ARAPAHOE COUNTY
CHECKLIST FOR DRAINAGE REPORT – PHASE 3

Revised June 2019

Yes	No	N/A	Report Requirements
I. COVER SHEET			
			A. Name of Project/Site Name
			B. Address
			C. Owner Contact Information (Name, Company, Address, Phone)
			D. Developer Contact Info (Name, Company, Address, Phone)
			E. Engineer Contact Info (Name, Company, Address, Phone)
			F. Submittal date and revision date(s) as applicable
			G. Case Number(s)
			Table of Contents
			Certification Statement** - Engineer
			Certification Statement** - Developer
			** see Stormwater Management Manual for Certification verbiage
II. GENERAL LOCATION AND DESCRIPTION			
			A. Site Location
			1. Site Vicinity Map
			2. Legal Description include Township, Range, Section, and ¼ Section
			3. Existing and proposed streets adjacent to and within proposed development, or within area of proposed drainage improvements
			4. Names of surrounding or adjacent developments, including land use or zoning information
			B. Description of Property
			1. Total Site/Project Area in Acres
			2. Current and Proposed Zoning
			3. Existing Site Conditions Ground cover, vegetation, site topography and slopes
			4. Existing irrigation canals or ditches
			5. Significant geologic features
			6. NRCS Soils Classification Map and discussion
			7. Proposed Land Use, site activities and operations
			8. Total Proposed Impervious Area – existing and proposed. Include removed, replaced, and new impervious area (square feet and acres) and total change in impervious area
			9. Total Disturbed Area
			C. Groundwater Investigation
			1. Discuss groundwater investigations and results
			2. Identify potential groundwater issues
			3. Discuss improvements to mitigate groundwater impacts
III. FLOODPLAIN			
			A. Major Drainageway – Designated Floodplain
			1. Identify site Floodplain Zone

Yes	No	N/A	Report Requirements
			2. Source of Floodplain Delineation. FEMA Flood Insurance Rate Map(s) including panel date and number and/or UDFCD Flood Hazard Area Delineation (FHAD) study
			3. Floodplain Modifications required, including level of encroachment, velocities, depths, stabilization measures, water surface elevations, etc.
			4. Floodplain Modification Studies required, including Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) requirements
			5. County Floodplain Development Regulations and Floodplain Development Permit
			B. Major Drainageway – Undesignated Floodplain (non-FEMA>130ac)
			1. Discuss methodology of Floodplain Delineation
			2. Floodplain modifications required, including level of encroachment, velocities, depths, stabilization measures, water surface elevations, etc.
			3. Floodplain development regulations and Floodplain Development Permit
IV. DRAINAGE BASINS AND SUB-BASINS			
			A. Major Drainage Basins
			1. Major drainage basin characteristics and flow patterns and paths adjacent to and within the proposed development
			2. Existing and proposed land uses and impervious values within the basins
			3. Discussion of all drainageway master planning or studies that affect the major drainageways, i.e. UDFCD Major Drainageway Plan (MDP) and Outfall Systems Planning (OSP) studies
			4. Discuss site restrictions imposed by Master Plans, including design imperviousness
			5. Condition of the drainage channel within or adjacent to the development, including existing condition, need for improvements, and impact on proposed development
			6. Impacts of proposed development to major basin flow patterns and paths, under fully developed conditions
			7. If within the Cherry Creek Basin, note additional requirements from Control Regulation 72 that shall apply.
			B. Minor Drainage Basins
			1. On-site and Off-site minor drainage basin characteristics and flow patterns and paths
			2. Existing and proposed land uses within the basins
			3. Discuss previous Drainage Studies or Master Development Plans for the Site or Project
			4. Discuss Drainage Studies for Adjacent Developments
			5. Discuss impacts of the Minor Basin Characteristics, flow patterns and paths, under both historic and developed conditions
			6. Summary of Sub-Basin Characteristics, size in acres, C2, C5 and C100 values and Q2, Q5 and Q100 values. Values to match calculations in appendix.

Yes	No	N/A	Report Requirements
			7. Discuss impacts of the off-site flow patterns and paths, under fully developed conditions
			8. Discussion of irrigation facilities that will influence or be impacted by the site drainage

V. EXISTING STORMWATER CONVEYANCE, STORAGE, AND/OR WATER QUALITY FACILITIES			
			A. Existing Stormwater Storage and/or Water Quality Facilities
			1. Accessibility to existing regional or sub-regional detention and/or water quality facility, include name and location of facility
			2. If utilizing a regional facility, discuss conformance with each of the requirements noted in the SMM (channel stability, facility must be implemented and functional, maintenance/ownership, adequate capacity, water quality or flood control as primary use). Facility cannot be listed by name by CCR 1003-32 through 5 CCR 1002-38. Discuss conformance with each of these requirements.
			3. Discuss limitations and restrictions from Master development or drainageway plan, mentioning capacity and water quality. Include relevant source pages in Appendix
			4. Does existing facility meet current Standards and Regulations?
			5. Discuss existing storage facility modifications needed, including rebuild or abandonment
			B. Existing Stormwater Conveyance Facilities
			1. Existing Conveyance Facilities and how it will be incorporated into proposed development design
			2. Discuss limitations and restrictions from Master development or drainageway plan, including capacity. Include relevant source pages in Appendix
			3. Existing Conveyance Facility Modifications, including rebuild or abandonment
			4. Discuss any known issues with existing conveyance system

VI. DRAINAGE DESIGN CRITERIA			
			A. Regulations
			1. County Criteria and optional provisions selected, as applicable
			2. UDFCD criteria and optional provisions selected, as applicable
			3. Cherry Creek Basin Control Regulation No. 72
			B. Compliance with Phase II Assumptions
			1. State any changes from the design assumptions used in the Phase II drainage calculations (i.e. the maximum % imperviousness value, slope of the basin, etc.)
			2. State any conditions of Approval from the Phase II Drainage Report (i.e. completion of Master Drainage Plan or FHAD, etc.)
			C. Hydrologic Design Criteria
			1. Methods used to determine runoff calculations

Yes	No	N/A	Report Requirements
			2. Design storm recurrence intervals, including water quality, minor and major storms
			3. Design rainfall
			4. Detention storage calculation method(s)
			5. Detention storage release rate calculation method
			D. Hydraulic Design Criteria
			1. Methods used to determine conveyance facility capacities
			2. Hydraulic grade line calculation method and loss coefficients
			3. Methods used to calculate water surface profiles
			4. Detention pond routing
			E. Water Quality Control Measure (CM) Design Criteria
			1. Water quality CM requirements
			2. Methods used to determine and size water quality CM facilities, including 20/10 Pretreatment, WQCV, mean concentration of TSS median value of 30 mg/L or less for Pollutant Removal Standard, etc.
VII. PROPOSED STORMWATER CONVEYANCE OR STORAGE FACILITIES			
			A. Proposed Stormwater Storage Facilities
			1. Detention pond designs, including release rates, storage volumes and water surface elevations for the Water Quality Capture Volume, Excess Urban Runoff Volume, 100-year, and emergency overflow conditions, outlet structure design, emergency spillway design, etc.
			2. Pond outfall locations and design, including method of energy dissipation
			3. How is runoff conveyed from all pond outfalls to the nearest major drainageway, including a discussion of the flow path and capacity downstream of the outfall to the nearest major drainageway
			4. Discuss maintenance aspects of the design and easements and tracts that are required for stormwater storage purposes
			5. Discuss impacts to stormwater management facility design, caused by site constraints, such as streets, utilities, light rail rapid transit, existing structures, etc.
			B. Proposed Stormwater Conveyance Facilities
			1. General onsite conveyance concepts, including drainage paths and patterns
			2. Storm sewer design, including inlet and pipe locations and sizes, tributary basins and areas, peak flow rates at design points, hydraulic grade lines, etc.
			3. Discuss storm sewer outfall locations and design, including method of energy dissipation
			4. Discuss open channel and swale designs, including dimensions, alignments, tributary basins and areas, peak flow rates at design points, stabilization and grade control improvements, low flow or trickle channel capacities, water surface elevations, etc.

Yes	No	N/A	Report Requirements
			5. Discuss allowable street capacities
			6. Discuss general offsite conveyance concepts, including drainage paths and patterns. Discuss how proposed conveyance will connect to ultimate outfall.
			7. Discussion of the facilities needed offsite for the conveyance of minor and major flows to the major drainageway
			8. Discuss maintenance aspects of the design and easements and tracts that are required for stormwater conveyance purposes
VIII. WATER QUALITY CONTROL MEASURE			
			A. Non-Structural Control Measures
			1. Discussion of non-structural control measures that will be part of the stormwater management plan; i.e. preserving open space, protecting natural systems, and incorporating existing landscape features into proposed development
			B. Structural Control Measures (CM)
			1. Discuss CM Standard(s) which will be utilized to meet water quality requirements (WQCV, Pollutant Reduction, Runoff Reduction, Regional WQCV, Constrained Redevelopment).
			2. For the CM Standard selected, discuss treatment and/or infiltration provided (such as 100% of calculated WQCV for WQCV Standard, reduction in mean concentration of TSS to 30 mg/L or less for Pollutant Removal Standard, 60% of calculated WQCV for Runoff Reduction Standard, 20/10 pretreatment for Regional WQCV)
			3. Discuss CM(s) that will be utilized to meet water quality requirements (EDB, MEDB, SF, RG, GS, GB or other)
			4. Discuss design of the CM(s), including tributary areas, sizing, treatment volumes or areas (as applicable), design features, etc.
			5. If Pollutant Removal Standard is utilized: (a) discuss how event mean concentration of TSS may be reduced to median value of 30 mg/L or less. Include references to manufacturer specifications in appendices of drainage report and (b) discuss how project meets SMM requirements.
			6. If Constrained Redevelopment Site is utilized, discuss how project meets SMM requirements.
			7. If the Runoff Reduction Standard is utilized as the only means for meeting water quality requirements onsite, a soils analysis and recommendation from a geotechnical engineer is required to justify that Site geology and other factors allow appropriate infiltration to occur.
			8. Justify MDCIA techniques have been maximized for proposed Site.
			9. Justify that hierarchy for MDCIA has been followed to obtain the maximum benefit for reduction in runoff volume in terms of stormwater quality, as follows: (a) Parking lot(s) and driveway(s) or other paved surfaces subject to routine vehicular use and/or deicing activities, (b)

Yes	No	N/A	Report Requirements
			Other paved areas (not parking lot or driveways), (c) Roof areas or sidewalks, or (d) Other areas identified with potential pollutants.
			10. Discuss how runoff is conveyed from all CM outfalls in a storm sewer system, drainageway, or other designated drainage system (to the nearest major drainageway), including a discussion of the flow path and capacity downstream of the outfall to the nearest major drainageway.
			11. Discuss design constraints, including any special requirements for operations and maintenance
			12. Subsurface Soils Analysis: • Recommendation for a full infiltration, partial infiltration, or no infiltration section, based on the requirements noted in Volume 3 of the USDCM • Recommendation of the use of onsite soils (amended, as necessary), or import of suitable materials. • If Rain Garden or Sand Filter, discuss soils analysis by geotechnical engineer for suitability of onsite soils for infiltration.
			C. Source Controls
			1. Discuss site activities or operations that have potential to impact stormwater quality
			2. Discuss source controls that are necessary to prevent potential illicit discharge from site activities
			3. Discuss any proposed non-stormwater direct connection to the storm sewer. Proposed connections, in accordance with the SMM, IDDE Plan, and allowed by the CDPHE. Also note that any non-stormwater direct connections will require a Direct Connection License Agreement.
			D. Exclusions
			1. Discuss exclusion(s) from Water Quality (if applicable). Include for which exclusion(s) project qualifies and state conditions which project meets.
			2. For Sites that utilize Pavement Management, Roadway Redevelopment, Existing Roadway Areas, Non-residential and Non-commercial Infiltration Conditions, Sites with Land Disturbance that will Remain Undisturbed, Stream Stabilization, and/or Trail Exclusions, list and include reason for exclusion and acreage of excluded impervious area.
			3. For Sites that utilize WQCV Standard, and cannot capture 100%, justification as to why it is not practicable to capture portions of site and drain to that control measure or to implement a separate control measure.
IX. ADDITIONAL PERMITTING REQUIREMENTS			
			A. Compliance with Section 404 of the Clean Water Act
			B. Compliance with the Endangered Species Act
			C. Other local, State, or Federal requirements

Yes	No	N/A	Report Requirements
X. CONCLUSIONS			
			A. Compliance with Standards
			1. Arapahoe County Criteria/ SMM
			2. UDFCD Criteria
			3. Master Plans and UDFCD Outfall Systems Plans
			4. Cherry Creek Basin Control Regulation No. 72
			B. Variances
			1. Identify provisions by section number for which a variance will be requested, or has been approved by County
			2. Provide justification for each variance requested noting the criteria for variances from the SMM
			C. Drainage Concept
			1. Discuss overall effectiveness of stormwater management design to properly convey, store and treat stormwater
XI. REFERENCES			
			A. Source all tables, figures, charts, drawings, etc. used in design of stormwater facilities and included in appendix of the report
			B. Reference all criteria, master plans, reports, or other technical information discussed in the drainage report
XII. APPENDICES			
			A. Reference and Miscellaneous Material
			1. Vicinity Map. North Arrow, Scale, label adjacent arterial roadways and drainageways. No copyrighted material
			2. FEMA FIRM panel, with site location shown
			3. NRCS Custom Soil Resource Report (all pages)
			4. Relevant portions of the FHAD/OSP/MDP
			5. Relevant portions of the previous drainage study for the project
			6. If project is in multiple MS4 permit jurisdictions, provide a copy of the agreement between agencies how project is managed.
			7. Variance Request and Response Letters
			B. Hydrologic Computations
			1. Design Rainfall Values, ACSWMM Table 6-1 or NOAA Atlas 14
			2. Land Use Assumptions, C values, both existing and proposed
			3. Determination of runoff coefficients, times of concentration, and runoff calculations, existing and developed conditions
			4. Colorado Urban Hydrograph Procedure (CUHP) input parameter determination
			5. EPA SWMM Input parameter determination
			6. Peak flow rate calculations for the minor and major storms
			7. CUHP/EPA SWMM input and output
			8. Hydrograph data, if applicable

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			9. Connectivity diagram showing relationship/connectivity of basins, conveyance facilities, detention ponds, and design points
			10. Floodplain hydrology
			C. Hydraulic Computations
			1. UD Detention Worksheet
			2. Stage-storage-discharge determination for detention ponds
			3. Detention pond routing calculations
			4. Orifice sizing calculations
			5. Emergency spillway sizing calculations
			6. Culvert Capacities
			7. Storm sewer capacities and hydraulic grade lines, including loss coefficients
			8. Street capacity calculations
			9. Crosspan capacity calculations
			10. Inlet capacities
			11. Manhole sizing
			12. Curb Cut capacity calculations
			13. Open channel or swale capacities
			14. Low flow and trickle channels
			15. Stabilization and grade control improvements
			16. Water surface profiles
			17. Downstream/outfall capacity to the nearest major drainageway
			18. Energy dissipation at pipe outfalls
			19. Floodplain modeling
			20. Design and sizing of WQ CM, include USDCM T-0 "Quantify Runoff Reduction" and the 20/10 Calculator for regional pretreatment
			D. Drainage Plans
			HISTORIC/EXISTING DRAINAGE PLAN
			1. 24" x 36" in size (22" x 34" also acceptable for half size sets)
			2. Title block and legend
			3. Scale 1" = 20' to 1" = 100', as required to show sufficient detail
			4. Show boundaries of entire development or project and any off-site areas which flow to/through the development or project
			5. Existing topographic contours with labels with a 5-foot maximum contour interval a minimum of 100-feet beyond property lines
			6. Show and label all existing stormwater conveyance, water quality and/or storage facilities
			7. Floodplain limits, based on available information or preliminary delineation information
			8. Drainage basin and sub-basin boundaries
			9. Show and label existing utilities and structures
			10. All property lines and existing drainage easements
			11. Streets and roadways with ROW and flowline widths, type of curb and gutter or roadside swale, slopes, flow directions and crosspans

Yes	No	N/A	Report Requirements
			12. Location and elevation of all existing 100-year floodplain boundaries, including source of designation. All floodplain designations that exist for the site should be included, i.e. FEMA FIS, FHAD, and others.
			13. Adjacent developments or ownerships
			14. Summary Runoff Table
			15. Case Number(s) in the lower left-hand corner
			16. Approval block (located in the lower, right-hand corner, IDCS 3.7.3)
			PROPOSED DRAINAGE PLAN
			1. 24" x 36" in size (22" x 34" also acceptable for half size sets)
			2. Title block and legend
			3. Scale 1" = 20' to 1" = 100', as required to show sufficient detail
			4. Show boundaries of entire development or project and any off-site areas which flow to/through the development or project
			5. Existing (dashed or screened) and proposed (solid) topographic contours with labels with a 5-foot maximum contour interval (existing contours must extend a minimum of 100-feet beyond the property lines)
			6. Show and label all <u>existing</u> stormwater management facilities, including irrigation ditches, roadside swales, open channels, drainageways, storm sewers, culverts, detention ponds, WQ structures, etc. Information must be included regarding materials, sizes, lengths, shapes and slopes
			7. Drainage basin and sub-basin boundaries with basin designations and design points
			8. Show and label <u>proposed</u> stormwater management facilities, including irrigation ditches, roadside swales, open channels, drainageways, storm sewers, culverts, detention ponds, WQ structures, etc. Information must be included regarding materials, sizes, lengths, shapes and slopes
			9. Proposed flow directions
			10. Show and label existing utilities and structures
			11. Label and dimension all property lines, existing and proposed drainage easements
			12. Streets and roadways with ROW and flowline widths, type of curb and gutter or roadside swale, slopes, flow directions and crosspans
			13. Proposed outfall points and existing or proposed facilities to convey runoff to nearest major drainageway, without damage to downstream properties
			14. Location and elevation of all existing and proposed 100-year floodplain boundaries, including the source of designation. All floodplain designations that exist for the site should be included, i.e. FEMA FIS, FHAD, and others.
			15. Adjacent developments or ownerships
			16. Summary Runoff Table, includes Basin ID, contributing area, runoff coefficient, % imperviousness, runoff value, design point and routed flows.
			17. Appropriate warning signage provided for the storage facilities
			18. Case Number(s) in the lower left-hand corner
			19. Approval block (located in the lower, right-hand corner, IDCS 3.7.3)