#### PRELIMINARY DRAINAGE STUDY

FOR

# Deer Creek Subdivision Grand Junction, Colorado

December 9, 2021

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Prepared By:

Monty D. Stroup

"I hereby certify that this Preliminary Drainage Study for Deer Creek Subdivision was prepared by me (or under my direct supervision) in accordance with the provisions of the *Stormwater Management Manual* for the owners thereof. I understand that the (local jurisdiction) does not and will not assume liability for drainage facilities designed by others."

Reviewed By:

Keith P. Mendenhall, PE State of Colorado, #31818

I, Jeff Grant hereby certify that the drainage facilities for Deer Creek Subdivision shall be constructed according to the design presented in this report. I understand that the City of Grand Junction does not and will not assume liability for the drainage facilities designed and/or certified by the engineer. I understand that the City of Grand Junction reviews drainage plans but cannot, on behalf of Deer Creek Subdivision, guarantee that the final drainage design review will absolve Jeff Grant and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Final Plat and/or Final Development Plan does not imply approval of my engineer's design.

Name of Developer

Authorized Signature

Date

# I. Location and Description of Property

#### A. Property Location:

Deer Creek Subdivision is located in the City of Grand Junction, County of Mesa, State of Colorado, more particularly being in the NW 1/4, NE 1/4, Section 35, T.1 N., R.1 W., Ute Meridian. The Property's physical address is 780 26 1/2 Road.

The subject property is located approximately 600 feet east of 26 ½ Road. The property is contiguous with existing Sedona Subdivision along it's east boundary line. Amber Way is an existing 44-foot wide unimproved R.O.W. which will provide primary access to the site from the east.

#### **B.** Description of Property:

The project area, (subject property within the boundary) contains approximately 8.90 acres, and is currently occupied by 1 – single family residential structure which is to remain in-place.

The property's historic land use has been one single family residential structure combined with an agricultural use as pasture land. The north ½ of the property is currently covered with pasture grass. The south ½ of the property is covered with Thick Brush, Willows, Elm Trees and Old Cottonwood Trees. This type of ground cover is not considered desirable in terms of landscaping and is to be removed with the overlot grading. The property is currently zoned Residential use, (R-4). The property is bounded to the east by the existing Sedona Subdivision. The property is bounded to the south by an acreage size undeveloped parcel with one single family Residence on it. This parcel is zoned R-4 and is currently being used as pasture land. To the west of and adjacent to the property is Lot 2, Holy Family Subdivision. This acreage sized Lot is occupied by an existing single family residential structure and is zoned R-4. To the northeast and north of, and adjacent to the property is Lot 1, Holy Family Subdivision. This is an acreage sized parcel occupied by the Roman Catholic Diocese School, associated Parking Lot and Soccer Field. The land use in the vicinity of the project is best described as medium density Residential.

Topography of the site is considered moderately steep from the north and south towards it's center draining from the north at an average slope of 4% and from the south at an average slope of 8% towards an existing natural channel which bisects the site running from the northeast to the southwest. This natural drainage conveys onsite stormwater runoff and offsite irrigation tailwater combined with detention pond discharge from the existing Sedona Subdivision east of and adjacent to the property.

The Onsite study area, Sub-Basins H1 (1.46 Ac.) and H2 (7.44 Ac,) and Offsite Study Area Subbasin OFH1 (Sedona Sub., 1.84 Ac,) soils are classified as follows and shown on Exhibits B1 through B8 of this report:

BkD Blackston very gravelly loam, 5 to 25% slopes, Hydro. Group "C" Bl Blackston gravelly loam, 2 to 25% slopes, Hydro. Group "C" Fe Fruita clay loam, 0 to 2% slopes, Hydro. Group "C" Fe Fruita clay loam, 2 to 5% slopes, Hydro. Group "C"

# II. Drainage Basins and Sub-Basins

#### A. Major Basin Description:

The site is defined as being in "Zone X Area of Minimal Flooding", and is not within any designated 100 Year Floodplain, as shown on Exhibit A2.

The site is situated in the upper portion of the lower one-third of a large, (17 Sq. Mile) drainage basin referred to as the Leach Creek Drainage Basin. This Major Drainage Basin extends from Northeast to Southwest from the foot of the Bookcliffs to the Colorado River. See Exhibit A1 in the Appendix of this Study.

#### **B. Detailed Sub-Basins Description:**

#### Historic Condition Onsite Sub-basin H1, (1.46 Acres), Exhibit A3.

This is a long narrow Sub-Basin which is adjacent to the Existing Sedona Subdivision to the East. This Sub-Basin parallels the north boundary line of the site draining generally from the northeast to the southwest in an overland sheetflow fashion discharging into an existing Irrigation & Tailwater Ditch adjacent to the west boundary line of the project site. This Sub-Basin's ground cover is pasture grass.

#### Historic Condition Onsite Sub-basin H2, (7.44 Acres), Exhibit A3.

This Sub-Basin is the remaining area of the site south of and adjacent to Sub-Basin H1. Sub-Basin H2 is also adjacent to and contiguous with the west line of the existing Sedona Subdivision. This Sub-Basin is considered moderately steep from the north and south towards it's center draining from the north at an average slope of 4% and from the south at an average slope of 8% towards an existing natural channel which bisects the site running from the northeast to the southwest. This natural drainage conveys onsite stormwater runoff and offsite irrigation tailwater combined with detention pond discharge from the existing Sedona Subdivision east of and adjacent to the property. Sub-Basin H2 discharges flows into and continues within the existing natural channel southwest towards I-70. This Sub-Basin's ground cover consists of an existing Single Family Residence, Asphalt Driveway, Pasture grass, Brush and Trees.

#### Historic Condition Offsite Sub-basin OFH1, Sedona Subdivision, (1.84 Acres), Exhibit A3.

This Offsite Sub-Basin is part of Sedona Subdivision adjacent to the East Boundary line of the project site. Sub-Basin OFH1 consists of (4) Existing Single Family Lots and the Sedona Subdivision's Stormwater Detention. The west one-half of the existing lots are graded away from the existing detention pond and drain from the north and the south discharging to the existing natural channel bisecting the Deer Creek property.

#### Historic Condition Existing Natural Drainage Channel

The existing natural drainage channel which bisects the site from the northeast to the southwest conveys irrigation tailwater, plus detained stormwater runoff from Offsite Areas east of the project

site which are developed. This flow is addressed in subsequent sections of this narrative including Appendix F of this study.

#### Developed Condition Onsite Sub-basin A1 (3.74 Ac.), Exhibit A4

This Developed Condition sub-basin shall direct stormwater runoff via proposed lot grading, proposed shared driveways and proposed roadway improvements into the north side of Amber Way. This runoff shall be conveyed via curb & gutter to a single combination inlet in sump condition at Design Point #2.

#### Developed Condition Onsite Sub-basin A2 (1.30 Ac.), Exhibit A4

This Developed Condition sub-basin shall direct stormwater runoff via proposed lot grading and proposed roadway improvements into the south side of Amber Way. This runoff shall be conveyed via curb & gutter to a single combination inlet in sump condition at Design Point #3 where it combines with runoff from Design Point #2. This combined runoff is then conveyed south under a proposed Shared Driveway via an 18-Inch diameter RCP Storm Drain Line "A" to Design Point #5.

#### Developed Condition Onsite Sub-basin A3 (1.28 Ac.), Exhibit A4

This Developed Condition sub-basin shall direct stormwater runoff via proposed lot grading, a flag driveway and proposed roadway improvements into the east side of Athena Way. This runoff shall be conveyed via curb & gutter south to a 15-foot wide concrete V-Pan at a single low point in Athena Way to Design Point #4 where it combines with runoff from Sub-Basin A4. This combined runoff is then conveyed west via a Sidewalk Drain Through discharging into a 3-foot wide Concrete Curb Pan.

#### Developed Condition Onsite Sub-basin A4 (0.58 Ac.), Exhibit A4

This Developed Condition sub-basin shall direct stormwater runoff via proposed lot grading, a 3foot wide Concrete Curb Pan and proposed roadway improvements into the east side of Athena Way. This runoff shall be conveyed via curb & gutter north to a 15-foot wide concrete V-Pan at a single low point in Athena Way to Design Point #4 where it combines with runoff from Sub-Basin A3. This combined runoff is then conveyed west via a Sidewalk Drain Through discharging into a 3-foot wide Concrete Curb Pan.

#### Developed Condition Onsite Sub-basin A5 (1.10 Ac.), Exhibit A4

This Developed Condition sub-basin shall direct stormwater runoff from the north and the south towards it's center where it combines with runoff from Design Point #4. This combined runoff is then conveyed southwest via a 3-foot wide Concrete Curb Pan to a single low point and area inlet in the Shared Driveway of Tract B at Design Point #5 where it combines with runoff from Design Point #3. This combined runoff is then conveyed west via an 18-inch RCP Storm Drain Pipe, Line A discharging into the proposed detention pond.

# Developed Condition Onsite Sub-basin A6 (0.53 Ac.), Exhibit A4

This Developed Condition sub-basin shall direct stormwater runoff north to the south from the center of the proposed lots towards a concrete catch curb & gutter adjacent to the south boundary of the project site. The catch curb & gutter will convey the runoff southeast to a single curb inlet in sump condition at Design Point # 6 on Lot 28. The runoff will then be conveyed south via a 12-inch RCP Storm Drain Pipe, Line C discharging into the proposed detention pond.

#### Developed Condition Onsite Sub-basin A7 (0.29 Ac.), Exhibit A4

This Developed Condition sub-basin is the proposed detention pond. It collects all developed runoff from the project site.

#### Developed Condition Onsite Sub-basin A8 (0.08 Ac.), Exhibit A4

This Developed Condition sub-basin is the west face of the embankment of the proposed detention pond.

#### Developed Condition Offsite Sub-basin OF1 (0.78 Ac.), Exhibit A4

This Developed Condition offsite sub-basin consists of the west one-half of 2-existing Single Family Residential Homes in Sedona Subdivision. Stormwater runoff from this sub-basin is directed towards the west line of Sedona Subdivision which is the east line of Deer Creek Subdivision. At this point the runoff will be directed south along the boundary line to the north R.O.W. of the proposed extension of Amber Way. At the north R.O.W., Design Point #1 the flow will be conveyed via sidewalk drain through into the north curb & gutter of Amber Way. This runoff will continue in the north one-half of Amber Way west to the single low point and curb inlet at Design Point #2. This flow will combine with runoff from sub-basin A1 and be conveyed south in Storm Drain Line A to the proposed detention pond.

#### Developed Condition Offsite Sub-basin OF2 (0.07 Ac.), Exhibit A4

This Developed Condition offsite sub-basin consists of the south one-half of the proposed extension of Amber Way. Stormwater runoff will be directed along the south curb & gutter of Amber Way west to the single low point and curb inlet at Design Point #3. This flow will combine with runoff from Design Point #2 and be conveyed south to in Storm Drain Line A to the proposed detention pond.

#### III. Drainage Facility Design

#### A. General Concept:

The "Mesa County / City of Grand Junction, Stormwater Management Manual, SWMM" (Reference 1), was used as the basis for this preliminary analysis and facility design.

As the project is a single family residential development containing approximately 8.90 acres the "SCS Unit Hydrograph Method" will be used to calculate developed flowrates for the 10 Year and

100 Year Storm Events. The maximum allowable release rates for each storm event shall be determined based on the requirements of the "Mesa County / City of Grand Junction, Stormwater Management Manual, SWMM" (Reference 1). The major storm is the 100-year frequency rainfall event. The minor storm is the 10-year frequency rainfall event. All drainage elements proposed for the project, shall be designed to collect, convey and attenuate the 100 Year major storm event. The plan proposes to duplicate the historic drainage conditions and to preserve existing onsite drainage patterns as much as possible. The developed stormwater runoff from the project shall be routed from the north and the south towards the center of the project site discharging to the proposed Water Quality/Detention Pond located adjacent to the west boundary line of the project . Developed condition SCS runoff curve numbers (CN) to be used in the final computations are based on a composite value for the percentage of impervious (I) area for a given basin or site under consideration. Calculations to arrive at the (CN) values shall be based on the S.C.S. soils type and proposed lot improvements. The composite curve number calculations for the developed conditions and the resultant SCS Method runoff coefficients (CN) for each of the developed and historic sub-basins are presented in the Appendix B of this Preliminary Drainage Study.

The Precipitation Data for the "Leach Creek/Horizon Drive Watershed" presented in the (SWMM), Reference 1, Appendix C is to be used for final design and analysis.

Times of Concentration shall be calculated based on methods presented in (SCS Tr55). The calculated Times of Concentration for the developed conditions sub-basins will be presented in Appendix C of the Final Drainage Study.

Based on the proposed landscaping, grading and drainage plans for the project, no changes to the existing drainage patterns are anticipated. The proposed drainage patterns shall continue to direct runoff generally from the north and the south towards the center of the site ultimately discharging into the existing natural drainage channel at the west boundary line of the site.

#### **B. Detailed Analysis**

The proposed site plan provides for the ultimate development of 30 single family residential lots, roadway improvements, storm sewer improvements and a water quality / detention pond adjacent to the west line of the site.

#### Historic Conditions.

Historic conditions and associated stormwater runoff shall be analyzed in the Final Drainage Study. See the Historic Drainage Basins Map, Exhibit A3.

#### Proposed Conditions.

As shown on the attached Developed Basins Map, (Exhibit A4) the proposed lot grading, street grading and storm sewer improvements divide the site into 8 drainage sub-basins, A1 through A8 totaling 8.90 acres. A detailed description of each sub-basin is provided in Section II, B. Detailed Sub-basins Description of this drainage study.

Developed Sub-basins OF1 & A1 shall be conveyed within the north one-half of Amber Way to a

single low point, Single Combination Inlet A1 at Design Point #1.

Developed Sub-basins OF2 and A2 shall be conveyed within the south one-half of Amber Way to a single low point, Single Combination Inlet A2 at Design Point #2.

Developed Sub-basins A3, A4 and A5 shall be conveyed within a proposed 3-foot wide concrete curb pan west to a single low point, Single 30" x 30" I.D. Area Inlet A3 at Design Point #5 in the Tract B Shared Driveway.

The combined runoff from Developed Sub-Basins OF1, A1, OF2, A3, A4 & A5 shall be conveyed via an 18-Inch RCP Storm Drain Line A into the proposed Water Quality / Detention Pond. A Hydraulic Analysis and Design of Storm Drain Line A will be included in the Final Drainage Study.

Developed Sub-basin A6 shall be conveyed to a single low point, Single Curb Inlet C1 at Design Point #6. Runoff from this Developed Sub-basin shall be discharged into the Water Quality / Detention Pond via a 12-Inch RCP Storm Drain Line C.

A Hydraulic Analysis and Design of Storm Drain Line C will be included in the Final Drainage Study.

**Developed Sub-basins OF2 & OF3. Stormwater runoff from these Developed Sub-basins will combine with a 18.83 CFS 100 Year Released Rate from the existing Sedona Subdivision's Detention / Irrigation Pond, (Reference 4).** This Combined Runoff shall be collected at Design Point #9 by a 30" x 30" I.D. Area Inlet B1. This combined flow will be conveyed underground by a proposed 24-Inch RCP Storm Drain Line B under the proposed Water Quality / Detention Pond adjacent to the west boundary line of the site. Prior to discharging runoff into the existing natural drainage channel, the Flow in Storm Drain Line B will combine with the 100 Year Release flowrate from the project's proposed Water Quality / Detention Pond.

A Hydraulic Analysis and Design of Storm Drain Line B will be included in the Final Drainage Study.

# C. Extended Detention Basin (EDB) - Sedimentation Facility

Developed stormwater runoff shall be directed to the proposed (EDB) adjacent to the west boundary line of the project site. Discharge from the pond shall be directed via a 12-Inch PVC C900 line into the side of the proposed 24-Inch RCP Storm Line B without a manhole. This connection shall be made by casting a boot into the side of the 24-Inch RCP at the spring line. The combined flow will be discharged into the aforementioned existing natural drainage channel at the toe of the detention pond at the west boundary line of the site.

#### Regulated Discharge Rate from the Proposed (EDB)

Based on a developed basin area of 8.90 acres the maximum allowable discharge rates from the proposed Extended Detention Basin are preliminarily calculated to be Q10r = 1.07 CFS and Q100r = 4.45 CFS, (Exhibit D3). The final release rates may be less based on the ultimate capacity of the 24-Inch RCP Storm Drain Line B.

# WQCV Water Quality Capture Volume Calculations:

The minimum required Water Quality Capture Volume, (WQCV), shall be calculated in the Final Drainage Study. The volume shall be based on the subdivision's developed condition percent impervious area of 44.19%, (Exhibit B11).

#### Extended Detention Basin (EDB) Outlet Structure Design:

The outlet structure is proposed to be a 24-inch x 24-inch inside dimension rectangular concrete box modified to drain the water quality capture volume (WQCV) over a 40-hour period as per Section 1600 of the SWMM, Reference 1. The outlet box is to be constructed with a block out in the pond facing wall of the box. The structure is to be fitted with a perforated orifice plate attached to the inside face of the box and stainless steel perforated plate type trash rack to filter the WQCV and a larger Box Type Trash Grate to filter the minor and major storm events. The trash rack plate and the Box Grate shall be attached to the outside face of the box. The perforated orifice plate shall be a 1/4-inch thick mild steel flow control plate with a series of small diameter circular openings arranged in 1 vertical column spaced evenly center to center. The orifice / weir plat shall have a rectangular lower stage opening for discharge of the 10 Year Storm Event. The orifice / weir plate shall have an upper stage larger rectangular opening for discharge of the 100 Year Storm Event. The orifice / weir plate shall be "powder coated" to prevent rusting. The trash rack shall be a 1/8-inch thick stainless steel plate with 3/8-inch diameter perforated openings on 9/16-inch centers, or an approved equal. Calculations for sizing the perforated flow control plate and the stainless steel trash rack shall be included in Appendix D of the Final Drainage Study.

The overflow trash rack on the top of the outlet structure shall be a 1 1/2-inch by 1 1/2-inch by 1/8-inch Aluminum Tubular Material, Type 6063 with a grate spacing of 6-inches on center.

The outlet structure details shall be included in Appendix D of the Final Drainage Study.

#### Preliminary Detention Pond Calculations:

Based on the proposed conditions the detention pond shall have a calculated minimum **10 -Year Storm Detention Volume of 4,040 Cubic Feet** and a **100 - Year Storm Detention Volume of 12,880 Cubic Feet**.

The actual maximum **10** - **Year Storm Release Rate** from the detention pond will be calculated along with it's maximum water surface elevation and are to be included in the Final Drainage Study.

The actual maximum **100- Year Storm Release Rate** from the detention pond will be calculated along with it's maximum water surface elevation and are to be included in the Final Drainage Study.

The detention pond's minimum storage volume requirements and the detention pond's design and stage / storage calculations are to be presented in Appendix D of the Final Drainage Study.

The detention pond shall have a 3-foot wide concrete curb-pan, (trickle channel) and an access & maintenance ramp as per (SWMM) requirements.

### Preliminary Detention Pond Volume Provided With the Proposed Design:

The preliminary proposed design provides a calculated 100 Year Detention Storage Volume of 12,880 cubic feet at a maximum water surface elevation of 4,720.34. Exhibit D7. Based on a top of pond bank elevation of 4,722.00 this design provides for 1.66-feet of freeboard to the top of the pond's bank.

# D. Street, Pipe, Inlet and Drain Through Capacity Calculations

All proposed conveyance elements including streets, pipes, inlets and sidewalk drain throughs shall be sized to convey the 100 Year Storm Event. Capacity calculations shall be presented in Appendix E of the Final Drainage Study.

#### IV. Emergency Conditions Scenario - Storm Drain Line B (Sedona Subdivision Interceptor)

The City of Grand Junction Engineer has requested that the impact of an Emergency Conditions Scenario be evaluated. This Emergency Conditions Scenario is based on the assumption that the existing Sedona Subdivision Detention / Irrigation Pond fails to function as designed as a result of plugging of the outlet pipe or a breach of the Pond's bank.

In order to evaluate this Emergency Conditions Scenario it was necessary to identify all tributary offsite areas west and northwest of the existing Sedona Subdivision Detention / Irrigation Pond which could generate Stormwater Runoff Infow to the Pond.

#### The offsite areas were indentified as and summarized as follows:

Tributary Areas – North of the U.S. Government Highline Canal including Sub-basins North of H Road. These areas are identified and analyzed by 2 separate Drainage Studies, (References 2 and 3). The total area defined by these studies is 148.04 acres. The number of Detention Ponds associated with these areas is 5. The potential stormwater runoff from these areas was calculated using the SCS Unit Hydrograph Procedure. The total 100 Year Storm Event calculated flow rate conveyed under the Canal is 14.75 CFS, (Exhibits F12 & F13).

This runoff is conveyed under the Canal by an existing 24-Inch RCP where it is then directed west towards 27 Road. At 27 Road this runoff begins to combine with stormwater runoff from 2 existing Developed Parcels defined as Aspen Heights Townhomes and Skyline Subdivision. The combined runoff is assumed to overtop 27 Road at the existing lots located at 780 and 782 Jade Lane. This runoff is assumed to continue to and through Alpine Meadows Subdivision via street grading, and storm drain/ irrigation pipes of unknown size where it combines with stormwater runoff from Alpine Village Subdivision at a single low point adjacent to existing lots located at 778 and 780 Jordanna Road. From this low point the combined stormwater runoff would be conveyed via an open swale and storm drain pipe of unknown size between existing lots located at 776 and 780 S. Sedona Court to the existing Sedona Subdivision Detention / Irrigation Pond.

The total calculated area, (Sub-Basin OFA1 51.56 Acres plus Offsite Areas North of the Canal 148.04 Acres) contributing stormwater runoff into the existing Sedona Subdivision Detention / Irrigation Pond is approximately 199.66 Acres. See the Deer Creek Area Basins Map, Exhibit F18.

# The Sedona Subdivision Total Detention Pond 100 Year Inflow Rate was calculated to be 46.26 CFS at Design Point # 9 as shown on Exhibits F23 through F25 using the SCS Unit Hydrograph Procedure.

The proposed Storm Drain Line B (Sedona Subdivision Interceptor), was modeled and analyzed to determine it's ultimate capacity under Emergency Conditions. This ultimate capacity is based on the maximum achievable head over the proposed 30" x 30" I.D. Area Inlet B1. This Inlet is surrounded on 3-sides by a proposed concrete retaining wall, Exhibit F26. The wall functions to create a barrier at the east line of the project. The retaining wall provides for grading of proposed Lots west towards Athena Way and away from the Sedona Subdivision. The proposed wall height is reduced quickly as it proceeds north and south away from Inlet B1following the existing grades along the east boundary line of the site. The maximum elevation of the top of wall at Inlet B1 is 4,729.88. The elevation of the top of wall directly above and west of Inlet B1 is 4,729.17. This elevation represents the top of a 14-foot long Emergency Overflow Weir. The elevation of the top of grate of Inlet B1 is 4,722.50. This elevation difference provides 6.67-feet of headwater depth at Inlet B1. At this (HwD) Headwater Depth the 24-Inch RCP will convey 29.45 CFS. The remaining 16.81 CFS will be conveyed west by the proposed Overflow Weir in the retaining wall. See Exhibits F26 through F30 for the Storm Drain and Weir Analysis.

#### V. Conclusion

This Preliminary Drainage Study has been prepared to address site-specific drainage concerns in accordance with the requirements of the City of Grand Junction, Mesa County, Colorado. The Appendix of this report includes criteria, exhibits, tables and design nomographs to be used in the final design of this project.

# VI. References

1. <u>Mesa County / City of Grand Junction Stormwater Management Manual SWMM)</u>, City of Grand Junction, Mesa County, Colorado, December 31, 2007.

2. <u>Final Drainage Report for Boockcliff Tech. Park,</u> Williams Engineering, Inc., Rexburg, ID., Date November , 2006.

3. <u>Final Drainage Study for Eagle Estates Subdivision</u>, Summit AE, Grand Junction Colorado, Date May 15, 2018.

4. <u>Preliminary Drainage Plan (Study) Study for Sedona Subdivision</u>, Costin Engineering Inc., Castle Rock Colorado, Date October 25, 1992.