

STORMWATER

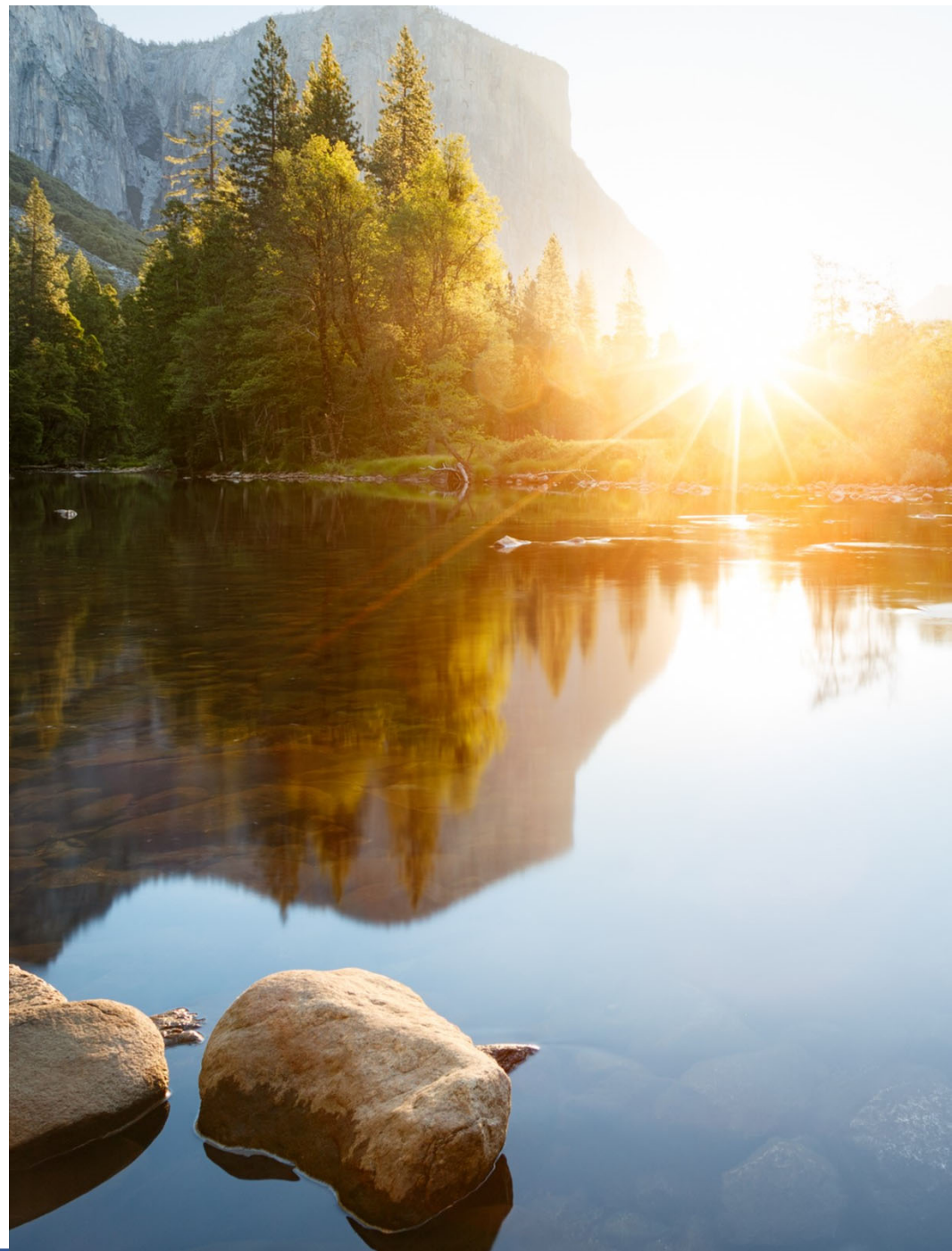
Sanitation Review of Subdivisions

Outline

- When and why we review stormwater
- Rules and Regulations
 - Exemptions and Exclusions
- Submittal Requirements
- Stormwater Report
- Design Criteria
 - Simplified Plans
 - Standard Plans
 - Initial Stormwater Facility
 - Volumes and Flows
 - Conveyance Structures
 - Facilities (Retention, Detention, Infiltration)
- Drawings
- Maintenance Plan

What triggers stormwater review?

- Given statutory authority by legislation (Sanitation in Subdivisions Act)
- Develop rules (ARMs)
- Provide guidance as to how to meet rules (Circulars)



What triggers stormwater review?

- Statutory Authority – MCA 76-4-104(2), (6)(e) (since April 1973) [Sanitation Act Review]

The rules must provide for “standards and technical procedures applicable to storm drainage plans and related designs, in order to ensure proper drainage ways, except that the rules must provide a basis for not requiring storm water review under this part for parcels 5 acres and larger on which the total impervious area does not and will not exceed 5%. Nothing in this section relieves any person of the duty to comply with the requirements of Title 75, chapter 5, or rules adopted pursuant to Title 75, chapter 5.”

What triggers stormwater review? (con't)

- ARM 17.36.110 – Certificate of Approval

“(1)..the reviewing authority shall issue a certificate of subdivision approval if..(c)the reviewing authority determines that (v) storm drainage will have proper drainageways and the drainage will not pollute state waters.”

What triggers stormwater review? (con't)

- ARM 17.36.310 – Storm Drainage
 - The applicant shall submit a storm drainage plan in accordance with department Circular DEQ-8
 - PE must design certain stormwater proposals
 - Maintenance plans are needed
 - Easements must be provided to maintain facilities (if needed)
 - Exemptions
 - Treatment for stormwater entering surface waters
 - Waivers from any requirement are allowed

Other Rules

- ARM 17.36.104 – Lot Layout Document

Need to show location of drainageways, and locations, sizes, and design details of proposed facilities

- ARM 17.36.323 – Setbacks
 - Storm water ponds and ditches must be at least 25 feet from individual/shared drinking water wells (waiver), or 100 feet from public drinking water wells (deviation)
 - 10 feet away from sealed components (waiver)
 - 25 feet away from drainfields (waiver)

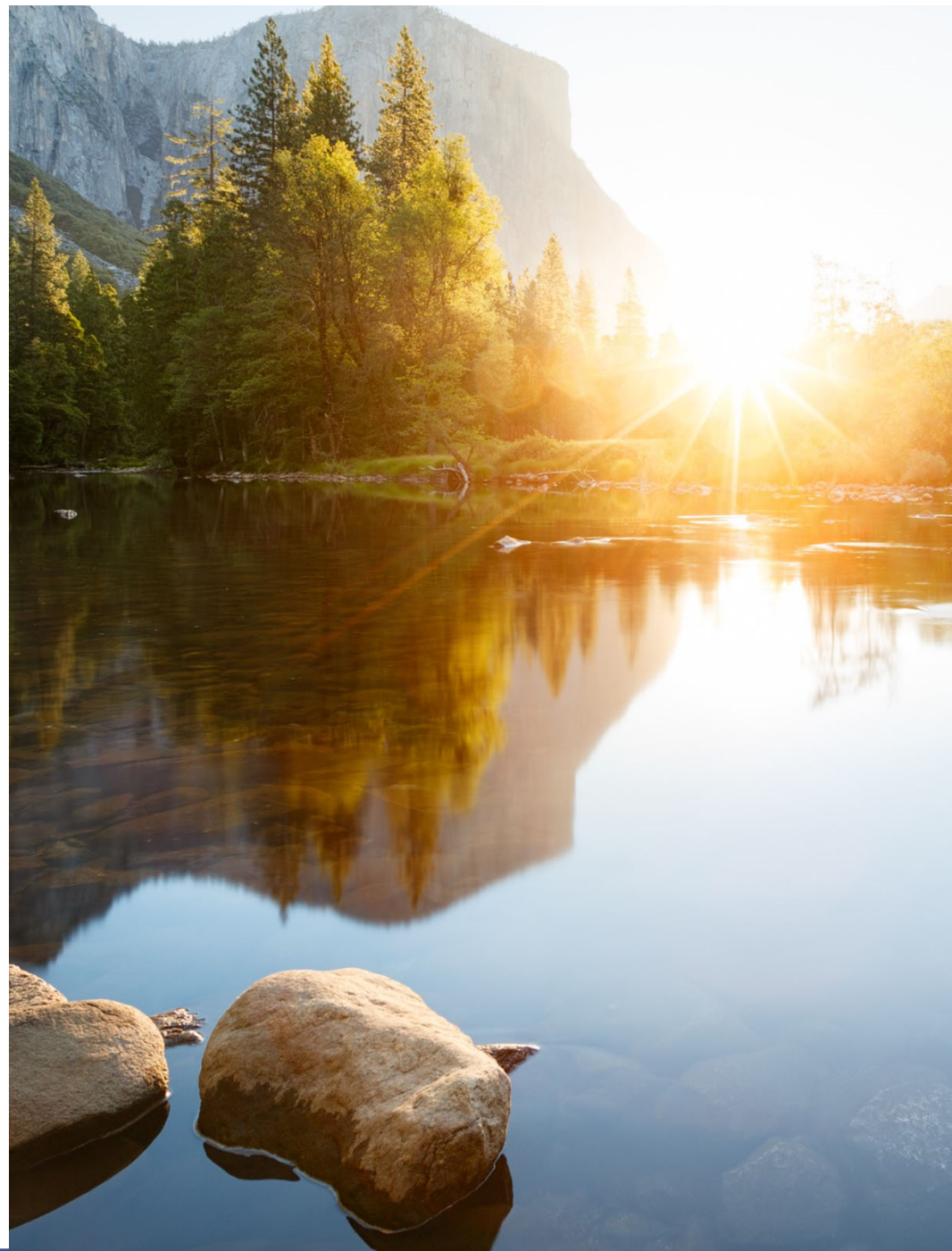


Exemptions

- ARM 17.36.310(6):
 - MS4 (Municipal Separate Storm Sewer System), 1st or 2nd Class Municipality (need form)
 - Lots 5 acres or larger with less than 5% impervious area

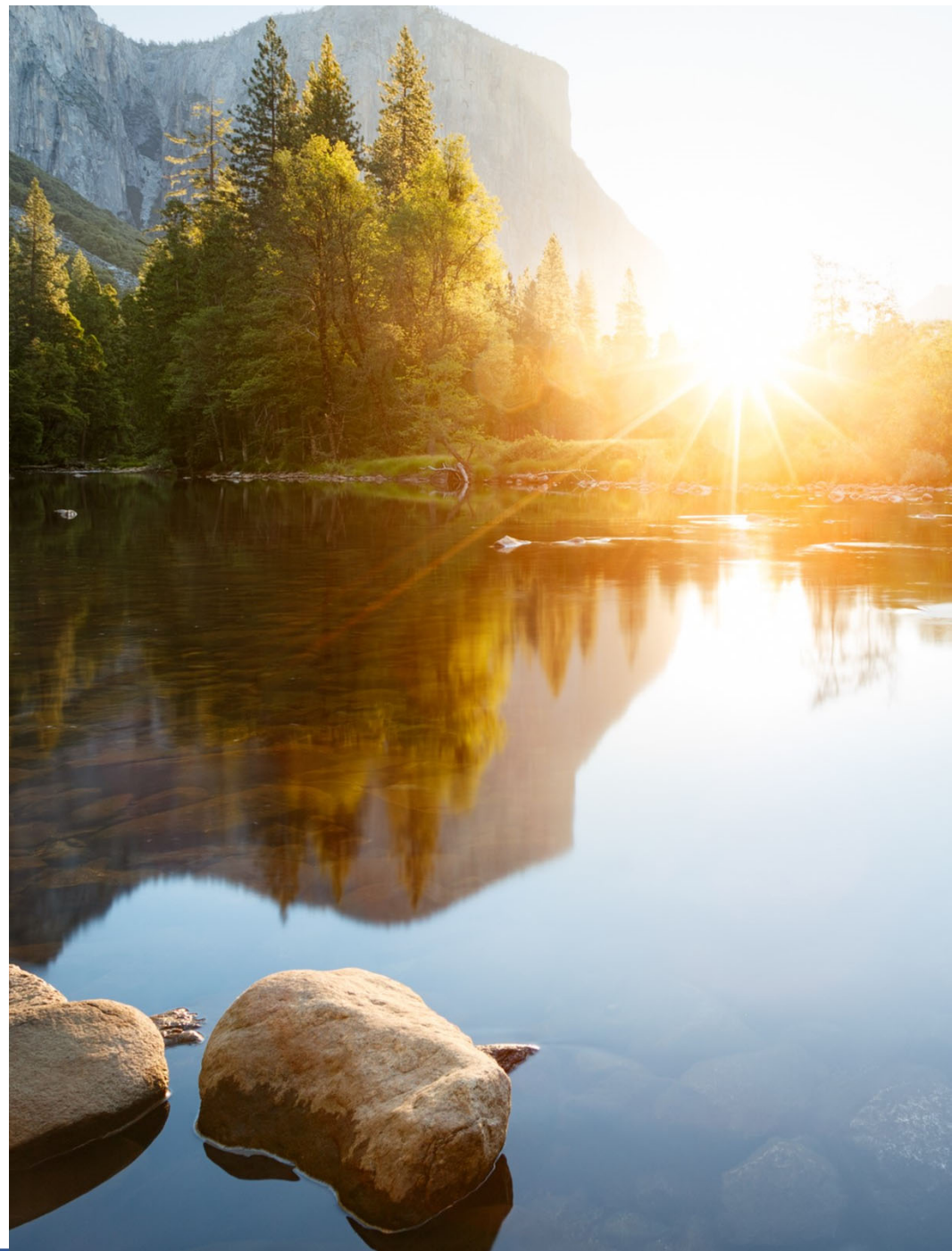
Exclusions

- ARM 17.36.310 (new – part of rule update)
Lots that are using a 76-3-207 Platting Act exemption (except family transfers) do not need stormwater review if they will be used for one living unit and each lot has no more than 25% impervious area



Wait, what about MFEs?

- MFEs are still reviewed for stormwater – however the municipality/CWSD does review instead of DEQ





What is required for submittal? (ARM 17.36.310)

- Must be designed per DEQ-8
- PE design required for
 - 6 or more lots
 - A lot with more than 25% impervious
- Maintenance plan
- Can request a deviation from a requirement in DEQ-8 or waiver from any requirement in ARM 17.36.310

Submittal Components

- Stormwater report (with calculations)
- Drawings/plan set*
- Specifications (if not on drawings/plans)*
- Operation and maintenance plan (4 sets)
- Deviation/waiver requests
- If COSA, lot layout needs locations and details

** PE designs need PE stamp - three sets of documents*

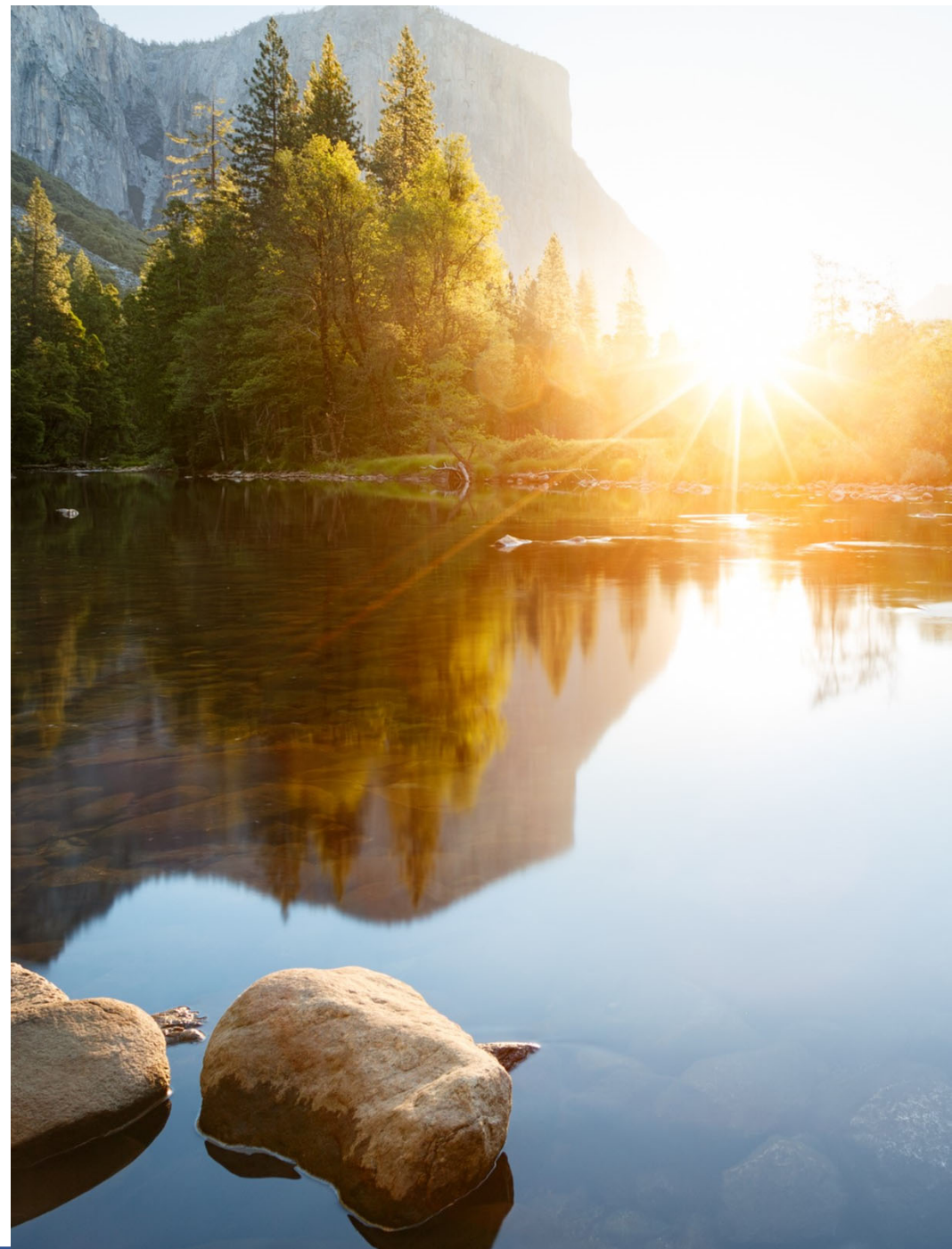


Stormwater Report

- Narrative describing the project, the existing conditions and how stormwater moves through the site, vegetation and soils, and how the stormwater will move through the site once developed
- State whether using Simplified or Standard Plan and why
- Describe the stormwater facilities (conveyance and retention/detention/infiltration) and how they were sized
- Calculations supporting design using design criteria

Design Criteria (DEQ-8)

- Simplified Plan
- Standard Plan
- Initial Stormwater Facility
- Volumes and Flows
- Conveyance Structures
- Facilities (Retention, Detention, Infiltration)





Simplified Plan (DEQ-8, Section 3.2)

- Can only be used when:
 - Slope of each lot = 3% or less
 - Total impervious area of lot less than or equal to 25% total acreage
 - Does not alter runoff patterns offsite
 - No increase of volume runoff for 100-year event

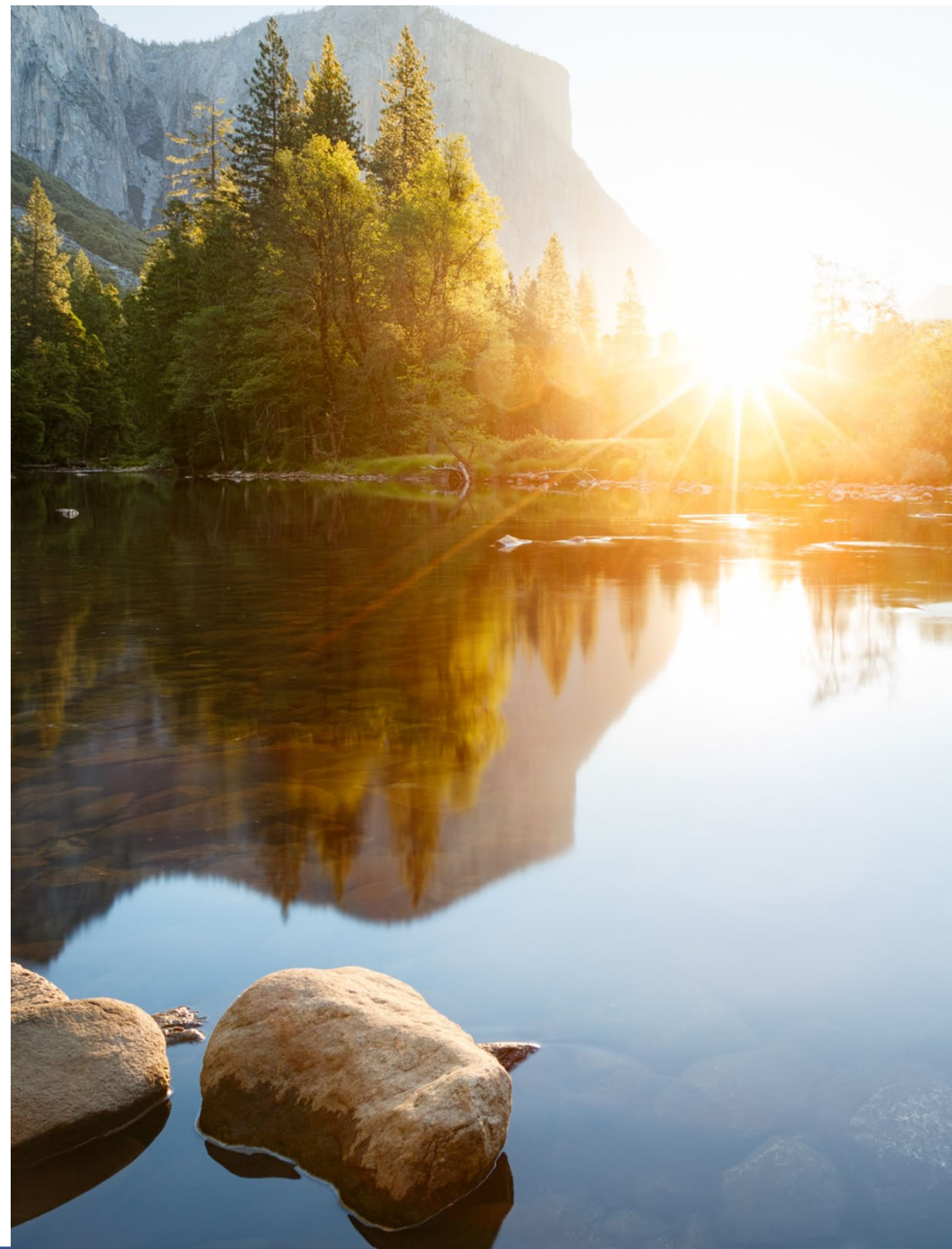
Standard Plan (DEQ-8, Section 3.2)

- Must use if not using Simplified Plan
 - Must address peak flow and volume
 - Cannot exceed pre-development runoff during 2-year storm event
 - Cannot overtop roadways or driveways during 10-year storm event
 - Cannot inundate buildings or drainfields during 100-year storm event



Initial Stormwater Facility (DEQ-8, Section 3.4)

- Must determine facility size based on 0.5 inches of rain over total impervious area
- Can be part of other facility (retention, etc.)
- Facility can infiltrate, evaporate, and/or capture for re-use



Volumes and Flows for Stormwater Plans

- Determined by
 - Surface types (the hardness of a surface and its ability to absorb rainwater)
 - How the surface types change from before to after the proposed project
 - Rainfall intensity (how much rain how often)
 - Method of using information to calculate runoff (flowrates and volumes of water)

Volumes and Flows

- Surface Types
 - Pavement
 - Roofs
 - Gravel
 - Lawn/landscaping
 - Undeveloped
- Surface types have a runoff coefficient (C) where the higher the number, the more impervious it is (e.g. 0.9 for roofs, and 0.1 for lawns)





Volumes and Flows (con't)

- Determine Pre- and Post-Development Conditions
 - Undeveloped areas or areas without an existing Sanitation in Subdivision Act approval are UNDEVELOPED for Pre-development condition
 - For rewrites (existing approval), EXISTING conditions are used for pre-development conditions
 - Post-development based on proposed project surfaces

Rainfall Intensity (DEQ-8, Section 3.6)

- Must be derived from 24-hour storm. Approved sources are:
 - NOAA Atlas 2 (link in DEQ-8, Section 3.6)
 - Table in Appendix A of DEQ-8
 - IDF Curve (available online at DEQ website)
 - Other source with reviewing authority approval

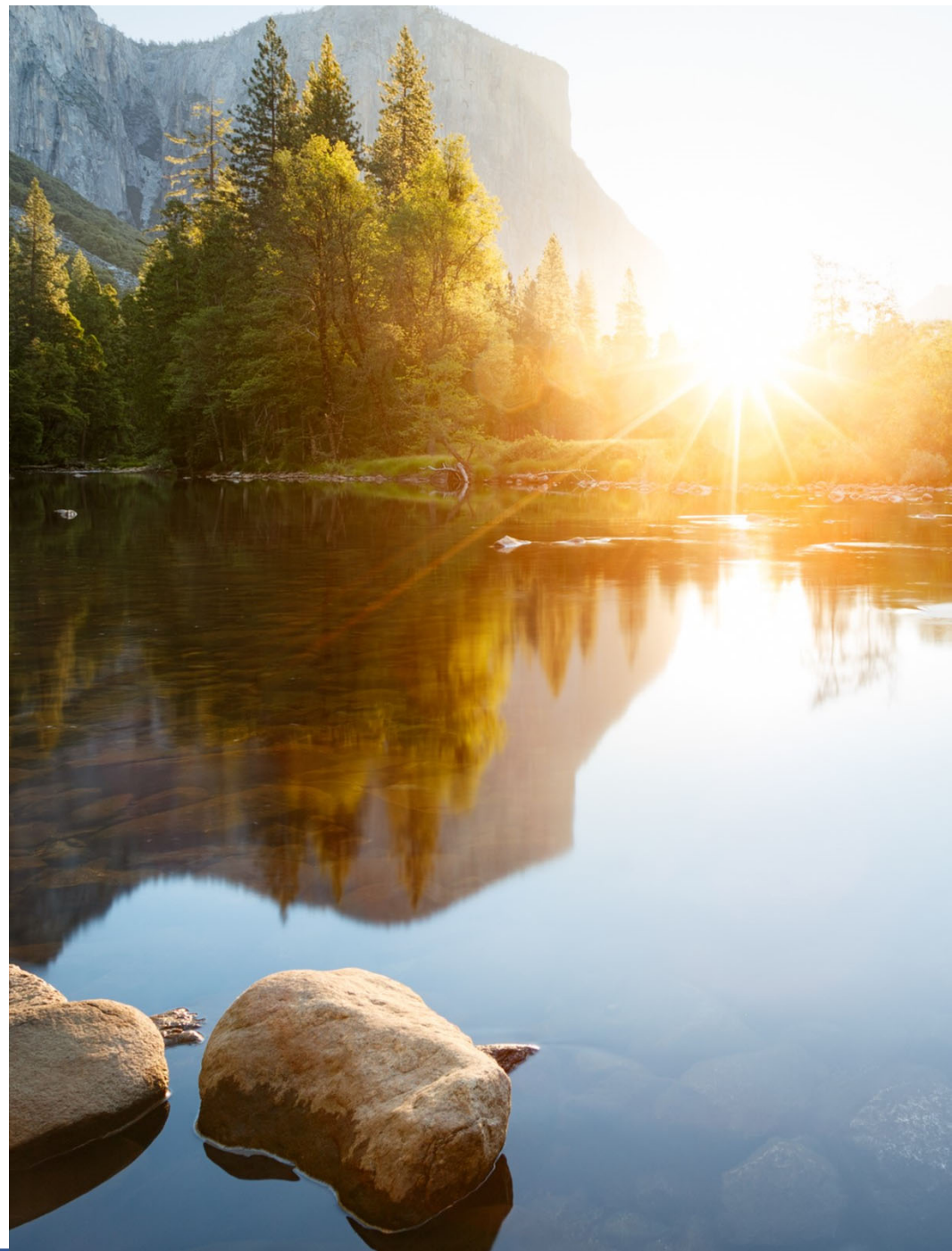
Volumes and Flows (DEQ-8, Sections 3.8 and 3.9)

- Must provide:
- Pre-development peak flow for 2-year storm
- Post-development peak flow for the 2-, 10- and 100-year storm event.



Volumes and Flows (con't)

- Flows from development cannot change offsite basins.
- If offsite basins flow onto development, must provide 2-, 10-, and 100-year flow rates.



Acceptable Methods (DEQ-8, Section 3.7)

- Must be computed per Appendix B. Approved methods are:
 - Rational Method/Modified Rational Method (DEQ Stormwater Plan Spreadsheets)
 - SCS Curve Number/TR-55 Method (3 square miles or smaller, minimum time of concentration is 5 minutes, must use IDF curve, must use weighted average CN)
 - Computer models (AutoCAD, HEC-1, WINTR-55, WINTR-20 and SWMM) (minimum time of concentration is 5 minutes, must use IDF curve, calculations and assumptions provided, show hydrographs, and schematic of routings)

Acceptable Methods (DEQ-8, Section B.1.1.)

- What is Rational Method/Modified Rational Method?
 - Determines peak flow for areas less than 200 acres
 - Represented by

$$Q = C * i * A$$

- Where Q = flowrate, C = runoff coefficient, i = rainfall intensity, and A = area
- Modified uses flowrate for 3600 seconds to determine volume

Acceptable Methods Stormwater Plans

- Both use Rational Method/Modified Rational Method
- Available on DEQ website
- Use rainfall intensity from Appendix A or from IDF Curve



Simplified Plan – Appendix F

Appendix F: Simplified Storm Drainage Plan



Subdivision Name	Example Subdivision	
EQ#	55-5555	
County		
Location		
Lot/Area No.		
Max. Slope on Lot	2.5 %	OK
Impervious Surfaces	7.7 %	OK
Will Alter Off-site Pass-Through?	No	OK

Rational Method Co-Efficients (C)	
0.9	Paved/hard surfaces
0.8	Gravel surfaces
0.1	Lawn/landscaping
0.2	Unimproved areas

$$Q = C \cdot i \cdot A$$

100-year, 24-hour, i 3.04 inches

Total Area/Lot Size 1.5 acres = 65340 ft²

Pre-Development Characteristics			100-year, 24-hour i (volume)
Paved/House Area	0 acres	0 ft ²	V = 0 ft ³
Gravel Area	0 acres	0 ft ²	V = 0 ft ³
Lawn/Landscaping	0 acres	0 ft ²	V = 0 ft ³
Unimproved Area	1.5 acres	65340 ft ²	V = 3310.56 ft ³
Total	1.5 acres	65340 ft²	V_{Total} = 3310.56 ft³

Post-Development Characteristics			100-year, 24-hour i (volume)
Paved/House Area	0.07346189 acres	3200 ft ²	V = 729.6 ft ³
Gravel Area	0.04132231 acres	1800 ft ²	V = 364.8 ft ³
Lawn/Landscaping	0.22956841 acres	10000 ft ²	V = 253.333 ft ³
Unimproved Area	1.15564738 acres	50340 ft ²	V = 2550.56 ft ³
Total	1.5 acres	65340 ft²	V_{Total} = 3898.29 ft³

Increase in Runoff Volume (Minimum Retention Pond Size)	ΔV = 587.73 ft³
--	-----------------------------------

= input field

Standard Plan – Appendix G

Appendix G: Standard Storm Drainage Plan



Subdivision Name Example Subdivision		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2">Rational Method Co-Efficients (C)</th> </tr> <tr> <td>0.9</td> <td>Paved/hard surfaces</td> </tr> <tr> <td>0.8</td> <td>Gravel surfaces</td> </tr> <tr> <td>0.1</td> <td>Lawn/landscaping</td> </tr> <tr> <td>0.2</td> <td>Unimproved areas</td> </tr> </table>		Rational Method Co-Efficients (C)		0.9	Paved/hard surfaces	0.8	Gravel surfaces	0.1	Lawn/landscaping	0.2	Unimproved areas
Rational Method Co-Efficients (C)													
0.9	Paved/hard surfaces												
0.8	Gravel surfaces												
0.1	Lawn/landscaping												
0.2	Unimproved areas												
EQ#	55-5555												
County													
Location													
Lot/Area No.		$Q = C \cdot I \cdot A$											
Intensity Values													
2-year, T_c	1.25 inches/hour												
2-year, 24-hour	1.25 inches												
10-year, T_c	1.9 inches/hour												
100-year, T_c	3.04 inches/hour												
100-year, 24-hour	3.04 inches												
Total Area/Lot Size 1.5 acres = 65340 ft ²													
Initial Stormwater Facility Volume (0.5" x Impervious Area) = 208.3 ft ³													

Pre-Development Characteristics			2-year, T_c (flow rate)	2-year, 24-hour (volume)	10-year, T_c (flow rate)	100-year, T_c (flow rate)	100-year, 24-hour (volume)
Paved/House Area	0 acres	ft ²	$Q = 0.000$ ft ³ /sec	$V = 0.000$ ft ³	$Q = 0.000$ ft ³ /sec	$Q = 0.000$ ft ³ /sec	$V = 0.000$ ft ³
Gravel Area	0 acres	ft ²	$Q = 0.000$ ft ³ /sec	$V = 0.000$ ft ³	$Q = 0.000$ ft ³ /sec	$Q = 0.000$ ft ³ /sec	$V = 0.000$ ft ³
Lawn/Landscaping	0 acres	ft ²	$Q = 0.000$ ft ³ /sec	$V = 0.000$ ft ³	$Q = 0.000$ ft ³ /sec	$Q = 0.000$ ft ³ /sec	$V = 0.000$ ft ³
Unimproved Area	1.5 acres	65340 ft ²	$Q = 0.378$ ft ³ /sec	$V = 1361.250$ ft ³	$Q = 0.575$ ft ³ /sec	$Q = 0.920$ ft ³ /sec	$V = 3310.560$ ft ³
Total	1.5 acres	65340 ft²	$Q_{total} = 0.378$ ft³/sec	$V_{total} = 1361.250$ ft³	$Q_{total} = 0.575$ ft³/sec	$Q_{total} = 0.920$ ft³/sec	$V_{total} = 3310.560$ ft³

Post-Development Characteristics			2-year, T_c (flow rate)	2-year, 24-hour (volume)	10-year, T_c (flow rate)	100-year, T_c (flow rate)	100-year, 24-hour (volume)
Paved/House Area	0.07346189 acres	3200 ft ²	$Q = 0.083$ ft ³ /sec	$V = 300.000$ ft ³	$Q = 0.127$ ft ³ /sec	$Q = 0.203$ ft ³ /sec	$V = 729.600$ ft ³
Gravel Area	0.04132231 acres	1800 ft ²	$Q = 0.042$ ft ³ /sec	$V = 150.000$ ft ³	$Q = 0.063$ ft ³ /sec	$Q = 0.101$ ft ³ /sec	$V = 364.800$ ft ³
Lawn/Landscaping	0.22956841 acres	10000 ft ²	$Q = 0.029$ ft ³ /sec	$V = 104.167$ ft ³	$Q = 0.044$ ft ³ /sec	$Q = 0.070$ ft ³ /sec	$V = 253.333$ ft ³
Unimproved Area	1.15564738 acres	50340 ft ²	$Q = 0.291$ ft ³ /sec	$V = 1048.750$ ft ³	$Q = 0.443$ ft ³ /sec	$Q = 0.708$ ft ³ /sec	$V = 2550.560$ ft ³
Total	1.5 acres	65340 ft²	$Q_{total} = 0.445$ ft³/sec	$V_{total} = 1602.917$ ft³	$Q_{total} = 0.677$ ft³/sec	$Q_{total} = 1.083$ ft³/sec	$V_{total} = 3898.293$ ft³

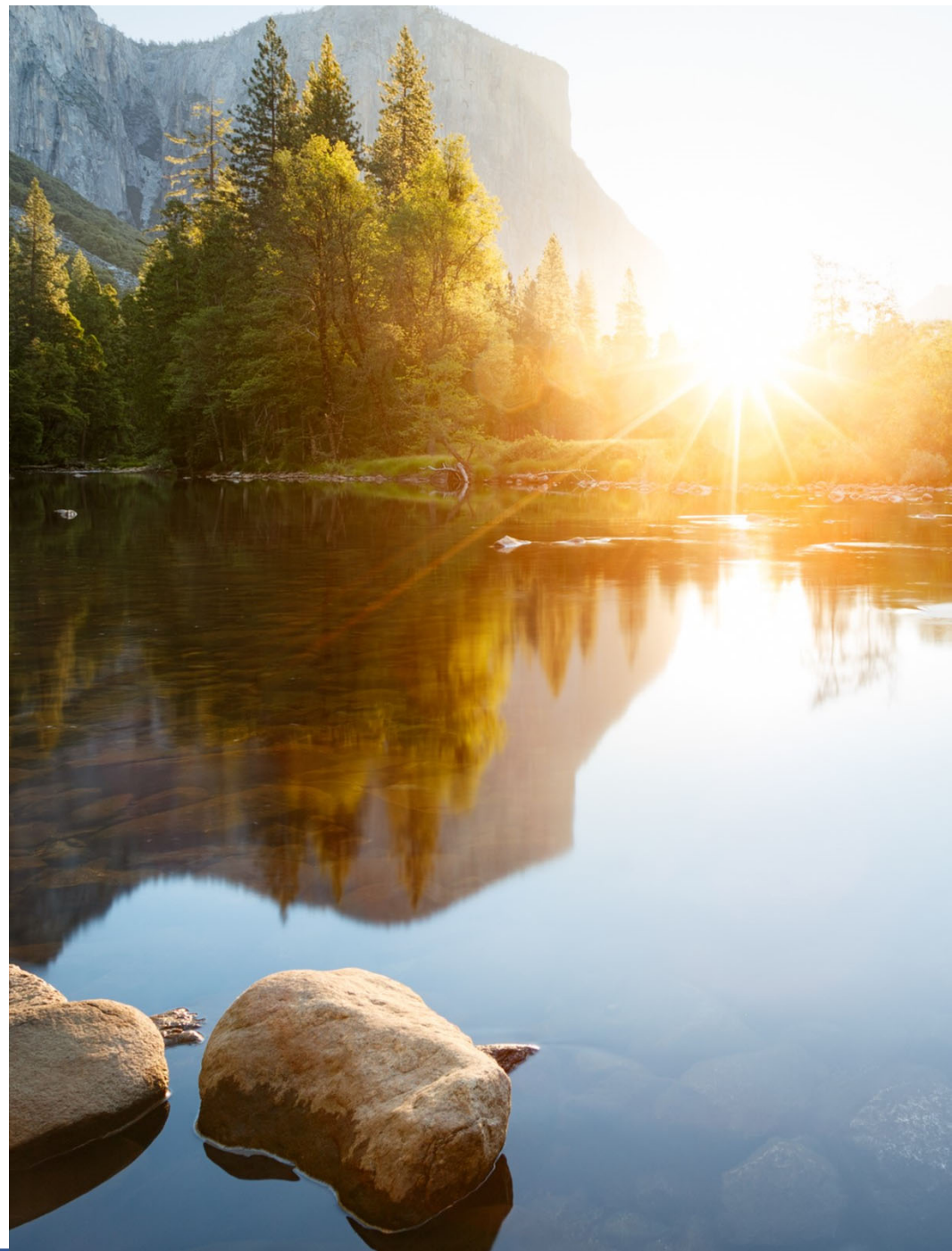
Runoff Flow/Volume Change	$\Delta Q = 0.067$ ft ³ /sec	$\Delta V = 241.667$ ft ³	$\Delta Q = 0.102$ ft ³ /sec	$\Delta Q = 0.163$ ft ³ /sec	$\Delta V = 587.733$ ft ³
----------------------------------	---	--------------------------------------	---	---	--------------------------------------

Required Minimum Facility Volume: **241.7** ft³

= input field

Acceptable Methods IDF Curve

- Intensity-Duration-Frequency (IDF) Curve
- Available on DEQ website
- Adjusts rainfall by location
- Minimum time of concentration (T_c) is 5 minutes
- Must select longest T_c



IDF Curve

Time of Concentration (T_c)

- Flow of water over land, going from sheet flow, to shallow flow, concentrated/channel flow, and culvert/pipe flow.
- Sheet flow has a maximum length of 300 feet, as it usually goes to shallow flow by then
- T_c is total value of all estimated/calculated flow times for each flow type
- Longest flow path stormwater would take is used



IDF Curve

Rainfall Intensity for DEQ 8

1. Location Data:

Latitude:	46.298815
Longitude:	-112.819262
Distance to nearest state:	1.74
Climate meteorological:	HELENA WB CITY
2-hour, 24-hour rainfall:	1.23

2. Pre-Development Hydrologic Path:

Flow Type	Surface Description	Flow Length [ft]	Land Slope [ft/ft]	Channel Diameter [in]	Depth of Flow in Channel [ft]	Channel - Top Width [ft]	Channel - Bottom Width [ft]	Cross Sectional Flow Area	Wetted Perimeter [ft]	n	Storage Velocity [ft/s]	T1 [hr]	T1 [min]
Sheet	Shrub Grass Prairie	388	0.04	42	42	2	4			0.45	n/a	0.47	28.18
		58	0.04	15	8								

Report is <https://www.scs-software.com/IDF101>

3. Post-Development Hydrologic Path:

Flow Type	Surface Description	Flow Length [ft]	Land Slope [ft/ft]	Channel Diameter [in]	Depth of Flow in Channel [ft]	Channel - Top Width [ft]	Channel - Bottom Width [ft]	Cross Sectional Flow Area	Wetted Perimeter [ft]	n	Storage Velocity [ft/s]	T1 [hr]	T1 [min]
Sheet	Shrub Grass Prairie	58	0.04	45	18	42				0.45	n/a	0.44	6.72
Shallow	Forest	428	0.04							0.842	0.47	0.88	8.24
Channel, Triangular	Vegetation	288	0.04		42	8		4.88	15.42	0.885	4.58	0.84	2.44
Channel	PVC	18	0.04	18	5	5		8.88	2.35	0.84	15.58	0.88	0.84

Report is <https://www.scs-software.com/IDF101>

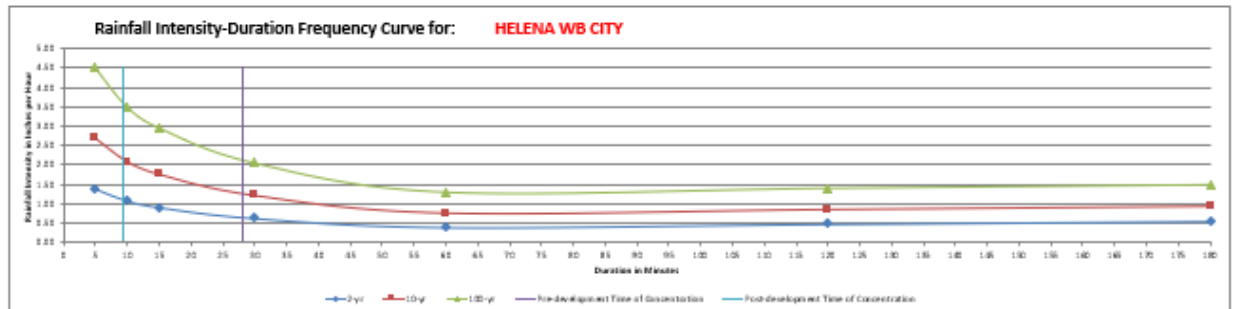
4. Time of Concentration and Rainfall Intensity (24-hour storm event):

Pre-Development Path

Total Time of Concentration	28.18
Rainfall Intensity [in/hr]	0.64
Rainfall Intensity [in/hr]	1.51
Rainfall Intensity [in/hr]	2.28

Post-Development Path

Total Time of Concentration	3.33
Rainfall Intensity [in/hr]	1.45
Rainfall Intensity [in/hr]	2.45
Rainfall Intensity [in/hr]	3.53



IDF Curve

1. Location Data:

Latitude:	46.590819
Longitude:	-112.013262
Distance to closest station (km)	1.74
Closest meteorological station	HELENA WB CITY
2-hour, 24-hour precipitation (in)	1.29

2. Pre-development Hydraulic Path:

Flow Type	Surface Description	Flow Length (ft)	Land Slope (ft/ft)	Culvert Diameter (in)	Depth of Flow in Channel (in) or Culvert (in)	Channel - Top Width (ft.)	Channel - Bottom Width (ft.)	Cross Sectional Flow Area (ft^2)	Wetted Perimeter (ft)	n	Average Velocity (ft/s)	Tt (hr)	Tt (min)
Sheet	Short Grass Prairie	300	0.04	12	12	2	1			0.15	n/a	0.47	28.18
		50	0.01	15	8								

Appendix F: <http://www.nrcs.usda.gov/Internet/F3>

3. Post-development Hydraulic Path:

Flow Type	Surface Description	Flow Length (ft)	Land Slope (ft/ft)	Culvert Diameter (in)	Depth of Flow in Channel (in) or Culvert (in)	Channel - Top Width (ft.)	Channel - Bottom Width (ft.)	Cross Sectional Flow Area (ft^2)	Wetted Perimeter (ft)	n	Average Velocity (ft/s)	Tt (hr)	Tt (min)
Sheet	Short Grass Prairie	50	0.04	15	10	12				0.15	n/a	0.11	6.72
Shallow	Paved	120	0.04							0.012	8.17	0.00	0.24
Channel_Triangular	Vegetation	200	0.04		12	8		4.00	16.12	0.085	1.38	0.04	2.41
Culvert	PVC	10	0.04	18	9			0.88	2.36	0.01	15.50	0.00	0.01

Appendix F: <http://www.nrcs.usda.gov/Internet/F3>

IDF Curve

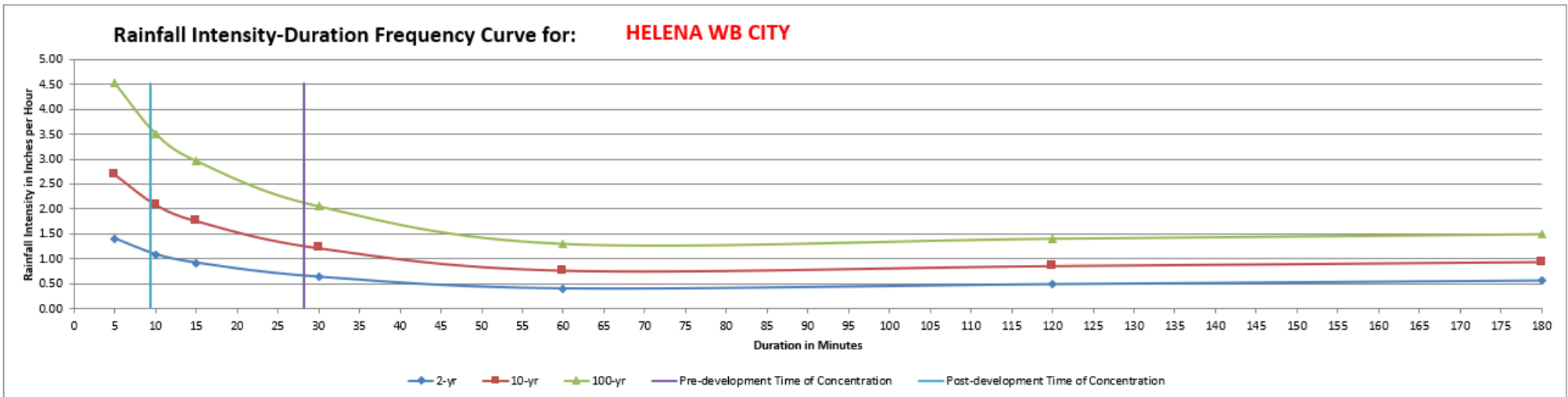
4. Time of Concentration and Rainfall Intensity (24-hour storm event):

Pre-development Path

Total Time of Concentration (min)	28.18
Rainfall Intensity (in/hr), 2 Year	0.68
Rainfall Intensity (in/hr), 10 Year	1.31
Rainfall Intensity (in/hr), 100 Year	2.20

Post-development Path

Total Time of Concentration (min)	9.39
Rainfall Intensity (in/hr), 2 Year	1.13
Rainfall Intensity (in/hr), 10 Year	2.15
Rainfall Intensity (in/hr), 100 Year	3.63



IDF Curve

1. Total Drainage Area Size

Drainage Area Size (sq. ft.)	65,340.00
------------------------------	-----------

2. Pre-development Drainage Area Characteristics:

Surface Type	Square Footage Acres	
Paved Area	0.00	0.00
Structural	0.00	0.00
Graveled Area	0.00	0.00
Landscape	0.00	0.00
Unimproved	65,340.00	1.50
Totalize	65,340.00	1.50

3. Post-development Drainage Area Characteristics:

Surface Type	Square Footage Acres	
Paved Area	0.00	0.00
Structural	3,200.00	0.07
Graveled Area	1,800.00	0.04
Landscape	10,000.00	0.23
Unimproved	50,340.00	1.16
Totalize	65,340.00	1.50

4. Required Initial Stormwater Facility Volume (Retained on Site)

	Cubic Feet	Acro-Feet
Retained First 0.5 inch runoff volume	208.33	0.00

5. Weighted Coefficient

Surface Type	Pre-	Post-
Paved Area	0.00	0.00
Structural	0.00	0.07
Graveled Area	0.00	0.03
Landscape	0.00	0.02
Unimproved	0.30	0.23
Total Weighted Coef.	0.30	0.35
Cu	0.20	0.236

6. Flow Calculation (cfs)

Frequency of Storm Event	Pre-	Post-	Change (Post-Pre)
2-year	0.20	0.40	0.19
10-year	0.39	0.76	
100-year	0.66	1.28	

7. Volume Calculation (cf)

Frequency of Storm Event	Pre-	Post-	Change (Post-Pre)
2-year	736.59	1,430.75	694.16
10-year	1,410.61	2,739.97	1,329.37
100-year	2,374.91	4,613.05	2,238.14

8. Final Required Volume

DEQ Final Minimum Pond Size (cf)	694.16
Simplified Storm Water Plan Minimum Pond Size (cf)	567.26

IDF Curve

Flow Data for DEQ 8

1. Total Drainage Area Size

Drainage Area Size (sq. ft.)	65,340.00
------------------------------	-----------

2. Pre-development Drainage Area Characteristics:

Surface Type	Square Footage	Acres
Paved Areas	0.00	0.00
Structures	0.00	0.00
Graveled Area	0.00	0.00
Landscape	0.00	0.00
Unimproved	65,340.00	1.50
Total lot size	65,340.00	1.50

3. Post-development Drainage Area Characteristics:

Surface Type	Square Footage	Acres
Paved Areas	0.00	0.00
Structures	3,200.00	0.07
Graveled Area	1,800.00	0.04
Landscape	10,000.00	0.23
Unimproved	50,340.00	1.16
Total lot size	65,340.00	1.50

IDF Curve

4. Required Initial Stormwater Facility Volume (Retained on Site)

	Cubic Feet	Acre-Feet
Retained First 0.5 inch runoff volume	208.33	0.00

5. Weighted Coefficient

Surface Type	Pre-Development	Post-Development
Paved Areas	0.00	0.00
Structures	0.00	0.07
Graveled Area	0.00	0.03
Landscape	0.00	0.02
Unimproved	0.30	0.23
Total Weighted Coef.	0.30	0.35
Cw	0.20	0.236

6. Flow Calculation (cfs)

Frequency of Storm Event	Pre-Development	Post-Development	Change (Post-Pre)
2-year	0.20	0.40	0.19
10-year	0.39	0.76	
100-year	0.66	1.28	



Conveyance Structures (DEQ-8, Section 4)

- Open Channels (capacity and velocity calcs, typical section and plan view, erosion protection)
- Storm Sewers (capacity and volume calcs; velocity 3 fps to 10 fps, profiles showing size, type, % grade, existing and proposed ground surface; inverts; hydraulic grade line; no closed loops)
- Culverts (capacity and velocity calcs; inverts; roadway elevations and runoff water elevations for 10-year and 100-year storm; erosion protection)
- DEQ-8, Appendix E provides conveyance structure equations

Facilities (DEQ-8)

- Retention (Section 5.2)
- Detention (Section 5.3)
- Infiltration (Section 6)
- Pre-Treatment (Section 7)
- Must be
 - Sized based on volume/flowrates calculated
 - Where flows naturally go
 - Shown on plans with cross-sections and design details
 - Safety precautions



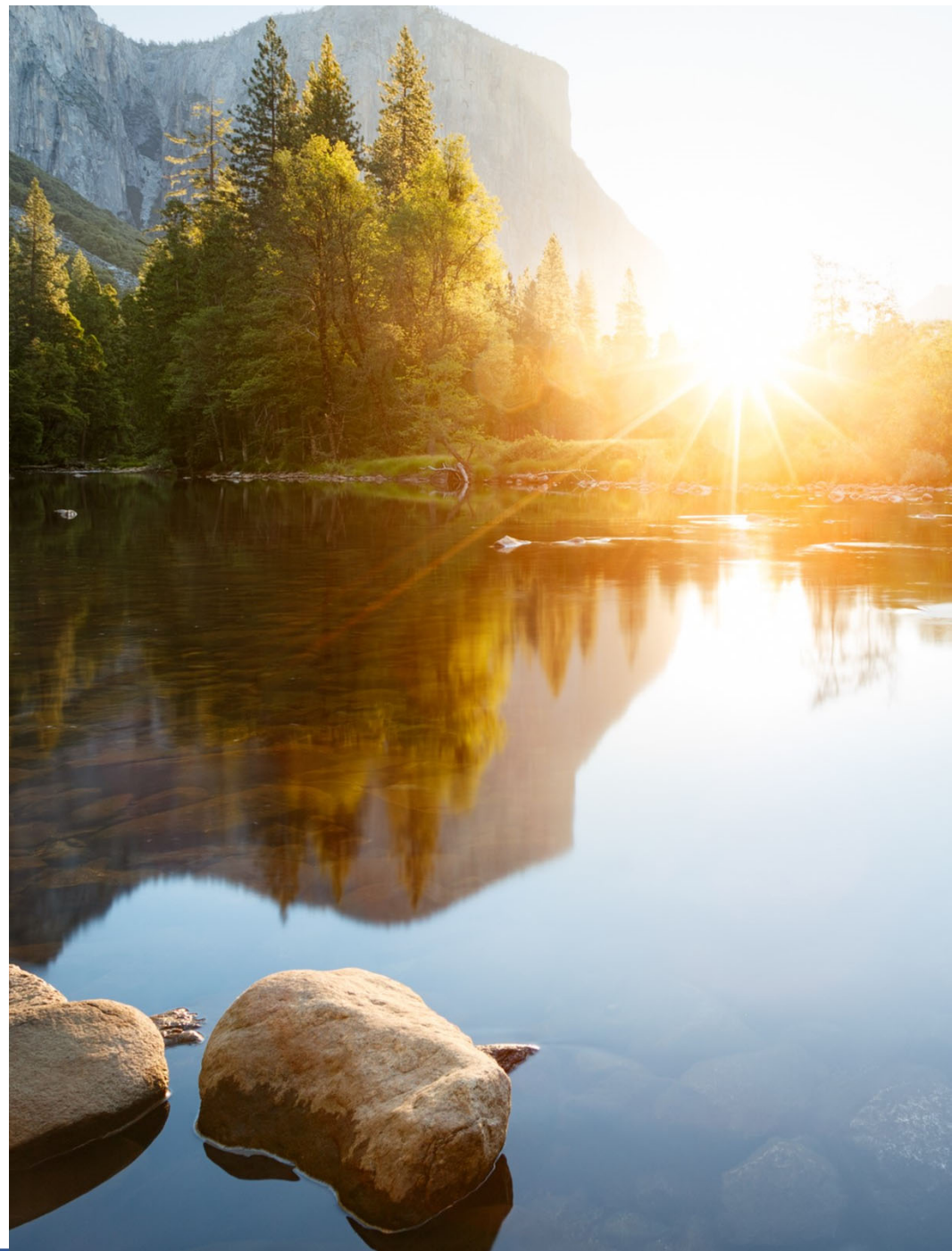
Retention Facility (DEQ-4, Section 5.2)

- Can be used with either Simplified or Standard Plans
- Sized per change in volume (2-year storm event for standard plan, 100 year for simplified plan) (no consideration for infiltration or outlet)
- Can be used for Initial Stormwater Facility (ISWF) minimum volume (must choose larger of ISWF or change in 2-year volume for standard plan)
- Side slopes not less than 3:1 and stabilized
- Should not hold runoff more than 72 hours.



Detention Pond (DEQ-8, Section 5.2)

- Cannot be used for Simplified Plans
- Captures and releases runoff at flow rate equal to or less than pre-development 2-year flowrate
- Can be used for Initial Stormwater Facility minimum volume (ISWF volume provided as retention)
- Should not hold runoff more than 72 hours.
- Outlet must be stabilized
- Outlet is a designed structure (DEQ-8, Appendix D)





Infiltration Facilities (DEQ-8, Section 6)

- Includes sumps, french drains, boulder pits, dry wells, lawns/landscaping, and infiltration basins
- Some infiltration trenches can be considered Class V injection wells by EPA



Infiltration Facilities (con't)

- Except for lawns/landscaping, facilities must be:
- Based on infiltration rates per DEQ-8 Appendix C
- Above seasonal high groundwater levels
- Lined with 30 mil filter fabric
- Void spaces of rock is 30%
- Drains within 48 hours
- Has a pretreatment facility



Pre-Treatment Facilities (DEQ-8, Section 7)

- Pretreatment facilities are:
 - Vegetative filter strips
 - Vegetated swales
 - Screens
 - Oil/Water Separators
 - Proprietary Products
 - Drain Inlet Inserts

Drawings/Plan Sets

- Show any easements, existing and proposed roads, driveways, buildings, wells, drainfields, and utilities
- Locations, sizes, and design details of stormwater facilities
- Any drainageways or floodplains
- Direction of drainage (flow arrows)
- Profile sheets for proposed conveyance structures

Maintenance Plan (DEQ-8, Section 2.5)

- Must provide a maintenance plan which includes:
 - Procedures for long-term O&M (inspections, vegetation management, cleaning, etc.)
 - Responsible party
 - Easement information



A Quick Note about PE Design

- Storm drainage plans that need PE design:
 - Do not have a three-year expiring approval (new)
 - Certification and as-builts are not required for retention ponds designed on residential lots (must stay on lot) (new)
 - Certification and as-builts are required for those that treat runoff from 2 or more lots (new)
 - Certification and as-builts for any other facilities are required per ARM 17.36.121(2) through (4)



Summary

- What is DEQ looking for?
 - What stormwater is coming into the development and what is leaving the development?
 - Will stormwater runoff cause flooding either within or downstream on a neighboring property (demonstrated)?
 - Will stormwater cause pollution concerns, particularly for surface waters and drinking water wells?
 - Does the design meet ARM 17.36.310 (or have an approved waiver)? PE design?
 - Does the design meet DEQ-8 requirements (or have an approved deviation)?

Questions?



Connect with us!

- **Jenifer Ramsey, PE**
- *Environmental Engineer*
- Jenifer.Ramsey@mt.gov
- 406.444.6713



Facebook



Twitter



Instagram



YouTube