included

** Allowable road over-topping included in adequacy analysis

*** Based on proposed (with selected drainage basin plan) flows

N.E. Not Evaluated, not EPCDOT responsibility

minimize impacts to wetlands and waters from the project to the maximum extent practicable. Individual permit applications are advertised for public comment and are reviewed by federal, state and local agencies. The processing of individual permits requires a minimum of 60-90 days, and wetland mitigation is required for impacts to jurisdictional wetlands and waters at a 1:1 mitigation replacement ratio.

Wetlands, streams and riparian areas along the Gieck Ranch Basin should be preserved and protected to the maximum extent practicable. Impacts to wetlands and waters should be avoided and minimized by the project design. All impacts to wetlands and waters will need to be mitigated following a mitigation plan approved by the U.S. Army Corps of Engineers.

### G. Mitigation Guidelines and Recommendations

The U.S. Army Corps of Engineers would like to see project design plans for the Gieck Ranch Basin that minimize hard-lining the channel, with an emphasis on vegetative restoration measures. The existing floodway channel should be maintained to allow for overbank flooding that promotes the use of the floodway and adjacent floodplain during storm events. Water storage facilities should avoid impacts to wetlands and the Gieck Ranch riparian corridor. A wetlands and riparian buffer zone should be established and preserved along the Gieck Ranch drainageways to protect aquatic resources.

Mitigation opportunities include wetlands restoration and creation along the wetter sections of Gieck Ranch tributaries, and restoration of riparian habitats. Wetlands creation and restoration work generally involves site grading, planting wetland plant species, and seeding with native wetlands seed. Mitigation bank credits could potentially be purchased to offset wetlands impacts that result from the drainage basin project in order to meet wetlands mitigation requirements, if mitigation bank credits are available. Section 404 permit authorization must be obtained from the U.S. Army Corps of Engineers prior to initiating work in jurisdictional wetlands. It is recommended that the Corps be contacted in advance of all proposed work activities that could impact wetlands or waters to insure compliance with current Section 404 wetlands regulations. Best Management Practices (BMP's) for erosion and sediment control should be followed during all project activities.

## VI. Evaluation of Alternatives

### A. Introduction

This section describes the process for the development of alternative plans for drainageway improvements within the Gieck Ranch Drainage Basin. If not mitigated, future development would cause 100-year return period peak runoff rates within the basin to increase from 4,326 cfs to 7,687 cfs, an increase of 78%. Total runoff volume from the basin would increase by 20% for the 100-year event. This would increase flood flows and thereby increase the size and elevation of the 100-year floodplain, increasing the number of buildings that could be potentially flooded. Many of the existing drainage structures would have insufficient capacity to pass the increased flood flows and could potentially be damaged as well. In addition, smaller rainfall events would produce more runoff volume due to the increase in impervious surface areas. The estimated increase in runoff volume from 2-year event is 56%. As a result, channel erosion could be expected. Feasible alternatives were identified to address these long-term affects of urbanization on the basin.

The development of alternatives was accomplished in a two-step process. In the first step, several possible alternatives were evaluated for feasibility using parameters compared on qualitative and relative quantitative bases. Based on the results of the first step, feasible alternatives were selected by the Sponsors for further evaluation and screening in the second step.

### B. Planning Goals and Evaluation Parameters

During the planning study process several planning goals were developed as a basis for alternative evaluation. These were refined into 5 general planning goals that are identified as the following:

- Identify existing facilities that are impacted by the 100-year storm event and improvements that will be required to control flooding as a result of new development.
- Provide stormwater management within developing areas of the basin that reduce the affects of runoff and sedimentation and maintain channel stability in order to minimize improvements required on reaches downstream of developments.

the number of storms that create runoff, and increases the overall volume of runoff discharged from a site. In a newly developed area, this increased volume of runoff leads to elevated soil moisture in the drainageways. Native vegetation that is adapted to periodically moist soils begins to "drown" and die off in the wet channel conditions. Erosion of the channel begins as the roots that used to hold soils in place disappear. In-stream measures are needed to keep the receiving waterways form undergoing undesirable geomorphic changes. Measures to be considered for use in combination with any of the detention methods described above include vegetation augmentation and selective channel stabilization using structural methods and/or bio-engineered channels.

With vegetation augmentation, better adapted native hydric species are used to augment the existing vegetation early in the process when stormwater runoff is first introduced. This allows the dry channel to transform to a wet channel while not permitting the loss of soils.

Selective channel stabilization includes a number of structural methods to reduce erosion of channel banks where needed at selected sites. Stabilization usually involves armoring of the channel banks with riprap or a combination of riprap with other bioengineered stabilization measures. Bioengineered channels emphasize the use of vegetative components in combination with structural measures to stabilize and protect stream banks from erosion. Selective channel stabilization is particularly effective in areas where channel erosion is already occurring and protection of property and improvements is required. Grade control structures to prevent head-cutting of the channel invert may be required with this approach.

**5. Channelization**

Channelization involves the use of constructed, lined channels to control flood flows around or through urbanized areas. They are generally lined with riprap and are the most expensive of the alternatives considered. This alternative has a high potential for impacts to environmental resources also. Grade control structures would also be required with this approach, adding to the infrastructure costs.

**D. Evaluation Matrix**

An evaluation matrix was developed to assist in the initial development of the possible alternatives. The matrix is presented in Table 9.0 where alternatives are ranked relative to each other for each of the evaluation parameters.

Table 9.0: Alternatives Evaluation Matrix

| | Alternative | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | Do - nothing | Prudent Line | On-Site Detention | Regional Detention | Small Regional Full Spectrum Detention | Channel Stabilization | Channel -ization |
| Infrastructure costs | Good | Good | Fair | Poor | Fair | Fair | Poor |
| Maintenance | Poor | Good | Fair | Fair | Fair | Good | Fair |
| Flood damage reduction | Poor | Fair | Good* | Good | Good* | Poor | Poor |
| Channel stability | Poor | Poor | Fair | Fair | Fair | Good | Good |
| Environmental impacts | Good | Fair | Fair | Fair | Fair | Fair | Poor |
| Impacts on roads | Poor | Poor | Good | Good | Good | Good | Good |
| R-O-W/property | Good | Poor | Good | Fair | Fair | Good | Good |
| Trails and open space | Fair | Good | Poor | Good | Good | Poor | Poor |
| Stormwater quality | Poor | Poor | Good | Fair | Good | Fair | Fair |

*Good rating applies only if properly maintained. Studies have shown that this is not typical when the facilities are privately owned.

**E. Feasible Alternatives - Conclusions and Recommendations**

Based on the hydrologic and hydraulic analyses and the initial evaluation of alternatives, the following conclusions are made and strategies are recommended for further evaluation in Step 2 of the process:

1. Different areas of the basin will be subjected to differing levels of development. The majority of the high density development is expected to occur in the northwest and central sections, whereas the northeast and southern sections are expected to remain less developed. Different alternative approaches should be used for the different areas.

2. The do-nothing approach is not suitable for use in developed areas. It can be applied to specific reaches that are stable and do not expect to see any significant impacts from development, such as

## VII. Drainage Basin Plan Development

### A. Selected Plan

The selected plan consists of integrating the selected alternative outlined in the previous section. This includes the construction of the small regional full spectrum detention basins and the recommended channel improvements shown on the plan and profile sheets located in the Appendices. The future conditions hydrologic and hydraulic models were updated to determine the affect of the full spectrum regional ponds on peak flows, volumes and channel velocities. Revised hydrologic and hydraulic modeling results are provided in Sections 17 and 18 of the Technical Addenda. Table 11 presents a summary of discharge rates for the selected plan incorporating the full spectrum regional detention facilities.

Table 11: Summary of Flows at Selected Design Points – Selected Plan Developed Conditions

| Design Point ID | Design Point Location | Hydrologic Element | Q2 (cfs) | Q5 (cfs) | Q10 (cfs) | Q100 (cfs) |
|---|---|---|---|---|---|---|
| 1 | Haegler Diversion at Eastonville Road | POND HD-S1 | 5 | 25 | 32 | 338 |
| 2 | West Fork at Eastonville Road | WF-J2 | 2 | 17 | 45 | 114 |
| 3 | Main Channel at Eastonville Road | POND MS-S1 | 28 | 119 | 253 | 573 |
| 4 | Main Channel Tributary 2 at Eastonville Road | POND MST2-S1 | 21 | 65 | 126 | 271 |
| 5 | East Fork Tributary at Eastonville Road | EFT1-B1 | 25 | 46 | 73 | 134 |
| 6 | East Fork at Eastonville Road | EF-B1 | 33 | 59 | 92 | 168 |
| 7 | Haegler Diversion at Highway 24 | HD-J4 | 7 | 33 | 138 | 429 |
| 8 | West Fork at Highway 24 | WF-J3 | 6 | 38 | 97 | 242 |
| 9 | West Fork Tributary at Highway 24 | POND WFT1-S1 | 1 | 8 | 24 | 66 |
| 10 | Main Channel at Highway 24 | MS-J6 | 49 | 190 | 391 | 877 |
| 11 | Main Channel Tributary 3 at Highway 24 | MST3-B1 | 1 | 3 | 7 | 19 |
| 12 | East Fork Tributary at Highway 24 | EFT1-J2 | 43 | 95 | 164 | 337 |
| 13 | East Fork at Highway 24 | EF-J4 | 160 | 334 | 564 | 1102 |
| 14 | Main Channel at Elbert Road (Further South of) | MS-B10 | 1 | 2 | 6 | 16 |
| 15 | Main Channel at Elbert Road (South of) | MS-J8 | 1 | 3 | 6 | 18 |
| 16 | Main Channel at Elbert Road | MS-J7 | 50 | 193 | 399 | 896 |
| 17 | East Fork at Elbert Road | EF-J6 | 162 | 344 | 588 | 1169 |
| 18 | Confluence of East Fork and Main Channel | MS-J9 | 160 | 390 | 775 | 1774 |
| 19 | West Fork at Judge Orr Road | POND WF-SR1 | 18 | 86 | 273 | 753 |
| 20 | Main Channel at Judge Orr Road (West of) | POND WF-S3 | 1 | 2 | 4 | 11 |
| 21 | Main Channel at Judge Orr Road | MS-J11 | 154 | 407 | 828 | 1920 |
| 22 | Confluence of West Fork and Main Channel | MS-J12 | 160 | 500 | 1085 | 2679 |
| 23 | Main Channel at Falcon Highway | MS-J16 | 141 | 494 | 1103 | 2842 |
| 24 | Main Channel at Falcon Highway (East of) | MS-B20 | 2 | 7 | 15 | 38 |
| 25 | South Fork at Falcon Highway | SF-B1 | 4 | 13 | 27 | 65 |
| 26 | Main Channel at Peyton Highway | MS-J19 | 150 | 520 | 1163 | 3003 |
| 27 | South Fork at Peyton Highway | SF-J1 | 18 | 40 | 70 | 148 |
| 28 | South Fork at J.D. Johnson Road | SF-J4 | 51 | 117 | 212 | 455 |
| 29 | Main Channel at Jones Road | MS-J20 | 154 | 528 | 1179 | 3054 |
| 30 | South Fork at Jones Road | SF-J5 | 54 | 124 | 226 | 484 |
| 31 | South Fork Tributary at Jones Road | SET1-B1 | 24 | 47 | 78 | 152 |
| 32 | Main Channel at J.D. Johnson Road (North) | MS-J21 | 154 | 529 | 1184 | 3068 |
| 33 | Confluence of South Fork and Main Channel | MS-J22 | 188 | 602 | 1341 | 3449 |
| 34 | Main Channel at J.D. Johnson Road (South) | MS-J23 | 193 | 612 | 1367 | 3520 |
| 35 | South Fork Tributary at J.D. Johnson Road | SET1-J1 | 38 | 77 | 131 | 272 |
| 36 | Main Channel at Log Road (North) | MS-J25 | 195 | 616 | 1375 | 3546 |
| 37 | Main Channel at Log Road (South) | MS-J26 | 196 | 618 | 1378 | 3557 |
| 38 | Southeast Fork at Log Road | SE-J2 | 70 | 145 | 247 | 498 |
| 39 | Main Channel at McDaniels Road | MS-J29 | 199 | 626 | 1395 | 3594 |
| 40 | Southeast Fork at McDaniels Road | SE-J3 | 73 | 153 | 263 | 537 |
| 41 | Total Combined Outfall | MS-J29 and SE-J3 | 272 | 779 | 1657 | 4131 |

Comparison to the existing conditions flows presented in Tables 6.1 through 6.4 shows that implementation of the selected plan will result in developed peak discharge rates that are slightly lower than existing discharge rates. This should reduce potential for flood damage within the basin.

### B. Small Regional Detention Basins

The recommended plan includes the construction of 17 small regional detention storage basins, 15 of which would incorporate full spectrum detention. Ponds WF-SR1 and MS-SR1 exceed the contributing area size limitation for full spectrum detention. For these two ponds, the water quality

control volume should be provided. Pond WFT1-S1 will only provide detention for the property located in Basin WFT1-B1 and the pond should be constructed when this property is developed. The locations of the basins shown on the plan sheets are conceptual. The final location and sizes of the basins are to be determined during final design of proposed development projects. It is possible that the location and basin size may vary from the conceptual design as long as sufficient detention storage is provided to meet required discharge rates and the excess urban runoff volumes are provided as outlined in the Urban Drainage and Flood Control District Criteria for full spectrum detention. Table 12 lists the detention basin data for the selected plan. Some areas of the drainage basin may encounter seasonal high ground water tables. Final sizing of the detention basins should be done in such a way as to minimize the need for underdrains.

### C. Channel Improvements

Recommended channel improvements consist of vegetation augmentation, selective channel stabilization such as selectively armoring existing channel banks with riprap at outside channel bends and at bridge and culvert outlets, bio-engineered stabilization treatment, and low flow linings, some channelization, and construction of grade control structures. The recommended channel improvements have been selected to minimize environmental impacts and retain natural channel characteristics as much as possible since the basin is mostly undeveloped and the majority of the existing drainageways have not been disturbed at this time. There are large areas of the basin that are to remain as vacant or agricultural land based on the El Paso County 2030 Land Use Codes. Specific channel improvements to the drainageways in these areas were not recommended. It is assumed that these channels will remain in private ownership which lowers the feasibility of channel improvements that require permanent right-of-way or easements for construction and maintenance. The recommended approach for these areas is to provide as-needed improvements.

Table 12: Detention Basin Data

| Basin ID | Excess Urban Runoff Volume (ac-ft) | Detention Storage Volume (ac-ft) | Discharge Rate (cfs) |
|---|---|---|---|
| HD-S1 | 21.4 | 41.0 | 345 |
| HD-S2 | 2.4 | 7.0 | 92 |
| WF-S1 | 7.3 | 17.0 | 115 |
| WF-S2 | 2.7 | 13.8 | 134 |
| WF-S3 | 4.3 | 9.0 | 11 |
| WF-S4 | 29.7 | 52.0 | 359 |
| WFT1-S1 | 2.2 | 9.0 | 70 |
| WF-SR1 | WQCV* | 30.0 | 802 |
| MS-S1 | 12.2 | 42.0 | 583 |
| MS-S2 | 0.6 | 5.2 | 58 |
| MS-S3 | 4.8 | 19.0 | 147 |
| MS-S4 | 11.8 | 30.0 | 29 |
| MS-S5 | 2.9 | 6.1 | 26 |
| MS-SR1 | WQCV* | 50.0 | 2,900 |
| MST2-S1 | 3.9 | 21.5 | 275 |
| MST4-S1 | 6.4 | 20.0 | 137 |
| MST5-S1 | 11.6 | 30.0 | 90 |

* Use Water Quality Control Volume

Table 13 lists the recommended approach to channel improvements on a reach by reach basis. As land development projects proceed within the drainage basin the location and specific type of selective channel improvements will need to be identified during the project design phase based on site specific conditions. There may be some overlapping of approaches between reaches. For example, some selective stabilization may be needed in reaches designated for vegetation augmentation and vice-versa. The methods outlined in the City/County Drainage Criteria Manual and the El Paso County Engineering Manual should be applied during final design analysis. Some specific channel improvements have been identified for several areas such as the Haegler Diversion channel upsizing and realignment at Judge Orr Road. These improvements are called out on the selected plan drawings.

Table 13: Channel Improvements By Reach

| Drainageway | Reach ID | Reach Length (ft) | Channel Approach |
|---|---|---|---|
| Haegler Diversion | HD-R1a | 3875 | Selective Stabilization |
| Haegler Diversion | HD-R1b | 5737 | Channelization |
| Haegler Diversion | HD-R2 | 2826 | Vegetation Augmentation |
| Haegler Diversion | HD-R3 | 2207 | Selective Stabilization |
| Haegler Diversion | HD-R4 | 5161 | Vegetation Augmentation |
| Haegler Diversion | HD-R5 | 3784 | Selective Stabilization |
| West Fork | WF-R1 | 1775 | Channelization |
| West Fork | WF-R2 | 2281 | Vegetation Augmentation |
| West Fork | WF-R3 | 3029 | Selective Stabilization |
| West Fork | WF-R4a | 1717 | Vegetation Augmentation |
| West Fork | WF-R4b | 2001 | Vegetation Augmentation |
| West Fork | WF-R4c | 1601 | Selective Stabilization |
| West Fork | WF-R4d | 1198 | Selective Stabilization |
| West Fork | WF-R5 | 1200 | Selective Stabilization |
| West Fork | WF-R6 | 863 | Selective Stabilization |
| West Fork | WF-R7a | 2341 | Vegetation Augmentation |
| West Fork | WF-R7b | 1594 | Vegetation Augmentation |
| West Fork | WF-R8a | 4002 | Selective Stabilization |
| West Fork | WF-R8b | 1600 | Selective Stabilization |
| West Fork - Trib. WF1 | WFT1-RI | 5601 | Vegetation Augmentation |
| Gieck Main | MS-R1 | 2400 | Vegetation Augmentation |
| Gieck Main | MS-R2 | 2000 | Selective Stabilization |
| Gieck Main | MS-R3 | 1200 | Selective Stabilization |
| Gieck Main | MS-R4a | 1278 | Channelization |
| Gieck Main | MS-R4b | 1341 | Channelization |
| Gieck Main | MS-R5 | 6181 | Vegetation Augmentation |
| Gieck Main | MS-R6 | 804 | Selective Stabilization |
| Gieck Main | MS-R7a | 1554 | Vegetation Augmentation |
| Gieck Main | MS-R7b | 3191 | Vegetation Augmentation |
| Gieck Main | MS-R7c | 1354 | Vegetation Augmentation |
| Gieck Main | MS-R8a | 314 | Vegetation Augmentation |
| Gieck Main | MS-R8b | 783 | Selective Stabilization |
| Gieck Main | MS-R8c | 568 | Selective Stabilization |
| Gieck Main | MS-R11a | 3376 | Selective Stabilization |
| Gieck Main | MS-R11b | 2405 | Selective Stabilization |
| Gieck Main | MS-R12 | 620 | Selective Stabilization |
| Gieck Main | MS-R13 | 3158 | Vegetation Augmentation |
| Gieck Main | MS-R14 | 7422 | Selective Stabilization |
| Gieck Main | MS-R15 | 3306 | Selective Stabilization |
| Gieck Main | MS-R16 | 2294 | As-needed Improvements |
| Gieck Main | MS-R17 | 542 | As-needed Improvements |
| Gieck Main | MS-R18 | 5457 | As-needed Improvements |
| Gieck Main | MS-R19 | 1604 | As-needed Improvements |
| Gieck Main | MS-R20a | 1197 | As-needed Improvements |

Table 13: Channel Improvements By Reach, cont.

| Drainageway | Reach ID | Reach Length (ft) | Channel Approach |
|---|---|---|---|
| Gieck Main | MS-R20b | 1227 | As-needed Improvements |
| Gieck Main | MS-R21a | 1990 | As-needed Improvements |
| Gieck Main | MS-R21b | 1584 | As-needed Improvements |
| Gieck Main | MS-R21c | 2242 | As-needed Improvements |
| Gieck Main | MS-R22 | 3360 | As-needed Improvements |
| Gieck Main | MS-R23 | 3268 | As-needed Improvements |
| Gieck Main | MS-R24 | 1927 | As-needed Improvements |
| Gieck Main | MS-R25a | 1603 | As-needed Improvements |
| Gieck Main | MS-R25b | 1615 | As-needed Improvements |
| Gieck Main | MS-R25c | 384 | As-needed Improvements |
| Gieck Main | MS-R26 | 803 | As-needed Improvements |
| Gieck Main | MS-R27 | 1597 | As-needed Improvements |
| Gieck Main | MS-R28 | 3599 | As-needed Improvements |
| Gieck Main | MS-R29 | 797 | As-needed Improvements |
| Gieck Main | MS-R30 | 2004 | As-needed Improvements |
| Gieck Main - Sub Trib M1 | MST1-R1 | 4799 | Selective Stabilization |
| Gieck Main - Sub Trib M2 | MST2-R1 | 3896 | Selective Stabilization |
| Gieck Main - Sub Trib M2 | MST2-R2 | 6504 | Vegetation Augmentation |
| Gieck Main - Sub Trib M3 | MST3-R1 | 5599 | As-needed Improvements |
| Gieck Main - Sub Trib M4 | MST4-R1 | 6000 | Selective Stabilization |
| Gieck Main - Trib. M5 | MST5-R1 | 7200 | Selective Stabilization |
| East Fork | EF-R1 | 2659 | As-needed Improvements |
| East Fork | EF-R2 | 2400 | As-needed Improvements |
| East Fork | EF-R3 | 4800 | As-needed Improvements |
| East Fork | EF-R4 | 1122 | As-needed Improvements |
| East Fork | EF-R5 | 2161 | As-needed Improvements |
| East Fork | EF-R6 | 1410 | As-needed Improvements |
| East Fork | EF-R7 | 4876 | As-needed Improvements |
| East Fork - Trib. EF1 | EFT1-R1 | 3200 | As-needed Improvements |
| East Fork - Trib. EF1 | EFT1-R2a | 2400 | As-needed Improvements |
| East Fork - Trib. EF1 | EFT1-R2b | 4041 | As-needed Improvements |
| East Fork - Trib. EF1 | EFT1-R3 | 2394 | As-needed Improvements |
| South Fork | SF-R1 | 2017 | As-needed Improvements |
| South Fork | SF-R2 | 4120 | As-needed Improvements |
| South Fork | SF-R3 | 3063 | As-needed Improvements |
| South Fork | SF-R4 | 1167 | As-needed Improvements |
| South Fork | SF-R5 | 2434 | As-needed Improvements |
| South Fork | SF-R6 | 4799 | As-needed Improvements |
| South Fork - Trib. SF1 | SFT1-R1 | 2400 | As-needed Improvements |
| Southeast Fork | SE-R1 | 5596 | As-needed Improvements |
| Southeast Fork | SE-R2 | 2786 | As-needed Improvements |
| Southeast Fork | SE-R3a | 3209 | As-needed Improvements |
| Southeast Fork | SE-R3b | 2940 | As-needed Improvements |
| Southeast Fork - Trib. SEF1 | SET1-R1 | 3301 | As-needed Improvements |

The criterion used for sizing proposed channel sections and determining channel armoring has been average channel velocity. A maximum permissible velocity of 5 feet per second was used in areas to be developed. This corresponds to EPC DCM Table 10-4 values for earth lined channels with 0% to 5% slopes for prairie type grasses. In order to minimize the need for hard-lining of channels, check or drop structures have been recommended to reduce the channel slope and to prevent head-cutting of the channel. For this report, drop structures have been designed for a maximum drop of 5 feet and check structures have been designed for a maximum of 2.5 feet. The grade control structures should extend to the channel banks to prevent head cutting at the ends of the structure. Extensive use of grade control structures has eliminated the need for the hard-lining of channels with riprap in almost all locations, allowing for the use of soft-lined channels instead. Low flow linings can be utilized to protect the channel from increased frequency and volume of runoff from minor storm events where native channels will be altered. Recommended design methodologies for grade control structures and low flow linings are presented in Chapter 10 of the City/County DCM and in Volume 2 of the Urban Storm Drainage Criteria Manual. The 100-year velocities shown on the plan sheets have been adjusted to account for recommended channel improvements. Supporting calculations are provided by reach cross-sections in Section 19 of the Technical Addenda.

**D. Roadway Bridge and Culvert Replacements**

Many of the roadway culverts and a few of the bridges were found to be deficient for the 100-year storm event. Recommended replacements are shown on the plan view sheets in Appendix C. The replacement structures were sized in accordance with the City/County Drainage Criteria Manual. Because of erosive soils, riprap armor protection of the channel and abutments at bridges is recommended. The riprap protection should extend on either side of the bridge and should be accompanied with a cutoff wall at the downstream end to prevent undercutting of the armor protection.

**E. Impacts on Environmental Resources**

The overall approach of the selected plan is to minimize environmental impacts and retain natural channel characteristics as much as possible. Still, there will be some potential impacts due to channelization in areas where it cannot be avoided, construction of detention basins, construction of grade control structures and improvements made to culverts and bridges. Many of these impacts will be temporary in nature. Environmental impacts may be mitigated by the utilization of vegetation augmentation and bio-engineered channel stabilization where wetland vegetation is introduced.

**F. Right-of-Way Acquisition**

The drainageways that pass through areas to be developed should be in dedicated drainage tracts, easements or rights-of-way to provide access to maintain or improve the channels as needed. This is an issue that should be addressed through the development review and approval process. It is assumed that all of the small regional detention basins will be owned and maintained by private entities; therefore county access will not be required. One area where additional right-of-way may be required is at the Haegler Diversion channel on the north side of Judge Orr Road. The El Paso County Major Transportation Corridors Plan calls for widening of Judge Orr Road. The selected plan calls for the channel to be realigned so that it is not using the road embankment as one of the channel side slopes. Additional room will be needed to separate the channel from the roadway when this work is done. There are several deficient roadway structures where the adjacent channel invert will need to lowered to accommodate a larger structure. Temporary construction easements may be required to do this work. No cost has been included in the fee estimates for temporary easements.

**G. Stormwater Quality**

In January 2006 the County adopted the El Paso County Addendum to the City of Colorado Springs Drainage Criteria Manual Volume 2: Stormwater Quality Policies, Procedures and Best Management Practices (BMPs) which has been incorporated into the El Paso County Engineering Criteria Manual as Appendix 1. The goal of the Addendum is to provide engineering criteria for water quality protection measures. In addition to establishing permitting, inspection, and enforcement policies, the addendum provides guidance and requirements for the selection of structural BMP's for new development. It is the responsibility of the entity conducting any land disturbance activity to submit a Stormwater Management Plan for temporary erosion control prior to the start of construction and to properly control surface runoff, erosion, and sedimentation during construction activities. It is important that the erosion control plan be adhered to and maintained as specified in the Addendum.

THIS DRAWING IS CONCEPTUAL IN NATURE AND IS NOT TO BE USED AS THE SOLE BASIS FOR FINAL DESIGN, CONSTRUCTION, OR REMEDIAL ACTION. FURTHER STUDIES UNDER EPC DOT'S DIRECTION SHOULD BE PERFORMED PRIOR TO SUCH DECISIONS.

## Legend

- Streams
- Roads
- Basin Boundary
- Matchlines

0 1 2 Miles

PREPARED BY:
Drexel, Barrell & Co. Engineers · Surveyors
1800 38TH STREET
3 S 7TH STREET
6513 W 4TH STREET
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BOULDER, COLORADO 80301 (303) 442-4338
COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
GREELEY, COLORADO 80634 (970) 351-0645

PREPARED FOR:
**REALTY DEVELOPMENT SERVICES**
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO:
**GIECK RANCH**
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

| DESIGNED BY: | RJB |
|---|---|
| DRAWN BY: | BLF |
| CHECKED BY: | RJB |

REVISION DESCRIPTIONS | DATE

DRAWING INFO:
GIECK RANCH
KEY MAP
MAIN STEM

| DATE: | JOB NO: | SET |
|---|---|---|
| AUGUST 2007 | C7706-1 | PL |
| SCALE: H: 1" = 6000' V: | DRAWING NO.: 6D 038 | SHEET K1 |

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## Legend

- Streams
- Roads
- Basin Boundary
- Matchlines

0 1 2 Miles

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CONTACT: ROBERT BENNETT

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF
CHECKED BY: RJB

REVISION DESCRIPTIONS | DATE

DRAWING INFO: GIECK RANCH
KEY MAP
MAIN STEM TRIBUTARY #3

DATE: AUGUST 2007
SCALE: H: 1" = 6000' V:
JOB NO: C7706-1
DRAWING NO.: 6D 038
SET PL
SHEET K4

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## Legend

- Streams
- Roads
- Basin Boundary
- Matchlines

0 1 2 Miles

PREPARED BY: Drexel, Barrell & Co. Engineers Surveyors
1800 38TH STREET, BOULDER, COLORADO 80301 (303) 442-4338
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PREPARED FOR: REALTY DEVELOPMENT SERVICES
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COLORADO SPRINGS, COLORADO 80903
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PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF
CHECKED BY: RJB

REVISION DESCRIPTIONS | DATE

DRAWING INFO: GIECK RANCH
KEY MAP
HAEGLER DIVERSION

DATE: AUGUST 2007
SCALE: H: 1" = 6000' V:
JOB NO: C7706-1
DRAWING NO.: 6D 038
SET: PL
SHEET: K7

THIS DRAWING IS CONCEPTUAL IN NATURE AND IS NOT TO BE USED AS THE SOLE BASIS FOR FINAL DESIGN, CONSTRUCTION, OR REMEDIAL ACTION. FURTHER STUDIES UNDER EPC DOT'S DIRECTION SHOULD BE PERFORMED PRIOR TO SUCH DECISIONS.

## Legend

- Streams
- Roads
- Basin Boundary
- Matchlines

0 1 2 Miles

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PREPARED FOR: **REALTY DEVELOPMENT SERVICES**
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO: **GIECK RANCH**
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

| | |
|---|---|
| DESIGNED BY: | RJB |
| DRAWN BY: | BLF |
| CHECKED BY: | RJB |

REVISION DESCRIPTIONS — DATE

DRAWING INFO: GIECK RANCH KEY MAP WEST FORK

| | | | |
|---|---|---|---|
| DATE: AUGUST 2007 | JOB NO: C7706-1 | SET PL | |
| SCALE: H: 1" = 6000' V: | DRAWING NO.: 6D 038 | SHEET K8 | |

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

N

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| MS-R7c | 2.62 | 877 | 4.82 |
| MS-R8a | 0.66 | 896 | 2.71 |
| MS-R8b | 1.79 | 896 | 5.21 |
| MS-R8c | 1.00 | 896 | 4.63 |
| MS-R11a | 1.26 | 1774 | 3.80 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| MS-R7c | Vegetation Augmentation |
| MS-R8a | Vegetation Augmentation |
| MS-R8b | Selective Stabilization |
| MS-R8c | Selective Stabilization |
| MS-R11a | Selective Stabilization |

Note:
See Technical Addenda for grade control data.

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PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

| REVISION DESCRIPTIONS | DATE |
|---|---|
| PER EPCDOT COMMENTS | FEBRUARY 2008 |
| PER EPC FINAL REVIEW | JANUARY 2010 |

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
MAIN STEM #28

DATE: AUGUST 2007
SCALE: H: 1" = 200' V: NONE
JOB NO: C7706-2
DRAWING NO.: 6D 038
SET: PL
SHEET: 28

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| MS-R7b | 1.85 | 877 | 5.10 |
| MS-R7c | 2.62 | 877 | 4.82 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| MS-R7b | Vegetation Augmentation |
| MS-R7c | Vegetation Augmentation |

Note:
See Technical Addenda for grade control data.

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COLORADO SPRINGS, COLORADO 80903
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PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

| REVISION DESCRIPTIONS | DATE |
|---|---|
| PER EPCDOT COMMENTS | FEBRUARY 2008 |
| PER EPC FINAL REVIEW | JANUARY 2010 |

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
MAIN STEM #29

DATE: AUGUST 2007
SCALE: H 1" = 200' V NONE
JOB NO: C7706-2
DRAWING NO.: 6D 038
SET: PL
SHEET: 29

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| MST3-R1 | 1.80 | 19 | 1.61 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| MST3-R1 | As-needed Improvements |

Note:
See Technical Addenda for grade control data.

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PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MUM
CHECKED BY: RJB/TML

| REVISION DESCRIPTIONS | DATE |
|---|---|
| PER EPCDOT COMMENTS | FEBRUARY 2008 |
| PER EPC FINAL REVIEW | JANUARY 2010 |

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
MAIN STEM TRIBUTARY-3 #1

DATE: AUGUST 2007
SCALE: H: 1" = 200' V: NONE
JOB NO: C7706-2
DRAWING NO.: 6D 038
SET: PL
SHEET: 44

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

N

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| HD-R5 | 1.67 | 468 | 2.87 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| HD-R5 | Selective Stabilization |

Note:
See Technical Addenda for grade control data.

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25 NORTH TEJON STREET, SUITE 300
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PROJECT INFO: **GIECK RANCH**
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

| DESIGNED BY: RJB | REVISION DESCRIPTIONS | DATE |
|---|---|---|
| DRAWN BY: BLF/MLM | PER EPCDOT COMMENTS | FEBRUARY 2008 |
| CHECKED BY: RJB/TML | PER EPC FINAL REVIEW | JANUARY 2010 |

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
HAEGLER DIVERSION #1

| DATE: AUGUST 2007 | JOB NO: C7706-2 | SET PL |
|---|---|---|
| SCALE: H: 1" = 200' V: NONE | DRAWING NO.: 6D 038 | SHEET 55 |

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

N

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| HD-R4 | 1.75 | 429 | 2.71 |
| HD-R5 | 1.67 | 468 | 2.87 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| HD-R4 | Vegetation Augmentation |
| HD-R5 | Selective Stabilization |

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25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

REVISION DESCRIPTIONS: PER EPC FINAL REVIEW — DATE: JANUARY 2010

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
HAEGLER DIVERSION #3

DATE: AUGUST 2007
SCALE: H: 1" = 200' V: NONE
JOB NO.: C7706-2
DRAWING NO.: 6D 038
SET: PL
SHEET: 57

GRADE CONTROL STRUCTURE
SEE FIGURE VII-7
(TYPICAL)

START PROPOSED CHANNEL.
BOTTOM WIDTH = 50'
SIDE SLOPES = 10 : 1

WF-R6

POND: WF-SR1
Q100 IN = 951 CFS
Q100 OUT = 753 CFS
DETENTION STORAGE = 29 AC-FT.

34 SE

35 SW

3 NE

2 NW

ELBERT RD

JUDGE ORR RD

SEE HAEGLAR DIVERSION PLAN VIEW
SHEETS FOR CHANNEL AND DROP
STRUCTURE DETAILS

WF-R7a

STRUCTURE #39
EXISTING: 36" CMP
NOTE: EXISTING STRUCTURE TO REMAIN

END PROPOSED CHANNEL.
TIE INTO EXISTING CHANNEL.

STRUCTURE #38
EXISTING: 67" X 95" CMP
PROPOSED: 4 - 12' X 5' CBC
(CONSIDER 3-SIDED CBC PER CDOW COMMENTS)
NOTE: STREAM INVERT LOWERED TO
ACCOMMODATE LARGER STRUCTURE.

See sheet 69

See sheet 67

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

N

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| WF-R6 | 1.04 | 698 | 3.45 |
| WF-R7a | 1.18 | 753 | 2.19 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| WF-R6 | Selective Stabilization |
| WF-R7a | Vegetation Augmentation |

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CONTACT: ROBERT BENNETT, P.E., CFM

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

| REVISION DESCRIPTIONS | DATE |
|---|---|
| PER EPCDOT COMMENTS | FEBRUARY 2008 |
| PER EPC FINAL REVIEW | JANUARY 2010 |

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
WEST FORK #4

| DATE: | JOB NO: | SET |
|---|---|---|
| AUGUST 2007 | C7706-2 | PL |
| SCALE: H: 1" = 200' V: NONE | DRAWING NO.: 6D 038 | SHEET 68 |

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

N

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| WF-R4d | 1.45 | 242 | 3.60 |
| WF-R5 | 1.52 | 394 | 4.32 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| WF-R4d | Selective Stabilization |
| WF-R5 | Selective Stabilization |

Note:
See Technical Addenda for grade control data.

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COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

| REVISION DESCRIPTIONS | DATE |
|---|---|
| PER EPC/DOT COMMENTS | FEBRUARY 2008 |
| PER EPC FINAL REVIEW | JANUARY 2010 |

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
WEST FORK #5

DATE: AUGUST 2007
SCALE: H: 1" = 200' V: NONE
JOB NO: C7706-2
DRAWING NO.: 6D 038
SET: PL
SHEET: 69

## Environmental Key

- Ponds
- Riparian: Good
- Riparian: Poor
- Potential Wetlands

The channel is considered dry unless shown as one of the above environmental categories.

## Legend

- *Proposed Future Conditions 100-yr Flood Limits*
- Streams
- Reaches
- Reach Breaklines
- Cross-sections
- Roads
- Structures
- Section Lines
- 5-ft contours
- 2-ft contours

N

0 100 200 Feet

| Reach | Slope (%) | $Q_{100}$ (cfs) | $V_{100}$ (ft/s) |
|---|---|---|---|
| WF-R4b | 1.60 | 242 | 3.36 |
| WF-R4c | 2.44 | 242 | 2.91 |
| WF-R4d | 1.45 | 242 | 3.60 |

RECOMMENDED PLAN IMPROVEMENTS

| Reach | |
|---|---|
| WF-R4b | Vegetation Augmentation |
| WF-R4c | Selective Stabilization |
| WF-R4d | Selective Stabilization |

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1800 38TH STREET, BOULDER, COLORADO 80301 (303) 442-4338
3 S 7TH STREET, COLORADO SPRINGS, COLORADO 80905 (719) 260-0887
6513 W 4TH STREET, GREELEY, COLORADO 80634 (970) 351-0645
CONTACT: ROBERT BENNETT, P.E., CFM

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
CONTACT: RAY O' SULLIVAN (719) 227-1022

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

DESIGNED BY: RJB
DRAWN BY: BLF/MLM
CHECKED BY: RJB/TML

REVISION DESCRIPTIONS: PER EPC FINAL REVIEW — DATE: JANUARY 2010

DRAWING INFO: GIECK RANCH DBPS
PLAN VIEW
WEST FORK #6

DATE: AUGUST 2007
SCALE: H: 1" = 200' V: NONE
JOB NO: C7706-2
DRAWING NO.: 6D 038
SET: PL
SHEET: 70

NOTE: SEE TECHNICAL ADDENDA FOR GRADE CONTROL STRUCTURES AND PROPOSED ROADWAY STRUCTURE DATA.

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PREPARED BY: Drexel, Barrell & Co. Engineers • Surveyors<br>3 SOUTH 7th STREET COLORADO SPRINGS, COLORADO 80905 (719)260-0887<br>BOULDER (303)442-4338 • DENVER (720)214-0955 • GREELEY (970)351-0645 • GRAND JUNCTION (970)257-1350 • STEAMBOAT SPRINGS (970)879-1523<br>CONTACT: SCOTT STEVENS, P.E. | PREPARED FOR:<br>REALTY DEVELOPMENT SERVICES<br>25 NORTH TEJON STREET, SUITE 300<br>COLORADO SPRINGS, COLORADO 80903<br>(719) 227-1022<br>CONTACT: RAY O'SULLIVAN | PROJECT INFO:<br>GIECK RANCH<br>DRAINAGE BASIN PLANNING STUDY<br>EL PASO COUNTY, COLORADO | DESIGNED BY: RJB<br>DRAWN BY: BLF/MLM<br>CHECKED BY: RJB/TML | REVISION DESCRIPTIONS<br>PER EPC FINAL REVIEW | DATE<br>JANUARY 2010 | DRAWING INFO.<br>GIECK RANCH MAIN NORTH 4<br>FLOOD PROFILES<br>(REACH: MS-R8a TO MS-R8c) | DATE: AUGUST 2007<br>SCALE: H: 1" = 200' V: 1" = 20'<br>JOB NO: C7706-2<br>DRAWING NO.: 6D 038<br>SET: PR<br>SHEET: 14 |

PREPARED BY: Drexel, Barrell & Co. Engineers • Surveyors
3 SOUTH 7th STREET COLORADO SPRINGS, COLORADO 80905 (719)260-0887
BOULDER (303)442-4338 • DENVER (720)214-0955 • GREELEY (970)351-0645 • GRAND JUNCTION (970)257-1350 • STEAMBOAT SPRINGS (970)879-1523
CONTACT: SCOTT STEVENS, P.E.

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 227-1022
CONTACT: RAY O'SULLIVAN

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

| DESIGNED BY: RJB | REVISION DESCRIPTIONS | DATE |
|---|---|---|
| DRAWN BY: BLF/MLM | PER EPC FINAL REVIEW | JANUARY 2010 |
| CHECKED BY: RJB/TML | | |

DRAWING INFO: GIECK RANCH MAIN NORTH 3 FLOOD PROFILES (REACH: MS-R7a TO MS-R7c)

| DATE: | JOB NO: | SET |
|---|---|---|
| AUGUST 2007 | C7706-2 | PR |
| SCALE: H: 1" = 200' V: 1" = 20' | DRAWING NO.: 6D 038 | SHEET 15 |

| | | | | | | |
|---|---|---|---|---|---|---|
| PREPARED BY: Drexel, Barrell & Co. Engineers • Surveyors<br>3 SOUTH 7th STREET COLORADO SPRINGS, COLORADO 80905 (719)260-0887<br>BOULDER (303)442-4338 • DENVER (720)214-0955 • GREELEY (970)351-0645 • GRAND JUNCTION (970)257-1350 • STEAMBOAT SPRINGS (970)879-1523<br>CONTACT: SCOTT STEVENS, P.E. | PREPARED FOR:<br>REALTY DEVELOPMENT SERVICES<br>25 NORTH TEJON STREET, SUITE 300<br>COLORADO SPRINGS, COLORADO 80903<br>(719) 227-1022<br>CONTACT: RAY O'SULLIVAN | PROJECT INFO:<br>GIECK RANCH<br>DRAINAGE BASIN PLANNING STUDY<br>EL PASO COUNTY, COLORADO | DESIGNED BY: RJB<br>DRAWN BY: BLF/MLM<br>CHECKED BY: RJB/TML | REVISION DESCRIPTIONS: PER EPC FINAL REVIEW<br>DATE: JANUARY 2010 | DRAWING INFO.<br>GIECK RANCH SUB-TRIBUTARY M3<br>FLOOD PROFILES<br>(REACH: MST3-R1) | DATE: AUGUST 2007<br>SCALE: H: 1" = 200' V: 1" = 20'<br>JOB NO: C7706-2<br>DRAWING NO.: 6D 038<br>SET: PR<br>SHEET: 24 |

PREPARED BY: Drexel, Barrell & Co. Engineers • Surveyors
3 SOUTH 7th STREET COLORADO SPRINGS, COLORADO 80905 (719)260-0887
BOULDER (303)442-4338 • DENVER (720)214-0955 • GREELEY (970)351-0845 • GRAND JUNCTION (970)257-1350 • STEAMBOAT SPRINGS (970)879-1523
CONTACT: SCOTT STEVENS, P.E.

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 227-1022
CONTACT: RAY O'SULLIVAN

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

| DESIGNED BY: RJB | REVISION DESCRIPTIONS | DATE |
|---|---|---|
| DRAWN BY: BLF/MLM | PER EPC FINAL REVIEW | JANUARY 2010 |
| CHECKED BY: RJB/TML | | |

DRAWING INFO: GIECK RANCH HAEGLER DIVERSION FLOOD PROFILES (REACH: HD-R4 & HD-R5)

| DATE: | JOB NO: | SET |
|---|---|---|
| AUGUST 2007 | C7706-2 | PR |
| SCALE: H: 1" = 200' V: 1" = 20' | DRAWING NO.: 6D 038 | SHEET 28 |

PREPARED BY: Drexel, Barrell & Co. Engineers • Surveyors
3 SOUTH 7th STREET COLORADO SPRINGS, COLORADO 80905 (719)280-0887
BOULDER (303)442-4338 • DENVER (720)214-0955 • GREELEY (970)351-0645 • GRAND JUNCTION (970)257-1350 • STEAMBOAT SPRINGS (970)879-1523
CONTACT: SCOTT STEVENS, P.E.

PREPARED FOR: REALTY DEVELOPMENT SERVICES
25 NORTH TEJON STREET, SUITE 300
COLORADO SPRINGS, COLORADO 80903
(719) 227-1022
CONTACT: RAY O'SULLIVAN

PROJECT INFO: GIECK RANCH
DRAINAGE BASIN PLANNING STUDY
EL PASO COUNTY, COLORADO

| DESIGNED BY: RJB | REVISION DESCRIPTIONS | DATE |
|---|---|---|
| DRAWN BY: BLF/MLM | PER EPC FINAL REVIEW | JANUARY 2010 |
| CHECKED BY: RJB/TML | | |

DRAWING INFO. GIECK RANCH HAEGLER DIVERSION FLOOD PROFILES (REACH: HD-R2 & HD-R4)

| DATE: | JOB NO: | SET |
|---|---|---|
| AUGUST 2007 | C7706-2 | PR |
| SCALE: H: 1" = 200' V: 1" = 20' | DRAWING NO.: 6D 038 | SHEET 29 |

NOTE: SEE TECHNICAL ADDENDA FOR GRADE CONTROL STRUCTURES AND PROPOSED ROADWAY STRUCTURE DATA.

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PREPARED BY: Drexel, Barrell & Co. Engineers • Surveyors<br>3 SOUTH 7th STREET COLORADO SPRINGS, COLORADO 80905 (719)260-0887<br>BOULDER (303)442-4338 • DENVER (720)214-0955 • GREELEY (970)351-0645 • GRAND JUNCTION (970)257-1350 • STEAMBOAT SPRINGS (970)879-1523<br>CONTACT: SCOTT STEVENS, P.E. | PREPARED FOR: REALTY DEVELOPMENT SERVICES<br>25 NORTH TEJON STREET, SUITE 300<br>COLORADO SPRINGS, COLORADO 80903<br>(719) 227-1022<br>CONTACT: RAY O'SULLIVAN | PROJECT INFO: GIECK RANCH<br>DRAINAGE BASIN PLANNING STUDY<br>EL PASO COUNTY, COLORADO | DESIGNED BY: RJB<br>DRAWN BY: BLF/MLM<br>CHECKED BY: RJB/TML | REVISION DESCRIPTIONS: PER EPC FINAL REVIEW<br>DATE: JANUARY 2010 | DRAWING INFO. GIECK RANCH WEST FORK (LOWER) FLOOD PROFILES (REACH: WF-R7a TO WF-R8a) | DATE: AUGUST 2007<br>SCALE: H: 1" = 200' V: 1" = 20' | JOB NO: C7706-2<br>DRAWING NO.: 6D 038 | SET PR<br>SHEET 34 |

NOTE: SEE TECHNICAL ADDENDA FOR GRADE CONTROL STRUCTURES AND PROPOSED ROADWAY STRUCTURE DATA.

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PREPARED BY: Drexel, Barrell & Co. Engineers • Surveyors<br>3 SOUTH 7th STREET COLORADO SPRINGS, COLORADO 80905 (719)260-0887<br>BOULDER (303)442-4338 • DENVER (720)214-0955 • GREELEY (970)351-0645 • GRAND JUNCTION (970)257-1350 • STEAMBOAT SPRINGS (970)879-1523<br>CONTACT: SCOTT STEVENS, P.E. | PREPARED FOR: REALTY DEVELOPMENT SERVICES<br>25 NORTH TEJON STREET, SUITE 300<br>COLORADO SPRINGS, COLORADO 80903<br>(719) 227-1022<br>CONTACT: RAY O'SULLIVAN | PROJECT INFO: GIECK RANCH<br>DRAINAGE BASIN PLANNING STUDY<br>EL PASO COUNTY, COLORADO | DESIGNED BY: RJB<br>DRAWN BY: BLF/MLM<br>CHECKED BY: RJB/TML | REVISION DESCRIPTIONS: PER EPC FINAL REVIEW<br>DATE: JANUARY 2010 | DRAWING INFO. GIECK RANCH WEST FORK (MIDDLE) FLOOD PROFILES (REACH: WF-R5 & WF-R6) | DATE: AUGUST 2007<br>SCALE: H: 1" = 200' V: 1" = 20' | JOB NO: C7706-2<br>DRAWING NO.: 6D 038 | SET PR<br>SHEET 35 |

# Federal Emergency Management Agency

Washington, D.C. 20472

## LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

## PUBLIC NOTIFICATION OF REVISION

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. Therefore, this letter will be effective only after the 90-day appeal period has elapsed and we have resolved any appeals that we receive during this appeal period. Until this LOMR is effective, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below.

LOCAL NEWSPAPER Name: *El Paso County News*
Dates: 11/10/2004 11/17/2004

### PUBLIC NOTIFICATION

| FLOODING SOURCE | LOCATION OF REFERENCED ELEVATION | BFE (FEET NGVD) EFFECTIVE | BFE (FEET NGVD) REVISED | MAP PANEL NUMBER(S) |
|---|---|---|---|---|
| Haegler Ranch Tributary 2 | Approximately 310 feet upstream of confluence with Geick Ranch West Tributary | None | 6,735 | 08041C0575 F |
| | Approximately 3,140 feet upstream of confluence with Geick Ranch West Tributary | None | 6,779 | 08041C0575 F |
| Haegler Ranch Tributary 3 | Approximately 8,100 feet downstream of Curtis Road | None | 6,672 | 08041C0575 F |
| | Approximately 300 feet upstream of Curtis Road | None | 6,769 | 08041C0575 F |
| Haegler Ranch Tributary 4 | Approximately 4,000 feet downstream of Curtis Road | None | 6,688 | 08041C0575 F |
| | Approximately 300 feet upstream of Curtis Road | None | 6,758 | 08041C0575 F |

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2677 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Hazard Identification Section
Mitigation Division
Emergency Preparedness and Response Directorate 102929 101104080587 102IAC

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE UNINCORPORATED AREAS OF EL PASO COUNTY, COLORADO, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On March 17, 1997, the Department of Homeland Security's Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the unincorporated areas of El Paso County, Colorado, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Division has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate. The modified Base Flood Elevations (BFEs) revise the FIRM for the community.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate new hydrologic, hydraulic, and topographic data for Haegler Ranch Tributary 2 from approximately 310 feet upstream to approximately 3,140 feet upstream of the confluence with Geick Ranch West Tributary; for Haegler Ranch Tributary 3 from approximately 8,100 feet downstream to approximately 400 feet upstream of Curtis Road; and for Haegler Ranch Tributary 4 from approximately 4,100 feet downstream to approximately 400 feet upstream of Curtis Road. This has resulted in increases and decreases in SFHA width and increased BFEs for the above-mentioned tributaries. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

| Location | Existing BFE (feet)* | Modified BFE (feet)* |
|---|---|---|
| Haegler Ranch Tributary 2: | | |
| Approximately 310 feet upstream of confluence with Geick Ranch West Tributary | None | 6,735 |
| Approximately 3,140 feet upstream of confluence with Geick Ranch West Tributary | None | 6,779 |
| Haegler Ranch Tributary 3: | | |
| Approximately 8,100 feet downstream of Curtis Road | None | 6,672 |
| Approximately 300 feet upstream of Curtis Road | None | 6,769 |
| Haegler Ranch Tributary 4: | | |
| Approximately 4,000 feet downstream of Curtis Road | None | 6,688 |
| Approximately 300 feet upstream of Curtis Road | None | 6,758 |

*National Geodetic Vertical Datum, rounded to nearest whole foot

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Division must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

ZONE X
ZONE A
AREA REVISED BY LOMR DATED MARCH 9, 2004
33
34
32
ZONE A
ZONE A
ZONE A
Haegler Ranch Tributary 2
Geick Ranch West Tributary
ZONE A
JUDGE ORR ROAD
LIMIT OF DETAILED STUDY
6770
6775
6765
6750
6736
LIMIT OF DETAILED STUDY
ZONE AE
ZONE AE
LIMIT OF DETAILED STUDY
6760
6740
6768
ZONE X
ZONE A
4
LIMIT OF DETAILED STUDY
6740
6711
3
6720
6750
6758
6735
ZONE AE
6700
REVISED AREA
6720
6689
Haegler Ranch Tributary 3
6705
6675
ZONE A
6690
6675
LIMIT OF DETAILED STUDY
LIMIT OF DETAILED STUDY
9
10
Haegler Ranch Tributary 4
ZONE X
CURTIS ROAD
ZONE A
EL PASO COUNTY UNINCORPORATED AREAS 080059
16
15
APPROXIMATE SCALE IN FEET
2,000
0
2,000
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 575 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0575 F
COLORADO SPRINGS, CITY OF 080060 0575 F
REVISED TO REFLECT LOMR DATED FEB 16 2005
MAP NUMBER
08041C0575 F
EFFECTIVE DATE:
March 17, 1997
Federal Emergency Management Agency

Table 3. Summary of Discharges

| Flooding Source and Location | Drainage Area (square miles) | Peak Discharges (cubic feet per second) 10-Year | 50-Year | 100-Year | 500-Year |
|---|---|---|---|---|---|
| Haegler Ranch Tributary 2 At the confluence with Geick Ranch West Tributary | 1.47 | __1 | __1 | 592 | __1 |
| Haegler Ranch Tributary 3 At approximately 2,300 feet upstream of the confluence with Haegler Ranch Tributary 4 | 1.09 | __1 | __1 | 505 | __1 |
| Haegler Ranch Tributary 4 At approximately 3,700 feet upstream of the confluence with Haegler Ranch Tributary 3 | 0.60 | __1 | __1 | 130 | __1 |

1 Data Not Available

REVISED TO REFLECT LOMR DATED FEB 16 2005

TRI-CORE ENGINEERING

PROJECT NAME: Santa Fe Springs - Haegler Ranch Drainage Basin LOMR
PROJECT NUMBER: 6005
ENGINEER: RLS
DATE: 6/4/2004

## EXISITING HYDROLOGY CONDITIONS

## TIME OF CONCENTRATION CALCULATIONS

| BASIN | HA | HA1 | HA2 | HA3 | HA4 | HA5 | HA6 | HA7 | HA8 | HB | OS1 | OS2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AREA, A [ACRE] | 238.7 | 200.3 | 66.9 | 187.9 | 115.7 | 329.6 | 196.5 | 125.1 | 11.8 | 498.0 | 218.5 | 59.4 |
| SUB-BASIN LENGTH [MI] | 0.79 | 1.20 | 0.59 | 1.03 | 0.79 | 1.63 | 0.94 | 0.62 | 0.20 | 1.99 | 0.96 | 0.55 |
| CHANNEL ELEVATION CHANGE [FT] | 55 | 117 | 65 | 65 | 60 | 110 | 125 | 90 | 27 | 152 | 145 | 50 |
| H[1] | 28 | 59 | 33 | 33 | 30 | 55 | 63 | 45 | 14 | 76 | 73 | 25 |
| SUB-BASIN SLOPE [FT/FT] | 0.0132 | 0.0185 | 0.0209 | 0.0120 | 0.0144 | 0.0128 | 0.0252 | 0.0275 | 0.0256 | 0.0145 | 0.0286 | 0.0172 |
| | | | | | | | | | | | | |
| TIME OF CONCENTRATION (MIN)[2] | 33 | 40 | 22 | 42 | 32 | 59 | 29 | 21 | 9 | 65 | 29 | 23 |
| LAG-TIME OF CONCENTRATION (MIN)[3] | 20 | 24 | 13 | 25 | 19 | 35 | 18 | 12 | 5 | 39 | 17 | 14 |

[1] *Elevation difference between divide and outlet*
[2] $Tc=60(11.9L^3/H)^{0.385}$
[3] $Tc=60(11.9L^3/H)^{0.385} * 0.6$

FLOW DATA

Flow Title: ex-100yr
Flow File : P:\6005\0001\LOMR\6005_0001.f01

Flow Data (cfs)

| River | Reach | RS | PF 1 |
|---|---|---|---|
| Trib.3 to Black | Reach No. H9 | 8015 | 130 |
| Trib.2 to Black | Reach No. H8 | 12669 | 452 |
| Trib.2 to Black | Reach No. H8 | 10137 | 505 |
| Trib.1 to Black | Reach No. H7 | 3326 | 592 |

Boundary Conditions

| River | Reach | Profile | Upstream |
|---|---|---|---|
| Downstream | | | |
| Trib.1 to Black | Reach No. H7 | PF 1 | Normal S = 0.014 |
| Normal S = 0.017 | | | |
| Trib.2 to Black | Reach No. H8 | PF 1 | Normal S = 0.013 |
| Normal S = 0.005 | | | |
| Trib.3 to Black | Reach No. H9 | PF 1 | Normal S = 0.014 |
| Normal S = 0.016 | | | |

GEOMETRY DATA

Geometry Title: 6005_0001
Geometry File : P:\6005\0001\LOMR\6005_0001.g01

CROSS SECTION

RIVER: Trib.1 to Black
REACH: Reach No. H7 RS: 3326

INPUT
Description: Cross Section 45
Station Elevation Data num= 78

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 6780 | 1.28 | 6780 | 2.96 | 6780 | 7.4 | 6780 | 38.31 | 6779.82 |
| 39.48 | 6779.82 | 40.1 | 6779.82 | 51.98 | 6779.76 | 57.71 | 6779.74 | 69.8 | 6779.72 |
| 71 | 6779.71 | 74.2 | 6779.7 | 79.75 | 6779.68 | 83.44 | 6779.66 | 87.22 | 6779.64 |
| 88.7 | 6779.63 | 98.89 | 6779.58 | 105.05 | 6779.55 | 110.99 | 6779.52 | 117.52 | 6779.5 |
| 121.66 | 6779.48 | 124.01 | 6779.47 | 132.61 | 6779.39 | 138.38 | 6779.36 | 144.59 | 6779.34 |
| 145.36 | 6779.33 | 150 | 6779.307 | 151.43 | 6779.3 | 152.25 | 6779.3 | 181.96 | 6779.19 |
| 191.41 | 6779.13 | 204.1 | 6779.03 | 208.83 | 6779 | 214.91 | 6778.98 | 220.66 | 6778.96 |
| 221.22 | 6778.95 | 227.64 | 6778.93 | 228.19 | 6778.93 | 231.42 | 6778.9 | 234.52 | 6778.88 |
| 235.57 | 6778.89 | 261.4 | 6778.89 | 266.03 | 6778.92 | 305.11 | 6778.96 | 317.9 | 6778.82 |
| 322.45 | 6778.76 | 323.5 | 6778.76 | 337 | 6778.53 | 337.86 | 6778.53 | 341.71 | 6778.53 |
| 342.24 | 6778.54 | 342.8 | 6778.54 | 343.36 | 6778.54 | 353.8 | 6778.27 | 363.1 | 6778 |
| 369.86 | 6777.01 | 371.7 | 6776.84 | 372.82 | 6776.78 | 373.06 | 6776.73 | 373.37 | 6776.69 |
| 373.61 | 6776.68 | 374.24 | 6776.67 | 374.53 | 6776.66 | 375.81 | 6776.66 | 377.23 | 6776.66 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 377.84 | 6776.67 | 378.06 | 6776.67 | 380.06 | 6776.68 | 380.18 | 6776.75 | 380.78 | 6776.86 |
| 388.45 | 6778 | 391.86 | 6778 | 393.07 | 6778.26 | 3986779.351 | | 400.93 | 6780 |
| 401.56 | 6780 | 404.07 | 6780.97 | 419.34 | 6780.95 | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .03 | 150 | .03 | 398 | .03 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 150 | 398 | 340 | 260 | 265 | .1 | .3 |

CROSS SECTION OUTPUT Profile #PF 1

| | | | | |
|---|---|---|---|---|
| E.G. Elev (ft) | 6779.55 | Element | Left OB | Channel |
| Right OB | | | | |
| Vel Head (ft) | 0.30 | Wt. n-Val. | | 0.030 |
| W.S. Elev (ft) | 6779.25 | Reach Len. (ft) | 340.00 | 260.00 |
| 265.00 | | | | |
| Crit W.S. (ft) | 6779.25 | Flow Area (sq ft) | | 134.99 |
| E.G. Slope (ft/ft) | 0.016054 | Area (sq ft) | | 134.99 |
| Q Total (cfs) | 592.00 | Flow (cfs) | | 592.00 |
| Top Width (ft) | 230.75 | Top Width (ft) | | 230.75 |
| Vel Total (ft/s) | 4.39 | Avg. Vel. (ft/s) | | 4.39 |
| Max Chl Dpth (ft) | 2.59 | Hydr. Depth (ft) | | 0.59 |
| Conv. Total (cfs) | 4672.3 | Conv. (cfs) | | 4672.3 |
| Length Wtd. (ft) | 260.00 | Wetted Per. (ft) | | 231.10 |
| Min Ch El (ft) | 6776.66 | Shear (lb/sq ft) | | 0.59 |
| Alpha | 1.00 | Stream Power (lb/ft s) | | 2.57 |
| Frctn Loss (ft) | 3.71 | Cum Volume (acre-ft) | | 8.28 |
| C & E Loss (ft) | 0.03 | Cum SA (acres) | | 10.07 |

Warning: The energy equation could not be balanced within the specified number of iterations. The
program used critical depth for the water surface and continued on with the calculations.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical
depth, the calculated water surface came back below critical depth. This indicates that there is
not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

| | | | |
|---|---|---|---|
| Vel Total (ft/s) | 3.55 | Avg. Vel. (ft/s) | 3.55 |
| Max Chl Dpth (ft) | 1.60 | Hydr. Depth (ft) | 0.80 |
| Conv. Total (cfs) | 7083.9 | Conv. (cfs) | 7083.9 |
| Length Wtd. (ft) | 160.00 | Wetted Per. (ft) | 209.61 |
| Min Ch El (ft) | 6731.16 | Shear (lb/sq ft) | 0.35 |
| Alpha | 1.00 | Stream Power (lb/ft s) | 1.23 |
| Frctn Loss (ft) | 1.54 | Cum Volume (acre-ft) | 0.50 |
| C & E Loss (ft) | 0.03 | Cum SA (acres) | 0.60 |

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than
0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.
This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: Trib.1 to Black
REACH: Reach No. H7 RS: 169

INPUT
Description: Cross Section 56
Station Elevation Data num= 41

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 6731.42 | 26 | 6731.124 | 9.59 | 6730 | 9.66 | 6730 | 10.52 | 6730 |
| 11.83 | 6730 | 15.82 | 6730 | 19.15 | 6730 | 31.27 | 6730 | 32.83 | 6730 |
| 33.35 | 6729.98 | 34.91 | 6730 | 38.49 | 6730 | 39.18 | 6730 | 39.85 | 6730 |
| 47.53 | 6729.94 | 53.19 | 6730 | 55.55 | 6730 | 63.61 | 6730 | 68.75 | 6730 |
| 73.47 | 6730 | 74.71 | 6730 | 76.08 | 6730 | 76.55 | 6730 | 76.56 | 6730 |
| 79.35 | 6729.96 | 80.59 | 6730 | 89.02 | 6730 | 101.07 | 6730 | 111.83 | 6730 |
| 120.61 | 6730 | 123 | 6731.075 | 123.41 | 6731.26 | 125.01 | 6731.75 | 125.79 | 6732 |
| 133.05 | 6733.73 | 134.13 | 6734 | 135.73 | 6734 | 136.06 | 6734 | 137.31 | 6734.3 |
| 148.78 | 6734.285 | | | | | | | | |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .03 | 2 | .03 | 123 | .03 |

| Bank Sta: Left | Right | Coeff Contr. | Expan. |
|---|---|---|---|
| 2 | 123 | .1 | .3 |

CROSS SECTION OUTPUT Profile #PF 1

| | | | | |
|---|---|---|---|---|
| E.G. Elev (ft) | 6731.40 | Element | Left OB | Channel |
| Right OB | | | | |
| Vel Head (ft) | 0.47 | Wt. n-Val. | | 0.030 |
| W.S. Elev (ft) | 6730.93 | Reach Len. (ft) | | |

| | | | |
|---|---|---|---|
| Crit W.S. (ft) | 6730.93 | Flow Area (sq ft) | 108.00 |
| E.G. Slope (ft/ft) | 0.014041 | Area (sq ft) | 108.00 |
| Q Total (cfs) | 592.00 | Flow (cfs) | 592.00 |
| Top Width (ft) | 119.40 | Top Width (ft) | 119.40 |
| Vel Total (ft/s) | 5.48 | Avg. Vel. (ft/s) | 5.48 |
| Max Chl Dpth (ft) | 0.99 | Hydr. Depth (ft) | 0.90 |
| Conv. Total (cfs) | 4996.0 | Conv. (cfs) | 4996.0 |
| Length Wtd. (ft) | | Wetted Per. (ft) | 119.67 |
| Min Ch El (ft) | 6729.94 | Shear (lb/sq ft) | 0.79 |
| Alpha | 1.00 | Stream Power (lb/ft s) | 4.34 |
| Frctn Loss (ft) | | Cum Volume (acre-ft) | |
| C & E Loss (ft) | | Cum SA (acres) | |

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is
below critical depth). Water surface set to critical depth.

CROSS SECTION

RIVER: Trib.2 to Black
REACH: Reach No. H8 RS: 12669

INPUT
Description: Station 122+55 Cross Section No. 1
Station Elevation Data num= 60

| Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev | Sta | Elev |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 6772.61 | 22.61 | 6772 | 22.96 | 6772 | 26.44 | 6772 | 27.42 | 6772 |
| 27.67 | 6772 | 28.16 | 6771.99 | 137.98 | 6770 | 138.68 | 6770 | 141.19 | 6770 |
| 142.24 | 6770 | 148.75 | 6770 | 150.91 | 6770 | 154.98 | 6770 | 173 | 6769.082 |
| 174.21 | 6769.02 | 187.82 | 6768.37 | 189.46 | 6768.29 | 195.66 | 6768 | 195.79 | 6768 |
| 196.13 | 6768 | 196.16 | 6768 | 197.88 | 6768 | 203.26 | 6768 | 203.71 | 6768 |
| 204.17 | 6768 | 204.72 | 6768 | 205.14 | 6768 | 212.3 | 6767.85 | 250.99 | 6767.81 |
| 251.81 | 6767.56 | 256.23 | 6767.63 | 261.25 | 6767.67 | 300.27 | 6768 | 300.76 | 6768 |
| 301.82 | 6768 | 304.85 | 6768 | 305.36 | 6768 | 307.13 | 6768 | 323.3 | 6768 |
| 327.49 | 6768 | 332.35 | 6768.13 | 333.33 | 6768.16 | 334.19 | 6768.18 | 357.17 | 6768.82 |
| 360.59 | 6768.89 | 365.66 | 6769.02 | 369.03 | 6769.1 | 370 | 6769.123 | 375.54 | 6769.25 |
| 388.56 | 6769.48 | 392.13 | 6769.55 | 413.18 | 6770 | 414.19 | 6770 | 414.74 | 6770 |
| 414.79 | 6770 | 422.64 | 6770.24 | 423.36 | 6770.24 | 438.11 | 6770 | 452.87 | 6770 |

Manning's n Values num= 3

| Sta | n Val | Sta | n Val | Sta | n Val |
|---|---|---|---|---|---|
| 0 | .03 | 173 | .03 | 370 | .03 |

| Bank Sta: Left | Right | Lengths: Left | Channel | Right | Coeff Contr. | Expan. |
|---|---|---|---|---|---|---|
| 173 | 370 | 110 | 183 | 470 | .1 | .3 |

CROSS SECTION OUTPUT Profile #PF 1

## VICINTY MAP

1"=5000'

## LEGEND

- EX. MAJOR CONTOUR
- DRAINAGE BASIN BOUNDARY
- OVERLAND FLOW DIRECTION
- CHANNELIZED FLOW DIRECTION
- HAEGLER/GIECK BASIN BOUNDARY
- DESIGN POINT
- 100-YEAR FLOODPLAIN PER FIRM MAPS
- BASIN I.D. / BASIN AREA (Acres) — HA3 187.9

## RUNOFF SUMMARY TABLE

| BASIN | DRAINAGE AREA (ACRES) | RUNOFF 100 YR (cfs) |
|---|---|---|
| HA | 238.7 | 191.4 |
| HA1 | 200.3 | 139.6 |
| HA2 | 66.9 | 64.7 |
| HA3 | 187.9 | 126.8 |
| HA4 | 115.7 | 94.4 |
| HA5 | 329.6 | 178.5 |
| HA6 | 196.5 | 167.5 |
| HA7 | 125.1 | 138.8 |
| HA8 | 11.8 | 20.1 |
| HB | 498.0 | 245.8 |
| OS1 | 218.5 | 195.2 |
| OS2 | 59.4 | 57.6 |

## DESIGN POINT SUMMARY TABLE

| DESIGN POINT | RUNOFF 100 YR (cfs) | COMMENTS |
|---|---|---|
| *HG2 | 465.2 | FLOW TO HWY 24- H1,H2,H4,H6 |
| *HG3 | 286.1 | FLOW TO HWY 24- H3,H5 |
| *HG8 | 236.5 | FLOW TO HWY 24- H7,H8 |
| 1 | 417.3 | FLOW TO JUDGE ORR- HA,HG8 |
| 2 | 591.3 | FLOW JUDGE ORR - HA1,HG2 |
| 3 | 1058.6 | FLOW TO JUDGE ORR- HB,HG3,DP2 |
| 4 | 451.4 | FLOW TO CURTIS RD- HA2,DP1 |
| 5 | 506.2 | FLOW FROM HA4,DP4 |
| 6 | 676.0 | FLOW TO SITE BNDY- HA5,DP5 |
| 7 | 126.8 | FLOW TO CURTIS RD- HA3 |
| 8 | 287.1 | FLOW TO SITE BNDY- DP7,HA6 |
| 9 | 1055.8 | FLOW FROM SITE BNDY- DP6,8;HA7,8;OS1-2 |

* DENOTES LIMITS OF FEMA CASE #04-08-0012P FOURWAY RANCH STUDY

GRAPHIC SCALE
1000 0 500 1000
1 inch = 1000 ft.

| NO. | DESCRIPTION | REV BY | CKD BY | DATE |
|---|---|---|---|---|
| | | | | |

REVISION


TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193


SCALE (H): 1"=1000'
SCALE (V): N/A
DRAWN BY: DMM
DESIGNED BY: RLS
CHECKED BY: RLS
DATE: 05/21/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO, COUNTY
REALTY DEVELOPMENT SERVICES
25 NORTH TEJON
SUITE 300

# EXHIBIT 1
# HYDROLOGIC SUBBASIN MAP

PROJECT NO. 6005-0001
FILENAME 01DR_HIST.DWG
DRAWING NO. EXH. 1

EFFECTIVE CONDITION

MAP PANEL NO. 0575F

REVISED EFFECTIVE CONDITION

APPROXIMATE SCALE IN FEET
2000 0 2000

NATIONAL FLOOD INSURANCE PROGRAM

**FIRM**
**FLOOD INSURANCE RATE MAP**

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

**PANEL 575 OF 1300**
(SEE MAP INDEX FOR PANELS NOT PRINTED)

| COMMUNITY NAME | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COLORADO SPRINGS, CITY OF | 080060 | 0575 | F |
| EL PASO COUNTY, UNINCORPORATED AREAS | 080059 | 0575 | F |

**MAP NUMBER**
**08041C0575 F**

**EFFECTIVE DATE:**
**MARCH 17, 1997**

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

GRAPHIC SCALE
2000 0 1000 2000
1 inch = 2000 ft

| NO. | DESCRIPTION | REV BY | CKD BY | DATE |
|---|---|---|---|---|
| | | | | |

REVISION

TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193

SCALE (H): 1"=2000'
SCALE (V): N/A

DRAWN BY: DMM
DESIGNED BY: RLS
CHECKED BY: RLS

DATE: 05/21/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO, COUNTY

REALTY DEVELOPMENT SERVICES
25 NORTH TEJON
SUITE 300

EXHIBIT 2
REVISED FLOOD INSURANCE RATE MAP

PROJECT NO.
6005-0001

FILENAME
RATE_MAP_LOMR.DWG

DRAWING NO.
EXH. 2

| NO. | DESCRIPTION | REV BY | CKD BY | DATE |
|---|---|---|---|---|

REVISION


TRI-CORE ENGINEERING
5526 N. ACADEMY BLVD., SUITE 204
COLORADO SPRINGS, CO 80918
PHONE (719) 264-1560
FAX (719) 264-1193


SCALE (H): 1"=200'
SCALE (V): 1"=10'

DRAWN BY: KMV
DESIGNED BY: RLS
CHECKED BY: RLS

DATE: 06/04/04

SANTA FE SPRINGS
HAEGLER RANCH DRAINAGE BASIN LOMR
EL PASO COUNTY

REALTY DEVELOPMENT SERVICES
25 NORTH TEJON, SUITE 300
COLORADO SPRINGS, CO 80903

EXHIBIT 3 100-YEAR FLOODPLAIN BOUNDARY & PROFILE WORKMAP

PROJECT NO. 6005.0001

FILENAME PP-LOMR.DWG

DRAWING NO. EXH. 3

Architectural
Structural
Geotechnical

RMG
Engineers / Architects

Materials Testing
Forensic
Civil/Planning

# SOIL AND GEOLOGY STUDY

## Davis Subdivsion
## 6 parcels totaling 398.91 acres
## EL Paso County, Colorado

## PREPARED FOR:

## William Guman & Associates, Ltd
## 731 North Weber Street, Ste 10
## Colorado Springs, CO 80903

## JOB NO. 190392

## April 27, 2023


**Respectfully Submitted,**
**RMG – Rocky Mountain Group**

Kelli Zigler

**Kelli Zigler**
**Project Geologist**

**Reviewed by,**
**RMG – Rocky Mountain Group**

COLORADO REGISTERED
ANTHONY P. MUNGER
4/27/23
39818
PROFESSIONAL ENGINEER

**Tony Munger, P.E.**
**Sr. Geotechnical Project Manager**

DENOTES APPROXIMATE LOCATION OF TEST BORINGS

DENOTES APPROXIMATE LOCATION OF TEST PITS

NOT TO SCALE

JOB No. 190392

RMG
Materials Testing
Forensics
Civil / Planning
Architecture
Structural
Geotechnical

**Engineers / Architects**
SOUTHERN COLORADO OFFICE
2910 AUSTIN BLUFFS PKWY, SUITE 100,
COLORADO SPRINGS, CO 80918
(719) 548-0600 ~ WWW.RMGENGINEERS.COM
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

JUDGE ORR RD
DAVIS SUBDIVISION
EL PASO COUNTY, COLORADO
WILLIAM GUMAN AND ASSOCIATES

| | |
|---|---|
| ENGINEER: | TM |
| DRAWN BY: | NM |
| CHECKED BY: | TM |
| ISSUED: | 4-27-2023 |

TEST PIT/TEST BORING LAYOUT PLAN

SHEET No.
FIG-3

# APPENDIX F

# DRAINAGE MAPS

# JANE DAVIS RANCH

## EXISTING DRAINAGE MAP

### LAYER LINETYPE LEGEND

| | EXISTING | PROPOSED |
|---|---|---|
| BOUNDARY LINE | | |
| PROPERTY LINE | | |
| EASEMENT LINE | | |
| RIGHT OF WAY | | |
| CENTERLINE | | |
| STORM SEWER | | |
| SWALE/WATERWAY FLOWLINE | | |
| INDEX CONTOUR | 6100 | 6100 |
| INTERMEDIATE CONTOUR | | |
| CURB & GUTTER | | |
| FEMA FLOODPLAIN | 100YR | 100YR |
| SUB-BASIN DRAINAGE AREA | | |

BASIN TAG — BASIN ID #; AREA [AC] #.#; $C_{100}$; $C_5$

DESIGN POINT DESIGNATION

FLOW DIRECTION (EXISTING) FLOW DIRECTION (PROPOSED)

### BASIN SUMMARY TABLE

| Tributary Sub-basin | Area (acres) | Percent Impervious | $C_5$ | $C_{100}$ | $t_{c,5}$ (min) | $t_{c,100}$ (min) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|---|---|---|---|---|
| EXA | 19.37 | 2.0% | 0.08 | 0.35 | 35.0 | 44.0 | 0 | 13 |
| EXB | 5.12 | 4.3% | 0.10 | 0.36 | 32.0 | 42.0 | 0 | 3 |
| EXC | 54.95 | 2.0% | 0.08 | 0.35 | 34.0 | 43.0 | 1 | 34 |
| EXD | 114.1 | 2.1% | 0.08 | 0.35 | 43.0 | 52.0 | 1 | 44 |
| EXE | 105.2 | 2.0% | 0.08 | 0.35 | 39.0 | 47.0 | 1 | 53 |
| EXF | 37.91 | 2.0% | 0.08 | 0.35 | 38.0 | 48.0 | 0 | 14 |
| EXG | 16.19 | 2.4% | 0.08 | 0.35 | 32.0 | 41.0 | 0 | 11 |
| EXH | 44.49 | 2.4% | 0.08 | 0.35 | 39.0 | 49.0 | 0 | 16 |
| OS1 | 26.55 | 2.0% | 0.08 | 0.35 | 32.0 | 41.0 | 0 | 13 |
| OS2 | 11.56 | 2.0% | 0.08 | 0.35 | 33.0 | 42.0 | 0 | 6 |
| OS3A | 5.37 | 2.0% | 0.08 | 0.35 | 32.0 | 42.0 | 0 | 2 |
| OS3B | 20.89 | 2.0% | 0.08 | 0.35 | 33.0 | 42.0 | 0 | 12 |
| OS3C | 21.41 | 2.0% | 0.08 | 0.35 | 35.0 | 46.0 | 0 | 9 |
| OS4 | 60.07 | 2.0% | 0.08 | 0.35 | 36.0 | 44.0 | 1 | 33 |
| OS5 | 16.65 | 2.0% | 0.08 | 0.35 | 33.0 | 42.0 | 0 | 9 |

Values in BLUE are from the CUHP methodology, see separate calculations.

### DESIGN POINT SUMMARY TABLE

| DP# | $Q_5$ | $Q_{100}$ |
|---|---|---|
| 1 | - | 429 |
| 2 | 0 | 9 |
| 3 | - | 394 |
| 4 | - | 753 |
| 5 | 1 | 62 |
| 6 | 1 | 48 |
| 7 | - | 896 |
| 8 | 0 | 16 |

For values in RED, used reach flow from Giech Ranch DBPS by Drexel, Barrel & Co.

EXISTING DRAINAGE MAP
JANE DAVIS RANCH
JOB NO. 25274.00
03/14/2024
SHEET 1 OF 1


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# JANE DAVIS RANCH

## PROPOSED DRAINAGE MAP

### LAYER LINETYPE LEGEND

| | EXISTING | PROPOSED |
|---|---|---|
| BOUNDARY LINE | | |
| PROPERTY LINE | | |
| EASEMENT LINE | | |
| RIGHT OF WAY | | |
| CENTERLINE | | |
| STORM SEWER | | |
| SWALE/WATERWAY FLOWLINE | | |
| INDEX CONTOUR | 6100 | 6100 |
| INTERMEDIATE CONTOUR | | |
| CURB & GUTTER | | |
| FEMA FLOODPLAIN | 100YR | 100YR |
| SUB-BASIN DRAINAGE AREA | | |

BASIN TAG — BASIN ID #; AREA [AC] #.#; $C_{100}$; $C_5$

1 DESIGN POINT DESIGNATION

FLOW DIRECTION (EXISTING) ⇨ FLOW DIRECTION (PROPOSED) →

### BASIN SUMMARY TABLE

| Tributary Sub-basin | Area (acres) | Percent Impervious | $C_5$ | $C_{100}$ | $t_{c,5}$ (min) | $t_{c,100}$ (min) | $Q_5$ (cfs) | $Q_{100}$ (cfs) |
|---|---|---|---|---|---|---|---|---|
| A | 17.96 | 12.7% | 0.18 | 0.43 | 32.0 | 41.0 | 2 | 14 |
| B | 1.33 | 2.0% | 0.08 | 0.35 | 31.0 | 45.0 | 0 | 1 |
| C | 5.20 | 67.7% | 0.60 | 0.73 | 31.0 | 38.0 | 5 | 11 |
| D | 26.15 | 15.9% | 0.21 | 0.45 | 37.0 | 46.0 | 3 | 15 |
| E1 | 9.11 | 2.0% | 0.08 | 0.35 | 41.0 | 48.0 | 3 | 11 |
| E2 | 1.17 | 2.0% | 0.08 | 0.35 | 35.0 | 41.0 | 1 | 2 |
| F | 49.33 | 13.1% | 0.18 | 0.43 | 40.0 | 49.0 | 3 | 25 |
| G | 53.91 | 12.5% | 0.18 | 0.42 | 37.0 | 46.0 | 4 | 32 |
| H | 10.99 | 2.0% | 0.08 | 0.35 | 34.0 | 46.0 | 0 | 4 |
| I | 5.20 | 10.0% | 0.16 | 0.41 | 31.0 | 41.0 | 0 | 4 |
| J | 119.8 | 15.3% | 0.20 | 0.44 | 44.0 | 52.0 | 10 | 60 |
| K | 29.86 | 10.0% | 0.16 | 0.41 | 33.0 | 41.0 | 3 | 24 |
| L | 56.53 | 10.0% | 0.16 | 0.41 | 36.0 | 45.0 | 4 | 36 |
| M1 | 10.55 | 2.0% | 0.08 | 0.35 | 44.0 | 53.0 | 3 | 10 |
| M2 | 0.26 | 2.0% | 0.08 | 0.35 | 40.0 | 49.0 | 0 | 0 |
| OS1A | 18.68 | 2.0% | 0.08 | 0.35 | 32.0 | 41.0 | 0 | 12 |
| OS1B | 7.86 | 2.0% | 0.08 | 0.35 | 32.0 | 41.0 | 0 | 4 |
| OS2 | 11.56 | 2.0% | 0.08 | 0.35 | 33.0 | 42.0 | 0 | 6 |
| OS3 | 47.67 | 2.0% | 0.08 | 0.35 | 33.0 | 42.0 | 1 | 33 |
| OS4 | 60.07 | 2.0% | 0.08 | 0.35 | 36.0 | 44.0 | 1 | 33 |
| OS5 | 16.65 | 2.0% | 0.08 | 0.35 | 33.0 | 42.0 | 0 | 9 |

Values in BLUE are from the CUHP methodology, see separate calculations.

### DESIGN POINT SUMMARY TABLE

| DP# | $Q_5$ | $Q_{100}$ |
|---|---|---|
| 1 | 0 | 4 |
| 2 | 2 | 27 |
| 3 | - | 429 |
| 4 | 5 | 17 |
| 5 | 3 | 15 |
| 6 | - | 394 |
| 7 | 4 | 57 |
| 8 | 5 | 65 |
| 9 | - | 896 |
| 10 | 1 | 13 |
| 11 | 10 | 60 |
| 12 | 3 | 24 |
| 13 | 10 | 60 |
| 14 | - | 753 |

For values in RED, used reach flow from Giech Ranch DBPS by Drexel, Barrel & Co.

300 150 0 300 600

ORIGINAL SCALE: 1" = 300'

PROPOSED DRAINAGE MAP
JANE DAVIS RANCH
JOB NO. 25274.00
03/15/2024
SHEET 1 OF 1

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# DAVIS RANCH

## PROPOSED WATER QUALITY MAP

**PBMP Summary Table**

| Basins | Tributary Area (acres) | PBMP |
|---|---|---|
| A | 17.96 | POND 1 |
| B | 1.33 | EXCLUDED** |
| C | 5.20 | POND 2 |
| D | 26.15 | POND 3 |
| E1-E2 | 10.28 | EXCLUDED** |
| F | 49.33 | POND 4 |
| G | 53.91 | POND 5 |
| H | 10.99 | EXCLUDED** |
| I | 5.20 | EXCLUDED* |
| J | 119.80 | POND 6 |
| K | 29.86 | EXCLUDED* |
| L | 56.53 | EXCLUDED* |
| M1-M2 | 10.81 | EXCLUDED** |

*EXCLUDED BASED ON LARGE-LOT SINGLE FAMILY SITE PER ECM APP. I.7.B.5

** EXCLUDED BASED ON STREAM STABILIZATION SITE PER ECM APP. I.7.B.8

300 150 0 300 600

ORIGINAL SCALE: 1" = 300'

PROPOSED WATER QUALITY MAP
DAVIS RANCH
JOB NO. 25274.00
03/18/2024
SHEET 1 OF 1


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