T-S IRWM Plan Update: Storm Water Management Planning - Fall 2016

Document has been created as an update to the Tuolumne - Stanislaus Integrated Regional Water Management Plan. Public hearing on the update will be held on Wednesday December 21st, 1pm, at Tuolumne Utilities District.

Executive Summary

The executive summary will be updated in 2017/2018 to reflect the current status of the Region. Additions will start in Section 1.

Section 1

Addition to 1.3.1:

In April of 2014 the Tuolumne-Stanislaus Integrated Regional Water Management Authority was formed, and its Board of Directors became the RWMG for the T-S Region. The Board of Directors is made up of local public agencies from within the Region whose common interest is water management. The Board of the Authority meets monthly and relies on the recommendations of the Watershed Advisory Committee (WAC). The WAC also meets monthly and its members are interested stakeholders who are in good standing with the WAC Charter and the By-laws of the Board. Many of the WAC members from the Planning Grant Committee are still actively involved.
(Appendix H includes the Joint Powers Authority Agreement and By-Laws.)

Section 2

2.12 Storm Water

Within the Tuolumne-Stanislaus Region there are currently two plans that address storm water: the Tuolumne County Water Quality Plan and the Calaveras County Storm Water Management Plan. The plans which capture the status of storm water within the region are summarized in the following subsections.

2.12.1 Tuolumne County

The Tuolumne County Water Quality Plan (TCWQP) was published in 2007 and contains both an overview of the water quality within the County as well as the status of storm water. The findings of the TCWQP suggested that a range of Non-Point Source pollutants have the potential to impact the surface water quality within the region. The findings also showed that the region is at risk of further degradation by continuing urbanization and associated drainage modifications. The TCWQP outlines a program to address both over the twenty year planning horizon and includes prevention, source controls, and treatment controls. The Non-Point Source Pollutants monitored in the planning horizon of the TCWQP are as follows;

- Sediment
- Oil and grease
- Metals
- Nutrients
- Pathogens
- Organic compounds

- Pesticides
- Oxygen-Demanding Substances
- Floatable Materials
- Ecological Indicators

(Tuolumne County Water Quality Plan: Table 3-1, page 3-2)

The Tuolumne County Water Quality Plan in Chapter 3 outlines a program for Tuolumne County to implement that addresses all forms of Non-Point Source (NPS) Pollution that were thought to originate from lands within Tuolumne County's jurisdiction. The program includes Best Management Practices (BMPs) to address five of the U.S. Environmental Protection Agency's six required elements to reduce NPS pollution. The outline for the program is as follows;

- Illicit Discharge and Elimination
  - Structured Enforcement Policy
  - Storm Drain Outfall Mapping and Identification/Evaluation Program
  - Illicit Discharge Education Program
  - Storm Drain Stenciling Program
- Pre-Construction, Construction, and Post-Construction Activities
  - Standardized Practices for Establishing Storm water Management Measures - Process
    - *Scheduling*
    - *Site Conditions*
    - *Preservation of Existing Vegetation*
    - *Storm Water Run-Off and Concentrated Flows*
    - *Stockpile Management*
    - *Sediment Tracking Control*
    - *Wind Erosion Control*
    - *Non-Storm Water Management*
    - *Disturbed Soil Area Management*
    - *BMP Monitoring*
  - Require Implementation of BMPs
  - Establish a BMP Effectiveness Evaluation Process
  - BMP Guidelines/Storm Water Control Plan Handbook
  - Amend Title 12 (Grading Ordinance)
- New Development and Planning
  - Amend County Ordinance Code
  - Environmental Impact Analysis
  - Educate County Staff
- County Operations
  - Develop and Implement New Source Reduction Strategies
  - Roadway Drainage and Erosion Survey Program
  - Drainage Planning Program
  - Wastewater Regionalization and Connection Study

The program as outlined was designed to be a comprehensive approach to reducing the concentration of pollutants in storm water to the maximum extent practicable, which is the performance standard specified in Section 402(p) of the Clean Water Act. The BMPs presented in the TCWQP were chosen based on recognized hydrologic conditions in conjunction with their range of effectiveness and applicability to the various land uses present within Tuolumne County.

The TCWQP also included a Community and Voluntary Stewardships component. The public involvement activities outlined (below) were focused on maintaining and improving runoff water quality from urbanized and rural land uses.

- Establishing Oversight - Watershed Coordinator
- Citizen Monitoring
- Landowner Technical Assistance Programs: Erosion Control and Community Source Reduction Programs
  - Property Self Assessment: Watershed Owners Manual
  - Erosion Control Techniques
  - Non-Point Source Pollutant Reduction
  - Defensible Space/Fuel Modification Areas
- Existing County Programs
- Public Outreach
- Workshops
- Community Water Body Cleanup Activities
- Recognition Programs

As the TCWQP is implemented the County expects the program to expand to include the following;

- Better characterize the composition of storm water discharges
- Identify other sources of pollutants
- Continue to characterize the quality of receiving waters
- Inventory the storm drainage system(s)
- Develop greater focus on priority pollutants of concern
- Evaluate the performance of BMPS

Additionally, the County intended to evaluate the progress of the TCWQP every five years. To date both Tuolumne County and the Tuolumne County Resource Conservation District are working on the implementation of the TCWQP.

(Reference: Tuolumne County Water Quality Plan, February 2007)

2.12.2 Calaveras County

The Calaveras County Storm Water Management Plan (CCSWMP) was published in August of 2007, the document was written to address specific unincorporated communities within Calaveras County of which only Arnold, Murphy's and Copperopolis are found within the T-Stan IRWM region; the geographic boundaries of these areas coincide with established Community Plan boundaries. The incorporated City of Angels Camp is not a part of this plan, nor are they subject to regulation under the SWRCB storm water regulations. The CCSWMP does, however, state that areas outside of the

defined communities would be subject to many of the same controls and practices as those that will be implemented under the CCSWMP.

The plan itself includes background information about major surface water resources that are the receiving waters for all storm water runoff within the County, as well as, brief descriptions of existing storm water drainage systems and conveyances within the County. It identifies future efforts that will be undertaken to more clearly define the location, characteristics, and maintenance responsibilities for existing storm water infrastructure. The planning horizon of the document extends over a five year period. The document states that the County's effort to updates its General Plan will need to include consideration of selected land use controls and design criteria in order to reduce pollutant discharges from new, as well as, redevelopment projects. Specific goals relevant to watershed development and water quality protection include:

- Preserve and enhance the County's significant wildlife and botanical habitats,
- Protect streams, rivers, and lakes from excessive sedimentation due to development and grading,
- Protect and preserve riparian habitat along streams and rivers in the County,
- Preserve and protect the scenic qualities of the County,
- Conserve national, State, and regional recreation areas in the County,
- Preserve portions of the County's rivers and streams as a local recreation resource.

Section 6, Potential Sources of Storm Water Pollution, outlines the most prevalent sources of storm water pollution that are likely to adversely to impact surface water resources. These are the focus of proposed Best Management Practices (BMPs) of the CCSWMP:

- Sediment
- Nutrients
- Pathogens
- Litter
- Pesticides and Herbicides
- Oil and Grease
- Hazardous Materials

The plan proposes to develop a county-wide management effort to address and reduce these selected pollutant discharges into County-maintained storm water conveyance systems as a way to protect surface water resources through the following efforts:

- Public Education and Outreach
- Public Participation and Involvement
- Illicit Discharge Detection and Elimination
- Construction Site Storm Water Runoff Controls
- Post-Construction Storm Water Management in New Developments
- Pollution Prevention/Good Housekeeping For Municipal Operations, including:
    - Reduced use of toxic and petroleum-based cleaners and solvents
    - Minimization of the use of pesticides, herbicides, and fertilizers

- Scheduling the use of chemicals to avoid application immediately prior to rainfall events
- Routine litter and parking area clean-up
- Proper storage and disposal of hazardous and other waste
- Maintenance of drainage facilities
- Installation of culverts and other drainage appurtenances

The CCSWMP provides a description of management structure, administrative organization, and financial resources that are needed to ensure a satisfactory completion of the proposed water quality control measures.

(Reference: Calaveras County Storm Water Management Plan, August 2007)

As of September 2016, both the Tuolumne and Calaveras Plans have not been updated.

Section 3

3.2.4 Storm Water Planning

The Tuolumne-Stanislaus IRWM Plan, upon self certification, will be a Storm Water Management Plan Equivalent. Appendix G provides a handbook of Best Management Practices (BMPs) for Storm Water Management within the Region.

Section 2.12 includes a summary of the region's Storm Water Planning prior to the T-Stan IRWM Plan update in 2016 and the addition of Appendix G.

Section 4

Addition to 4.4.4. Basin Plan and Clean Water Act Water Quality Objectives

Currently, the T-Stan IRWM Region has four creeks listed on the 303d list, Sullivan, Curtis, Woods, and Littlejohn Creeks. All four creeks are listed on the 303d list for Escherichia coli (E.Coli) and Littlejohn Creek is additionally listed for an Unknown Toxicity. All have an expected TMDL completion dates of 2021.

The term "303(d) list" is short for a state's list of impaired and threatened waters. States are required to submit their list for EPA approval every two years. For each water on the list, the State identifies the pollutant causing the impairment, when known, and assigns a priority for development of Total Maximum Daily Loads (TMDL) based on the severity of the pollution and the sensitivity of the uses to be made of the waters.

Section 5

5.4 Plan Objectives and Measurable Planning Targets

Insert revised Plan Objectives. Adopted Spring 2016.

5.5 Objectives Summary and Prioritization

Revised T-Stan IRWM Plan Objectives adopted by Regional Water Management Group in September 2016.

	Objective:	Priority:		Measurable Planning Targets:	Anticipated Completion Date:
A	Ensure water consumers have access to a clean and safe water supply within the region.	**High**	**1**	Identify areas where water quality and water supply for basic health and sanitation needs are deficient.	2018
			2	Prioritize corrective actions to meet the needs identified in A.1.	2019
B	Improve water supply infrastructure wherever it is deteriorating or causing water quality and system reliability issues, prioritizing DACs and populated areas. (e.g. fireflow, contamination, etc.).	**High**	**1**	Determine which water distribution systems have water supply infrastructure deficiencies, evaluate options to remedy the issues.	2020
			2	Improve deficient water supply infrastructure and/or distribution in DAC and/or urban communities within the planning horizon.	2035
			3	Promote fire protection storage/conveyance at all community water systems.	2035
C	Reduce contamination in groundwater, surface water, water conveyance and storage systems.	**High**	**1**	Inventory and prioritize drainage and erosion conerns on exisitng roads. Reduce erosion from roads at five (5) high priority hydrologically-connected segments every five (5) years.	2035
			2	Evaluate the impact of stormwater, runoff, and onsite wastewater treatment systems on raw water conveyance and/or storage by 2015.	2025
			3	Strategically monitor selected waters to locate bacterial and other toxic contamination (such as mercury and contamination caused	2018

				by failing septic systems) and develop plans to reduce contaminants. Monitoring to occur at least annually. Prioritize contaminants and areas of treatment by 2018.	
			4	Identify and prioritize areas for extension of collection system and providing wastewater treatment to areas that are currently deficient Onsite Waste Treatment Systems (OWTS) by 2020.	2020
			5	Correct five (5) areas where failing septic systems or other wastewater facilities are contaminating surface water and/or groundwater by 2025 including implementation of prioritized extensions/corrections within planning horizon.	2025
			6	Coordinate with Counties to determine level of compliance with the Statewide Septic Systems Policy for OWTS systems, particularly those adjacent to 303(d) listed water bodies by 2025	2025
D	Improve wastewater infrastructure to meet discharge and disposal requirements and to reduce sanitary sewer overflows.	**Medium**	**1**	All wastewater treatment plant discharges comply with NPDES/WDR permits by 2020. Reduction of treated effluent discharges to surface waters is the desired goal where cost effective within planning horizon.	2035
			2	Identify areas of excessive sanitary sewer collection system inflow and infiltration, and reduce where insufficient capacity exists.	2022
			3	Reduce annual wastewater collection system preventable spill events by 20 percent over 2012 levels by 2020.	2020
E	Enhance watershed health and resiliency to increase	**High**	**1**	Prioritize areas for fuels management treatments and	2035

	sustainable water yield, ecosystem function and recreational opportunities.			increase the pace and scale of fuels management activities across the Region to reduce fuel loading by 30% within the planning horizon.	
			2	Identify priority areas for improved water yield, water quality protection, and/or ecosystem function by 2019 and implement 5 projects within the Planning Horizon.	2035
F	Improve the condition and ecosystem function and value of meadows, forests, and rangelands.	**Medium**	**1**	Summarize, synthesize, and prioritize available meadow information and identify high priority meadows for restoration by 2018.	2018
			2	Restore ecosystem function to at least one meadow per year beginning in 2017 and continuing within the planning horizon.	2035
			3	Coordinate with the Yosemite Stanislaus Solutions Collaborative and agencies to identify forest and/or rangeland priority projects.	2035
G	Assist in the protection and recovery of native aquatic and other water dependent species, prioritizing sensitive special status, threatened and endangered, rare and unique, and culturally sensitive.	**Supporting**	**1**	Coordinate with state, federal, and tribal governments; non-governmental organizations to identify sites with at-risk species where threats can be corrected or reduced.	2035
			2	Implement corrective projects at 5 sites within planning horizon.	2035
			3	Maintain the continued presence of species such as Yosemite Toad, Foothill Yellow Legged Frog, Sierra Nevada Yellow-Legged Frog, Western Pond Turtle, and habitat for the California Red-legged frog as evaluated through projects to restore critical habitat.	2035
			4	Support projects that maintain the continued presence of hardhead,	2035

				Chinook salmon, and steelhead in the Tuolumne and Stanislaus Rivers.	
H	Restore, preserve, and promote the regeneration of wetlands, springs, fens, vernal pools, and native riparian communities, and reduce invasive species.	**Supporting**	**1**	Complete an inventory and prioritization of areas of riparian plant habitat by 2020.	2020
			2	Restore 4 acres of springs and riparian habitat by 2016, and an additonal 16 acres by 2020.	2020
			3	Complete a baseline inventory of wetland habitat within IRWM boundaries within planning horizon.	2035
			4	Inventory and locate riparian sites with invasive plant species by 2025.	2025
			5	Reduce invasive infestations such as himalayan blackberry, bull thistle, mullein, and star thistle at 5 sites within the planning horizon.	
I	Reduce the risk of localized flooding, and improve stormwater management and retention.	**Supporting**	**1**	Complete an assessment to identify substandard drainage structures and improvements needed to reduce risk of structural failure by 2020.	2020
			2	Evaluate feasibility of permeable surfaces and other innovative projects to attenuate flood events in up to 3 locations by 2020 and implementation within the planning horizon.	2020
			3	Coordinate with the area agencies Local Hazard Mitigation Plan updates to improve regional flood management by addressing preparedness, response, and post flood actions throughout the planning horizon in accordance with Stormwater chapter of IRWMP.	
			4	Evaluate and identify appropriate stormwater BMPs for application throughout the region by 2017.	2017

			5	Support jurisdictional agencies to develop and improve implementation of stormwater best management practices by conducting annual coordination meetings.	Ongoing
			6	Support 5 stormwater retention projects for water reuse and/or energy projects by 2020.	2020
J	Improve energy efficiency of water/wastewater systems.	**Supporting**	**1**	Identify alternative energy sources such as wind, solar, biomass, or, hydroelectric to improve water management effciency by 2022.	2022
			2	Implement 2 local cost effective renewable water related energy projects by 2025.	2025
			3	Strategically upgrade infrastructure to improve energy efficiency and reduce GHG emissions of water/wastewater systems by 2027.	2027
K	Improve water supply efficiency and reliability of man-made conveyance systems.	**Medium**	**1**	Identify and complete 6 high priority capital improvement projects (i.e. ditch lining, pipe replacements, controls, diversions, storage, etc.) to water conveyance systems by 2020.	2020
			2	Reduce water loss in man-made water conveyance systems to 10-20% within the planning horizon.	2035
L	Increase water conservation strategies and water use efficiency (WUE) by both municipal (residential and commercial) and agricultural end users.	**Medium**	**1**	Meet water use efficiency GPCD targets identified in UWMPs by 2020.	2020
			2	Increase regional water reuse by 2020 utilizing new technologies.	2020
			3	Improve interagency collaboration to cost-effectively deliver WUE programs.	2035
			4	Implement at least one water recycling and one water reuse project by 2022.	

M	Develop sufficient reliable and affordable water supplies and infrastructure to meet regional demands of existing and projected water supply needs including multi-year drought and climate change.	**High**	**1**	Identify supply sources (both groundwater and surface water), vulnerable to contamination, climate change, and/or interruption from human or nature-caused effects by 2020.	2020
			2	Evaluate the potential opportunities and challenges presented by new storage facilities options that may improve the reliability of existing supplies and projected water supply needs by 2022.	2022
			3	Identify potential conjunctive use projects that may improve in-region supply reliability by 2025.	2025
			4	Develop diversified water supply portfolios during planning horizon.	2035
			5	Evaluate potential to reoperate existing facilities to increase supply availability and reliability by 2018.	2018
			6	Evaluate opportunities for multi-agency water supply facilities and interties by 2018.	2018
N	Integrate land use and natural resource planning to support watershed protection actions that restore, sustain and enhance watershed functions.	**Medium**	**1**	Assess where there are deficiencies and/or opportunities currently in the integration of an all lands planning approach to support watershed protection actions by 2020.	2020
			2	Prioritize and implement corrective actions identified in M.I. (the assessment) by 2024.	2024
O	Assess, plan, and prepare for natural disaster impacts that affect watersheds and water resources.	**Medium**	**1**	Identify opportunities to improve interagency coordination on land use, resource planning and management.	2035
			2	Develop a process to communicate with all resource management agencies operating projects within the IRWM region by 2020.	2020

P	Protect and preserve tribal watershed values and water use.	**Supporting**	**1**	Work collaboratively to support tribal watershed values in regional planning efforts.	Ongoing
			2	Coordinate and communicate to achieve effective tribal participation.	Ongoing

Section 6

Addition to 6.3.5.5 Land Use Planning Management

The T-Stan Region plans to identify storm water capture and recharge opportunities in the future and to prioritize projects that utilize publicly owned lands and easements such as parks, open space, schools, and government complexes to capture, filter, and infiltrate storm water runoff. The Region will also prioritize projects that utilize storm water Best Management Practices (BMPs) to increase effective storm water runoff management for new and upgraded infrastructure and development.

Section 7

Current T-S IRWM Project List to be added, as well as, the following subsection:

7.4 Storm Water Project Integration

This section describes the project solicitation, development, and review process that will be used by the T-Stan IRWM to select and prioritize Storm Water projects for inclusion in the T-S IRWM Plan. The process detailed in the following subsections is outlined to identify those projects that will contribute towards achievement of T-S IRWM Plan Objectives and Measurable Planning Targets in Section 5.

7.4.1 Storm Water Project Solicitation

The solicitation for Storm Water Projects will be opened annually along with the general call for projects. Prior to the call for projects the Watershed Advisory Committee (WAC) will review the Evaluation Structure for consistency with current regulations, guidelines, and funding opportunities.

The call for Storm Water projects will be open for 30 days annually with projects submitted to the T-Stan Administrator. Project proponents must complete the general project worksheet as well as the Storm Water Project Worksheet. Worksheets are available online via the T-Stan website www.tstan-irwma.org and can be submitted electronically. Project worksheets must be complete and submitted on time in order to be considered for inclusion in the plan.

7.4.2 Storm Water Project Evaluation

The projects submitted will be evaluated by the Project Scoring Committee, appointed by the WAC, based on the Evaluation Structure shown below:

Project Evaluation Criteria	Criteria Weight	Performance Measure	Performance Measure Units	Performance Measure Weights

Area Effected by Project	20%	Size of Area Directly Effected	sq.ft.	50%
		Size of Area Indirectly Effected (Larger area indirectly affected downstream or downslope.)	sq.ft.	50%
Impact of Project on Region	20%	Number of People Effected	# people	33%
		Health and Safety (Value of health, repair or emergency response events alleviated by this project.)	$ value	33%
		Alleviates Flooding Impacts (Value to repair multiplied by the number of occurrences of flooding events.)	$ value	33%
Water Quality & Quantity Impacts	20%	Impact to Surface Water Quality (Targeted percent reductions of pathogen, sediment, nutrient or toxin loading in surface waters.)	% reduction	25%
		Potable Water Savings (Quantity of potable water supply offset by project proposal.)	gallons (annually)	25%
		Infiltration and Groundwater Recharge Potential (Quantity expected to be infiltration to subsurface or groundwater potentials.)	gallons	25%
		Impact to Impervious Surfaces (Area of impervious surface removal.)	sq.ft.	25%
Environmental Impacts	20%	Top Soil Loss Reduction (Quantity annually retained on native slopes.)	cu.yds.	33%
		Habitat Generation or Restoration (Area of project site that will generate or restore native habitat.)	sq.ft.	33%
		Ambient Temperature Mitigation (Reduction of heat island effect in targeted temperature decrease.)	temperature	33%
Effectiveness of Project	20%	Project Integration (Number of integrated benefits of implementation of project proposal.)	#	20%

		Resiliency of Project (Number of adaptive strategies in project proposal that provide durability and effectiveness for catastrophic events.)	#	20%
		Education/Demonstrative Potential (Public outreached annually.)	# people (annually)	20%
		Leverage of Funding (dollars leveraged)	($)	20%
		Monitoring and Evaluation Techniques (Review committee score of study design and length of monitoring techniques.)	review score	20%

The Project Scoring Committee will then report on the results of the storm water project review and recommend a slate of projects to the WAC for inclusion in the T-S IRWM Plan. The WAC will discuss the project presented and provide a recommendation to the Board of Directors for inclusion. Project proponents will be given the opportunity to provide a presentation on their project to the WAC before a recommendation is developed.

The Project Scoring Committee will use the Scoring Sheet shown below in reviewing projects. The Scoring Sheet reflects the Evaluation Structure and as such will be updated when changes are made to the structure.

T-S IRWMP Storm Water Project Scoring Sheet:

	Project Evaluation Criteria:	**Area Effected by Project**		**Impact of Project on Region**		
Project: (Name & Number)	**Performance Measures:**	Directly Effected (sq.ft.)	Indirectly Effected (sq.ft.)	# People Effected	Health & Safety ($ value)	Flooding Impact ($ value)
	Project Data:					
	Project Scoring:					

Water Quality & Quantity Impacts				**Environmental Impacts**		
Surface Water Quality (% reduction)	Potable Water Savings (gallons)	Infiltration/Ground water Recharge (gal)	Impervious Surface Impact (sq.ft.)	Top Soil (cu.yds.)	Habitat Restoration (sq.ft.)	Temp. Mitigation (degrees)

Effectiveness of Project						
Integration (#)	Resiliency (#)	Education/Demo (# people/annual)	Funding Leverage ($)	Monitoring (Reviewer Score)	**Reviewer Score:**	**Weighted Project Score:**

7.4.3 Inclusion of Storm Water Projects

The Board of Directors of the Tuolumne-Stanislaus IRWM Authority, as the Regional Water Management Group, will accept proposed Storm Water projects into the T-S IRWM Plan. After acceptance projects will be added to the T-S IRWM Plan Project List as well as the T-S IRWM Storm Water Project List.

Projects previously added to the T-S IRWM Plan Project List can submit a Storm Water Project Worksheet during the call for projects to be considered for addition to the Storm Water Project List.

Section 9

Insert current project list in place of Table 9-2: Project Financing Summary.

Section 10

10.1.1 Coordination by RWMG and Coordinating Committee

Modify last bullet to include the updated web address: www.tstan-irwma.org

Appendix G Storm Water Best Management Practices Handbook

Appendix G
Tuolumne-Stanislaus Storm Water Best Management Practices Handbook

Purpose

This appendix and handbook have been developed for educational purposes for the Tuolumne-Stanislaus Integrated Regional Water Management Plan. The information and Best Management Practices included in this handbook are meant to be used as a guide, prior to implementation of any practices seek assistance from a licensed professional and development of site specific design.

Introduction

Prior to the development of urban areas in the Tuolumne-Stanislaus Region a diverse collection of habitats captured and conveyed rainwater within the region. Rivers and streams conveyed flows, intact wetlands functioned as natural filters and buffers during storms. These conditions allowed rainwater to infiltrate the soil replenishing groundwater supplies, contributing to stream flows and

sustaining vegetation. Our current urban areas are made up of impervious surfaces, such as roofs, streets, and parking areas, which cause rainfall to flow faster and in greater amounts than in pre-development conditions, in turn increasing runoff and decreasing infiltration.

Runoff is conveyed by pipes, driveways, streets and storm drains to creeks and rivers where it can cause flooding, road damage, stream erosion and landslides. Though it starts as relatively clean rainwater runoff collects sediment and pollutants as it flows over the landscape, such as oil and grease, lawn fertilizers, etc.

The negative impacts of runoff can be reduced by changing the way we construct development and by encouraging the use of storm water Best Management Practices (BMPs) by landowners within the Region.

Understanding and Evaluating Storm Water

BMPs can be used to minimize the effects of storm water runoff and follow a simple theory of slow it, spread it, sink it. Slow runoff down, spread it out over pervious surfaces, and sink it back into the ground.

Low Impact Development (LID) is another common term normally referred to in larger scale developments that incorporate storm water management practices. LID can be applied to government, residential, and commercial development and redevelopment. It is utilized as a cost effective method for managing runoff and protecting the environment.

Benefits of implementing BMPs and LID:

- *Conserves Water - Water can be conserved through capturing rainwater, using plants with low water needs or directing runoff to areas where water can be stored in the soil for later use by plants.*
- *Creates Wildlife Habitat - BMPs that use vegetation, using the appropriate plants, can create habitat for local wildlife and act as natural pest control.*
- *Improve Landscapes Aesthetics - Many BMPs can beautify landscapes.*
- *Reduce Peak Flows and Facilitate Runoff Timing - Peak flows occur when runoff reaches its highest point, by changing the timing of runoff, peak flows can be reduced and flooding potential mitigated.*
- *Reduces Erosion - BMPs that reduce erosion limit the loss of topsoil and reduce sediment entering waterways.*
- *Protects Infrastructure - BMPs reduce runoff that can damage structures and public infrastructure such as roads.*

Economic Benefits of LID:

- *Reduced costs of storm water infrastructure such as curbs and gutters.*
- *Increased land values.*
- *Added green space and parks.*
- *Decreased spending on current and future environmental conservation programs.*

The following information and BMPs address storm water and are organized by areas that contribute to runoff on a structure or other impervious development.

Roofs

Roofs generate the most runoff on a home or building and should be outfitted with gutters and downspouts and routed away from sensitive areas such as septic system leachfields, hillsides, and building foundations. Water from non-guttered roofs can cause erosion, damage structures, and contribute to pollution.

One inch of rain on 1,500 square-foot roof can generate approximately 1,000 gallons of runoff.

Roof and Elevated Structure BMPs:

1. *Gutters and downspouts work to direct water to safe locations away from bare soil and buildings.*
2. *Vegetative or rock drip line protection slows runoff, reducing erosion and increasing infiltration. (The area underneath decks, stairs, and other elevated structures where water impacts the ground is called the drip line.)*
3. *Rain barrels and tanks, downspout diverters, and rain gardens are potential solutions for treating downspout runoff by slowing water down and spreading it out.*
4. *Terracing or retaining walls may be added to sloped areas to keep rock or other mulch in place to protect hillsides*

Walkways, Driveways and Hard Surfaces

Walkways and hard surface areas often become the conduits for runoff. When constructing a walkway or other hard surface always consider where it will drain, angle towards vegetated areas or utilize a porous material that will reduce runoff and promote infiltration.

Traditional driveways have been constructed to divert runoff to streets and act as a conduit for large volumes of runoff. Large volumes of runoff increase the chance for damage such as potholes, flooding, and erosion.

Walkway, Driveways and Hard Surface BMPs:

1. *Mulch, gravel, or wood chips work well in low traffic areas and allow for infiltration.*
2. *Turf block work work well in medium traffic areas such as parking areas.*
3. *Paver Stones or pervious concrete can be used in high traffic areas and should be used with vegetative borders to allow runoff to infiltrate.*
4. *Asphalt berm or waterbed can be added to existing driveways to slow and spread runoff to vegetated or rocked infiltration areas.*
5. *A rocked or vegetated seal lining the edge of road or driveway reduces erosion potential.*

Landscapes and Soil

Landscapes with bare soil and slopes are vulnerable to the impacts of runoff without protective vegetative cover they erode and increase runoff. Erosion reduces soil fertility, can compromise support structures for buildings, and eventually lead to events such as landslides. Erosion can be identified by uneven soil surfaces, depressions in the soil that create small gullies, and any sign that indicates soil loss. Vegetation, site specific, plays an important role in preventing soil loss.

Landscape and Soil BMPs:

1. *Mulch protects soil from the direct impact of rain and slows runoff across soil.*
2. *Retaining walls help hold sloped areas in place and slow runoff.*
3. *Site specific vegetation can slow and spread runoff and prevent soil erosion.*

Rain Water Collection

Collecting and storing water from roofs is a great way to slow water down rain water by temporarily storing it for irrigation or other non-potable uses. It's important to use water regularly, take advantage of gravity, and seal and maintain storage to eliminate debris and insect breeding. Below is a calculation to determine how much water can be harvested from a roof.

Rain Water Harvest Calculation:
Harvested Water (gallons) = Catchment Area (foot squared, length x width) multiplied by Rainfall Depth (inches) multiplied by 0.623 (conversion factor)

Rain Gardens

A rain garden is a specialized landscape design that captures storm water runoff and allows water to sink back into the ground. It utilizes plants to remove pollutants and improve infiltration. Design can be as simple as a shallow depression filled with plants that can survive in both moist and dry conditions, areas with larger amounts of runoff or limited infiltration can be engineered. Large scale projects are known as bioretention systems.

Swales

Swales are shallow channels designed to slow water down, spread it out and allow it to sink and be stored in the soil. Once saturated, they convey water to a safe outlet such as a rain garden. Swales can be either vegetated or rock lined.

Large Scale & Multi Component Systems

Techniques discussed in this handbook can be enlarged or used in combination address storm water management on larger parcels and in conjunction with a variety of land uses. Large integrated BMP systems have the advantage of addressing multiple resource concerns including erosion control and water quality. Large projects should evaluate site specific conditions, costs, engineering limits and regulatory compliance. Multiple treatment systems utilizing two or more BMPs in a series are known as a "treatment train." An example would be a rainwater harvest system combined with a bioretention system, native vegetation drip line protection, and permeable pavers. It's important to note that large scale projects will often trigger the need to engineering and permitting.

Maintenance

All BMPs will require maintenance, be sure to identify maintenance needs in the design phase of a projects to avoid failure and adverse effects.

Summary of BMPs:

- Gutters
  The shape and size of gutters determines the amount of water they can handle from a roof during a storm. Select gutters at least five inches wide made of galvanized steel or aluminum.
- Downspouts
  Space downspouts 20 to 50 feet apart. Adding additional downspouts can increase capacity where necessary helping slow water and spread it out. Do not exceed 45-degree angle bends.
- Vegetated Drip Line Protection
  Healthy grass or turf around the foundation of a building or plants, shrubs, or flower beds completely bordered by wood, rock, or turf.
- Rocked Drip Line Protection
  Three-quarter to one and a half inch washed drain rock is an adequate size to prevent the rock from being moved by rainfall. Installing non-woven geotextile fabric beneath rock and then bordering the rock with wood or other materials will reduce maintenance and increase effectiveness.
- Rain Water Collection Systems
  - Rain Barrels - Advantages include inexpensive, takes up little space, and are easy to install.
  - Water Tank & Cisterns - Can be installed above or below ground, increased storage capacity.
- Splash Guards
  Simple devices that reduce the initial force of the water at outlets and allow it to spread into an infiltration area.
- Downspout Hose Adapter
  Allows a standard garden hose to contact directly to a downspout, hose can then be moved to different locations.
- Rock Dissipators
  Placed at outlets to slow runoff by reducing initial impact of concentrated, high velocity runoff.
- Rain Gardens
- Bioretention System
- Vegetated Swales
- Rock Lined Swales
- Infiltration Trenches
  Fabric lined, rock filled trenches or shallow rock filled pits that receive and infiltrate storm water runoff.
- Infiltration Pits
  Nearly identical in principle and design to a trench, but is typically smaller and vertically aligned.
- Paver Stones/Flag Stones

Normally made of pre-cast brick, concrete, stone or other materials and installed over a sand base.

- Turf Block
  Concrete block with holes can be filled with sand or planted, provide stability for driveways and walkways.
- Pervious Pavement
  Contain pore spaces that allow for infiltration of runoff, water seeps through materials to a rock base layer underneath and is naturally filtered through the underlying soil. Keep clear of soil, rocks, leaves, and other debris.
- Mulch
  Simply a protective layer of materials that is spread on top of the soil, can be organic or inorganic materials.
- Vegetation/Planting
  Plants cover and protect the soil, once established plants provide excellent long term erosion control. Roots knit together to hold soil in place.
- Erosion Control Blankets
  Tool that can be used to improve the success rate of new plantings and can quickly add a layer of protection to bare soils. Use decomposable netting.
- Water Bars
  Used to break up runoff into small units so that it does not have enough energy to erode soils. Divert water away from streets and allow it to infiltrate.
- Slotted Channel Drain
  Consists of a metal grated conveyance structure that transports water to a safe location. Decorative varieties are available.
- Terraces & Rock/Wood Retaining Walls
  Used to reduce the gradient or slope and provide level or gently sloping areas for establishing vegetation.

Resource Guide

American Rainwater Catchment Systems
www.arcsa.org

California Stormwater Quality Association
www.casqa.org

Center for Watershed Protection
www.cwp.org

Low Impact Development Center
www.lowimpactdevelopment.org

Greywater Action

www.greywateraction.org

Stormwater Manager's Resource Center
www.stormwatercenter.net

OEHHA: Office of Environmental Health Hazard Assessment, Cal EPA
www.oehha.ca.gov

Handbook References:

Santa Cruz Resource Conservation District
Slow it. Spread it. Sink it.

Sonoma Resource Conservation District
Slow it. Spread it. Sink it. Store it.

OEHHA - What is Low Impact Development (LID)?

Sierra Watershed Progressive, Groveland, CA

Developed for the T-S IRWMA and its member organizations.