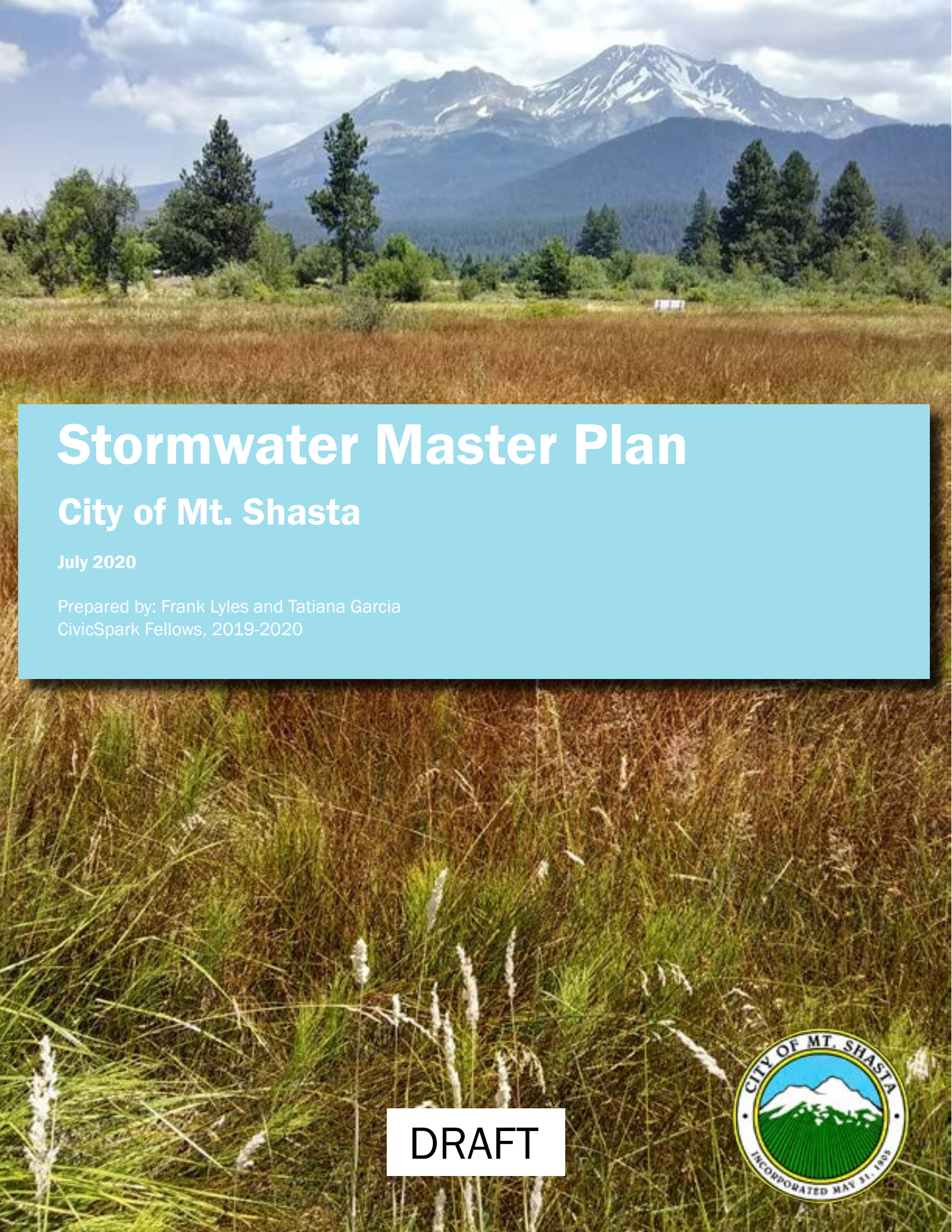

Stormwater Master Plan

City of Mt. Shasta

July 2020

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CivicSpark Fellows, 2019-2020

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Executive Summary

The City of Mt Shasta has updated its Stormwater Master Plan (Plan) to identify and prioritize stormwater and dry weather runoff capture projects that provide multiple benefits, including water quality, water supply, flood management, ecosystem services, and community enhancement.

The original Stormwater Master Plan (adopted 1999), is considered obsolete by City staff and does not sufficiently guide Public Works Department operations, maintenance, or capital improvement priorities. As a result, the City has missed opportunities to improve its drainage system and implement multi-benefit green infrastructure projects. As existing infrastructure continues to age, improvements must be made to prevent system failure. Climate change will further exacerbate the City's drainage issues in the future, as storms intensify and winter precipitation shifts on average from snow to rain. A full update of the Plan was needed to address these challenges and highlight opportunities to improve.

Today, Mt Shasta's stormwater system consists of remnant creeks and wetlands which are interconnected to an aging network of pipes, drains, ditches, and culverts. There is a great deal of deferred maintenance in the system, with key pieces of infrastructure at or beyond their design lifetime. Drainage in Mt Shasta is further complicated by the presence of saturated, poorly draining soils in many parts of the City. However, there are substantial opportunities to improve drainage in the City while also restoring the habitat value of creeks and wetlands. By implementing multi-benefit projects, the City can improve local water quality, flood management, and the environment for the community in a cost-effective manner. An updated Plan will also improve the City's financial capacity and eligibility for outside funding sources such as grants and bonds.

The new Plan begins with an introduction reviewing relevant regulations at the local, state, and Federal level. Chapter 2 provides demographic information on Mt Shasta's residents, with an emphasis on equity. Chapter 3 lists City Staff and external stakeholders essential to planning and implementation. Chapter 4 provides a description of the City's environmental setting. The existing drainage system and known infrastructure deficiencies are described in Chapter 5. Chapter 6 identifies potential projects, which are prioritized in accordance with State guidelines in the Chapter 7. The City's plan to monitor and report progress is documented in Chapter 8. Chapter 9 provides an overview of funding considerations and the Proposition 218 process. The Plan concludes in Chapter 10 with a strategy for the Public Works Dept's Operations and Maintenance of the City's Stormdrain system. Appendices are listed in Chapter 11.

Notes for readers: "Mt Shasta" refers to the City of Mt Shasta while "Mount Shasta" refers to the volcano itself.

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Table of Contents

1.Introduction.....6

2. Demographics, and Vulnerable Populations.....10

3. Public Outreach, Coordination, and Collaboration.....11

4. Environmental Setting.....16

5. Existing Drainage System.....38

6. Identification of Multi-Benefit Projects.....42

7. Project Prioritization and Implementation.....46

8. Monitoring Progress and Reporting.....50

9. Project Funding.....51

10. Operations and Maintenance.....54

11.Appendices.....59

1. Introduction

The City of Mt Shasta maintains a Municipal Separate Storm Sewer System (MS4) to convey runoff from impervious surfaces within the City to receiving water bodies. These storm drains are critical infrastructure which reduce the risk of flooding, protect public and private property, and improve water quality downstream. In 1999, the City adopted a Stormwater Master Plan, written by Kellogg Engineering, to guide the long term management of its storm drains. The 1999 Plan cataloged the City's existing drainage system and identified approximately $700,000 of needed infrastructure improvements (the equivalent of about $1.08 million in 2020 dollars after adjusting for inflation). Expanding undersized pipes, extending curbs and gutters along roads, and adding new drain inlets were major themes of the Plan. Relatively little attention was given to concepts like Green Infrastructure, Low Impact Development (LID), water quality, climate change, snow management, rain-on-snow precipitation events, watershed-scale hydrology, funding sources, stakeholder engagement, or operations and maintenance. In the 20 years since the 1999 Stormwater Master Plan was adopted, about half of the infrastructure improvements have been built. Lack of reliable local funding was a major reason the City did not more fully implement the projects identified in the Plan. Mt Shasta Public Works staff have indicated that they now consider the 1999 Plan obsolete and in need of a full update.

Since 1999, Best Management Practices (BMP) for stormwater management have evolved significantly, with experts now placing much greater emphasis on Green Infrastructure, Low Impact Development (LID), and other techniques which attempt to restore natural hydrology to urbanized watersheds.[1] These techniques offer multiple benefits beyond flood management, including water quality, water supply, community aesthetics, and environmental quality. The Mt Shasta Stormwater Master Plan update seeks to address deficiencies in the previous plan with these paradigm shifts in mind. For example, the Plan includes robust stakeholder engagement, funding, and maintenance considerations. This update directly advances the Mt Shasta 2045 vision and meets the Water Resource Element Goal 12 "…to update the Stormwater Master Plan every 5 years".

Legal Framework and Relevant Regulations

The City of Mt Shasta's Stormwater Master Plan must comply with Federal, State, and local regulations. These laws form the basis for regulating stormwater discharges in the US and California, but not all of them apply to the City of Mt Shasta or its MS4 at this time. The exact requirements of key legislation and its applicability to Mt Shasta specifically is discussed below.

The 1972 Federal Clean Water Act (CWA) "establishes the basic structure for regulating

1 Environmental Protection Agency. (2019, December 4). What is Green Infrastructure? Retrieved from https://www.epa.gov/green-infrastructure/what-green-infrastructure

discharges of pollutants into the waters of the United States and regulating quality standards for surface waters."[2] In 1987, Congress expanded the law to include stormwater discharge and require certain jurisdictions to obtain National Pollutant Discharge Elimination System (NPDES) permits for their Municipal Separate Sewer Systems (MS4s). The United States Environmental Protection Agency (USEPA) can delegate permitting authority to State agencies in its place, which is the case in California where the State Water Resources Control Board is responsible for enforcing the CWA. Key to the law's enforcement is §303(d), which establishes a legally binding list of "sensitive water bodies" which have been impaired by pollution. The USEPA is authorized "to assist states, territories and authorized tribes in listing impaired waters and developing Total Maximum Daily Loads (TMDLs) for these water bodies. A TMDL establishes the maximum amount of a pollutant allowed in a water body and serves as the starting point or planning tool for restoring water quality."[3] In summary, the CWA authorizes the State Water Board to establish water quality rules like TMDLs (on behalf of the USEPA) and to enforce these rules through the issuing of NPDES permits.

Not all MS4s are regulated under the CWA; the MS4s of small cities with populations of less than 10,000 like the City of Mt Shasta are usually exempt from permitting requirements. [4]However, the USEPA and State Water Board retain the discretion to force small municipalities to undergo NPDES permitting for a number of reasons, including if the municipality's MS4 discharges to sensitive waters as defined by §303(d). The only §303(d) listed water body near the City of Mt Shasta is Lake Siskiyou, which was recently listed for excess mercury (Hg). No TMDL has been established yet, nor has the source of the excess mercury been identified. While the City of Mt Shasta is currently not required to obtain a NPDES permit for its MS4, it could conceivably be forced to in the future if water quality downstream of the City deteriorates. The proactive stormwater management represented by this Plan update may be an effective strategy for avoiding the regulatory and administrative burden associated with needing to obtain a NPDES permit.

> Municipalities with populations under 10,000 are excused from MS4 permit requirements under the Clean Water Act unless they meet one or more of the following criteria: discharging to sensitive waters; high population density; high growth or growth potential; contiguity to an urbanized area; significant contributor of pollutants to waters of the United States; or ineffective water quality protection by other programs. Of these designation criteria, discharges to sensitive waters are the most relevant to the City of Mt Shasta.

2 Environmental Protection Agency. (2019, March 11). Summary of the Clean Water Act. Retrieved from https://www.epa.gov/laws-regulations/summary-clean-water-act

3 Environmental Protection Agency . (2020, March 24). Clean Water Act Section 303(d): Impaired Waters and Total Maximum Daily Loads (TMDLs). Retrieved from https://www.epa.gov/tmdl

4 Environmental Protection Agency. (2012, June). Stormwater Phase II Final Rule Who's Covered? Designation and Waivers of Regulated Small MS4s. Retrieved from https://www3.epa.gov/npdes/pubs/fact2-1.pdf

California's most important state-level regulation is the Porter-Cologne Act, originally established in 1967 before the passage of the Federal CWA. The Porter-Cologne Act gives the State Water Resources Control Board authority to govern water quality and beneficial uses of surface- and groundwater. It also authorizes the Water Board to create management objectives that protect and maintain clean and safe waters. The State and Regional Water Boards can issue permits for entities that discharge waste, but waste disposal is not a right and is subject to discretion from the Board. The Boards are empowered to levy fines, issue abatement orders, and pursue civil and criminal legal actions to enforce compliance.[5] The City of Mt Shasta is located in Region 5: Central Valley Regional Water Quality Control Board. The Water Board has listed the following beneficial uses as potential (P) or existing (E) immediately around and downstream of Mt Shasta (Table 1.1).

		Agriculture		**Recreation**			**Freshwater Habitat**		**Spawning**	**Wild**
Surface Water Bodies	**Hydro Unit Number**	Irrigation	Stock Watering	Contact	Canoeing and Rafting	Other noncontact	Warm	Cold	Cold	Wildlife Habitat
Sacramento River: Source to Box Canyon Reservoir	525.22	**E**	**E**	**E**		**E**		**E**		**E**
Lake Siskiyou	525.22			**E**		**E**	**E**	**E**	**P**	**E**
Sacramento River: Box Canyon Reservior to Shasta Lake	525.2	**E**	**E**	**E**	**E**	**E**		**E**	**E**	**E**

The protection of these beneficial uses is legally enforceable under the Porter-Cologne Act, although the only specific objectives listed in the current Central Valley Basin Plan are for temperature.[6] Because the surface water bodies near Mt Shasta are generally of excellent quality with many beneficial uses, any significant deterioration in water quality could trigger enforcement action under the Porter-Cologne Act.

Another relevant state-level regulation is the California Environmental Quality Act (CEQA), which requires state and local agencies to review public projects for potential environmental impacts, and to disclose and minimize environmental damage.[7][8] A project is considered "public" if it is pursued by a public agency or will require a discretionary permit from one. If an initial study finds that a project may produce potentially significant impacts, the lead agency will require feasible mitigation or alternatives to the impacts and may also require an Environmental Impact Report (EIR) to be prepared. The Governor's Office of Planning and Research (OPR) administers and oversees CEQA, but it does not enforce the law per se; instead, the law is primarily enforced through "the public review process and, very often, through litigation or the threat thereof."[9] This Stormwater Master Plan update is considered a project under CEQA and

5 Jones, A., Harter, T., Bianchi, M., & Harper, J. (2003). Water Pollution Control Legislation. Retrieved from https://anrcatalog.ucanr.edu/pdf/8088.pdf
6 California Water Resources Control Board Central Valley Region. The Water Quality Control Plan (Basin Plan), The Water Quality Control Plan (Basin Plan) (2018).
7 Jones, A., Harter, T., Bianchi, M., & Harper, J. (2003). Water Pollution Control Legislation. Retrieved from https://anrcatalog.ucanr.edu/pdf/8088.pdf
8 Placeworks. (2019). A Practical Guide to the California Environmental Quality Act (6th ed.).
9 Placeworks. (2019). A Practical Guide to the California Environmental Quality Act (6th ed.).

will require what is known as a Programmatic EIR, which will analyze the Plan itself and the programs and capital improvement projects it proposes. The environmental impacts of the Plan will be compared to the alternative under a scenario in which the Plan is not updated. Therefore, CEQA is a crucial law affecting the Plan update.

The City of Mt Shasta is loosely following the guidelines for Storm Water Resource Plans produced by the State Water Control Board in 2015. "With limited exceptions for certain small disadvantaged communities, Water Code Section 10563(c)(1) requires stormwater and dry-weather runoff capture projects be included in a SWRP to receive stormwater grants from bond measures passed by the State of California after January 1, 2014."[10] While the City qualifies as a small disadvantaged community and is exempt from the specific requirements of these guidelines, a thorough good-faith effort to voluntarily comply can only serve to strengthen the City's management of stormwater and eligibility for grants.

In this spirit, a number of other regulations listed in the Water Board's guidelines are relevant to the Master Plan update. This Plan complies fully with the goals and intent of the Upper Sacramento River Integrated Regional Water Management Plan. While there are no mosquito control districts in the Mt Shasta area, this Plan will implement mosquito-related best management practices to the extent possible as described in the Overview of Mosquito Control Practices in California. The City includes natural wetland areas that can serve as breeding habitat for mosquitoes, so mosquito abatement must be balanced with the need to preserve wetland habitats which offer many other positive ecosystem services related to stormwater management. No groundwater basins have been identified in the Mt Shasta area, which makes the Sustainable Groundwater Management Act (SGMA) largely inapplicable at this time. This Plan, where it recommends stormwater capture and reuse, will do so before runoff reaches a natural channel in compliance with Water Code § 10561.7. Lastly, this Plan is fully consistent with the City of Mt Shasta's General Plan (including its Water Resource Element) and existing City codes and ordinances.

10 California State Water Resources Control Board. Storm Water Resource Plan Guidelines , Storm Water Resource Plan Guidelines (2015).

2. Demographics, and Vulnerable Populations

The City of Mt Shasta has a population of 3,284 people and is considered a severely economically disadvantaged community (DAC) based on the 2018 American Community Survey median household income by census block group. Disadvantaged areas have a median household income (MHI) of less than 80% of the state's median household income, while severely disadvantaged areas have less than 60%. This corresponds to a median income below $51,026 in disadvantaged areas and below $38,270 in severely disadvantaged areas, as defined in 2016.[11] For reference, the MHI the City of Mt Shasta is $35,238.[12] Mt Shasta's residents are 93% White and 1% Black, with 5% identifying as two or more races.[13]

There are climate vulnerable communities within the City of Mt Shasta. The City experiences many of the vulnerabilities described in California's Fourth Climate Change Assessment North Coast Regional Report; the most relevant vulnerabilities for the purposes of the Stormwater Master Plan update include decreased stream flows, flood risks, loss of snowpack, prolonged droughts, heat-related illness, and wildfire and its air quality impacts.[14] Most of the City of Mt Shasta and the surrounding area are classified as being in very high fire hazard severity zones by CalFire.[15] The City may have reduced adaptive capacity due to its aging population (median age 55.1, with 20.1% of the population 65 or older),[16] low incomes as described above, low educational attainment,[17] and a small tax base. Mt Shasta currently enjoys relatively healthy environmental conditions, with a CalEnviroScreen 3.0 pollution burden percentile of just 6.[18]

In summary, the City of Mt Shasta enjoys a relatively clean environment but faces serious climate vulnerabilities; the City may have reduced adaptive capacity to cope with environmental

11 Dept of Water Resources. (2016). DAC Mapping Tool. Retrieved 2019, from https://gis.water.ca.gov/app/dacs/
12 US Census Bureau. (2018). Selected Economic Characteristics . Retrieved 2019, from https://data.census.gov/cedsci/table?q=&d=ACS 5-Year Estimates Data Profiles&table=DP03&tid=ACSDP5Y2018.DP03&g=0400000US06_1600000US0649852&lastDisplayedRow=81&mode=selection&vintage=2018&layer=place
13 US Census Bureau. (2018). 2018 American Community Survey 5-Year Estimates: Mount Shasta City, California. Retrieved 2019, from https://data.census.gov/cedsci/profile?q=Mount Shasta&g=1600000US0649852&tid=ACSDP5Y2018.DP05

14 Grantham, Theodore (University of California, Berkeley). 2018. North Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCC4A-2018-001.
15 CalFire. (2007, November). Fire Hazard Severity Zones Maps. Retrieved 2019, from https://osfm.fire.ca.gov/divisions/wildfire-planning-engineering/wildland-hazards-building-codes/fire-hazard-severity-zones-maps/
16 US Census Bureau. (2018). 2018 American Community Survey 5-Year Estimates: Mount Shasta City, California. Retrieved 2019, from https://data.census.gov/cedsci/profile?q=Mount Shasta&g=1600000US0649852&tid=ACSDP5Y2018.DP05
17 Public Health Alliance of Southern California. (2018). California Healthy Places Index (HPI). Retrieved 2020, from https://map.healthyplacesindex.org/
18 Office of Environmental Health Hazard Assessment (OEHHA). (2018, July 25). CalEnviroScreen 3.0. Retrieved 2020, from https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

and societal challenges now and in future. Because the City qualifies as a DAC and a climate vulnerable community, the update of the Master Plan will directly benefit these stakeholders and address stormwater-related environmental injustices.

3. Public Outreach, Coordination, and Collaboration

Public outreach, internal staff coordination, and outside agency collaboration are all key to the Plan update. Robust engagement helps meet the specific needs of the system, incorporate local knowledge, and community preferences. The City has established a Technical Advisory Committee (TAC) to provide oversight and review of the Plan update. The TAC's responsibilities include participating in public meetings; making decisions regarding project modeling and priorities; providing experienced knowledge and understanding of local infrastructure, hydrology, groundwater, and potential project constraints; soliciting feedback from other departments; providing data; and reviewing the draft and final Stormwater Master Plan. Its members are:

- Juliana Lucchesi, City Planner
- Rod Bryan, Public Works Director
- David Torres, Public Works Supervisor
- Muriel Terrell, Finance Director
- Paul Reuter & Seth Petrie, City Engineers (PACE Engineering)
- Frank Lyles and Tatiana Garcia, CivicSpark Fellows (2019-2020, temporary members)

While the TAC is tasked with ensuring proper coordination between departments within Mt Shasta's municipal government, it is even more crucial to the success of the Plan to gain the participation of external stakeholders and the public. A "stakeholder" is defined as an individual, group, coalition, agency, or other entity that is involved in, affected by, or has an interest in the implementation of the Master Plan. The TAC has prepared a Stakeholder Outreach, Education, and Engagement Plan (Outreach Plan), which is included in Appendix A and summarized briefly in this section. The Outreach Plan outlines the City's strategies to effectively engage stakeholders and the community, per the requirements of Water Code § 10565(a) and § 10562(b)(4).

Stakeholders can provide input into the development of the Master Plan, recommend potential projects or programs, and provide letters of support for the Master Plan. The Outreach Plan outlines a number of strategies to encourage this type of ongoing constructive engagement, in part relying on groups that have similar concerns as those addressed in the Plan. Public outreach meetings occurred throughout the development of the Plan update. Meetings were supplemented by digital outreach efforts including a page on the City website dedicated to the Master Plan update, where relevant documents and videos were made available and comments could be submitted, as well as through the use of office hours and an online survey.

Much of this outreach occurred in the spring of 2020 and was substantially disrupted by bans on in-person gatherings related to COVID-19. As a result, many of the community outreach strategies originally planned were instead adapted to digital formats. Robust stakeholder engagement will remain a priority throughout the update process, and opportunities for ongoing engagement are listed in the final section of this chapter.

The City of Mt Shasta is composed entirely of economically disadvantaged communities (DAC) based on the 2018 American Community Survey median household income by census block group.[19] There are also climate vulnerable populations within the community, as defined by California's Fourth Climate Assessment North Coast Regional Report.[20] Mt Shasta's vulnerable populations may be disproportionately more harmed by future stormwater events than other community members. Due to its aging population, low incomes, low educational attainment, and small tax base, the City may have reduced adaptive capacity to cope with environmental and societal challenges like decreased stream flows, flood risks, loss of snowpack, prolonged droughts, heat-related illness, and wildfire and its air quality impacts. The Plan update will directly benefit these stakeholders and address stormwater-related environmental injustices.

Public Meetings (in-person and virtual)

Public meetings are an established and effective mechanism to engage communities in planning efforts and projects. The City held a variety of meeting types to ensure engagement with a broad cross section of the community and adapt to restrictions on in-person gatherings set during the COVID-19 pandemic. Public notices of meetings were provided via flyers, posters, newspapers and newsletters, social media, mailers, and on the City websites. Examples of outreach materials used are included in Appendix B.

The first introduction to the Plan Update was on October 28, 2019 during a normally scheduled City Council meeting.[21] During the meeting, Council and the public heard a 15-minute introductory presentation from the Planning Department that detailed the purpose of the Plan Update, the concept of multi-benefit projects, and a tentative timeline for completing the Plan Update. At the conclusion of the presentation, attendees were encouraged to reach out to discuss any stormwater-related issues. The number of attendees at the meeting was not officially documented, but was approximately 50 individuals.

The second public meeting took place on March 5, 2020. The purpose of the meeting was to elicit feedback from the community about future stormwater policies and programs. Policies were understood to include changes and additions to the City's municipal code, while programs are processes and actions carried out over time. The format of this event began with a 15-minute introduction to the Plan Update followed by an hour-long facilitated break-out session. During the break-out, participants were able to visit three tables with stormwater-focused activities. At Table One, participants could write on maps to mark specific drainage issues and locations where they would like to see habitat restoration or other green

19 Dept of Water Resources. (2016). DAC Mapping Tool. Retrieved 2019, from https://gis.water.ca.gov/app/dacs/

20 Grantham, Theodore (University of California, Berkeley). 2018. North Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCC4A-2018-001.

21 Mt. Shasta City Council Regular Meeting Minutes: Monday, October 28, 2019. Mt Shasta, CA.

infrastructure projects completed. Participants at Table Two were able to vote on a list of 15 prepared policies and programs. Attendees were given stickers to represent "up" and "down" voting, the number of stickers used by each participant was not limited, and City representatives helped to discuss all lingering questions and ideas surrounding each policy and program to ensure adequate comprehension while voting. At Table Three, participants were able to take the online stormwater survey. A total of 8 people attended this meeting and a discussion of results can be found in the Programs and Policies section of this document.

On April 30, 2020 the third meeting was held virtually via Zoom as a result of the Stay-At-Home order issued in response to the COVID-19 pandemic. During this meeting, participants were shown potential capital improvement projects using a combination of GIS-based maps, photos, and 3D renditions. Following a description of each project's location, purpose, and expected outcomes, participants were given time to ask questions and give input before moving on to the next project. The video, audio, and chat log were all recorded and added to the City's website. A total of 6 people attended the virtual meeting. Comments received for all projects are included in the Appendices of this document as well as the chat log saved from the April 30th virtual meeting.

On June 16, 2020 the fourth meeting was held during the regularly scheduled Mt Shasta City Planning Commission meeting. Members of the Planning Department presented an overview of the full public draft of the updated Stormwater Master Plan, which had been released for public comment on June 12. Planning Commission members were given the opportunity to ask questions and members of the public could offer comments. This meeting was attended by X individuals.

On June 22, 2020 the fifth meeting was held during the regularly scheduled Mt Shasta City Council meeting. Members of the Planning Department again presented an overview of the full public draft of the updated Stormwater Master Plan. City Council members were given the opportunity to ask questions and members of the public could offer comments. This meeting was attended by X individuals.

Farmers' Market Tabling and Project Site Tours (In Progress)

The Mt Shasta Planning Department had originally planned to staff a table at the Mt Shasta Farmers' Market to raise awareness of the Plan update and solicit feedback from the public. Guided tours of project locations for members of the public were also planned. However, due to the COVID-19 pandemic and the resulting bans on large gatherings, neither of the above outreach strategies were ultimately pursued. Instead, project site tours of the City's top 3 projects' locations were limited to only include the City's TAC and members of the Planning Commission, City Council, and Beautification Committee. These tours were offered on an optional basis on 3 different occasions to avoid crowding, and were ultimately attended by X members.

Survey Results

The City conducted an electronic survey as part of the Plan update, which it hosted on its website and powered with Qualtrics. The survey was live from February 28 to June 1, and

received a total of 37 responses, of which 34 were from residents of the 96067 zip code (City of Mt Shasta). Key findings include a perception among respondents of high water quality in the City of Mt Shasta's creeks, wetlands and lakes (mean = 7.86 out of 10), but a lower perception of the quality of City's stormwater management (mean = 5.94 out of 10). Respondents indicated being less aware that soap from car washing, yard and pet waste, and sediment were harmful pollutants, but higher levels of awareness about other pollutants like motor oil and insecticide. Respondents indicated that fixing aging infrastructure, educating the public about best practices, restoring damaged ecosystems, and improving water quality should be top priorities for the City. Options like keeping costs low for developers and beautifying neighborhoods received the least support. The full survey results are included in Appendix C.

Ongoing Engagement Efforts

Even as the update process for the Stormwater Master Plan concludes, engaging proactively with the public on issues relating to drainage remains a priority for the City. Clear communication and community buy-in is vital to the successful implementation of this Plan. Therefore, the following engagement efforts will continue even after the updated Plan is approved by the City Council.

The City will maintain its Stormwater webpage into the future, so residents can access relevant information at any time. The webpage will include three main parts: first, educational materials and videos on stormwater best practices so residents seeking general information on stormwater can easily find it. A second section will include an overview of the Plan update process including project descriptions, a PDF version of this plan for review by residents, a portal to submit comments on the draft Plan, a form to illicit project suggestions, and an updated timeline on implementation progress. A third webpage will include a brief form for submitting complaints and maintenance requests related to City drainage.

Educational brochures with information on resident best practices related to stormwater management at private residences are displayed at the reception desk of City Hall. Brochures on invasive species and yard management are also included.

When deemed safe by public health officials after the end of the COVID-19 pandemic, the City Planning Department will begin tabling at the Mt Shasta Farmers' Market to educate local residents about stormwater issues and to encourage them to pursue best practices on their own properties.

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4. Environmental Setting

The City of Mt Shasta, California is located at the foot of its namesake volcano and the headwaters of the Sacramento River, about 50 miles south of the Oregon border. The City sits at an elevation of 3,586 ft in the valley between 14,179 ft Mount Shasta to the east and 9,026 ft Mount Eddy to the west. Runoff from the City drains southwest to Lake Siskiyou and the Sacramento River via two watersheds: Cascade Gulch (Hydrologic Unit Code 180200050103) and Wagon Creek (Hydrologic Unit Code 180200050102). This unique environmental setting creates many factors that influence climate, hydrology, water quality, and urban drainage.

Boundaries and Surrounding Uses

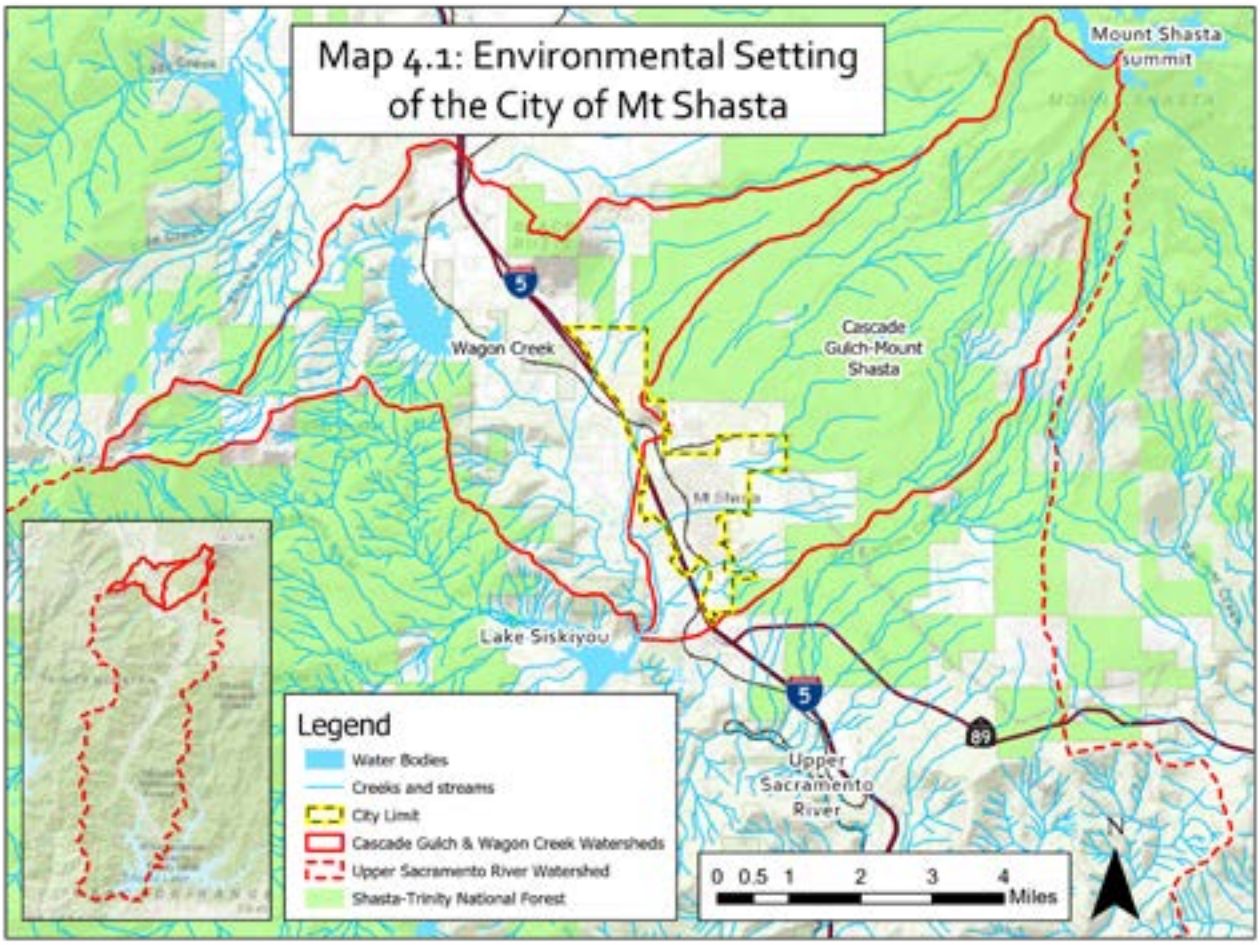
The State Water Board Guidelines for Stormwater Resource Plans require that plans describe in detail the jurisdictional boundaries and major land uses within the plan's watershed. The following section fulfills this requirement.

The City of Mt Shasta is within the Cascade Gulch-Mount Shasta and Wagon Creek subwatersheds (Hydrologic Unit Codes 180200050103 and 180200050102, respectively), which drain to Lake Siskiyou and the Sacramento River. These two watersheds are together referred to as Cascade-Wagon watershed or the Plan Watershed for the purposes of this Plan update. This Plan Watershed is ideal for the City's stormwater management analysis because 1) Mt Shasta City Limits includes area within both Cascade-Gulch and Wagon Creek; 2) the City of Mt Shasta is the only incorporated City in the Plan Watershed; 3) the Plan Watershed includes the vast majority of human development and population within Lake Siskiyou's drainage area; and 4) the remainder of Lake Siskiyou's watershed is almost entirely under the management of Shasta-Trinity National Forest and therefore beyond the scope of this City planning document (Map 4.1). For these reasons, the Plan Watershed balances thoroughness and feasibility, making it the ideal area for collaborative stormwater resource planning at the watershed scale.

Only 6.76% of the Plan Watershed is within Mt Shasta City Limits, while the remainder is under the primary jurisdiction of other agencies. 50.85% of the Plan watershed is within Shasta-Trinity National Forest and therefore under federal jurisdiction. The Plan watershed contains 42.39% of unincorporated land under the jurisdiction of Siskiyou County, including residential areas, some agriculture and light industry, and privately owned and managed timber production areas. Nearby cities outside the Plan Watershed include Weed 10 miles northwest of Mt Shasta, and Dunsmuir 9 miles south; nearby census-designated places include Black Butte, Azalea, and McCloud. Portions of Interstate-5 (I-5) and the Union Pacifc Railroad (UPR) pass through the City, travelling primarily in the north-south direction. The City is included in Caltrans' District 2 and within the Upper Sacramento, McCloud, and Lower Pit River Integrated Regional Water Management (IRWM) watershed boundary.

The City of Mt Shasta does not overlie any groundwater basins as delineated by Bulletin 118 of the Department of Water Resources (DWR).[22] Despite the abundant high-quality groundwater

22 Dept of Water Resources. Bulletin 118 Interim Update, Bulletin 118 Interim Update (2016).



underlying the City, because the region's geology is volcanic, the groundwater-bearing geologic units underneath the City are not considered by DWR to be a "basin." This distinction is legally binding, and means that the legal opportunities and obligations of overlying a groundwater basin do not apply to the City of Mt Shasta at this time. Some members of the USR IRWM group have expressed interest in lobbying DWR to designate a new groundwater basin in the Mt Shasta area, but no official actions to that end have been taken by any agency at this time.

Potable Water

The City is the only public water provider in the Plan Watershed, supplying an average of 285.9 million gallons per year to 1,838 water accounts and 3,642 individuals (2016-2019 average). All other residents in the Plan Watershed are served by private wells.

Open Space

The City contains a variety of parks and natural open spaces available for recreation. Mt Shasta Recreation and Parks District is a special district which operates two parks, Mt Shasta City Park and Shastice Park, which are 26 acres and 38 acres respectively. City Park is mostly open natural habitat, including Big Springs, hydrologically connected wetlands, and

forested walking trails; while Shastice Park features more developed sports facilities including soccer fields and a skate park. The Recreation and Parks District is currently updating its Master Plan, with a new emphasis on urban greenway connectivity. There are opportunities for future trail construction projects to coincide with stormwater improvements and green infrastructure, which makes the Recreation and Parks District an important stakeholder in this Plan update. At the south end of Mt Shasta, the City has acquired a 127-acre vacant property previously owned by Roseburg Forest Products. This property, called Roseburg Commerce Park, is currently undergoing brownfield remediation and will eventually be developed into two community parks in the future.

Other open spaces in the City not managed by the Recreation and Parks District include Spring Hill, a small volcanic cone reaching 4,290 feet in elevation. Spring Hill is located at the north end of the City, across Mt Shasta Blvd from the City Park, and is owned by Crystal Geyser Water Company but is open to the public. Just northeast of downtown Mt Shasta is a restored wetland habitat called Sisson Meadow, which is managed by the nonprofit organization Siskiyou Land Trust. Sisson Meadow is hydrologically interconnected with the City's stormdrain system. Although the City does not own Sisson Meadow, its central location and scenic beauty make it a favorite for locals and visitors alike.

Surrounding Uses

As illustrated in Map 4.2, the Plan Watershed is mostly forested, with a variety of other land uses clustered mostly along the I-5 corridor. Of these land uses, low density residential is the most common by area. Commercial land uses like timber production, aggregate mining for the production of concrete, Black Butte Transfer Station solid waste facility, Mt Shasta resort golf course, and small amounts of pastureland for cattle rearing also exist. While the City accounts for most development in the Cascade Gulch watershed, most development lies outside City Limits in the Wagon Creek watershed.

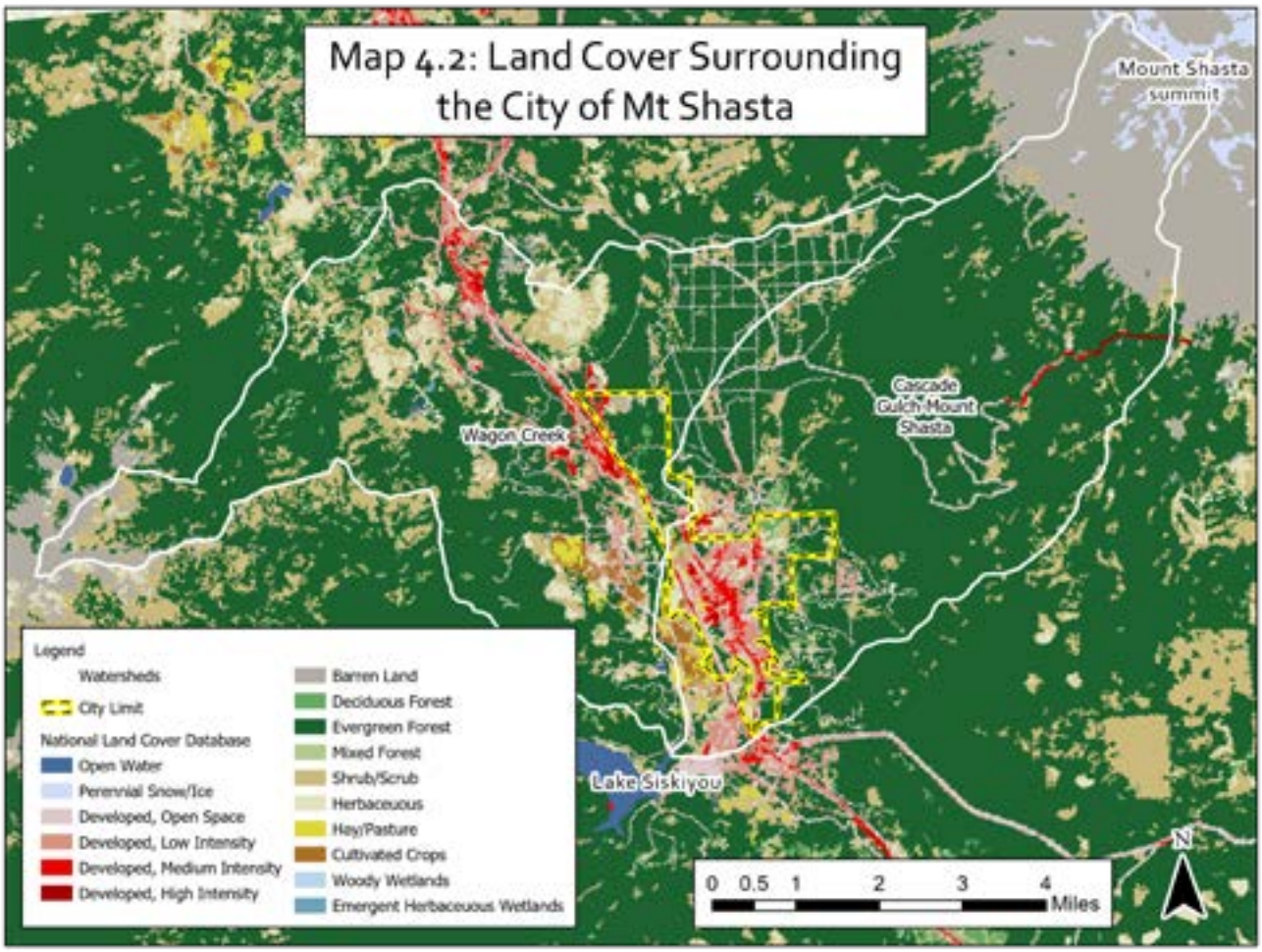
Climate

Like many alpine regions in California, the City experiences a Mediterranean Climate characterized by warm, dry summers and cold, wet winters. Long term average precipitation in the City is approximately 40 inches.[23] Most precipitation in the watershed falls between October and May, with December through February being the wettest months on average (Figure 4.1).[24] Major precipitation events are often associated with cyclonic storms from the Eastern Pacific in the winter months; summer thunderstorms occur but rarely produce significant rainfall.[25] However, long term average values can be misleading because there is

23 Shasta-McCloud Management Unit Shasta-Trinity National Forest. (2012, May). Mt. Shasta Watershed Analysis. Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5381830.pdf

24 Weather Service. (2020). Climate Mount Shasta - California. Retrieved from https://www.usclimatedata.com/climate/mount-shasta/california/united-states/usca0741/2018/12

25 Shasta-McCloud Management Unit Shasta-Trinity National Forest. (2012, May). Mt. Shasta Watershed Analysis. Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5381830.pdf



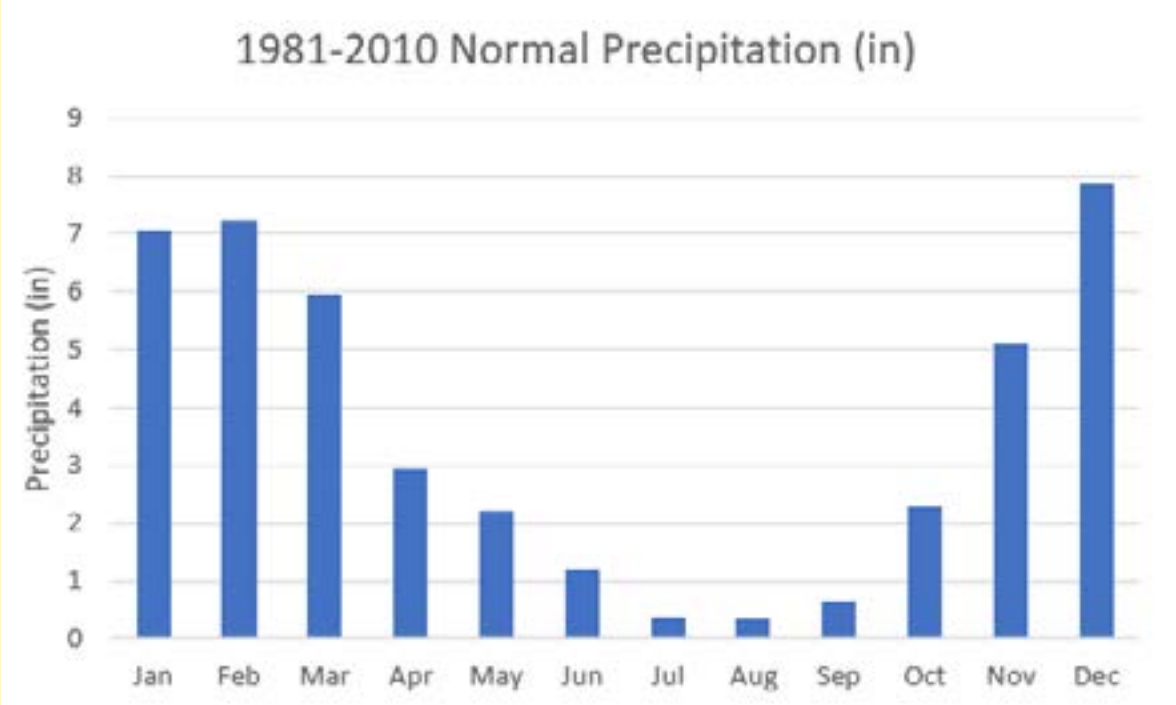


Figure 4.1: Average monthly normal precipitation levels in the City of Mt Shasta. Data obtained from: https://www.ncdc.noaa.gov/cdo-web/datatools/normals

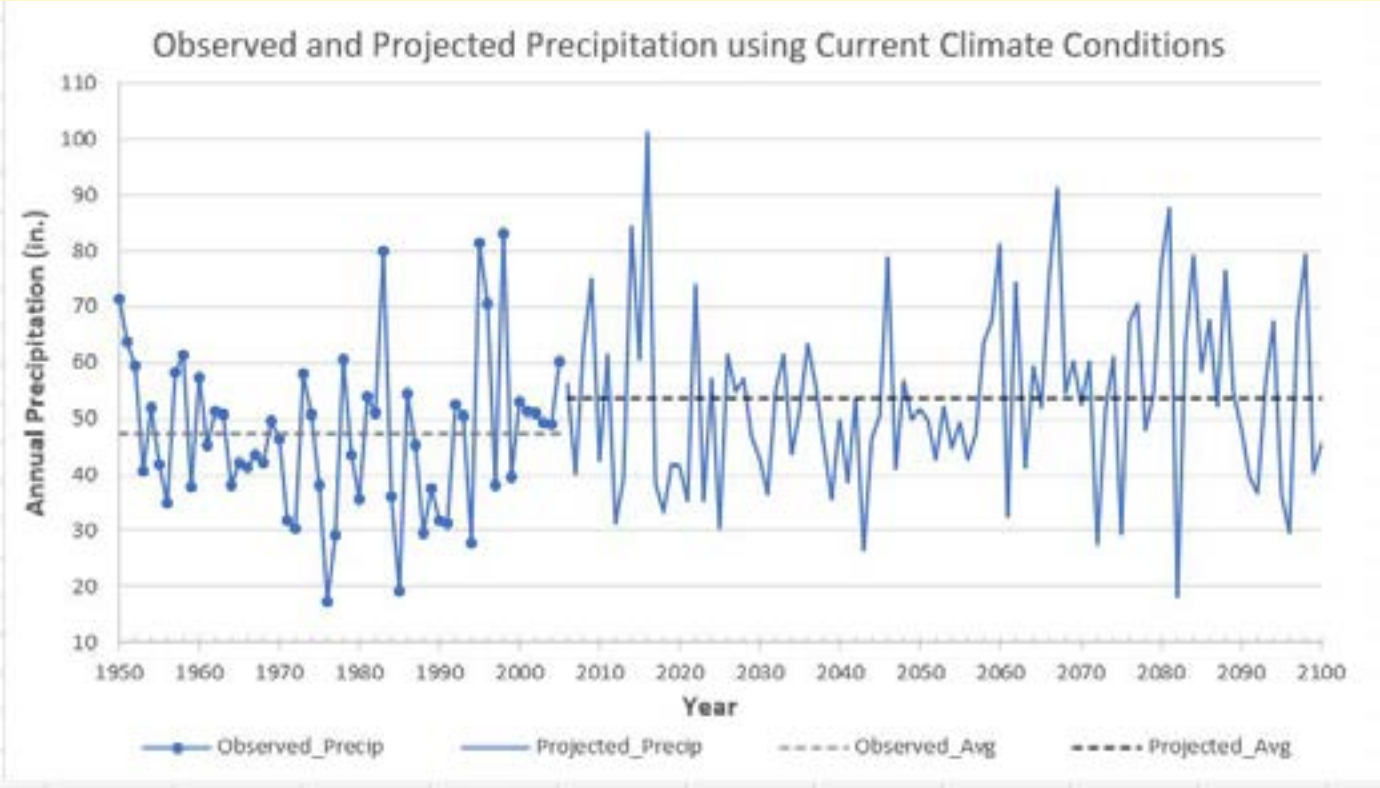


Figure 4.2: Observed and projected precipitation levels in the City of Mt Shasta using CanESM2. Note the observed data is graphed using points which indicates true values, whereas the projected data is drawn as simple lines. Source: CalAdapt

significant variability in precipitation year-to-year, with extreme wet and dry years being much more common than "average" years (Figure 4.2).

Climate change is expected to further exacerbate the region's year-to-year precipitation variability, with models predicting more "frequent, dramatic swings between wet and dry years" in what has been termed "precipitation whiplash" (Figure 4.3)[26]. Experts also predict that a greater percentage of the region's precipitation will be concentrated in a few major storms, called atmospheric rivers, which may increase the risk of both droughts and floods.[27]

Because of the very large elevation change between the City and Mount Shasta's summit (over 10,500 vertical ft in less than 9 miles), there are strong microclimate effects on and around the mountain. The most important effect is precipitation's dramatic increase with elevation, from an annual average of 40 inches in City Limits to over 70 inches above 7,000 ft. While the City experiences both rain and snow, precipitation is almost exclusively snow at elevations above 7,000 ft. In general, the south side of Mount Shasta is wetter and less windy, while a rain-shadow effect makes the north side of the mountain more windy and arid.[28] The City of

26 Grantham, Teodore (University of California, Berkeley). 2018. North Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCC4A-2018-001.
27 Grantham, Teodore (University of California, Berkeley). 2018. North Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCC4A-2018-001.
28 Grantham, Teodore (University of California, Berkeley). 2018. North Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCC4A-2018-001.

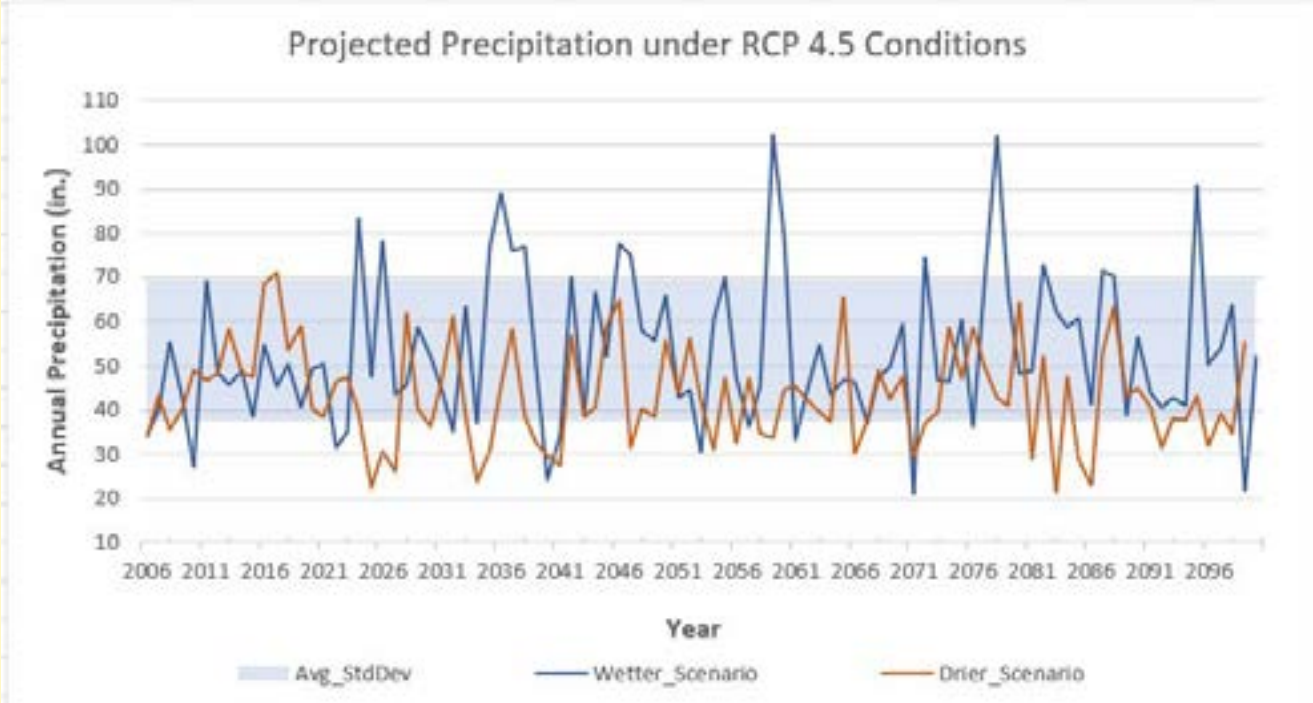


Figure 4.3: Projected precipitation levels in the City of Mt Shasta under RCP 4.5 Conditions; emissions peaking around 2040 then declining. The projected average value of 53.5 inches/year and corresponding standard deviation (σ), seen as a shaded buffer, represent the projected annual average under current climate conditions and were modelled using CanESM2. Model CNRM-CM5 was used to predict annual precipitation rates for "Wetter_Scenario" years and model HadGEM2-ES was used to show "Drier_Scenario" years. Source: CalAdapt

Mt Shasta sits on the southwest flank of the mountain between these extremes, with variable microclimate effects that can be difficult to predict.

Due to its alpine location, the City experiences cold snowy winters, which have important implications for drainage that most California cities don't need to consider. The Public Works Dept must remove snow from roads after winter storms by plowing, and individual residents are responsible for clearing their own driveways. Large snow berms form during the winter months, so runoff from impervious surfaces is often delayed or redirected, which allows for pollutants to become concentrated in snow banks before they are mobilized in runoff during thaw. Throughout the winter and early spring, the City experiences repeated freeze-thaw cycles which allow water to fill fractures and then widen them as water freezes and expands. This process, called frost-wedging, can significantly damage pavement, pipes, and other infrastructure. Other snow-related considerations include the City's deployment of anti-skid sand and cinders to its roads for traction purposes during snowy conditions, which add fine sediment to runoff when snow melts. Although the City is small, the presence of paved surfaces produces a small but noticeable urban heat island effect which accelerates snowmelt within the City compared to less developed locations just outside the City of Mt Shasta. Finally, because the coldest months are also the City's wettest, most of the City's stormwater runoff is generated in the winter when biological activity is seasonally dormant. The climate of Mt Shasta may therefore limit the effectiveness of green infrastructure techniques that have been proven effective in warmer regions of California, which seek to use plants or other organisms

to remove pollutants from runoff.

The City's previous Stormwater Master Plan considered warm rain-on-snow events beyond its scope. However, both local experience[29] and California's Fourth Climate Change Assessment [30]suggest these events are becoming more common (Figure 4.4). Rain-on-snow events deserve explicit consideration because snow-berms can obstruct the openings of storm drains and lead to water quality issues. The existing drainage system is designed for snowy winters instead of rainy winters. Certain engineering calculations, like the magnitude of 10 and 100-year floods, will explicitly account for climate change and the forecasted reduction in snow relative to rain and better prepare a system to meet future weather demands.

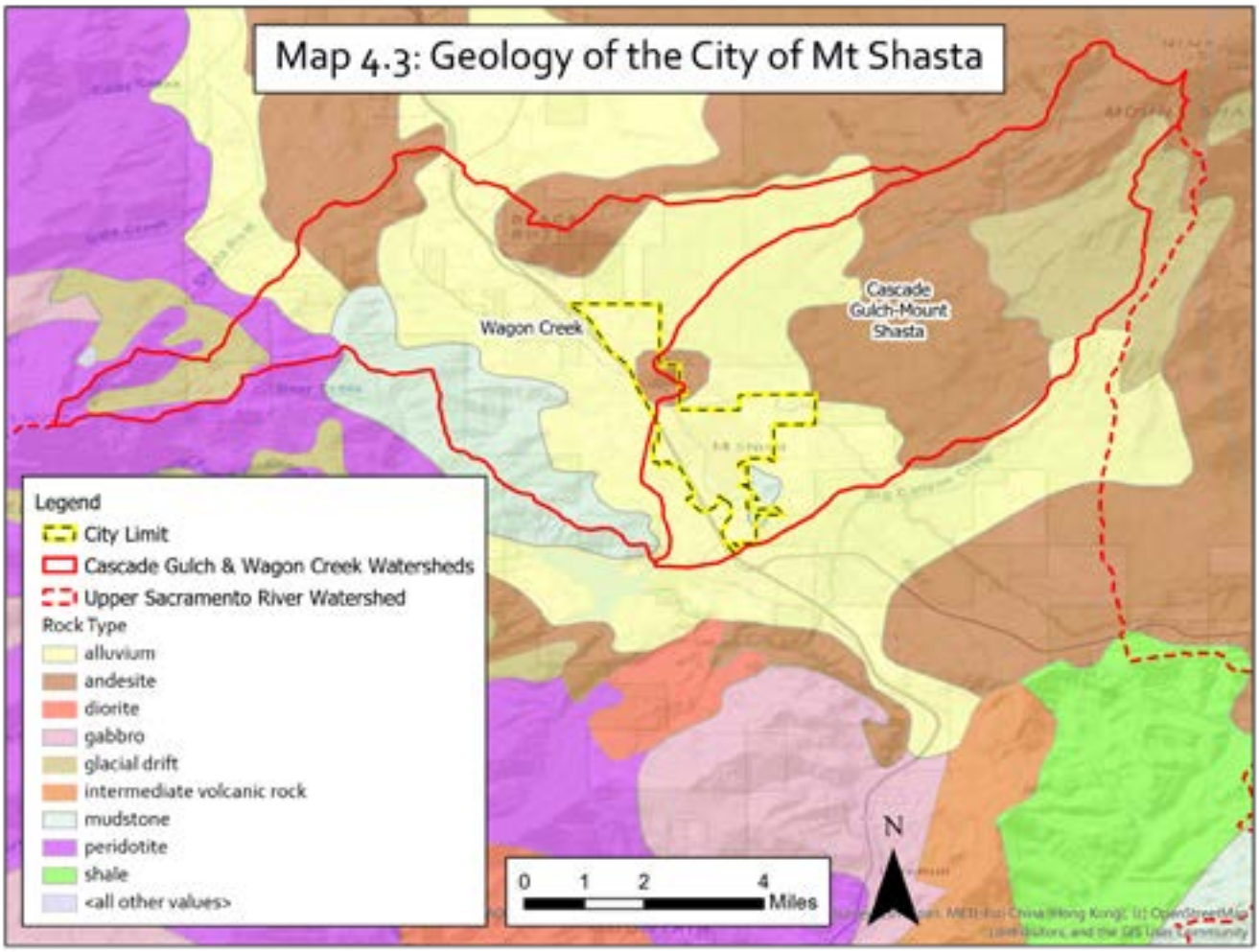
Figure 4.4: A rain on snow event caused local flooding throughout the City in February, 2017.

Geology

The geology of the surrounding mountains has a profound effect on hydrology and ecology in the City's watershed. The City of Mt Shasta lies at the boundary between two geologic provinces: the Cascade Range (Mount Shasta) and the Klamath Mountains (Mt Eddy). In the valley between these mountains, directly underlying the City, are a variety of geologic deposits including pyroclastic flows, volcanic debris flows, alluvial deposits, and sections of exposed volcanic and metamorphic bedrock (Map 4.3).[31] As a result of this varied geology, the City's

29 Lucchesi, J. (2017, February 13). Local Emergency Proclamation Ratification by Mt Shasta City Council.
30 Grantham, Teodore (University of California, Berkeley). 2018. North Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCC4A-2018-001.
31 Shasta-McCloud Management Unit Shasta-Trinity National Forest. (2012, May). Mt. Shasta Watershed Analysis. Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5381830.pdf

watershed includes areas where the hydrology is dominated by subsurface groundwater flow, and other areas where surface water bodies are fed directly by runoff. It is in this geologic context that alteration of natural hydrology by human development has occurred.



Immediately northeast of the City lies Mount Shasta, a major 14,179 ft stratovolcano of the High Cascades geologic province.[32] Stratovolcanoes like Mount Shasta are built of alternating layers of ash and lava; these volcanoes typically have steep slopes, infrequent but explosive eruptions, and are often composed of multiple overlapping cone formations.[33] Around the lower flanks of the mountain are numerous deposits of volcanic origin, including lava flows, debris and mud flows, and alluvial deposits from weathered volcanic rock.

The geology of Mount Shasta is important for three major reasons. First, the volcanic soils of the mountain are extremely permeable, which allows melting snowpack to infiltrate quickly into the ground rather than flowing over the land's surface.[34] As a result, there are no

32 Christiansen, R., Calvert, A., & Grove, T. (2017). USGS: Geologic Field-Trip Guide to Mount Shasta Volcano, Northern California. Retrieved from https://pubs.usgs.gov/sir/2017/5022/k3/sir20175022_k3.pdf

33 Oregon State University. (2020). Volcano World: Stratovolcanoes. Retrieved from http://volcano.oregonstate.edu/stratovolcanoes

34 Visser, A., Moran, J. E., Deinhart, A., Peters, E., Bibby, R., & Esser, B. K. (2016). California GAMA

permanent streams above 4500 ft elevation in the Cascade Gulch watershed; the hydrology of the upper watershed is instead dominated by groundwater flow through a volcanic fractured-rock aquifer. The second reason Mount Shasta's geology affects hydrology is that the volcanic aquifer within the mountain is structurally complex. The fractured rock system conveys Mount Shasta's spring water anywhere from 0 to 15 miles before water surfaces,[35] but the exact paths taken are not known. Although groundwater recharge from snowmelt high on the mountain feeds springs and wells at lower elevations, many policy-relevant details remain scientifically unresolved and will require additional research. These groundwater-fed springs are the third reason Mount Shasta's geology is crucial to the watershed: the two major creeks that flow through the City emerge from springs in or just above City Limits. Cold Creek and Big Springs Creek receive much of their flow from groundwater and therefore provide more consistent discharge than other streams. Numerous smaller springs and seeps are present and naturally contribute runoff to the City's storm drains during dry weather, especially in wetland areas.

Much of the Wagon Creek watershed also includes the volcanic terrain described above, but the western part of Wagon Creek Watershed drains the Eddy Range. This subrange of the Klamath Mountains is composed of metamorphic rocks which are much less permeable and therefore allow much less precipitation to infiltrate and become groundwater. Instead, parts of the watershed with Klamath Mountain geology have a hydrology dominated by surface runoff. This has created many permanent creeks with well developed riparian ecosystems and a more pronounced runoff response to precipitation events.[36]

Soils

Soil characteristics have important effects on hydrology at both a local and a landscape scale. Soils can influence infiltration rates, water chemistry, vegetation communities, and human development patterns, which can in turn affect each other in complex ways. Within City Limits, the major soil groups include Deetz gravelly loamy sand; Diyou loam, peat substrate; Neer-Ponto complexes; Asta gravelly sandy loam; and smaller quantities of other soil groups.[37] While it is not necessary to dwell on all the detailed properties of these soil groups, a few soil characteristics have direct implications for drainage. Two of the most important soil attributes, hydrologic rating and hydric rating, are discussed below.

Special Study: Tracers of recent recharge to predict drought impacts on groundwater: Mount Shasta Study Area. Lawrence Livermore National Laboratory,LLNL-TR-691810, Pp. 45. Retrieved 2018.

35 Visser, A., Moran, J. E., Deinhart, A., Peters, E., Bibby, R., & Esser, B. K. (2016). California GAMA Special Study: Tracers of recent recharge to predict drought impacts on groundwater: Mount Shasta Study Area. Lawrence Livermore National Laboratory,LLNL-TR-691810, Pp. 45. Retrieved 2018.

36 Upper Sacramento, McCloud, and Lower Pit Regional Watershed Action Group. (2018, December 13). FINAL DRAFT Upper Sacramento, McCloud, and Lower Pit Integrated Regional Water Management Plan. Retrieved from https://static1.squarespace.com/static/596f79d-12994ca9d650b05d8/t/5c12f6790ebbe886df317c13/1544746623253/Final Draft 2018 IRWM Plan_REVISED12132018.pdf

37 Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Official Soil Series Descriptions. Available online. Accessed 2020.

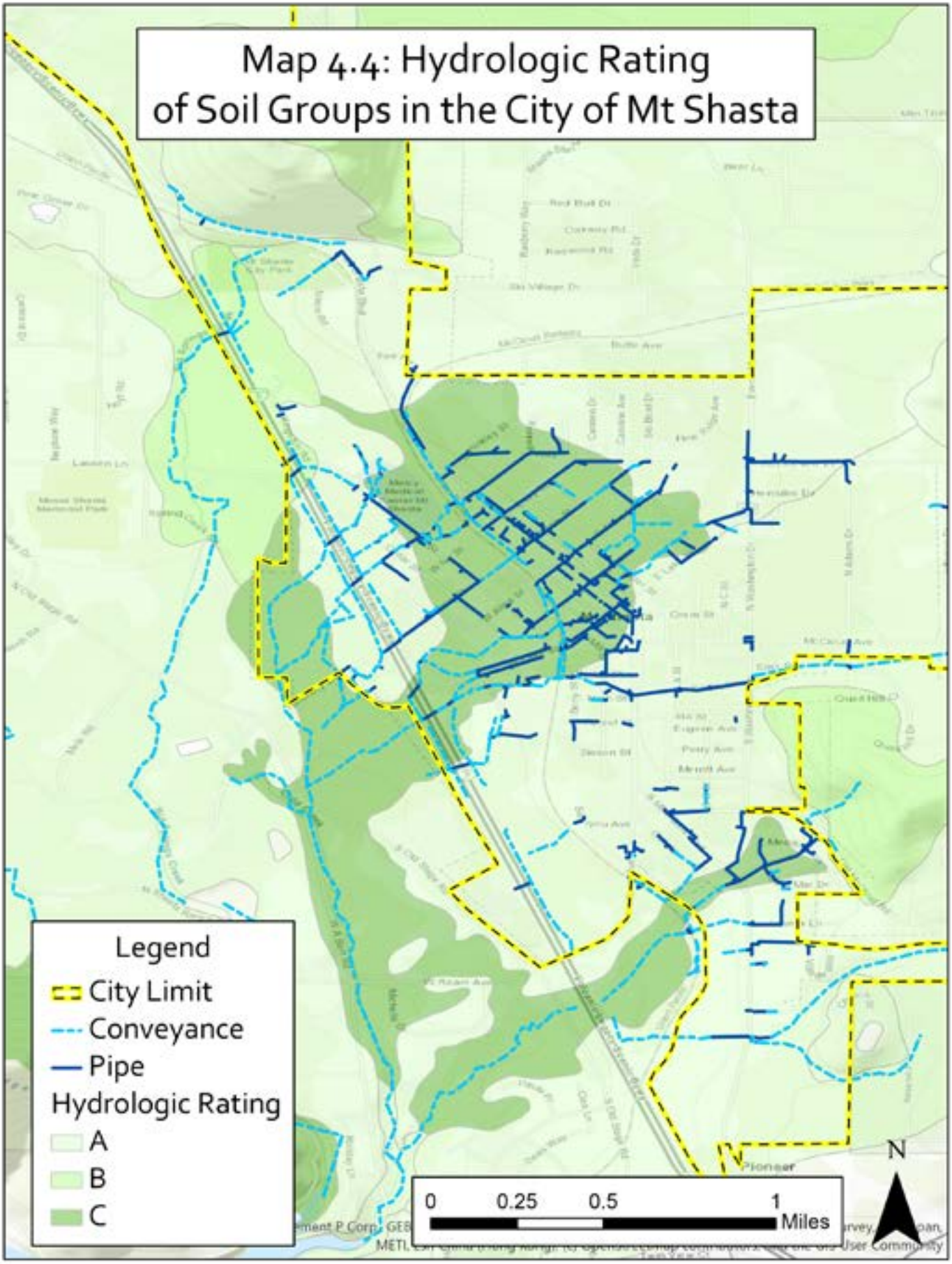
A soil's hydrologic rating is a classification that estimates the amount of runoff produced when rain falls on soil. The rating is based on a number of physical characteristics, including the speed at which water can be absorbed and the depth to groundwater. From these and other physical measurements, soils are categorized into 4 hydrologic groups, labeled A - D. Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted, while Group D soils have low infiltration rates and the highest runoff potential.[38][39] The City of Mt Shasta's watershed contains areas with soil groups from each of the four hydrologic ratings, although only Groups A - C are found within City limits.

As illustrated in (Map 4.4), presence or absence of the City's drainage infrastructure closely correlates with the distribution of hydrologic soil ratings. Most of the City's existing pipes and conveyances were built in areas corresponding to Group C soils, which is logical given that these soils types produce more runoff during precipitation events than Group A or B soils. The historic development of drainage infrastructure may in part have been a response to soil conditions. Of course, these hydrologic ratings reflect soil attributes before development, and have been altered by the construction of pavement, buildings, and other human infrastructure. In areas that are now fully developed with little or no original soil still exposed at the ground surface, the built environment will have a greater effect on how much runoff is produced than the underlying soil types. Conversely, new development will likely produce more "new" runoff if built on Group A and B soils, if these more absorbent soils are converted to impervious pavement and buildings.

Given these important differences in underlying soil characteristics throughout the City, design standards for new development or retrofits should reflect site conditions; some LID strategies are effective in areas with well draining soils but ill-suited for areas with low infiltration rates. Any LID strategy that relies on infiltrating runoff will perform best in A or B soil areas. The distribution of hydrologic ratings also has important implications for future Green Infrastructure development generally, with infiltration basins and swales being much better suited to Group A soils and constructed wetlands being more suited to Group C soils.

A soil's hydric rating (although easily confused with hydrologic ratings) is another distinct attribute with its own important implications for urban drainage. Hydric soils are those which "formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part."[40] In other words, hydric soils are defined by the prolonged presence of standing water, which in turn will dramatically reduce the amount of oxygen available to organisms. While most soils types contain small air pockets that plant roots use to respire, hydric soils have neither air pockets nor free oxygen. Instead, hydric soils usually contain distinct plant and microbe communities that have adapted to thrive in saturated, oxygen-poor conditions, and these soils are often associated with wetlands.[41]

38 Purdue University. (n.d.). Hydrologic Soil Groups. Retrieved from https://engineering.purdue.edu/mapserve/LTHIA7/documentation/hsg.html
39 Mitchell, R. (n.d.). Appendix A: Hydrologic Soil Groups . Retrieved from http://geology.wwu.edu/rjmitch/hydro_soil_groups.pdf
40 Soil Survey Staff. (n.d.). Hydric Soils - Introduction. Retrieved from https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/hydric/?cid=nrcs142p2_053961
41 Hurt. (2005). Hydric Soils. Encyclopedia of Soils in the Environment, 212–217. Retrieved from


Map 4.4: Hydrologic Rating of Soil Groups in the City of Mt Shasta
Legend
City Limit
Conveyance
Pipe
Hydrologic Rating
A
B
C
0
0.25
0.5
1
Miles
N

Map 4.5 shows the distribution of hydric soils in the City of Mt Shasta.

For the purposes of Mt Shasta's drainage, hydric soil ratings are important because they serve as a proxy for the extent of wetland and/or wet meadow soil conditions in the City. In areas that are very hydric, water is likely to pond at the surface, which can cause nuisance flooding, damage to building foundations, or increase infiltration of shallow groundwater into the sanitary sewer system. While very hydric areas are not good locations to attempt to infiltrate runoff through dry wells or swales, they may be excellent locations to construct or restore wetlands which offer other important stormwater quality benefits.

These differences in soils' hydrologic and hydric rating have important implications for future development and the feasibility of different stormwater management strategies. In general, the City's downtown area is built on hydric soils characteristic of wetlands and wet meadows with low infiltration rates, while large areas of the City's north and south ends overlie sandier, more permeable soils that naturally produce much less runoff. The City should be sensitive to these nuances, and understand that successful approaches to stormwater management must vary between neighborhoods.

Watershed Hydrology

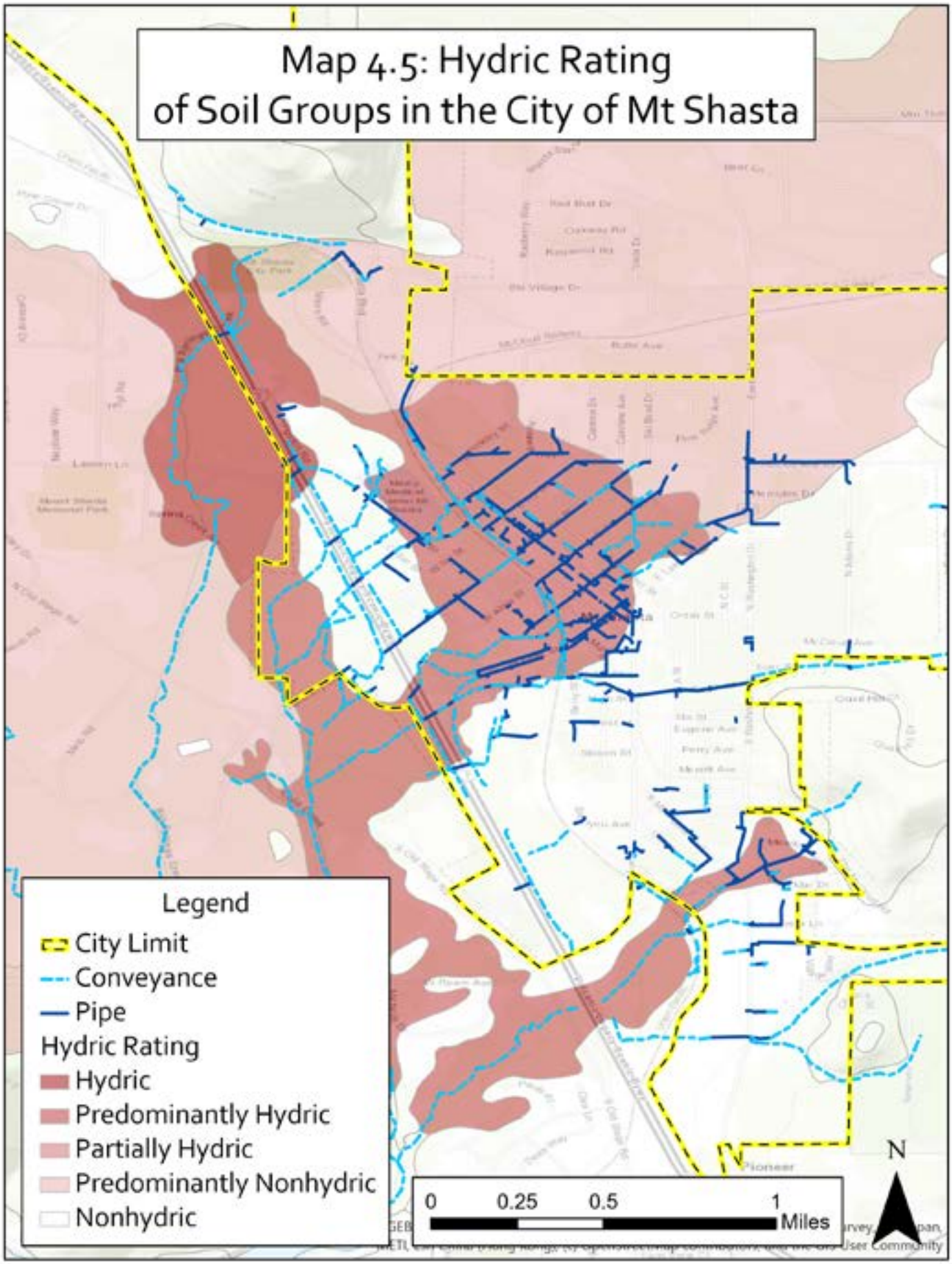
The City of Mt Shasta is located in an active hydrologic region where snow melt from Mount Shasta and the Eddy Range combine to form the headwaters of the Sacramento River. Generally speaking, the higher elevation areas of the Plan Watershed, especially on Mount Shasta itself, contain very porous soils and are dominated by subsurface flow with very little surface water. This zone of groundwater recharge transitions gradually to a zone of groundwater discharge starting at about 4100 ft elevation, where natural springs begin to emerge from the mountain. Many of these springs feed perennial creeks with very stable base flow. Numerous small unnamed springs in the vicinity of the City are also believed to contribute to the saturated soil conditions which sustain wetlands and wet meadows. The City of Mt Shasta's hydrologic setting can be summarized as consisting of upland areas with well draining soils, remnant wetlands with hydric soils, spring-fed creeks which have been altered and culverted in places, and man-made ditches. The wetlands, creeks, and ditches are discussed in more detail below.

Reliable supplies of groundwater have led to the formation of a palustrine (freshwater non-tidal)[42] wetland landscape in many parts of the City, with a variety of intermixed forested, scrub/shrub, and emergent wetlands. Forested wetlands have at least 30% aerial coverage by woody plants reaching 20 feet in height or greater (Figure 4.5a). Scrub/shrub wetlands are saturated lands with at least 30% aerial coverage by woody plants and stunted trees less than 20 feet in height (Figure 4.5b).[43] Emergent wetlands, often called marsh or wetland

https://www.sciencedirect.com/science/article/pii/B9780124095489051861

42 Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm (Version 04DEC1998).

43 Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Department of the Interior, Fish and Wildlife Service,


Map 4.5: Hydric Rating
of Soil Groups in the City of Mt Shasta
Legend
City Limit
Conveyance
Pipe
Hydric Rating
Hydric
Predominantly Hydric
Partially Hydric
Predominantly Nonhydric
Nonhydric
0
0.25
0.5
1
Miles
N

meadow, consist of saturated lands occupied by at least 30% areal coverage with persistent vegetation that is present throughout the year and consistent from year to year (Figure 4.5b). Emergent vegetation is defined as being rooted below water but has stems and leaves that extend above the water.[44] The general distribution of wetlands in Mt Shasta, as defined by the US Fish and Wildlife Service (FWS), is shown in Map 4.6. However, this designation comes with important caveats: the FWS wetland definition is nonregulatory[45], meaning the FWS definition is motivated by its agency's interest in managing wildlife habitat but its definition does not affect the jurisdiction of Federal law. The FWS National Wetland Inventory has identified 7.69% of the City (180 acres) as wetland based on 1983 aerial imagery. Importantly, the FWS stipulates that its wetland maps do not define "the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities."[46] In effect, the FWS suggests consulting other agencies and not relying on their maps to determine the geographic scope of the Clean Water Act. FWS wetland maps show areas where wetlands might potentially be, not where they are officially delineated in a legally binding sense.

Big Springs Creek, Cold Creek, and Mill Creek are natural drainages which flow through the City before draining to Lake Siskiyou. Big Springs Creek is the largest of these; it emerges from springs in Mt Shasta City Park and exits the City at the Park boundary under I-5. Big Springs Creek then continues flowing south through unincorporated low-density residential and agricultural areas until eventually joining Wagon Creek and Lake Siskiyou.

Cold Creek emerges from Cold Springs at an elevation of 4,167 feet on Mount Shasta, upstream of City Limits. The City owns rights to 100% of Cold Spring's waters for municipal purposes. The spring is capped and fully diverted from its channel to City water tanks. However, Cold Spring's production is often in excess of City needs, in which case excess flow is discharged to two main locations: the historic natural channel of Cold Creek; and an overflow ditch beginning near the City's water tanks at the top of Quail Hill, just east of City Limits. The historic channel of Cold Creek runs westward through the City but, due to human development, is culverted throughout much of this reach. The longest daylighted stretch of Cold Creek within the City is located between the UPR tracks and I-5. Currently, this area is overgrown with invasive plants and is lined with transient encampments, illegally constructed trails, and trash generated from neighboring businesses (Figure 4.6). West of I-5, Cold Creek is joined by several tributary ditches and then continues south parallel to W. A. Barr Rd until it reaches Lake Siskiyou.

Washington, D.C. Jamestown, ND: Northern Prairie Wildlife Research Center Online. http://www.npwrc.usgs.gov/resource/wetlands/classwet/index.htm (Version 04DEC1998).

44 Minnesota Dept of Natural Resources. (n.d.). Aquatic Plants: Emergent Plants. Retrieved from https://www.dnr.state.mn.us/aquatic_plants/emergent_plants/index.html

45 Tiner, R. W. (1997). Wetland Definitions and Classifications in the United States. Retrieved 2020, from https://water.usgs.gov/nwsum/WSP2425/definitions.html

46 U.S. Fish & Wildlife Service. (2018). National Wetlands Inventory: Data Limitations, Exclusions and Precautions. Retrieved 2020, from https://www.fws.gov/wetlands/data/Limitations.html

Figure 4.5: The City of Mt Shasta contains a variety of wetland types, including: A, Forested wetlands; B, Shrub/scrub wetlands; C, Emergent wetlands. In practice, these categories exist along a continuum, with many of the City's wetlands containing a mixture of one or more types.

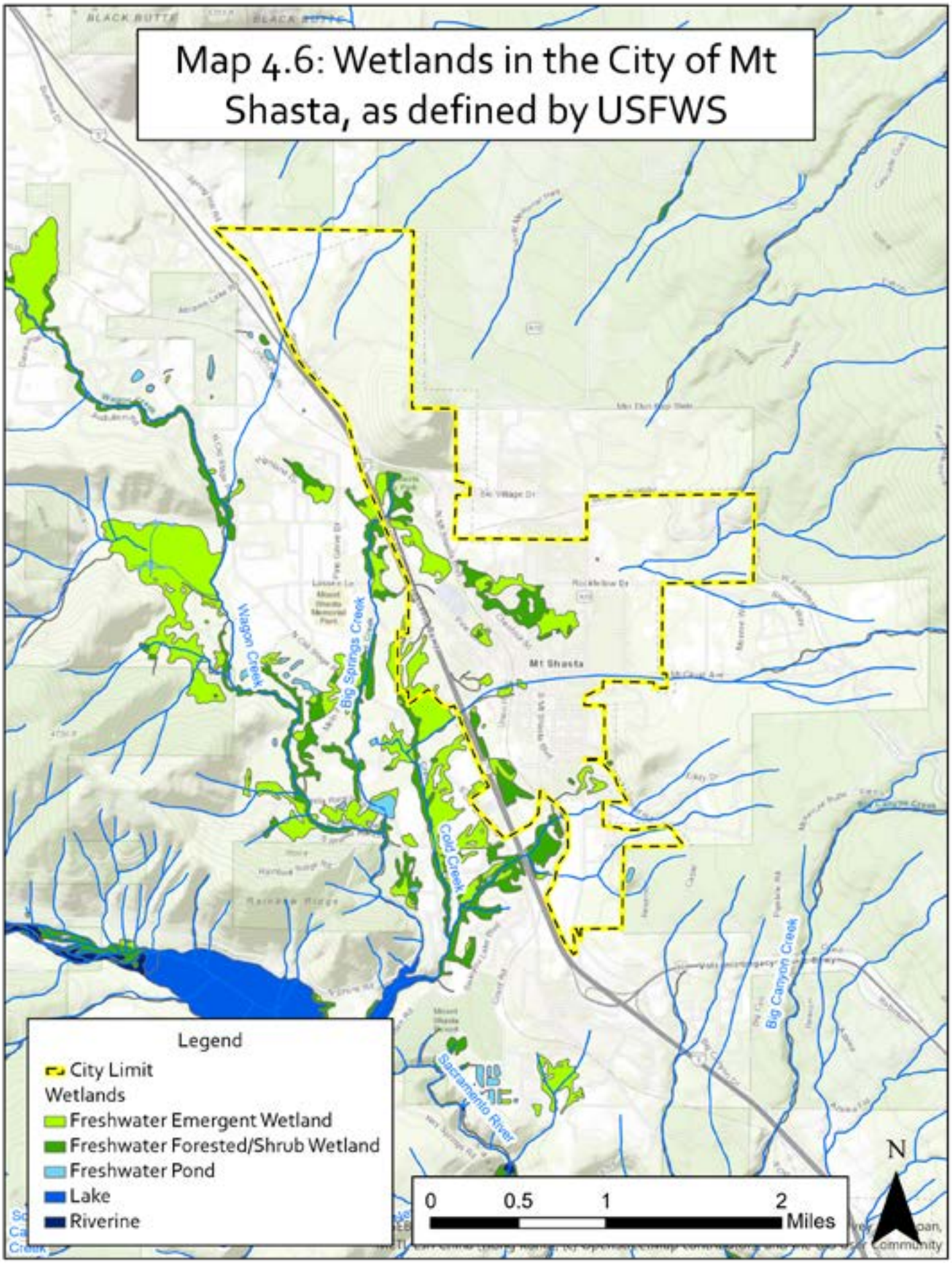

Map 4.6: Wetlands in the City of Mt Shasta, as defined by USFWS
Wagon Creek
Big Springs Creek
Cold Creek
Big Canyon Creek
Sacramento River
Mt Shasta
Legend
City Limit
Wetlands
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Freshwater Pond
Lake
Riverine
0
0.5
1
2
Miles
N

Figure 4.6: Cold Creek is a deeply incised urban creek that receives significant inputs of trash and debris from nearby encampments. Other sections of this creek are completely overgrown with invasive Himalayan Blackberry (Rubus armeniacus).

Mill Creek, the third major creek in the City, receives much of its baseflow from the overflow ditch fed by water discharged from the City's Water Tanks at Quail Hill. This overflow runs down a steep unlined channel before pooling in a reservoir locally known as "Speeny Pond", which is the beginning of Mill Creek proper. From the pond, Mill Creek is culverted under Old McCloud Rd and through residential and commercial properties until it daylights on the Roseburg Commerce Park property. Mill Creek was historically used to fill the man-made log pond of the Roseburg lumber mill, and although the pond is now drained, the Creek still runs through the old log pond basin. Soil contamination is known to exist in this area, although due to lack of water testing, it is not currently known whether Mill Creek is mobilizing any of these contaminants. Mill Creek exits City Limits through the west side of the log pond, passes under UPR and I-5, and then continues through undeveloped forest until its confluence with Cold Creek approximately ¼ mile upstream from Cold Creek's discharge point into Lake Siskiyou. The lower reach of Mill Creek outside City Limits was severely degraded in the 20th century due to flash flooding and land use impacts, but received substantial restoration work in the early 2000s that could serve as a model for other creeks in the Mt Shasta area.[47]

Small perennial tributary creeks to Cold Creek begin at Sisson Meadow and run westward through the center of the City. The creeks are culverted through the City's downtown, discharged between two commercial parking lots behind RiteAid, and continue through undeveloped parcels before exiting the City and joining Cold Creek west of I-5.

Most of the wet meadow habitat in the City is relatively small in acreage, however, two locations utilize the habitat for recreation purposes. Sisson Meadow, located between Castle St., Alma St, East Lake St, and Rockefellow Dr, is a 7.5 acre restored wetland meadow habitat that

47 Hesseldenz, T., & Tom Hesseldenz and Associates. (2004). Lower Mill Creek Corridor Resotration Project Final Report. Mt Shasta, CA.

allows visitors to enjoy a scenic boardwalk trail and offers amenities such as benches, picnic tables, and scenic viewpoints. Mercy Medical Center, a large local hospital between Pine St and North Mt Shasta Blvd also hosts a functioning wetland habitat on its property. The habitat on the hospital grounds includes trails, signage, perennial creeks, and a small pond feature.

Water Quality

The amount of chemicals and nutrients in waters is important to the overall health of the watershed. While some amount of chemicals and nutrients occur naturally through biological and geological processes, high levels of constituents can adversely affect ecosystems.[48] Water quality data available for the region is extremely sparse and variable in the parameters that have been tested. Multiple sources were compiled to gain some understanding about historic and more recent water quality levels. Overall, waters within the Plan Watershed are safe and of high quality

Regional Scale

The Upper Sacramento River, from its headwaters near Mt Shasta downstream to Shasta Lake, contributes very little of the total pollution found in the entire Sacramento River Basin. Regionally speaking, water is very clean. More specifically, lands within the Sacramento Headwaters sub basin (HUC 18020005) are believed to contribute very few pollutants to the larger Sacramento subregion (HUC 1802), based on the SPARROW model developed in 2012 by USGS. Of the pollutants generated by the 31 sub basins (small watersheds) within the subregion (entire Sacramento River watershed), it is estimated that only 0.01% of the total phosphorus, 0.02% of the total nitrogen, and 0.02% of the total suspended sediment are generated within the Upper Sacramento River sub basin. A more detailed breakdown of each pollutant source demonstrates the types of lands that contribute pollutants within the Sub Basin [Tables 4.1-4.3].[49] Data from the California Office of Environmental Health Hazard Assessment's (OEHHA) CalEnviroScreen 3.0 supports these findings.

Local Scale

To determine the health of local waters, two main sources from the US Environmental Protection Agency (EPA) were used for reference, the Ambient water quality criteria recommendations: information supporting the development of state and tribal nutrient criteria for rivers and streams in nutrient ecoregion II-western forested mountains and National Recommended Water Quality Criteria - Aquatic Life Criteria Table. The EPA has developed nutrient thresholds to help states evaluate and monitor the health of their local water bodies. To acknowledge regional differences in water quality, the EPA has divided the country into "ecoregions" and

48 California Water Resources Control Board Central Valley Region. The Water Quality Control Plan (Basin Plan) , The Water Quality Control Plan (Basin Plan) (2018).
49 Wise, D.R, 2019, SPARROW model inputs and simulated streamflow, nutrient and suspended sediment loads in streams of the Pacific Region of the United States, 2012 Base Year: U.S. Geological Survey data release, https://doi.org/10.5066/P9AXLOSM.

Source of Phosphorus	Total Generated in Sac. Basin	Total Generated in Sac. Headwaters Sub Basin	Percent Contribution to Total
Aggregated yield Urban land (kg/km2)	50.40	0.05	0.09%
Aggregated yield Wastewater treatment discharge (kg/km2)	451.41	0.00	0.00%
Aggregated yield Fertilizer and livestock manure applied to crop land (kg/km2)	45.11	0.00	0.00%
Aggregated yield Grazing cattle manure applied to pasture and range land (kg/km2)	140.24	0.00	0.00%
Aggregated yield Weathering of upland geologic material (kg/km2)	0.09	0.00	0.00%
Aggregated yield Channel sources (kg/km2)	39.08	0.01	0.02%
Aggregated yield Springs (kg/km2)	0.00	0.00	0.00%

Source of Nitrogen	Total Generated in Sac. Basin	Total Generated in Sac. Headwaters Sub Basin	Percent Contribution to Total
Aggregated yield from Urban land (kg/km2)	510.05	0.19	0.04%
Aggregated yield from Wastewater treatment discharge (kg/km2)	2116.28	0.00	0.00%
Aggregated yield from Fertilizer and livestock manure applied to crop land (kg/km2)	1563.94	0.01	0.00%
Aggregated yield from Scrub and grass land (kg/km2)	453.18	0.15	0.03%
Aggregated yield from Red alder trees (kg/km2)	2.93	0.00	0.00%
Aggregated yield from Atmospheric deposition (kg/km2)	1568.61	0.91	0.06%
Aggregated yield from Springs (kg/km2)	0.00	0.00	0.00%

Source of Sediment	Total Generated in Sac. Basin	Total Generated in Sac. Headwaters Sub Basin	Percent Contribution to Total
Aggregated yield from Urban land (MT/km2)	230.96	0.02	0.01%
Aggregated yield from Agricultural land (MT/km2)	149.07	0.00	0.00%
Aggregated yield from Forest land (MT/km2)	392.01	0.14	0.04%
Aggregated yield from Stream channels (MT/km2)	175.76	0.02	0.01%

Tables 4.1-4.3: Data generated from Sparrow showing sources of phosphorus, nitrogen, and sediment within the Sacramento Headwaters sub basin. The Sacramento Headwaters contribute very little of the total pollution in the overall Sacramento River Basin.

determined reference conditions based on their location and water body type; lakes and reservoirs, rivers and streams, and wetlands. The City of Mt Shasta is within Level 3, ecoregion 4, the Cascades.[50] Maximum contaminant levels for other pollutants of concern are found in the National Recommended Water Quality Criteria for Aquatic Life Criteria Table (Appendix D).[51]

The most recent data collected within the City was between 2010-2013 by the USGS California Water Science Center. The samples came from two locations, one from Cold Creek spring and the other from a City well located at the intersection of Lake Boulevard and North Washington Drive. Generally, waters from these samples can be classified as being soft,[52] acidic, and high in zinc (Appendix E). Local sediment characteristics likely cause the high zinc levels. Other than zinc, no other constituent from this dataset exceeds EPA standards.

Older data gathered from the 1970s and 1980s show pollutant levels within the City that exceed EPA standards, however, the reliability of the data is highly uncertain. Due to the lack of equipment accuracy, less stringent pollution monitoring practices, the closing of two lumber mills in the City, and lack of cohesion between the old dataset and the more recent dataset, only the 2010-2013 dataset aforementioned should be used to characterize present-day conditions.

The City of Mt Shasta currently has no internal program to monitor the quality of stormwater runoff within or downstream of the City, nor does it have a funding source to support such a monitoring effort. However, the City has developed a Quantifiable Metrics Action Plan (Appendix F) which outlines what water quality monitoring it plans to pursue when and if funding becomes available. The City has applied for grant funding in the past to support stormwater quality monitoring but has not been successful to date.

Pollution Generating Activities

Priority Water Bodies

Water quality in the Mt Shasta region is generally excellent, and no impaired water bodies are located within City Limits. However, all runoff generated in the City and from nearby unincorporated County and National Forest lands flows into Lake Siskiyou and eventually Shasta Lake. Both of these lakes are impaired with mercury according to §303(d) of the CWA.

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50 US Environmental Protection Agency, Office of Water, Office of Science and Technology, Health and Ecological Criteria Division. Ambient water quality criteria recommendations: information supporting the development of state and tribal nutrient criteria for rivers and streams in nutrient ecoregion II-western forested mountains (2000).

51 US Environmental Protection Agency. (2020). National Recommended Water Quality Criteria - Aquatic Life Criteria Table. Retrieved from https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

52 USGS. (2020). Hardness of Water. Retrieved from https://www.usgs.gov/special-topic/water-science-school/science/hardness-water?qt-science_center_objects=0#qt-science_center_objects

[53]Mercury can be found naturally in the environment in metallic, inorganic, and organic forms. Both human and natural processes are responsible for the occurrence and concentration of mercury levels in stream waters and streambed sediments.

Due to the County's rural nature and the lack of mercury-generating power plants, most mercury is assumed to come from the large amount of forest and wetland habitats in the region. Mercury levels in streambed sediments have been shown to increase with the presence of forested land cover. Mercury can also be emitted from volcanoes,[54] and its presence locally is likely elevated due to the long history of volcanism at nearby Mount Shasta. Methylmercury, the most common form of organic mercury, tends to increase in both stream water and streambed sediments with the presence of wetlands, which are also naturally abundant in the Plan watershed. Other likely sources of mercury deposition within the region include wildfires, the burning of wood and household trash, and the reintroduction of mercury in rain and snow via the water cycle.[55]

Mercury generated by residents of the City of Mt Shasta is likely low since burning is restricted to clean, non-treated lumber and vegetation.[56] However, mercury levels in local streams should be monitored in the future to aid efforts to improve the quality of impaired waters and protect water for downstream users. Although Lake Siskiyou is listed as impaired with mercury, no Total Daily Maximum Load (TDML) has been set and the source of the mercury has not been identified by regulators. The City is ready and willing to adjust its management approach as more detailed scientific information becomes available.

Human Effects

Populations living in and around the City of Mt Shasta affect the quality of the land and its resources. Interstate-5, which runs the length of California, closely follows the upper Sacramento River between the City of Mt Shasta and Shasta Lake. Traveling tourists, freight trucks transporting goods, and local commuters from neighboring towns bring high traffic volumes along I-5 each day. Vehicles traveling this stretch of highway contribute airborne, liquid, and solid pollutants into the Plan watershed year-round, but it is likely that relatively few of these vehicles begin or end their trips inside the City of Mt Shasta.

Another factor affecting the quality of waters in the Upper Sacramento River watershed is urban runoff. Urban runoff is pollutant laden stormwater carried over impervious surfaces from cities into storm drains and creeks.[57] Because of the rural nature of the City of Mt Shasta

53 US Environmental Protection Agency. (2016). California 303(d) Listed Waters for Reporting Year 2016. Retrieved from https://ofmpub.epa.gov/waters10/attains_impaired_waters.impaired_waters_list?p_state=CA&p_cycle=2016
54 Brigham , M. (n.d.). Mercury. Retrieved from https://www.usgs.gov/mission-areas/water-resources/science/mercury?qt-science_center_objects=0#qt-science_center_objects
55 US Environmental Protection Agency. (n.d.). Basic Information about Mercury. Retrieved from https://www.epa.gov/mercury/basic-information-about-mercury
56 City of Mt Shasta Municipal Code 7.15.050
57 California Stormwater Quality Association. (2003). Stormwater Best Management Practice Handbook.

as well as the low population, there are very few large paved surfaces in the City. However, the cumulative impacts of the City's approximately 50 miles of roads and hundreds of buildings and parking lots do produce polluted runoff and should be addressed. To that extent, specific areas within the City have been identified as having a high-risk of contributing pollutants such as trash, dirt, metals, and chemicals from vehicles. Areas identified include: auto mechanic shops, gas stations, and parking lots having more than 25 spaces.

Road salts and abrasives applied during the winter season also likely affect local waters. The City does not use de-icing chemicals or salt, but individual property owners and neighboring agencies within the Plan Watershed, including CalTrans and Siskiyou County, do. These deicing chemicals and sediments are likely entering water bodies in and near the City. For instance, Caltrans reported that for the 2015/2016 fiscal year, they applied 9,649.15 tons of sodium chloride, 19,517.46 tons of magnesium chloride, 900,816 gallons of sodium chloride brine (23% salt to water solution), and 105,002.37 tons of abrasives throughout District 2. Application of materials varies with temperature and depth of snow and ice cover (Appendix G). Due to the vast extent of District 2,[58] as well as the varying application levels and methods used, the exact amount of deicing and abrasive materials used near the City of Mt Shasta by Caltrans is unknown.[59] However, because Black Butte Summit is one of the snowiest and highest elevation sections of I-5, it is possible that a disproportionate share of CalTrans District 2's deicing chemicals are applied within the Plan watershed. Additionally, post-storm removal of salt and abrasives by Caltrans is believed to be minimal (CalTrans, personal communication, Dec 18, 2020).

In snowy conditions, Mt Shasta City Public Works staff apply volcanic cinders onto high-traffic and steeply sloping City roads and intersections and then remove as much of the cinders as possible when weather permits. Over the last 4 years, the City has applied an average of 90 cubic yards of cinders onto City streets annually. An unavoidable consequence of applying volcanic cinders is their accumulation in snow berms and eventual transport into the City drainage system and receiving waters with snowmelt. The contribution of fine sediment to the stormdrain system is partially, but not fully, mitigated by the City's street sweeping efforts.

Like many California cities, Mt Shasta includes a population of unsheltered individuals, many of whom lack access to adequate sanitation facilities or clean water. A point-in-time count conducted in January 2020 recorded 244 homeless people in Siskiyou County, with the highest concentrations along the I-5 corridor in the Cities of Mt Shasta, Weed, and Yreka.[60] Data on the City of Mt Shasta alone was not available. Additionally, because the count was conducted in the winter, when the unsheltered population is believed to be at its lowest, the number of individuals reported is likely far lower than the actual population during warmer seasons. The seasonal encampments that spring up on forested land in and around the City

58 Smith, C. (2016). An Overview of Winter Operations . Retrieved from http://ahmct.ucdavis.edu/wp-content/uploads/wploads/chris_smith_winter_operations_overview.pdf
59 CalTrans. (2016). Chapter R Snow Control . Retrieved from https://dot.ca.gov/-/media/dot-media/programs/maintenance/documents/29-chap-r-jan-2016-a11y.pdf
60 I-5 corridor holds most of Siskiyou's homeless population. (2020, March 14). Mount Shasta Herald . Retrieved from https://www.mtshastanews.com/news/20200314/i-5-corridor-holds-most-of-siskiyous-homeless-population

contribute trash and human waste to the Plan watershed. In many cases, encampments are abandoned after a few months of use, leaving behind pollutants like litter, human waste, pharmaceuticals, and chemicals unless eventually removed by community volunteers. There are no shelters for people experiencing homelessness between Yreka and Redding; this likely contributes to the issue.

5. Existing Drainage System

History of Drainage System Development

150 years ago, the land that is now the City of Mt Shasta consisted mostly of meadows and wetlands in the lowland areas, and mixed conifer and oak forest with well draining soils in the upland areas. "Judging by patterns observed from remnant undisturbed wetlands in the Mt Shasta area, stormwater runoff probably followed a complex network of small meandering stream channels during smaller storms, and sheet-flowed through wetlands areas during larger storms. As such, Mt Shasta's wetlands prior to European settlement probably functioned much like a broad floodplain, and erosive hydraulic forces during storm events were thereby minimized."[61] The region's indigenous people also regularly used prescribed fire to maintain these vegetation patterns and promote habitat for useful animals and plants. The ecology and hydrology of Mt Shasta was altered dramatically by the arrival of European settlers in the late 19th and early 20th century, as logging, agriculture, fire suppression, and urban development occurred. These historic changes in land use have direct implications for the performance of the City's drainage system that exists today.

Mt Shasta's early settlers built drainage infrastructure gradually, in an ad hoc manner without guidance from any City-wide planning documents. With the introduction of agriculture, farmers cleared riparian vegetation from around streams and wetlands, and constructed a network of ditches to drain saturated fields and to irrigate dry ones. This agricultural ditch network, which was not originally intended to handle urban stormwater runoff, has become the framework around which most of the City's other drainage infrastructure has evolved. With the construction of Interstate-5 (and the railroad to a lesser extent), runoff that had sheet-flowed through wetlands was instead conveyed to a finite number of culverts that cannot be easily expanded. Industrial logging has compacted the soil in many parts of the upper watershed, such that forest areas that historically produced little runoff even in large storms are now more susceptible to flash-flooding. Throughout the City's development, impervious areas like pavement and buildings expanded at the expense of open spaces like forests, floodplains, and wetlands, which has reduced infiltration and increased peak storm flows.

Maintenance of drainage infrastructure was also inconsistent over most of the City's history. Many key pipes and conveyances are undersized and have repeatedly proved to be insufficient

61 Hesseldenz, T., & Humphrey, J. (1995). Stormwater Runoff Analysis of the Proposed Expansion of Mercy Medical Center Mount Shasta.

to handle major storm events. The City's first Stormwater Master Plan, written in 1999, sought to address the worst problem areas, but 20 years later, the Plan's suggested projects have only partially been implemented. Today, Mt Shasta's stormwater system consists of remnant creeks and wetlands which are interconnected to an aging network of pipes, drains, ditches, and culverts. There is a great deal of deferred maintenance in the system, with key pieces of infrastructure at or beyond their design lifetime.

Existing System

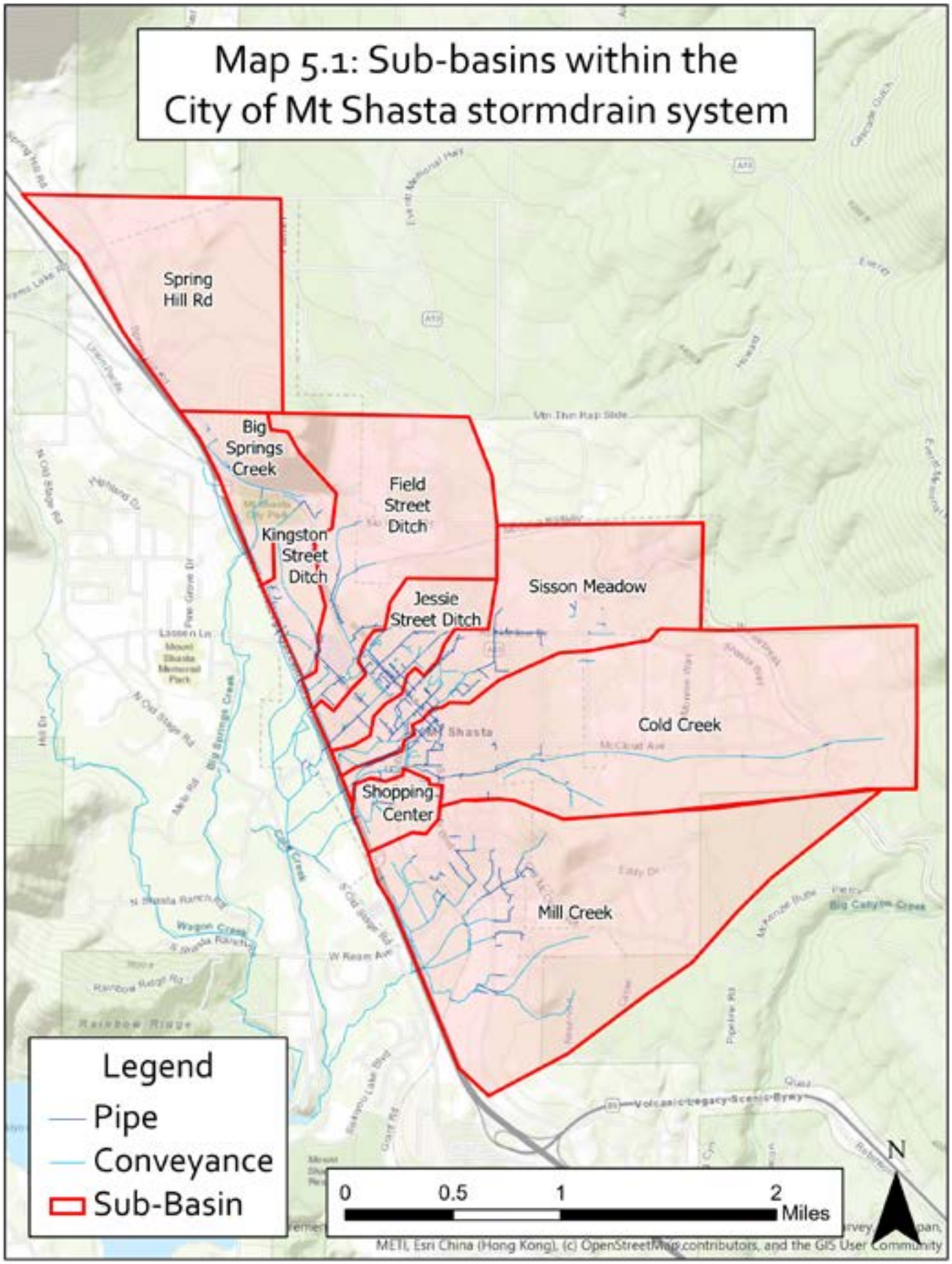
The City's stormdrain system consists of approximately 12.84 miles of enclosed pipe, 14.9 miles of open conveyances (including segments of natural creeks), 378 inlets, 87 manholes, and 37 outlets. The most common pipe materials are corrugated metal (44.1%), concrete (16.4%), polyvinyl chloride (13.0%), and high-density polyethylene (6.6%), with lesser amounts of asbestos concrete, steel, and cast iron. Pipe material has not been identified for 12.9% of the City's pipes, typically because these segments lacked above-ground access or accurate documentation. The gravity-controlled pipe network has been mended and replaced throughout the years, leading to the interconnection of various pipe materials. Because of the many materials used and their differing ages of installation, much of the pipe network is in various states of disrepair and City staff believe most of the pipes have reached the end of their design lifetime, although documentation is sparse.

Because all runoff generated in the City eventually flows through culverts under Interstate-5, the volume of stormwater these culverts can convey represents the limiting factor for the volume of stormwater runoff the City may produce. The drainage system can be divided into sub-basins based on which culvert under I-5 each area of the City drains through (Map 5.1). Sub-basin delineation is a crucial step in hydraulic and hydrologic modeling performed by the City Engineer. To date, adequate data has been gathered to allow City Engineers to model the City drainage system at the sub-basin scale (Table 5.1).

Drainage Basin	Hydrologic Rating	Drainage Area (ft^2)	Land Use by Category*	Dry Weather Flow (cfs)
Cold Creek	10% C, 20% B, 70% A	16488685.6	30% S, 20% B, 50% W	0.6
Sisson Meadow	50% C, 50% A	11541085.5	10% S, 20% B, 15% W, 30% D	1.14
Jessie St Ditch	80% C, 20% A	646274.0	60% S, 25% M, 10% B, 5% D	3.69
Mill Creek	15% C, 85% A	18084553.0	15% S, 15% M, 20% B, 10% L, 40% W	Needed
Shopping Center	90% C, 10% A	2352548.6	20% S, 50% B, 30% W	N/A
Field Street Ditch	85% C, 15% A	10864590.7	10% S, 70% L, 10% W, 10% D	Needed
Big Srings Creek	30% B, 70% A	7949732.0	10% S, 30% W, 60% D	Needed
Kingston Street Ditch	10% C, 70% B, 20% A	3371804.7	25% M, 15% B, 60% W	N/A
Spring Hill Road	10% B, 90% A	6395954.8	10% B, 60% W, 30% D	N/A

*Note: S= single-family areas, M= multi-unit, B= bussiness, D= developed parks, L= light industrial, W= woodlands

Table 5.1 Data that characterizes the City's drainage patterns by sub-basin.


Map 5.1: Sub-basins within the City of Mt Shasta stormdrain system
Spring Hill Rd
Big Springs Creek
Field Street Ditch
Kingston Street Ditch
Jessie Street Ditch
Sisson Meadow
Cold Creek
Shopping Center
Mill Creek
Legend
Pipe
Conveyance
Sub-Basin
0
0.5
1
2
Miles
N
METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Winter Conditions

The City's drainage system changes during the winter months when snow berms are piled up onto the streets. On wide high-traffic streets, snow berms are made to run through the center of the street, sometimes converting two-lane streets down to a single lane. On most streets in the City, the snow berms are located at the edges, along the curbs. City ordinances prohibit the act of covering storm drains with snow, but the snow berms along the curbs still affect the intended drainage course of flowing snow melt. Initially, snow melt is forced to follow the berms edge rather than the curb's and, eventually, snow melt creates a hole in the berms that allows the melt to flow under the berm and follow the curbline. This process may cause the runoff to bypass the intended drain it was meant to flow into and pick up excess pollutants on its new path. Although this process is recognized, few options exist to remediate it.

Deficiencies of the Existing Drainage System

The stormwater drainage system of the City of Mt Shasta is old and not well documented, creating ongoing problems for the City. Because of the lack of documentation, important details about the infrastructure, such as location, size, material, age, and connection points are lost. Some details, especially in older areas of the City, are known only to long-term residents and civil servants, while some remain unknown completely. Further, operation and maintenance (O&M) schedules are non-existent. The earliest recorded pipes were installed in the 1950's and have likely undergone serious erosion and wear, however, without an O&M schedule in place, periodic maintenance gets overlooked and occasionally causes system failures.

One such instance occurred in the New Years Flood of 1996/97. The City experienced a severe storm event that, when combined with the melting snowpack, exceeded the capacity of the existing infrastructure to handle the stormwater runoff. The stormwater damaged multiple buildings and homes, leading to the addition of curb and gutter sidewalks along multiple areas of the City, pipe replacements, and other improvements (1999 Plan).

Another difficulty the City encounters is standing water. Standing water occurs throughout the year due to a variety of reasons, the first and most unavoidable of which is the high groundwater table. Much of the soil underlying the City of Mt Shasta is saturated year round by groundwater resurfacing from nearby Mount Shasta. When the groundwater intersects the surface, it creates either a flowing rill or an unmoving pool. How the emerging water behaves depends on land use type, topography, soil type, and soil saturation. In some locations in the City, particularly near the center where the hydrologic rating is C (Map 4.4), there are numerous wetlands fed by emerging groundwater.

Standing water has also been discovered inside the City's stormwater infrastructure. Water can accumulate inside the infrastructure's catch basin if the outflow pipe is clogged or if the invert (depth) of the outflow pipe is located improperly. The City has created an interactive mapping system to help resolve this issue. With the map, City staff can identify malfunctioning or clogged drains and rate their level of urgency so that they may be addressed as needed.

6. Identification of Multi-Benefit Projects

Per SWRP Guidelines and Water Code, § 10561, projects identified in stormwater resource plans must achieve multiple, simultaneous benefits in the categories of:

- Environment
- Community
- Water supply
- Water quality
- Flood management.

To ensure these overarching goals were met, the City decided to pursue a multi-tiered approach of stormwater management in the form of adopted policies, actionable programs, and project developments. The combined effects of policies, programs, and projects are intended to balance stormwater management efforts throughout the Plan Watershed with a community-driven, cost effective, and pragmatic approach.

Policies were drafted with the intention of protecting and restoring wetland and riparian ecosystems, addressing current pollution issues, and to encourage the integration of low impact development in new and upgraded infrastructure and developments. Programs are intended to outline long-term stormwater improvement goals that foster watershed stewardship within the larger community. Lastly, stormwater capital improvement projects are intended to improve water quality and drainage infrastructure, enhance pedestrian safety and sidewalk connectivity, and lower flooding occurrences throughout the City.

Programs and Policies

Programs and policies were developed to further promote natural drainage patterns and other stormwater best management practices (BMPs). They were created by reviewing current City ordinances, researching modern BMPs, and by gaining input from the public. Programs and policies have been ordered below by public approval received at the March 5th Public Meeting (Tables 6.1 and 6.2). The combined effects of all programs, policies, and physical projects, once implemented, is expected to bolster the multiple benefits achieved for both dry and wet weather conditions.

Programs "The City should start..."	Votes of Approval/ Support
incentivizing the conversion of turf grass to natural stormwater focused features	5
utilizing alleyways for the creation of trails and stormwater features	5
creating an Adopt-a-Drain program	5
requiring roof gutters discharge to vegetated areas	4
purchasing properties exceeding 70% wetland and/or riparian area	4
providing setback and zoning options to developers to avoid wetland and riparian disturbance	3

Policies "The City should require..."	Votes of Approval/ Support
no net loss of wetlands in City limits	7
greater water quality protections in place for high-polluters	6
native plant buffers along wetland and riparian corridors	6
green infrastructure in parking lots	5
dedicating 10% of the width of new roads to green stormwater infrastructure	4
pervious surface for new developments	4
the installation of bioswales on street corners	2
a ban of certain household and yard chemicals	2
property owners with wetland or riparian corridors to dedicate a conservation easement	2

Programs

Incentivizing the conversion of turf grass to natural stormwater focused features: The practice of local governments creating native landscaping ordinances to promote the use of native vegetation is not new and has been approved in court proceedings on the merit of protecting the public's interest in public health, safety, and welfare.[62] Addressing the financial burden placed on the community, rather than simply creating an ordinance to promote native vegetation, the City will create a program that helps fund the process.

Utilizing alleyways for the creation of trails and stormwater features: City-owned alleys can be developed for the dual purpose of increasing active transportation opportunities as well as increasing stormwater management features. The City of Dubuque, Mississippi, has a very successful program in place that the City can use as a reference model.

Creating an Adopt-a-Drain program: Adopt a storm drain programs are created to enhance community awareness of stormwater runoff, build partnerships with citizens and private developers, and encourage sustained stewardship of stormwater infrastructure. Programs like these can be found all over the nation.

Requiring roof gutters discharge to vegetated areas: Rain and snow that accumulates on roofs often gets discharged onto City streets, where it picks up pollutants and transports them into local waterways. The significance of this issues is gaining so much attention, that some cities have even begun offering design guidelines and step-by-step instructions to help expedite the process of roof gutter redirection.

Purchasing properties exceeding 70% wetland and/or riparian area: Through this program, the City could preserve undeveloped wetland and riparian areas through acquisition. This program would allow the City to preserve wildlife habitat, improve water quality, reduce flood risks, and increase recreation opportunities.

62 T. Ankerson and E. Zimmerman. (2020). Model Native Plant Landscape Ordinance Handbook. Conservation Clinic. Retrieved from https://www.law.ufl.edu/_pdf/academics/centers-clinics/clinics/conservation/resources/model_native_plant.pdf

P**roviding setback and zoning options to developers to avoid wetland and riparian disturbances:** Guidance from municipalities is needed to determine the appropriate distance between developments and water courses. A suite of setback and zoning options should be designed to allow development flexibility and ensure the greatest environmental protections.

Policies

Requiring no net loss of wetlands in City limits: Wetlands are valuable habitat for native and migratory species, improving air quality, stormwater capture and treatment, and reducing flood risks. They should be preserved wherever possible.

Greater water quality protections in place for high-polluters: This policy would mandate the installation of stormdrain filters and other low impact developments near areas that are known to generate a substantial amount of pollution.

Native plant buffers along wetland and riparian corridors: Wetland and riparian buffers are areas of land that run adjacent to a water body and are managed to protect quality of water and natural habitat. Buffers can be created in a variety of ways, but all are created with the intention of enhancing natural environments and to deter from loss of life and property damage.

Green infrastructure in parking lots: Stormwater runoff from parking lots carries grease, oil, and metals that fall from vehicles directly into the City storm system and local waters. The addition of green infrastructure would help to capture, store, infiltrate, and facilitate the evapotranspiration of stormwater.

Dedicating 10% of the width of new roads to green stormwater infrastructure: New and redevelopment projects have the greatest potential for incorporating green infrastructure into roads. Green infrastructure such as vegetated strips along sidewalks, vegetated bump-outs, and vegetated curb-extensions can all increase pedestrian safety while managing stormwater runoff.

Pervious surface for new developments: Greater emphasis should be placed on balancing impervious surfaces with green, pervious surfaces that allow for natural infiltration to occur where rainfall lands. This policy will help reduce flood risks, improve water quality, and enhance the quality of local aquatic habitats.

The installation of bioswales at street corners: Areas of paved streets that do not allow parking or vehicle traffic can be retrofitted with green infrastructure to increase stormwater capture and treatment.

A ban on certain household and yard chemicals: Banning the sale of harmful chemicals within City limits would lessen the extent to which those chemicals are found in the watershed.

Of most concern are insecticide and herbicide products containing pyrethroids, chlorpyrifos, diazinon, and malathion.

Require property owners with wetlands and/or riparian corridors to dedicate a conservation easement: A conservation easement is a flexible tool that landowners can use to preserve the inherent quality and uses of their land. Landowners may retain ownership and use of their land or sell or donate it to the easement holder, who agrees to maintain it in perpetuity. This policy would encourage the preservation of high-quality natural environments.

Stormwater Projects

Projects were identified through a combination of local knowledge from City staff and community members, reviews of historic stormwater documentation including the previous Stormwater Master Plan, and field verification using the GIS. A main component of project determination was meeting the criteria of achieving multiple benefits per SWRP guidelines. Another major consideration was addressing the City's dilapidated infrastructure. Ultimately, the importance of these two components is reflected in each project. Detailed information about each project's location, drainage issues, and proposed changes can be found in Appendix H, the Stormwater Master Plan Project List. The City chose to include its project proposals in an appendix so ongoing community feedback can be incorporated into Project Proposals without the main Plan document needing to be edited or re-approved by elected officials after its passage.

Due to the lack of data and funding sources, the exact benefits of each project in terms of SWRP-defined quantifiable metrics have not been calculated. The quantification of most metrics has been postponed until projects reach further stages of development. In Lieu of quantified metrics, City staff have worked to identify and score projects based solely on the perceived, or potential, benefits of each project.

7. Project Prioritization and Implementation

Prioritization Methodology

The methodology used to score projects is loosely modeled after the scoring method created by the Mendocino County Water Agency. Projects are ranked and prioritized based on the score assigned to them for their technical benefits and TAC defined benefits. The sum of the technical score and TAC score is the total project score.

The technical score is determined by the project's benefits to the environment, community, water supply, water quality, and flood management. The TAC score is derived from other aspects of projects that the TAC feels are important to take into consideration. The TAC benefit categories are: cost feasibility, matching funds, improved public safety, technical feasibility, critical infrastructure upgrade, community support, and proximity to a vulnerable population. The TAC score is essential to factoring in community knowledge, understanding, and the real-life circumstances associated with each project.

Technical Score

The technical score is found by scoring and weighting the perceived benefits of each project. Projects earn scores for each primary and secondary benefit they are expected to fulfill, thus, more benefits achieved leads to a higher score. Each benefit category (environment, community, water supply, water quality, and flood management) and each primary and secondary benefit within those categories was assigned a weight determined by the TAC. Primary benefit scores are automatically doubled while secondary benefit scores are not. The assigned category weights act as multipliers for the sum of the primary and secondary benefit scores within each category (Figure 7.1, Benefit Matrix).

The following formula outlines how the technical score is calculated:

$$Technical\ Score = WC_E(2WP_E + WS_E) + WC_{WQ}(2WP_{WQ} + WS_{WQ}) + WC_C(2WP_C + WS_C) + WC_{WS}(2WP_{WS} + WS_{WS}) + WC_{FM}(2WP_{FM} + WS_{FM})$$

Where

WC = the weight of the benefit category
WP = the sum of all primary benefit weights
WS = the sum of all secondary benefit weights

Benefit Category	Weight (WC)	Benefit Type (P, S)	Benefit	Benefit Weight (WP, WS)	Quantifiable Metric (Unit)*
Environmental	3	Primary	In-stream Flow Improvement	3	Flow Rate (cfs) ; Temperature (F°)
			Riparian Enhancement	2	Length (ft) or Area (ft^2); Native Vegetation Growth & Invasives Removed (plants/ length of stream)
			Wetland Creation, Restoration, & Management	2	Area (acres)
			Increased Ability to Capture Trash	3	Trash Captured (lbs./per day or lbs./ length of stream)
		Secondary	Habitat Protection & Improvement	2	Area (Acres)
			Reestablishment of Natural Hydrograph	2	Flow Rate (cfs)
			Creation of Open Spaces & Wildlife Corridors	2	Area (Acres)
			Reduced Energy Use/ GHG Emissions/ Provides Carbon Sink	1	Energy Saved (kwh/year) ; Amount of GHG Removed (tons/year) ; Amount of Carbon Sequestered (10^6g/acre)
Water Quality	2	Primary	Nonpoint Source Pollutants Reduction	3	Decreased Concentrations (lbs./day or mon)
			Increased Infiltration/ Treatment of Runoff	3	Volume Infiltrated (acre-ft/year)
			Decrease Turbidity	1	Decreased Turbidity Levels (NTU)
		Secondary	Temperature Reduction	3	Temperature Reduction (F°)
			Herbicide Runoff Reduction	1	Decreased Concentrations (lbs./day)
Community	2	Primary	Employment Opportunities	1	Jobs Created (total)
			Recreational Area Development	3	Area (acres)
		Secondary	Public Education	3	Persons Served (total) ; Persons Involved (total)
			Youth Education Programs	2	Persons Served (total) ; Persons Involved (total)
Water Supply	1	Primary	Groundwater Supply	1	Volume (acre-ft/year)
			Stormwater Capture and Reuse	3	Volume (acre-ft/year)
			Surface Water Supply	2	Volume (acre-ft/year)
		Secondary	Water Conservation	2	Volume (mgd)
			Conjunctive Use	2	Volume (mgd)
Flood Management	3	Primary	Reduce Stormwater Runoff Rate & Volume	3	Flow Rate (cfs)
		Secondary	Decrease Flood Risks	3	Flow Rate (cfs) ; Reduced Area Affected (acres) ; Reduced Number of Homes Affected (total)
			Reduced Sanitary Sewer Overflows	3	Flow Rate (cfs) ; Decreased Area Affected (acres) ; Lowered Recurrence Interval (ocurrences/year)

*Note: Units of quatifiable metrics may vary.

TAC Score

The TAC score for each project is calculated as the average of all scores assigned by members of the TAC. TAC members first review pertinent information about each project and then assign scores to each TAC benefit category based on the perceived quality and benefits of the project. Projects are scored on a scale of one to ten, where one is the lowest possible score and ten is the highest (Table 7.2). The average of all TAC-assigned scores for each TAC benefit category is then totalled to find the final TAC Score. Once calculated, the added sum of the TAC score and the technical score creates the total project score.

TAC Benefit Category	Score [1-10]
Cost feasibility	
Matching funds	
Improved public safety	
Technical feasibility	
Community support	
Critical infrastructure upgrade	
Proximity to a vulnerable population	

Project Scores

Projects are listed below according to their total project scores (Table 7.3). The three highest scoring projects will be prioritized for completion within the next 5 years. When this document is updated in 5 years, it is expected that the three highest scoring projects will have been completed, or more likely, within various stages of completion. Future decisions will need to be made to determine when to remove partially completed projects from this list. Once projects are completed and removed from the list, lower scoring projects will then be given higher priority.

Ranking	Project	Total Score
TBD	Cold Creek Realignment & Restoration	TBD
TBD	Mill Creek Realignment & Restoration	TBD
TBD	E. Castle Street Improvements	TBD
TBD	Washington Dr Connections to S Mt Shasta Blvd	TBD
TBD	McCloud Avenue Improvements	TBD
TBD	Everitt Memorial Highway Retrofits	TBD
TBD	Ski Bowl Drive Retrofits	TBD
TBD	Forest St Improvements	TBD

Implementation Strategy

Once the Plan has been officially adopted by the City, it will be submitted to the overseers of the region's IRWM, the Regional Water Action Group (RWAG) (Wat. Code, § 10562, subd. (b)(7).) The City and members of RWAG will then collaboratively identify steps to be taken in order to successfully incorporate the Plan into the IRWM document.

Developing the projects, policies, and programs listed in this Plan Update is the responsibility of the City. As such, the City is responsible for: quantifying project benefits, making project revisions, determining the inclusion of additional projects, applying for grant funding, and consulting with key regulators and acquiring permits when necessary. It is at the sole discretion of the City to pursue recruitment of project partners, public private partnerships (P3), or any other agreements involving interested agencies or individuals. To aid future collaborative efforts, the City maintains a list of contacts from local non-profit groups.

Implementation Schedule

Implementation of the programs, policies, and projects in this Plan will occur simultaneously over the course of the next 5 years. The schedule of the actions undertaken are dependent upon scope, community buy-in and participation, and available funds.

Developing and adopting the policies in Table 6.2 will likely be the least time consuming and most cost-effective method to immediately improve water quality, lower flood peaks, and protect the native environment. It is expected that policies that received four or greater positive votes will be adopted within the next 2 years. Policies that did not score well during their introduction will be considered for revisions and possibly reintroduced at a later date. All adopted policies will be amended to the City's online ordinance archive where they can be accessed and reviewed by the public.

The programs listed in Table 6.1 will require extensive planning, framing, and funding to develop, as well as time and resources dedicated to educating the public and garnering support. Due to the substantial difference in time commitment, it is expected that the programs will take longer to reach phases of implementation. Therefore, only the three programs that received five votes will be prioritized for development over the next 5 years.

As previously mentioned, the three highest scoring projects will be prioritized for development within the next 5 years (Table 7.4). As funding becomes available, City Engineers will determine the quantifiable benefits associated with each project (Wat. Code, § 10565, subd. (b).) They will also be involved in each project's phases of planning, permitting, design, and construction. Because it is unknown when funding sources such as grants and matching funds will be secured, the schedule for project implementation should remain adaptable.

Project	Planning, Permitting, & Design Year(s)	Construction Year
Cold Creek Realignment & Restoration	2021-2022	2023
Mill Creek Realignment & Restoration	2022-2023	2024
E. Castle Street Improvements	2023-2025	2025
Washington Dr Connections to S Mt Shasta Blvd	TBD	TBD
McCloud Avenue Improvements	TBD	TBD
Everitt Memorial Highway Retrofits	TBD	TBD
Ski Bowl Drive Retrofits	TBD	TBD
Forest St Improvements	TBD	TBD

New Project Submissions

New projects can be submitted to the City at any time. Interested parties can access the Project Proposal form on the City website, download it and fill out the necessary information, and then submit it by mail or email (Appendix I). Proposals will have a two-part screening process. Initially, the proposal will be evaluated by the Planning Department to determine if the project meets State requirements. Projects that pass the initial screening process will be reviewed by the TAC on a biannual basis. TAC members will evaluate project merits to determine if the project can be pursued. New projects which pass screening will be given a project score and amended to the project list for the next iteration of the Plan update.

8. Monitoring Progress and Reporting

Stakeholder Involvement

Stakeholder involvement is crucial to the ongoing successful implementation of the Master Plan, because residents are often the first to notice when problems arise with the drainage system. Strategies for involving stakeholders on an ongoing basis are detailed in Chapter 3. Public Outreach, Coordination and Collaboration: Ongoing Engagement Efforts.
Post-implementation Review

The performance of each project will be evaluated by comparing the expected benefits of the project to the actual measured benefits once it has been implemented. Because the expected benefits of each project vary, so too will their performance measures. For instance, a project with the expected benefit of flood prevention will have different performance measures than a project intended to benefit water quality.

When the actual benefits of a project are lower than expected, additional steps should be taken to modify the project so that benefits are maximized as much as is feasible. An adaptive management approach that considers all factors relating to each project and the projects'

performance should be used when considering project modifications. It is expected that only projects that receive grant funding will proceed with this process of monitoring, modifying, and data reporting.

Data Management

Other than data gathered from Cold Creek Springs, no other in-stream data sources within the project boundary are currently available. To adequately understand project outcomes and effects to local waters, future testing and water quality monitoring should be scheduled as funding becomes available. Ideally, testing will be done on a quarterly basis for the following criteria: dissolved oxygen, temperature, pH, specific conductance, total suspended solids, nitrogen oxides and Total Coliform and Fecal Coliform/ E. coli MPN 15. These criteria can be tested in-house at the City WWTP and would cost $114.80 quarterly ($459.20 annually) for 8 sampling sites. A map showing eight proposed sampling locations can be found in Appendix D.

To improve access to stakeholders and the public, data will likely be a.) kept on the City's website, b.) stored in the City's geodatabase, and/or c.) uploaded onto CEDEN. Data should be updated quarterly to reflect quarterly testing dates. Public notice will be given when monitoring begins, is expected to conclude, and of any temporary delays in testing.

9. Funding Considerations

Historically, the City of Mt Shasta has charged ratepayers drainage fees well below the actual cost of service. Rate payers in 2020 are assessed $1 per rate payer per month resulting in approximately $24,500 in annual revenue. This funding source is not sufficient to maintain or improve the system and planning documents.

There are a number of types of funding sources that can be used to provide consistent funding for stormwater projects. Balloted approaches include a parcel-base special tax or sales-base special tax. Property ballot related fees also known as Proposition 218 ("Prop 218") are sources of local funding generation. Prop 218 is the most common funding mechanism for utility systems which charges rates to ratepayers within City service areas. Although frequently used for water and sewer system funding, only 50% of California jurisdictions use Prop 218 for stormwater funding.[63]

In this Plan update, the City seeks the following steps to develop a consistent funding source for stormwater projects:

63 SCI Consulting Group. (2017). Stormwater Funding Barriers and Opportunities. A Proposition 84 Grant with California Stormwater Quality Association. Retrieved from: https://www.casqa.org/sites/default/files/downloads/casqa_wp1_sw_funding_barriers_opportunities_-_2017-06-30.pdf

1. The City will complete a Capital Improvement Plan (CIP) that accurately anticipates when and how stormwater assets should be improved over the next 5 years. These costs include replacement of worn out parts of the existing system, expansions of the system where necessary, ongoing maintenance costs, and laboratory costs associated with water quality testing. Documenting the City's needs in a CIP will also improve the City's competitiveness for outside funding sources like grants.

2. The City will complete a rate study, to determine how to responsibly and equitably fund the true costs of the CIP. The goal of the rate study is to create financial capacity for the City, so negative outcomes like the depletion of financial reserves, the inability to maintain the drainage system, or violation of regulations are avoided. Because the City of Mt Shasta is a small disadvantaged community (DAC), the City is a very competitive grant applicant. Nevertheless, a rate study is still necessary to at least fund operating expenses and keep up with the pace of inflation. Many grants require at least some matching dollars from the grantee, and a new rate study will therefore improve the City's competitiveness for outside funding sources like grants.

3. After steps 1 and 2 as outlined above are completed, the City will need to pursue a Proposition 218 process in order to implement new stormwater rates. The success of this process will require buy-in from the City's staff, elected officials, and residents. Therefore it is crucial that this Stormwater Master Plan update be a public process, with robust community involvement throughout.

Case Study: Town of Moraga Stormwater Fee 218 Process

The Town of Moraga, California initiated a Prop 218 process to determine and approve a stormwater fee based on their 2015 Storm Drain Master Plan. The Plan outlined a Capital Improvements Program that identified $26 million of needed improvements to the current storm drainage system. This plan set the foundation for the fee study.[64]

The Town of Moraga has two distinct funding mechanisms for storm drain improvements, the National Pollutant Discharge Elimination System (NPDES) fees and developer impact fees. The town calculated that these two fees contribute 19.3% of the needed revenue for achieving the necessary system improvements. NPDES fees are associated with the state stormwater runoff permitting system that requires certain users to obtain a permit and pay local fees prior to development.

The Town of Moraga determined in their fee study that these two fee sources were not effective in raising the needed $26 million worth of improvement; therefore, the town pursued Proposition 218 rate payer fees. The success of the fee study came from the comprehensive outreach performed prior to the Proposition 218 vote. The town conducted 10 separate public outreach events and provided on demand education on the fee study through printout and website information.

64 SCIConsultingGroup. (2018). Town of Moraga Stormwater Fee Report. Retrieved from http://www.moraga.ca.us/dept/publicworks/Storm Drain/Moraga Stormwater Fee Report_FINAL.PDF

The final 218 rate schedule for storm drains collects fees based on land use category to cover the cost of the highest priority projects ($ 9 million). The medium and low priority projects were not considered in this fee study. The fee study also assumed no grant or general fund assistance. Part of the final fee schedule includes no sunset date to cover ongoing operations and maintenance and to address continuing unfunded mandates for stormwater. [65]

Potential State and Federal Funding Opportunities

A variety of funding sources will be used to help the City fund ongoing maintenance of the drainage system as well as newly constructed stormwater projects. Currently available State and Federal funding opportunities include:

- Prop 1 funding
  - Integrated Regional Water Management Implementation Grant Program (DWR)
  - Storm Water Grant Program for Implementation Projects (SWRCB)
- Prop 68 funding
  - Urban Stormwater and Waterways Improvement Program (CNRA)
  - Urban Green Infrastructure Program (CNRA)
  - Rural Recreation and Tourism Program (CDPR)
- Clean Water State Revolving Fund (SWRCB)
- Community Development Block Grant Program for Non-Entitlement Jurisdictions (CDHCD)
- Water & Waste Disposal Loan & Grant Program (USDA)
- Water Recycling Funding Program Construction Funding (SWRCB)
- Water Recycling Funding Program Planning Grant (SWRCB)
- Safe and Affordable Drinking Water Fund (SWRCB)
- Groundwater Grant Program (SWRCB)
- Nonpoint Source Pollution (NPS) Control Program (DWR)
- Sustainable Groundwater Planning Grant Program (DWR)
- WaterSMART Drought Response Program's Resiliency Grants (USBR)
- California River Parkways Grant Program (CNRA)
- Land and Water Conservation Fund (CDPR)

65 Town of Moraga. (2018). Storm Drain Funding. Retrieved from http://www.moraga.ca.us/StormDrainFunding

10. Operations and Maintenance

The City of Mt Shasta acknowledges that routine maintenance is the most cost-effective way to improve drainage and protect water quality. This Plan will ensure that the operations and maintenance responsibilities of the Public Works Department are clearly defined, organized, and accounted for in budgeting considerations. These guidelines are meant to be general in nature, and are not intended to be overly prescriptive or to overrule the situational judgement of Public Works Department Staff.

Asset Inspection

At least once annually and after any major storm event, all drainage infrastructure should be inspected. Using the most up-to-date GIS maps available, Public Works Staff will inspect City drain inlets, manholes, outlets, conveyances, and pipes. These asset inspections will be documented using GIS, and serve as triage to determine where sediment removal and vegetation control are needed most.

Sediment Removal

At least twice per year, sediment and other debris should be removed from drainage infrastructure that has been flagged during asset inspections. The most important times for sediment removal are 1) in late autumn, after the majority of deciduous vegetation has shed its leaves and 2) in late spring, at the end of the City's wet season.

Vegetation Control

Given the extensive network of creeks, ditches, and other above ground drainage conveyances in the City, the management of vegetation is an important aspect of the overall maintenance of the stormwater system. In particular, the City should attempt to control the spread of invasive species through drainage conveyances, especially Himalayan Blackberry (Rubus armeniacus) and Japanese Knotweed (Reynoutria japonica). However, not all conveyances lie in City right-of-ways. The City should therefore maintain an up-to-date list of private property owners and their contact information so that inadequately maintained conveyances on private land can be addressed without creating an unreasonable burden to City staff.

Removal Procedures for Himalayan Blackberry

To maintain the quality of local waters, City staff will only use mechanical methods to control the spread of Himalayan blackberry and avoid applying herbicides. The following are procedures for the removal of Himalayan blackberry.

Removal in Forested Lands, Ditches, and Riparian zones: In forested locations, Himalayan blackberry should be removed in the early spring when the plant begins to flower. Himalayan blackberry is vulnerable during this time because the majority of its reserve energy, which is usually stored in its roots, is now stored in their blooms. Thus, Himalayan blackberry is less likely to recover from damages incurred during the springtime. Himalayan blackberry grows in lightly forested areas and ditches due to the abundance of available sunlight. A strategy used to prevent removed Himalayan blackberries from returning is to plant fast growing or shade tolerant bushes and trees to prevent the Himalayan blackberries from receiving sunlight. Because blackberries also regrow quickly, this method requires monthly maintenance to ensure that new plantings are not overtaken by Himalayan blackberry. Hand tools such as loppers, weed eaters, and gloves should be used in this step to avoid damaging native plants. In creek beds, care should be taken to prevent soil erosion into creeks. Newly established plants will help decrease erosion.

Removal in Wetlands: Although less common, Himalayan blackberry can also survive in seasonal wetlands. When this occurs, removal is best during the fall, just before the onset of heavy precipitation. This strategy relies on the incoming precipitation to drown the damaged roots left remaining in the soil. If mechanical removal is correctly timed, then post-removal maintenance should be minimal. If Himalayan blackberry persists, then removal by hand would be the most effective method to use to ensure that the complete root crown of each plant is removed.[66]

Removal Procedures for Japanese Knotweed

The complete eradication of Japanese Knotweed in the City will be an extremely difficult process. One of the most precarious and troublesome aspects about this species is that the rhizomes, located in the plant's immense root structure, can survive for up to 3 years before resurfacing as a new plant stem. Because of this amazing survival strategy, the average time it takes to remove Japanese Knotweed is between 4 and 10 years. In stands of Japanese Knotweed that exceed 50 stems, only methods that employ a combination of mechanical removal and the application of herbicides are likely to be successful.

Because Japanese Knotweed grows in riparian environments, the City would need to obtain a General Permit before applying herbicides. This process is set by the State Water Resources

66 Soll, J. (2004). Controlling Himalayan Blackberry (Rubus armeniacus [R. discolor, R. procerus]) in the Pacific Northwest. The Nature Conservancy. Retrieved from: https://www.invasive.org/gist/moredocs/rubarm01.pdf

Control Board per Order 2013-0002-DWQ. Steps include[67]:

1. Prepare a Notice of Intent
2. Pay a new discharger fee of $2268.00 and annual fees thereafter
3. Prepare an Aquatic Pesticide Application Plan
4. Send Items 1-3 to the State Board

Due to the large time commitment and lack of available funding to proceed with the process outlined above, the City will not pursue herbicide application immediately following the adoption of this Plan Update. However, if the presence of Japanese Knotweed increases in the future, the option of obtaining a General Permit will be revisited.

Removal using Mechanical and Chemical Methods (Not to be used until permit is acquired): Weed eaters and mowers should never be used to treat Japanese Knotweed because they lead to the formation of new plants. Instead, removal of Japanese Knotweed should focus on destroying the immense root network and reducing the "root to shoot" ratio. It is essential to reduce the amount of roots and rhizomes available to the Japanese Knotweed in order to limit the plant's regenerative capabilities.

The treatment steps can be summarized as biannual visitations to perform mechanical extraction followed by herbicide application. Mechanical removal should be completed in the spring and herbicides should be applied in the fall once the plants have flowered. Mechanical removal should be in the form of digging or shallow excavation of the site. Digging and excavating an infested site is a good first step in the treatment process because it 1.) removes roots and 2.) will cause the remaining plant rhizomes to send up new stems and foliage which will increase the surface area available for herbicide treatment. The herbicide applied should be strong enough to reach the plant's roots and destroy the rhizomes. If the rhizomes are not destroyed, then the stems can reemerge within three years of treatment. The herbicide used should also be registered for use in California and approved for application in riparian and wetland areas. It should be noted here that even herbicides which fulfill these requirements are still expected to kill non-target species.

Removal using only Mechanical Methods: The only successful way to remove Japanese Knotweed without the use of herbicides is to completely uproot the plant by excavating at least 1 meter below the soil surface in a radius of 7-20 meters around the plants. While this method is considered to be fairly reliable because it removes the entire root structure, it is extremely invasive, which makes it impractical in situations where the potential damage to the environment outweighs the benefit of invasive species removal. Cases where this method should not be employed are riparian corridors, wetlands, and other environmentally sensitive areas. When employed, sites will need to be monitored for 4 years following the date of excavation and retreated if Japanese Knotweed returns.[68]

67 State Water Resources Control Board. (2020). National Pollutant Discharge Elimination System (NPDES) Pesticides - Weed Control. Retrieved from: https://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/weed_control.html

68 Michigan Department of Natural Resources. (2012). Japanese Knotweed. Invasive Species-Best Control Practices. Retrieved from:

Street Cleaning

The City currently pursues street cleaning on an as-needed basis, after major storms and during the fall for leaf control. Historically, this has proved an effective approach for reducing the inputs of sediment, trash, organic matter, and other debris from street surfaces into the stormdrain system without an overly prescriptive sweeping schedule.

Winter Conditions and Snow Management

The State of California's Stormwater Resource Plan Guidelines include very little discussion of snow management. However, because the vast majority of the City of Mt Shasta's precipitation falls during the winter and a significant portion falls as snow, this Master Plan must explicitly account for cold-climate stormwater management. Snow can accumulate for weeks or months before melting and mobilizing pollutants, so runoff from snowmelt behaves very differently than runoff from rain. Daily freeze-thaw cycles can release runoff from snow even when no precipitation has recently fallen. Freezing temperatures also undermine the effectiveness of certain stormwater Best Management Practices (BMPs) that are popular in warmer climates. The following strategies were adapted from the State of Minnesota guidance on stormwater management in cold climates, and were modified slightly to apply more directly to the specific conditions in the City of Mt Shasta:

1. *Pollution Prevention:* Pollution prevention is always the best way to manage the quality of runoff from urban and rural surfaces. The City of Mt Shasta can reduce the pollution-loading of urban snowpack by avoiding the application of deicing salts and being judicious with the application of volcanic cinders for traction. After snow has melted but ideally before a rain event, the City should sweep up any cinders that remain on the road surface before they can be carried into the stormdrain system. Erosion should be controlled, especially where grounds are newly disturbed at construction sites. Year round best practices including litter control, pet waste management, and education of the public will also yield cold weather benefits.

2. *Infiltration:* The highly soluble and perhaps toxic "first flush" of snowmelt should be infiltrated to the extent possible, provided the source area is not concentrated in deicing salts or other toxic pollutants. Because much of the City overlies soils with naturally high infiltration rates, simply leaving snow berms on unpaved surfaces will achieve this effect. Before the development of the City of Mt Shasta, most snowmelt would readily infiltrate the ground as it melted, and this is still possible in many parts of the City. Snow that is collected and removed from the Downtown area and deposited on the Roseburg property should be dumped on flat soil when possible. Note also that snow deposits should not be located directly over a designed infiltration facility because of the possibility of clogging from debris in the snow.

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https://mnfi.anr.msu.edu/invasive-species/JapaneseKnotweedBCP.pdf

3. *Meltwater Storage and Filtration:* the wetlands in the City of Mt Shasta offer an opportunity to naturally store and filter snowmelt runoff that cannot be infiltrated because of frozen or saturated ground. Although biological activity (and therefore biological uptake of pollutants) is often dormant during the winter months, wetlands still offer temporary storage capacity and the ability to physically filter out suspended solids.

4. *Additional considerations:* local experience indicates that snow berms piled on street curbs often physically block drain inlets and prevent runoff from entering the stormdrain system, which contributes to cold-weather street flooding. The City currently lacks a strategy to reduce the nuisance street flooding that can result. The City should consider implementing a policy of unblocking key drain inlets after all streets are plowed but before major thawing of snow begins.

11. Appendix

Appendix A: Stakeholder Outreach, Education, and Engagement Plan

Introduction

This Stakeholder Outreach, Education, and Engagement Plan (Outreach Plan) provides an outline of the public engagement and education activities the City of Mt Shasta will pursue as it updates its Stormwater Master Plan (Master Plan). While the City's 1999 Stormwater Master Plan contained no public outreach component, the current update process is an opportunity to ensure that the City's priorities align with those of the community it serves, and that key stakeholders and other interested members of the public are engaged, educated, and given opportunities to participate in the plan update process. For the purposes of this update, a stakeholder is defined as an individual, group, coalition, agency, or other entity that is involved in, affected by, or has an interest in the implementation of the Master Plan. This Outreach Plan outlines the City's strategies to effectively engage stakeholders and the community, per the requirements of Water Code § 10565(a) and § 10562(b)(4).[1]

Benefits to Stakeholders

The City of Mt Shasta is developing its Stormwater Master Plan to identify and prioritize stormwater and dry weather runoff capture projects that provide multiple benefits, including water quality, water supply, flood management, environmental quality, and community enhancement. While the City currently has a Stormwater Master Plan (adopted 1999), it is considered obsolete by City staff and does not sufficiently guide Public Works Department operations, maintenance, or capital improvement priorities. A full update of the Plan is needed to adequately address the drainage needs of the City. The update will allow the City to increase the use of green infrastructure, adapt to climate change, reduce flood risk, and improve stormwater treatment. All projects and programs called for in the updated Master Plan will result in water quality, water supply, flood control, environmental, and/or community benefits, therefore benefiting stakeholders by improving drainage, reducing pollutants in runoff, and/or restoring ecosystems. Stakeholders will be given opportunities to be involved throughout the plan's development, implementation, and project completion.

Engagement in Technical and Policy Issues

The City of Mt Shasta has assembled a Technical Advisory Committee (TAC) to provide education and participation opportunities to stakeholders and the public. Items for consideration include technical and policy issues related to the development and implementation of the Master Plan.

1 The City of Mt Shasta's Outreach Plan is modeled closely on the content and format of the Outreach, Education, and Engagement Plan for the Redding Stormwater Resource Plan prepared by Geosyntec consultants in November, 2017.

Stakeholders can provide valuable input into the planning process in a number of specific ways:

1. Provide input into the development of the Master Plan
2. Attend public meetings
3. Recommend potential programs, maintenance procedures, or ordinance changes
4. Recommend potential locations for project development
5. Provide local knowledge and input regarding conceptual programs and project designs
6. Comment on Public Draft of the Master Plan
7. Provide letters of support for the Master Plan and projects

Facilitating Public Participation

The City will conduct broad public education and engagement for the Master Plan. Effective public involvement requires establishing trust, developing relationships, and cultivating communication channels between all participating parties. Every meeting is an opportunity to increase transparency and inclusivity as well as build partnerships, and in that spirit, the Stakeholder list is always open to new Stakeholders. The City will also include online options for Stakeholders to contribute feedback, because the participation of community members that cannot attend meetings is nonetheless valuable. This Outreach Plan will use a variety of communication systems to disseminate information about the Master Plan, in part relying on groups that have dedicated memberships and similar concerns and issues as those addressed in the Master Plan.

Key principles of the Outreach Plan

Communication and outreach are the two pillars upon which a successful, technically competent and inclusive Master Plan. The Master Plan development will be based on the following key principles:

1. The Master Plan process is open and transparent, and engages all entities in the dialogue on stormwater resource management throughout the City.
2. Although the City is exempt from the requirements of the CA State Water Resource Control Board's Storm Water Resource Planning Guidelines, the Master Plan update will conform as closely to the Guidelines as can be practically achieved.
3. The Public and Interested Stakeholders will review and comment at key times in the Master Plan update development and implementation.

Stakeholder Identification and Inclusion

Several Stakeholders have presented an interest in participating in the Master Plan update process that represent a variety of interests including local ratepayers, developers, locally regulated commercial and industrial businesses, nongovernmental organizations, nonprofit organizations and the general public. Below is a list of initial Stakeholders, which will be updated as other groups or individuals participate in the Master Plan update process:

Type	Agency or Affiliation	Contact	Email
City/County	Siskiyou County - BOS		
	Siskiyou County - Lake Siskiyou Flood Control District		
	Siskiyou County - Public Works/Comm. Dev.		
	City of Dunsmuir		
Tribal	Winnemem Wintu Tribe		
	Shasta Tribe		
	Pit River Tribe		
Special Districts	Siskiyou County Flood Control District		
	Shasta Valley Resource Conservation District		
	Mt Shasta Recreation and Parks District		
Other Public Agencies	Shasta-Trinity National Forest		
	CA Dept of Fish and Wildlife		
	Central Valley Regional Water Quality Control Board		
	CalTrans		
Non-Governmental Organizations	CalTrout		
	Trout Unlimited		
	River Exchange		
	Siskiyou Land Trust		
	Pacific Forest Trust		
	Mt Shasta Bioregional Ecology Center		
	We Advocate Thorough Environmental Review		

Engaging Communities in the Project Design and Implementation

Public meetings are an established and effective mechanism to engage communities in planning efforts and projects. The following targeted Stakeholder meetings are designed to engage members of affected communities in the program and project design and implementation.

1. *First Stakeholder Meeting* *March 5, 2020*

   During the first Stakeholder meeting, the City will provide an overview of why the Master Plan is in need of update and the overarching goals of the update process. The City will solicit feedback on proposed conceptual program changes, perspectives on how to rank multibenefit priorities, and ask Stakeholders to identify potential locations for project consideration. The City will seek to incorporate local knowledge of opportunities and obstacles in project development. The meeting will conclude with a review of the opportunities for Stakeholder involvement going forward, and the anticipated Master Plan update timeline. Prior to the meeting, draft materials will be distributed through available email lists to provide the opportunity for review before the meeting.

   Agenda

   - Project overview
   - Introduce conceptual programs
   - Request input on other potential programs
   - Request input on multibenefit priority ranking
   - Request input on potential project locations
   - Opportunities for future Stakeholder involvement
   - Anticipated timeline

2. *Second Stakeholder Meeting* *April 30, 2020*

   During the second Stakeholder meeting, the City will present draft conceptual projects and their multiple benefits. Stakeholders will provide comments and feedback which may include restructuring the weighing of multiple benefits, re-prioritizing projects based on local benefits, and/or inclusion of necessary components to encourage implementation feasibility and long-term maintenance. The Stakeholders will also be consulted to discuss land ownership and acquisition, operations and maintenance responsibilities, and the community education and outreach required for each project. Prior to the meeting, draft materials will be distributed through available email lists to provide the opportunity for review before the meeting.

   Agenda

   - Present draft conceptual projects and benefit prioritization
   - Request input on multibenefit priority ranking
   - Request input on other potential project locations
   - Opportunities for future Stakeholder involvement
   - Updated project timeline

3. *Third Stakeholder Meeting* *Date June 16, 2020*

   During the third Stakeholder meeting, the final program and project descriptions, benefits,

and prioritization results will be presented. Prior to this meeting, a public draft of the Master Plan will be posted to the internet for review before the meeting. This step will help cultivate and develop partnerships required for Master Plan implementation and long-term maintenance.

Agenda

- Present public draft of Master Plan
- Request input on draft
- Request letters of support

In addition to the public meetings outlined above, the City will make an effort to engage community members and other Stakeholders through other methods. Many Stakeholders may have valuable knowledge and input to contribute to the Master Plan update process but be unable to attend a physical meeting at a specific time; their contributions are nonetheless valued. Therefore, the City will maintain a page on its website dedicated to the Master Plan update, where relevant documents will be made available and comments can be submitted. This page will also have a mapping feature so that Stakeholders can suggest locations for potential projects. Additional outreach strategies are described in the How to Get Involved section of this document.

Disadvantaged and Climate Vulnerable Communities

The City of Mt Shasta is comprised entirely of severely economically disadvantaged communities (DAC) based on the 2018 American Community Survey median household income by census block group. Disadvantaged areas have a median household income (MHI) of less than 80% of the state's median household income, while severely disadvantaged areas have less than 60%. This corresponds to a median income below $51,026 in disadvantaged areas and below $38,270 in severely disadvantaged areas, as defined in 2016.[2] For reference, the MHI the City of Mt Shasta is $35,238.[3]

Currently available information indicates that there are climate vulnerable communities within the City of Mt Shasta. The City experiences many of the vulnerabilities described in California's Fourth Climate Change Assessment North Coast Regional Report; the most relevant vulnerabilities for the purposes of the Stormwater Master Plan update include decreased stream flows, flood risks, loss of snowpack, prolonged droughts, heat-related illness, and wildfire and its air quality impacts.[4] Most of the City of Mt Shasta and the surrounding area are classified as being in very high fire hazard severity zones by CalFire.[5] The City may have reduced adaptive capacity due to its aging population (median age 55.1, with 20.1% of the

2 Dept of Water Resources. (2016). DAC Mapping Tool. Retrieved 2019, from https://gis.water.ca.gov/app/dacs/

3 US Census Bureau. (2018). Selected Economic Characteristics . Retrieved 2019, from https://data.census.gov/cedsci/table?q=&d=ACS 5-Year Estimates Data Profiles&table=DP03&tid=ACSDP5Y2018.DP03&g=0400000US06_1600000US0649852&lastDisplayedRow=81&mode=selection&vintage=2018&layer=place

4 Grantham, Teodore (University of California, Berkeley). 2018. North Coast Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCC4A-2018-001.

5 CalFire. (2007, November). Fire Hazard Severity Zones Maps. Retrieved 2019, from https://osfm.fire.ca.gov/divisions/wildfire-planning-engineering/wildland-hazards-building-codes/fire-hazard-severity-zones-maps/

population 65 or older),[6] low incomes as described above, low educational attainment,[7] and small tax base. Mt Shasta currently enjoys relatively healthy environmental conditions, with a CalEnviroScreen 3.0 pollution burden percentile of just 6.[8] In summary, the City of Mt Shasta faces serious climate vulnerabilities and may have reduced adaptive capacity to address these challenges.

Schedule

Ongoing communication with interested Stakeholders and the general public will be conducted through emails, publicly posted meeting announcements, and draft deliverables on the City website. Below is a summary of key milestones for public engagement and education in the initial Master Plan development phase of the project.

How to get involved

Outreach and stakeholder identification will be conducted through focused phone calls, emails, and public notices. Public notices will be provided via flyers, posters, newspapers and newsletters, social media, notices on drains, mailers, and/or websites. All outreach will be documented with sign-in sheets, meeting photographs, websites and flyer examples, and meeting notes.

6 US Census Bureau. (2018). 2018 American Community Survey 5-Year Estimates: Mount Shasta City, California. Retrieved 2019, from https://data.census.gov/cedsci/profile?q=Mount Shasta&g=1600000US0649852&tid=ACSDP5Y2018.DP05

7 Public Health Alliance of Southern California. (2018). California Healthy Places Index (HPI). Retrieved 2020, from https://map.healthyplacesindex.org/

8 Office of Environmental Health Hazard Assessment (OEHHA). (2018, July 25). CalEnviroScreen 3.0. Retrieved 2020, from https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

Appendix B: Sample Outreach Materials

Stakeholder Outreach email to interested organizations:

Greetings:

The City of Mt Shasta is currently in the process of updating its Stormwater Master Plan, and we invite you and your organization to be stakeholders in the update process. The updated Master Plan will identify and prioritize stormwater projects that provide multiple benefits, such as water quality, flood management, and community enhancement.

While the City's old Stormwater Master Plan (1999) included no public outreach at all, the current update process is an opportunity to ensure that the City's priorities align with those of the community it serves, and that key stakeholders and other interested members of the public are engaged, educated, and given opportunities to participate in the plan update process.

If your organization would like to participate as a stakeholder in the Master Plan update process, there are a number of ways you can get involved:

1. **Take our public survey.** This 5-minute survey is a quick and easy way to share your input with the City.
2. **Attend a public meeting.** There are 2 scheduled in the coming weeks.
3. **Plan Overview and Program Changes:** March 5, 6-8 pm @ City Park
4. **Presentation of Conceptual Projects:** April 30, 6-8 pm @ City Park
   A flyer for these events is attached to this email, and we encourage you to distribute it to your organization's members. A 3rd public meeting, to present the entire Draft Master Plan, will be scheduled for mid-June.
5. **Schedule a direct meeting with the Mt Shasta Planning Dept.** If your organization would like to be actively engaged in the Plan update process, we invite you to schedule a direct meeting with us. These meetings are an opportunity to ask questions, collaborate, provide local knowledge, and give direct input into the Master Plan process.
6. **Learn more about Stormwater Master Plan update on the City's website.** The page includes key documents and educational resources. https://mtshastaca.gov/stormwater-master-plan-update/
7. **Sign up to receive email updates.** Simply responding to this email with "SUBSCRIBE" will add your email to our contact list for monthly updates on the Master Plan update process.

Stakeholder participation is key to a successful Stormwater Master Plan. Thank you for your time, and we look forward to your collaboration.

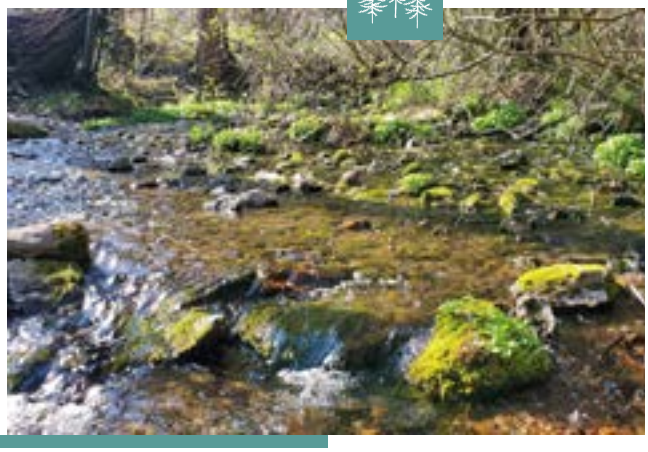
Postcard mailed to 300 randomly selected Mt Shasta residents:

Flyer advertising public meetings:

Updated Flyer for virtual public meeting:

Tri-fold brochure displayed at City Hall front desk:

According to the EPA, urban stormwater is the leading source of water pollution in the United States. But there's a lot individuals can do to help!



contact.

530-926-7510
305 N. Mt. Shasta Boulevard
Mt. Shasta, California 96067
mtshastaca.gov

City of Mt Shasta Stormwater

Citizen Best Practices

Learn what you can do to protect our local watershed!

What is LID?

Low Impact Development (LID) is the process of using natural landscape features to manage stormwater and snow melt at its source. The focus of LID is to promote stormwater as an invaluable resource.

Low Impact Development

DESIGNING WITH NATURE

City of Mt. Shasta Press Release in Mt Shasta Herald to advertise release of Master Plan public comment period:

Title: Stormdrains are a Vital Part of Mt Shasta's Water System

Mt Shasta is a community that prides itself on clean water. In the past when water-related issues have come before City Council, meetings are often crowded to the point of overflowing. It is surprising, then, that one of the most important water topics in our City receives so little attention.
I'm talking of course about Mt Shasta's stormdrain system. Stormdrains are vital infrastructure that capture runoff from rain and snowmelt and direct it out of the City, eventually to Lake Siskiyou and the Sacramento River. On its way, stormwater can pick up pollutants like motor oil, trash, pet waste, herbicides, sediment, or anything else present on Mt Shasta's pavement and lawns. Unlike our sanitary sewer system that flows to a treatment plant, stormwater runoff is not treated before it's discharged to local creeks. If managed improperly, stormwater can lead to flooding and poor water quality downstream.

Our stormdrains prevent flooding and protect local water quality, but they cannot run on autopilot. After decades of wear and tear, much of Mt Shasta's drainage system is sorely in need of repair and expansion. Our Public Works Department uses a Stormwater Master Plan to guide management of this infrastructure, but the old Plan from 1999 is now completely obsolete. The old Plan also contained serious omissions, including a failure to even mention water quality, climate change, snow management, community input, or operations and maintenance.

The Mt Shasta Planning Department has spent the past year updating the Stormwater Master Plan to better reflect the values of our community and ensure our vital infrastructure is properly managed. Its central goal is to plan multi-benefit projects that will reduce flooding, protect water quality, and enhance the environment simultaneously. For example, we are considering opportunities to use wetlands to naturally filter runoff while also creating wildlife habitat and reducing flood peaks.

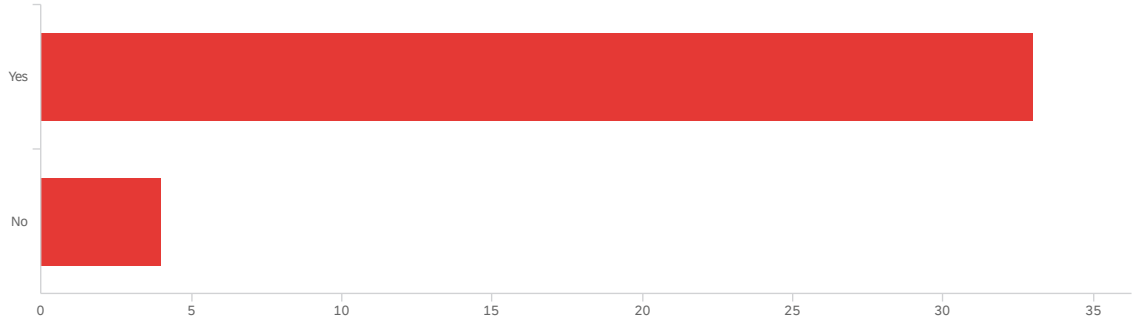
And that's where you can help: the draft Stormwater Master Plan has just been released for public comment. It will be presented to Mt Shasta City Planning Commission June 16 at 6 pm, and go before City Council June 22 at 5:30 pm. Both meetings are virtual due to COVID-19, but will be live-streamed on the City website, where there's additional information and a full PDF of the new draft Plan. Please consider tuning into these meetings to ask questions, comment on the updated Plan, suggest projects, or just learn more about stormwater in our City. Public comment on the draft Stormwater Master Plan is open from June 12 until July 3.

If you're interested in protecting Mt Shasta's water resources for decades into the future, participating in this Stormwater Master Plan update is a great way to help. You can find more information and a full copy of the draft Plan at:

https://mtshastaca.gov/stormwater-master-plan-update/

Appendix C: Survey Results

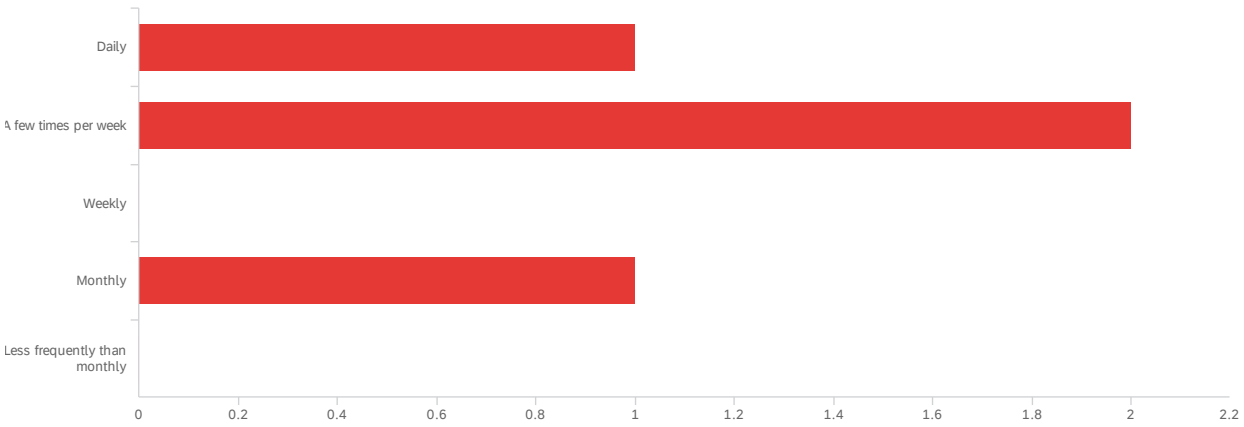
Do you live in the 96067 zip code area?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Do you live in the 96067 zip code area?	1.00	2.00	1.11	0.31	0.10	37

#	Field		Choice Count
1	Yes	89.19%	33
2	No	10.81%	4
			37

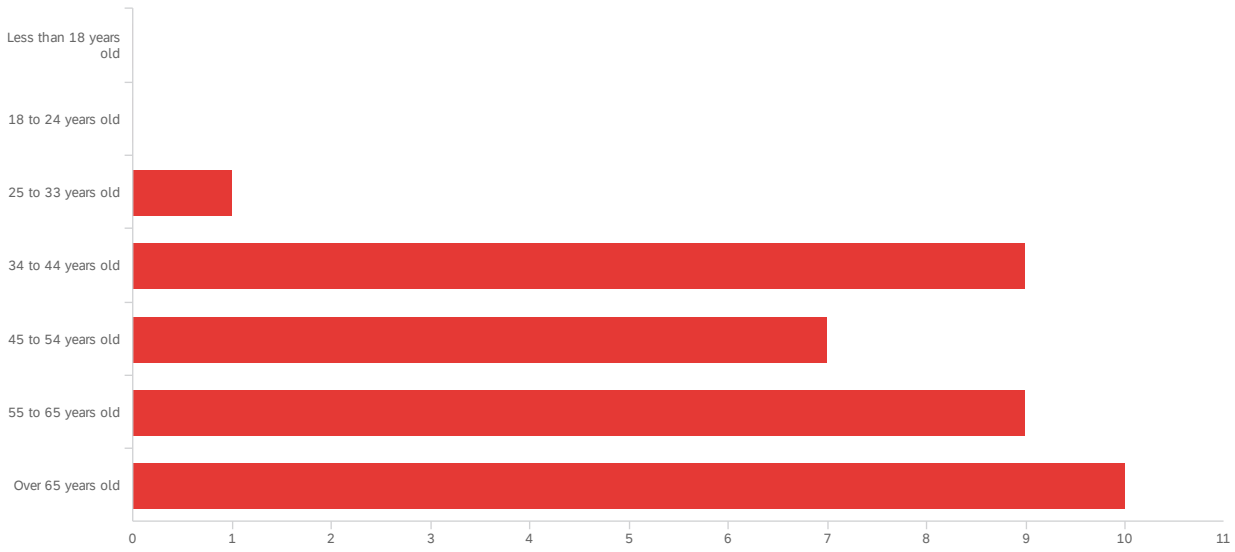
If you live outside the zip code, how often do you visit the City of Mt Shasta?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	If you live outside the zip code, how often do you visit the City of Mt Shasta?	1.00	4.00	2.25	1.09	1.19	4

#	Field		Choice Count
1	Daily	25.00%	1
2	A few times per week	50.00%	2
3	Weekly	0.00%	0
4	Monthly	25.00%	1
5	Less frequently than monthly	0.00%	0

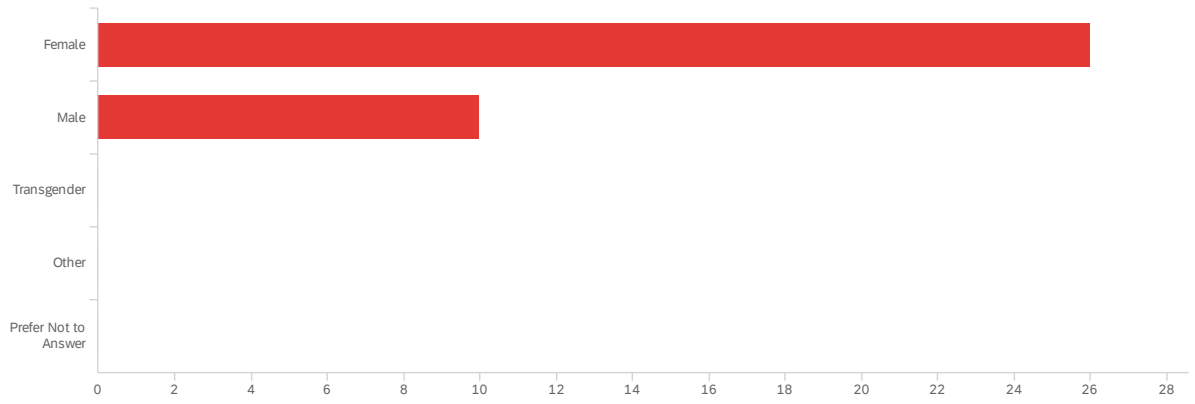
What is your age?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your age?	3.00	7.00	5.50	1.21	1.47	36

#	Field	Choice Count	
1	Less than 18 years old	0.00%	0
2	18 to 24 years old	0.00%	0
3	25 to 33 years old	2.78%	1
4	34 to 44 years old	25.00%	9
5	45 to 54 years old	19.44%	7
6	55 to 65 years old	25.00%	9
7	Over 65 years old	27.78%	10

What is your gender identity?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	What is your gender identity?	1.00	2.00	1.28	0.45	0.20	36

#	Field		Choice Count
1	Female	72.22%	26
2	Male	27.78%	10
3	Transgender	0.00%	0
4	Other	0.00%	0
5	Prefer Not to Answer	0.00%	0

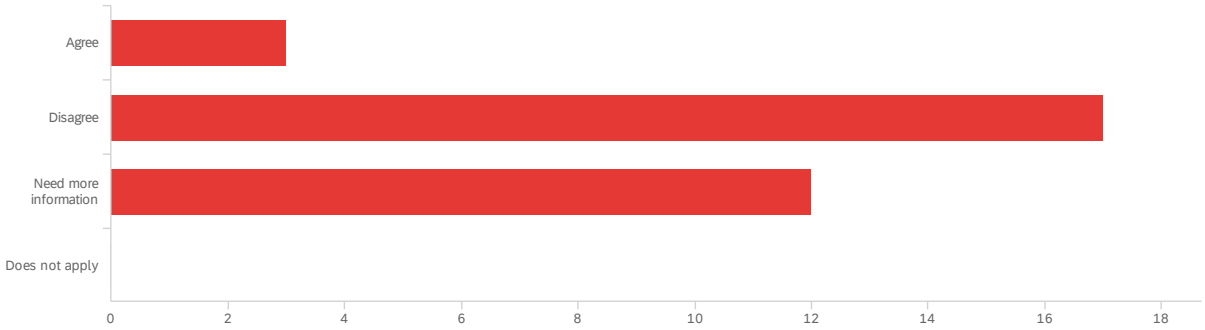
Please rate your perception of the overall quality of the water in the City of Mt Shasta's creeks, wetlands and lakes. "Quality of water" means how free it is from pollution. Rate it on a 0 to 10 scale where "0" means the water is "extremely polluted" and 10 means the water is "extremely clean."

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Quality of Water	2.00	10.00	7.86	1.55	2.40	36

Please rate your perception of the overall quality of stormwater management in the City. "Quality of stormwater management" means how effectively the City reduces flood risk and conveys runoff from storms safely out of the City. Rate it on a 0 to 10 scale where "0" means the management is "extremely poor/ ineffective" and "10" means the management is "extremely good/effective".

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Quality of Stormwater Management	2.00	10.00	5.94	2.21	4.88	34

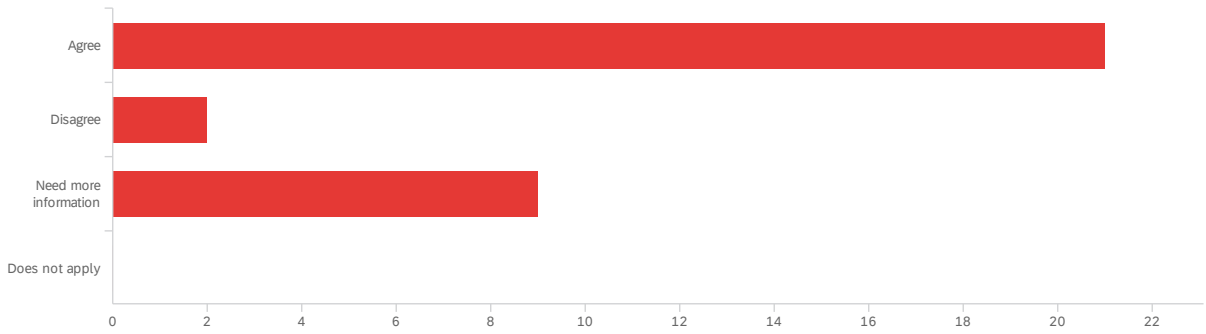
Drains on city streets for stormwater are connected to the same sanitary sewer system used for treating human waste.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Drains on city streets for stormwater are connected to the same sanitary sewer system used for treating human waste.	1.00	3.00	2.28	0.62	0.39	32

#	Field		Choice Count
1	Agree	9.38%	3
2	Disagree	53.13%	17
3	Need more information	37.50%	12
4	Does not apply	0.00%	0

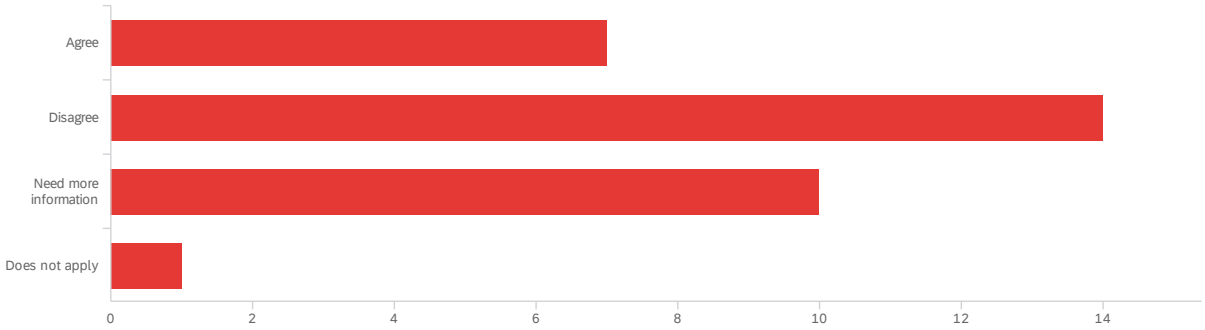
Stormwater runoff is the leading cause of pollution in rivers, wetlands and lakes.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Stormwater runoff is the leading cause of pollution in rivers, wetlands and lakes.	1.00	3.00	1.63	0.89	0.80	32

#	Field		Choice Count
1	Agree	65.63%	21
2	Disagree	6.25%	2
3	Need more information	28.13%	9
4	Does not apply	0.00%	0

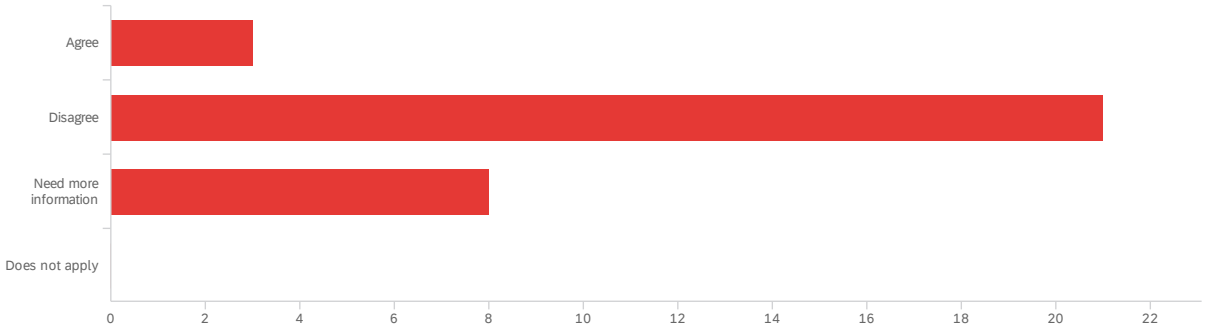
Pollution in our rivers, wetlands and lakes is more the result of industrial dumping practices than individual human activity.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Pollution in our rivers, wetlands and lakes is more the result of industrial dumping practices than individual human activity.	1.00	4.00	2.16	0.79	0.63	32

#	Field	Choice Count	
1	Agree	21.88%	7
2	Disagree	43.75%	14
3	Need more information	31.25%	10
4	Does not apply	3.13%	1

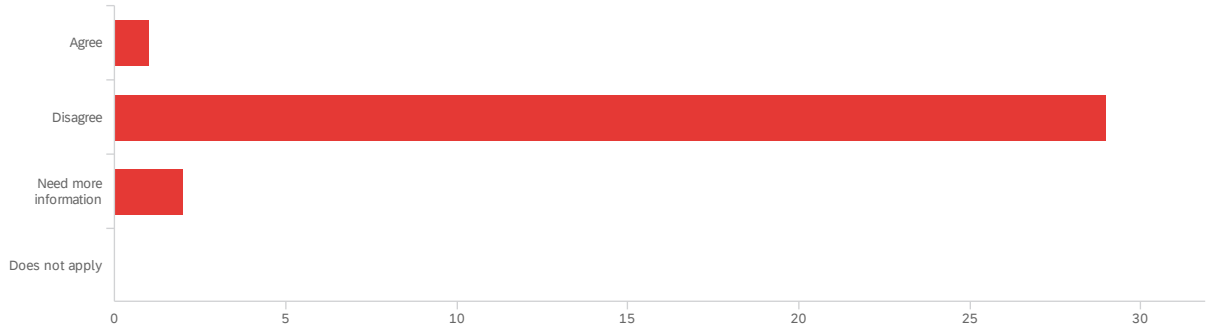
All water going into stormwater drains on the street is treated before being discharged into the environment.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	All water going into stormwater drains on the street is treated before being discharged into the environment.	1.00	3.00	2.16	0.57	0.32	32

#	Field	Choice Count	
1	Agree	9.38%	3
2	Disagree	65.63%	21
3	Need more information	25.00%	8
4	Does not apply	0.00%	0

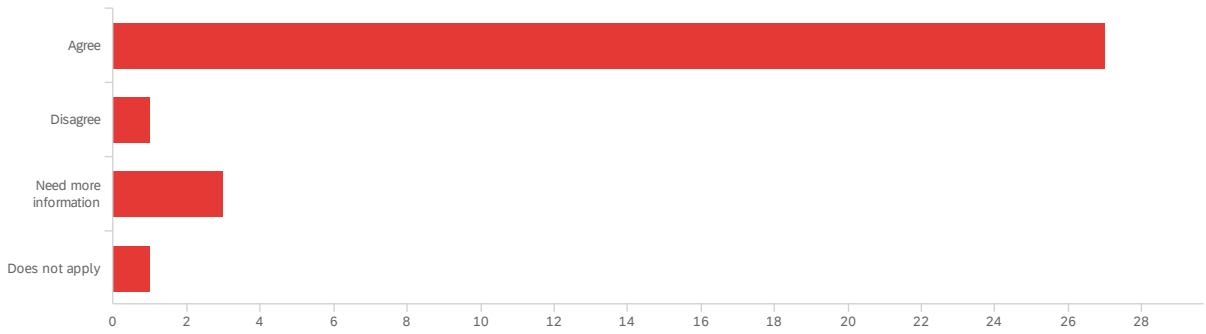
Hard surfaces such as roads and driveways are not significant sources of pollution in stormwater.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Hard surfaces such as roads and driveways are not significant sources of pollution in stormwater.	1.00	3.00	2.03	0.30	0.09	32

#	Field		Choice Count
1	Agree	3.13%	1
2	Disagree	90.63%	29
3	Need more information	6.25%	2
4	Does not apply	0.00%	0

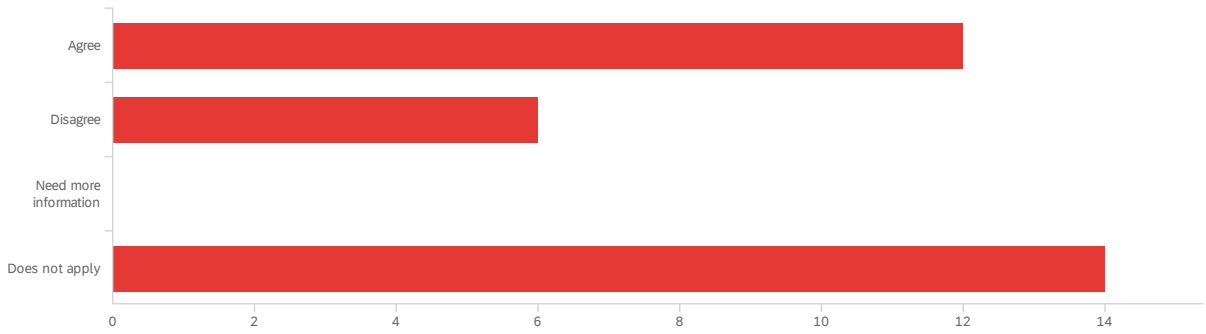
Fires have a significant impact on the water quality of rivers.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Fires have a significant impact on the water quality of rivers.	1.00	4.00	1.31	0.77	0.59	32

#	Field	Choice Count	
1	Agree	84.38%	27
2	Disagree	3.13%	1
3	Need more information	9.38%	3
4	Does not apply	3.13%	1

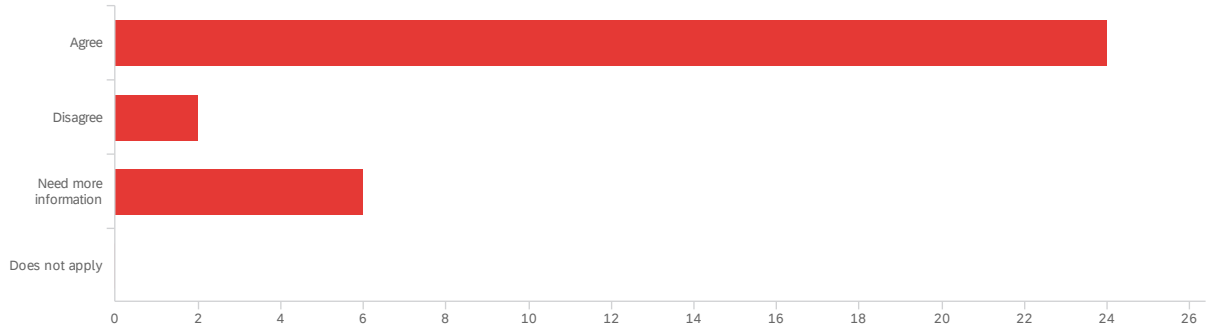
When I am outside with my pet, I always pick up my pet's waste.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	When I am outside with my pet, I always pick up my pet's waste.	1.00	4.00	2.50	1.37	1.88	32

#	Field		Choice Count
1	Agree	37.50%	12
2	Disagree	18.75%	6
3	Need more information	0.00%	0
4	Does not apply	43.75%	14

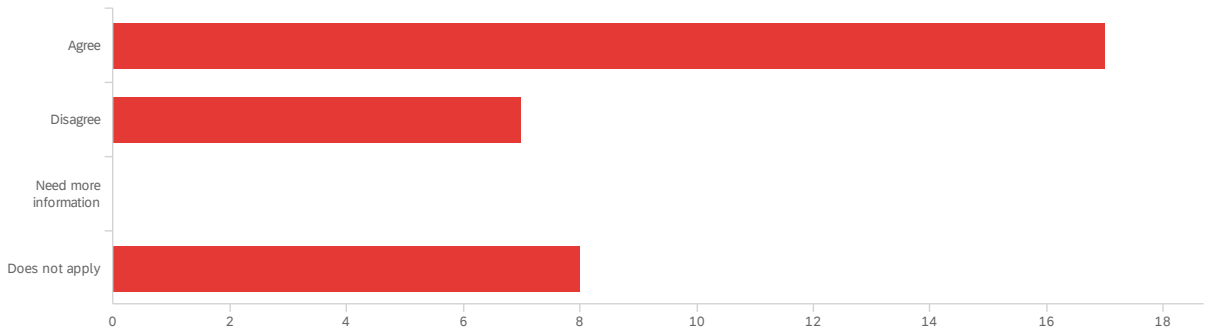
The best way to clean up spilled oil on the driveway is to fully absorb it using kitty litter or paper towels and deposit this waste in a garbage can.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	The best way to clean up spilled oil on the driveway is to fully absorb it using kitty litter or paper towels and deposit this waste in a garbage can.	1.00	3.00	1.44	0.79	0.62	32

#	Field		Choice Count
1	Agree	75.00%	24
2	Disagree	6.25%	2
3	Need more information	18.75%	6
4	Does not apply	0.00%	0

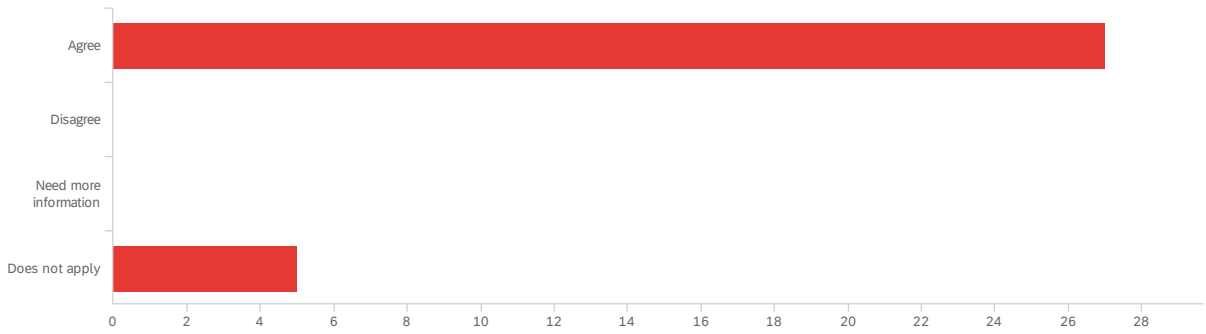
If my car or truck is dripping oil, I make sure the leak is fixed within three weeks.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	If my car or truck is dripping oil, I make sure the leak is fixed within three weeks.	1.00	4.00	1.97	1.24	1.53	32

#	Field		Choice Count
1	Agree	53.13%	17
2	Disagree	21.88%	7
3	Need more information	0.00%	0
4	Does not apply	25.00%	8

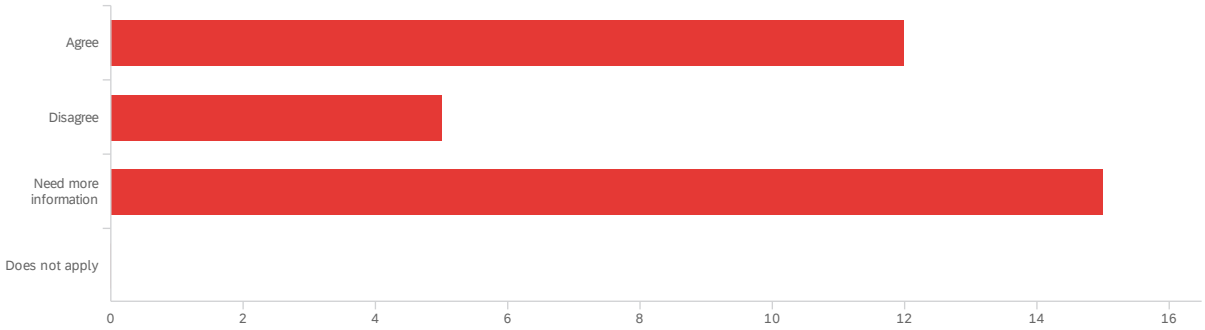
My household recycles all used motor oil.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	My household recycles all used motor oil.	1.00	4.00	1.47	1.09	1.19	32

#	Field		Choice Count
1	Agree	84.38%	27
2	Disagree	0.00%	0
3	Need more information	0.00%	0
4	Does not apply	15.63%	5

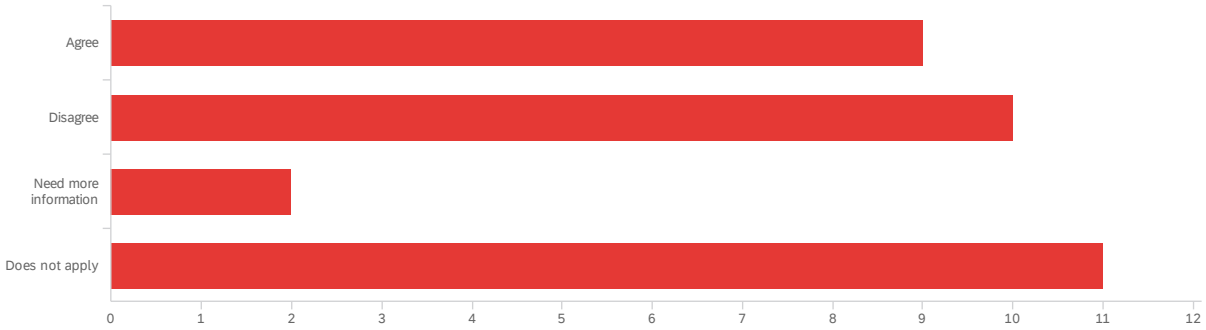
The runoff from washing a car with biodegradable soap is safe in stormwater drains.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	The runoff from washing a car with biodegradable soap is safe in stormwater drains.	1.00	3.00	2.09	0.91	0.83	32

#	Field	Choice Count	
1	Agree	37.50%	12
2	Disagree	15.63%	5
3	Need more information	46.88%	15
4	Does not apply	0.00%	0

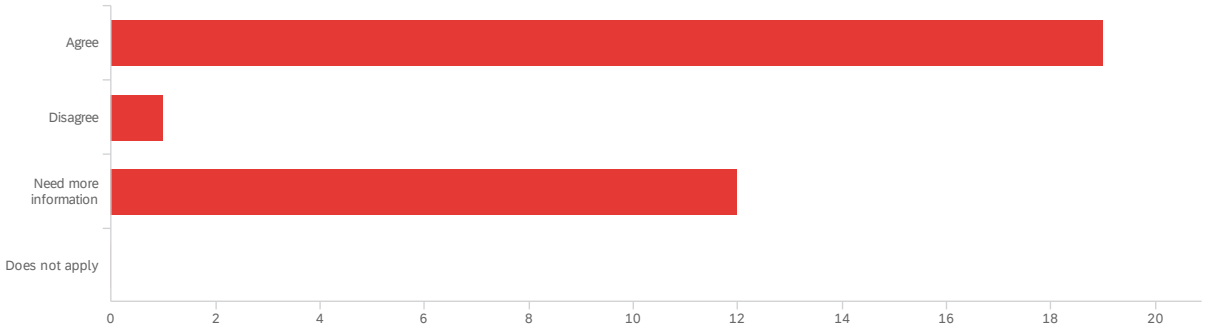
When I wash a motor vehicle at home, the soapy water ends up in a ditch or on the street.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	When I wash a motor vehicle at home, the soapy water ends up in a ditch or on the street.	1.00	4.00	2.47	1.22	1.50	32

#	Field		Choice Count
1	Agree	28.13%	9
2	Disagree	31.25%	10
3	Need more information	6.25%	2
4	Does not apply	34.38%	11

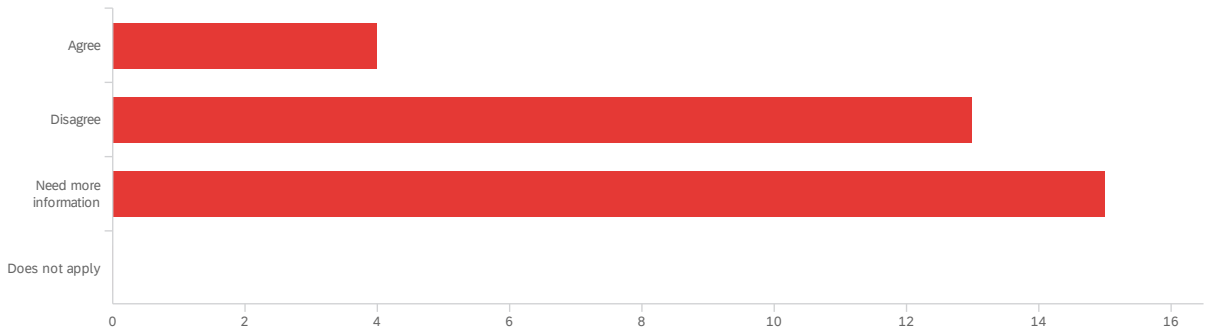
Washing a vehicle at a commercial car wash causes less pollution than washing a vehicle on the street using a biodegradable soap.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Washing a vehicle at a commercial car wash causes less pollution than washing a vehicle on the street using a biodegradable soap.	1.00	3.00	1.78	0.96	0.92	32

#	Field	Choice Count	
1	Agree	59.38%	19
2	Disagree	3.13%	1
3	Need more information	37.50%	12
4	Does not apply	0.00%	0

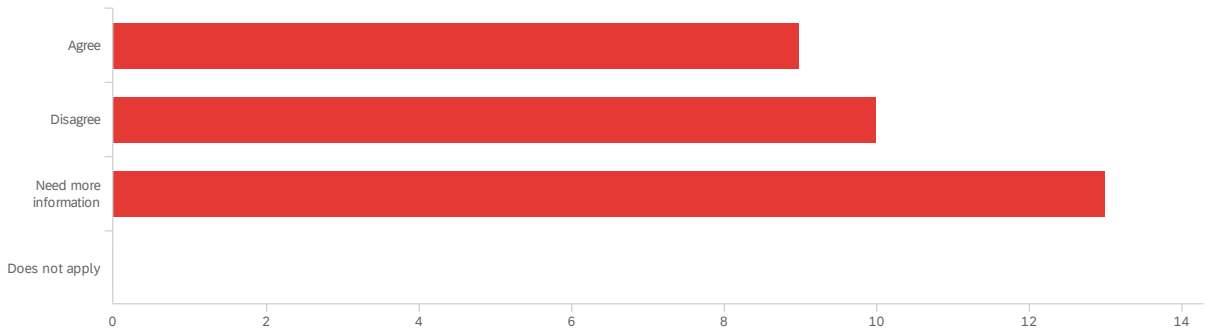
Grass clippings and leaves are not regarded as harmful in stormwater.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Grass clippings and leaves are not regarded as harmful in stormwater.	1.00	3.00	2.34	0.69	0.48	32

#	Field		Choice Count
1	Agree	12.50%	4
2	Disagree	40.63%	13
3	Need more information	46.88%	15
4	Does not apply	0.00%	0

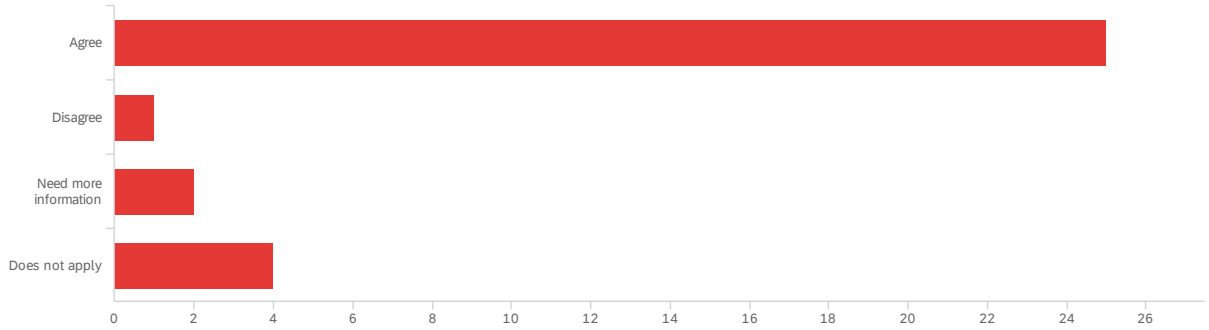
Sediment or dirt in stormwater is natural and not regarded as pollution.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Sediment or dirt in stormwater is natural and not regarded as pollution.	1.00	3.00	2.13	0.82	0.67	32

#	Field	Choice Count	
1	Agree	28.13%	9
2	Disagree	31.25%	10
3	Need more information	40.63%	13
4	Does not apply	0.00%	0

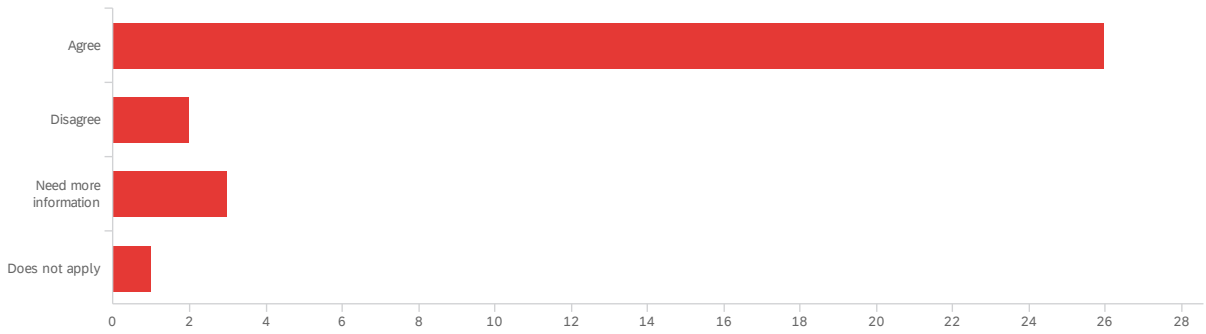
The downspouts at my house convey the water to an area where it is absorbed by the ground.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	The downspouts at my house convey the water to an area where it is absorbed by the ground.	1.00	4.00	1.53	1.06	1.12	32

#	Field	Choice Count	
1	Agree	78.13%	25
2	Disagree	3.13%	1
3	Need more information	6.25%	2
4	Does not apply	12.50%	4

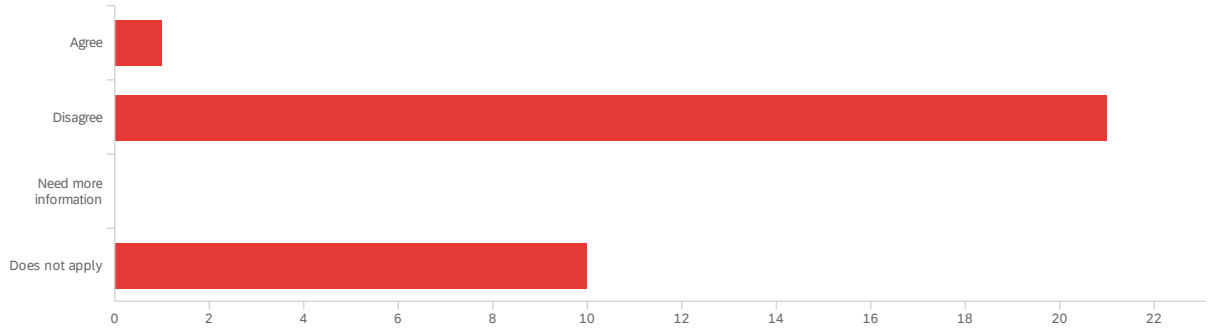
Using a mulching lawn mower reduces the need to fertilize a lawn.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Using a mulching lawn mower reduces the need to fertilize a lawn.	1.00	4.00	1.34	0.77	0.60	32

#	Field		Choice Count
1	Agree	81.25%	26
2	Disagree	6.25%	2
3	Need more information	9.38%	3
4	Does not apply	3.13%	1

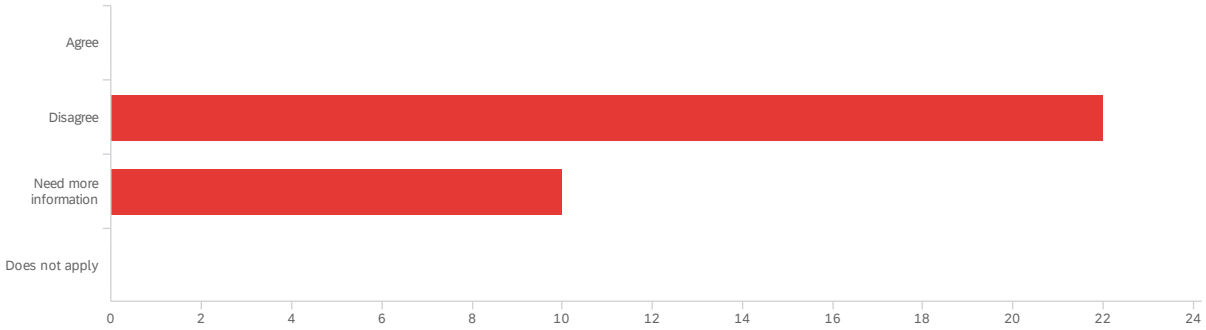
In the past 12 months, I may have applied a higher dose of insecticide or weed killer around my house than the directions say to use.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	In the past 12 months, I may have applied a higher dose of insecticide or weed killer around my house than the directions say to use.	1.00	4.00	2.59	0.96	0.93	32

#	Field	Choice Count	
1	Agree	3.13%	1
2	Disagree	65.63%	21
3	Need more information	0.00%	0
4	Does not apply	31.25%	10

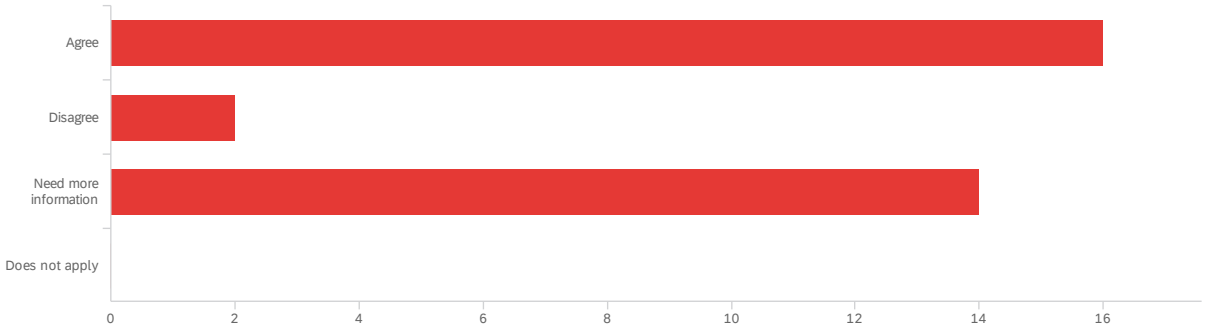
Bricks or pavers offer no advantage for reducing runoff over concrete or asphalt pavement.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Bricks or pavers offer no advantage for reducing runoff over concrete or asphalt pavement.	2.00	3.00	2.31	0.46	0.21	32

#	Field		Choice Count
1	Agree	0.00%	0
2	Disagree	68.75%	22
3	Need more information	31.25%	10
4	Does not apply	0.00%	0

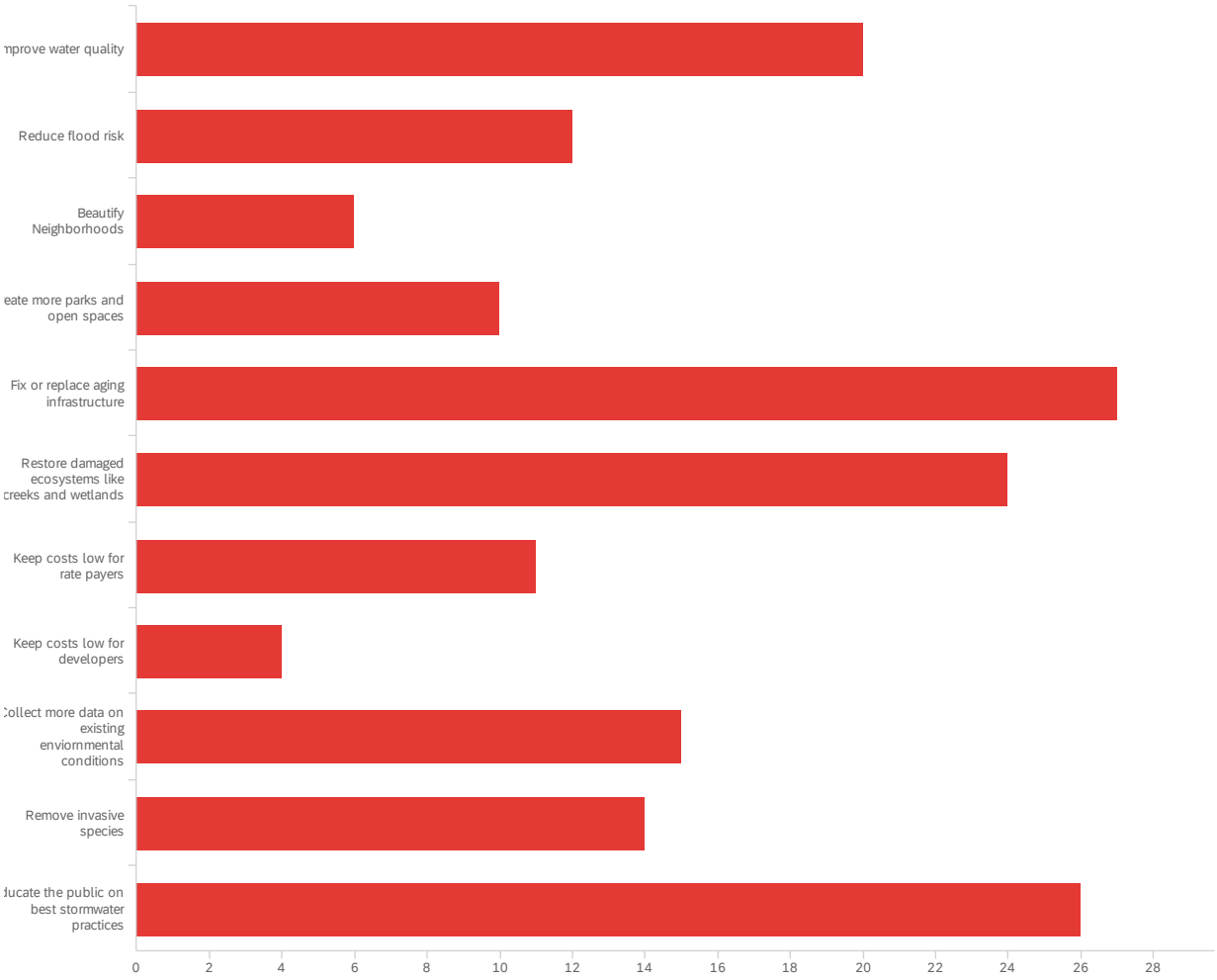
An illicit or unlawful stormwater discharge is primarily defined as anything that enters a storm drain system that is not made up entirely of stormwater.



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	An illicit or unlawful stormwater discharge is primarily defined as anything that enters a storm drain system that is not made up entirely of stormwater.	1.00	3.00	1.94	0.97	0.93	32

#	Field	Choice Count	
1	Agree	50.00%	16
2	Disagree	6.25%	2
3	Need more information	43.75%	14
4	Does not apply	0.00%	0

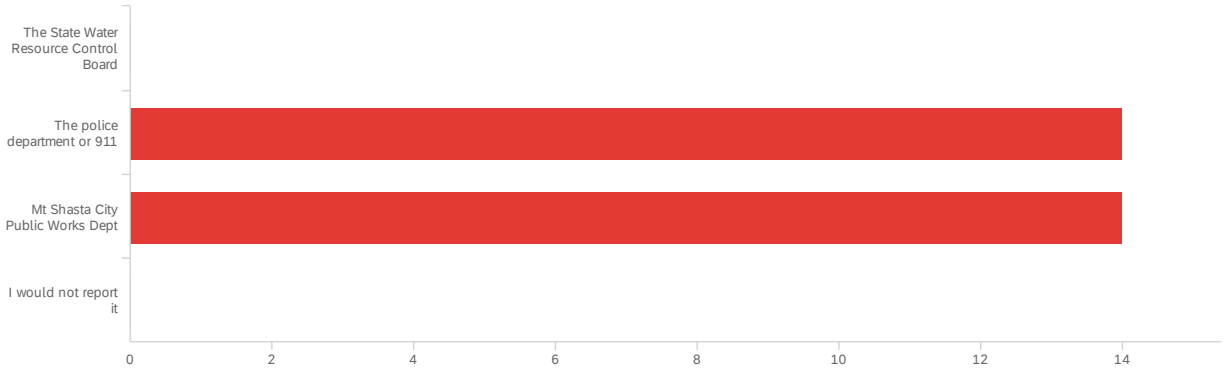
Which stormwater related priorities should the City emphasize? Check all that apply.



#	Field	Choice Count	
1	Improve water quality	11.83%	20
2	Reduce flood risk	7.10%	12
3	Beautify Neighborhoods	3.55%	6
4	Create more parks and open spaces	5.92%	10
5	Fix or replace aging infrastructure	15.98%	27
6	Restore damaged ecosystems like creeks and wetlands	14.20%	24
7	Keep costs low for rate payers	6.51%	11

#	Field	Choice Count	
8	Keep costs low for developers	2.37%	4
9	Collect more data on existing enviornmental conditions	8.88%	15
10	Remove invasive species	8.28%	14
11	Educate the public on best stormwater practices	15.38%	26

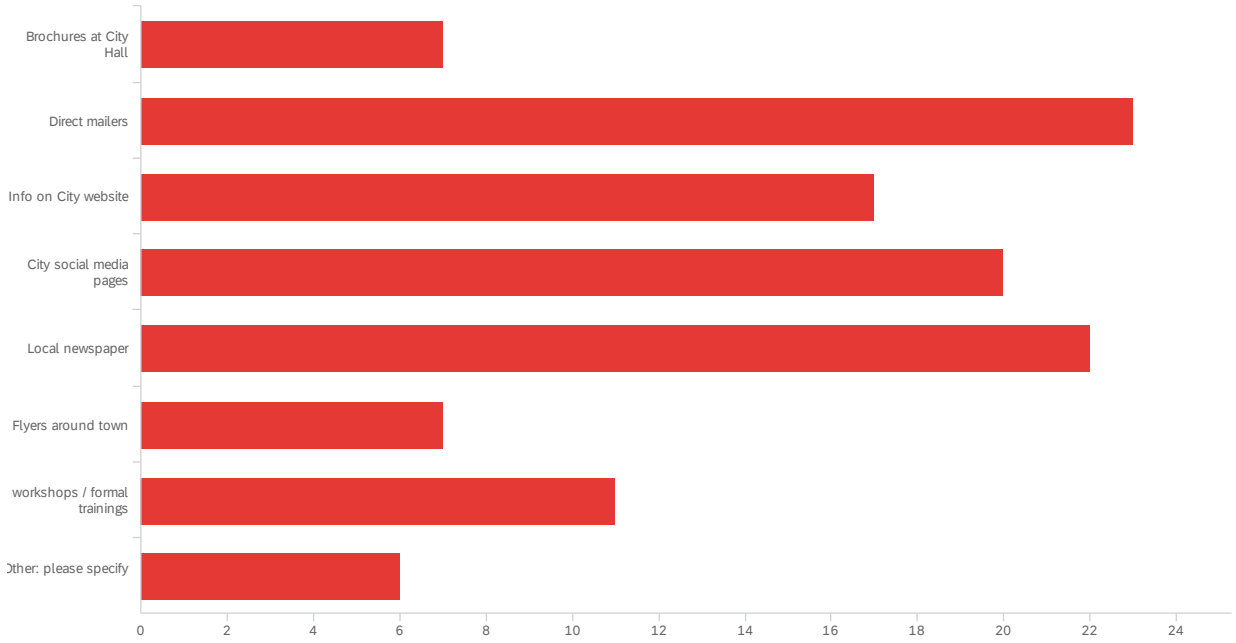
If you witnessed someone pouring a gallon of used paint thinner into a stormwater drain, which agency would you call first to report it?



#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	If you witnessed someone pouring a gallon of used paint thinner into a stormwater drain, which agency would you call first to report it?	2.00	3.00	2.50	0.50	0.25	28

#	Field		Choice Count
1	The State Water Resource Control Board	0.00%	0
2	The police department or 911	50.00%	14
3	Mt Shasta City Public Works Dept	50.00%	14
4	I would not report it	0.00%	0

Which of the following would be effective ways for the City to share educational materials about stormwater best practices with you? (check all that apply)



#	Field		Choice Count
1	Brochures at City Hall	6.19%	7
2	Direct mailers	20.35%	23
3	Info on City website	15.04%	17
4	City social media pages	17.70%	20
5	Local newspaper	19.47%	22
6	Flyers around town	6.19%	7
7	workshops / formal trainings	9.73%	11
8	Other: please specify	5.31%	6

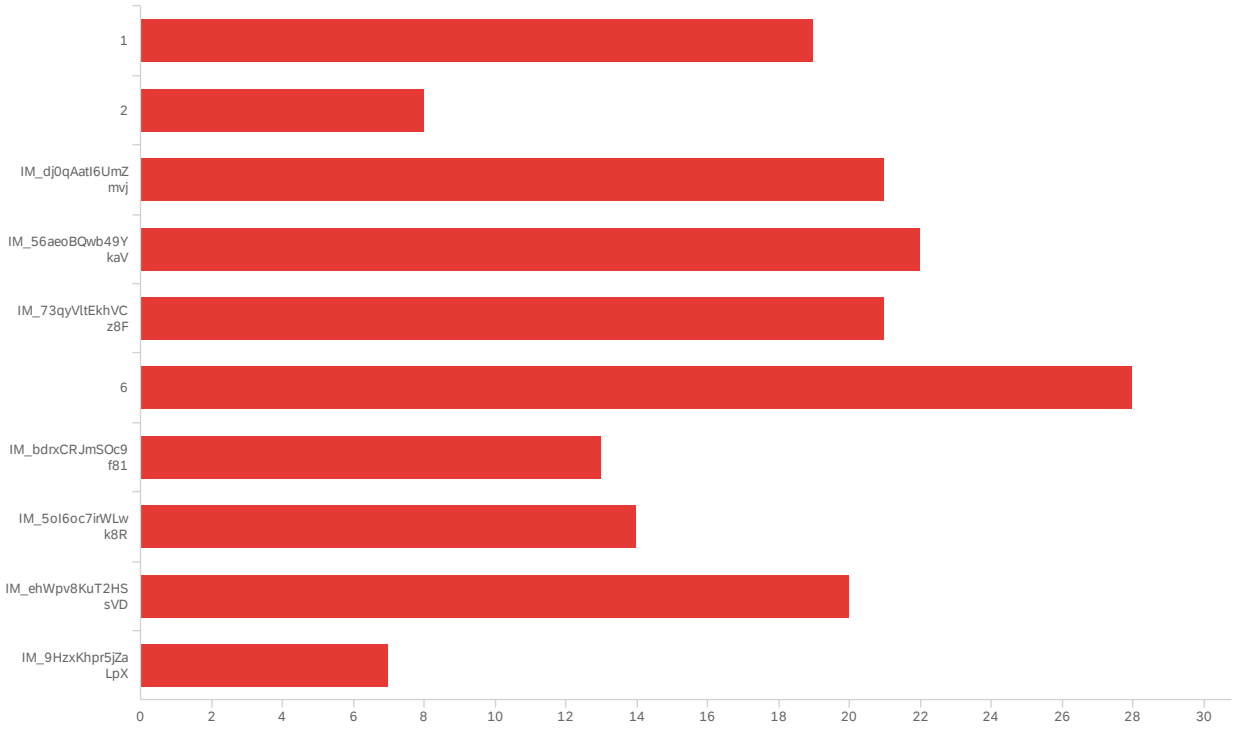
Q36_8_TEXT - Other: please specify

Other: please specify

Other: please specify
young people's education via school programs
Email newsletter
Community Volunteer Work Days
All of the above , the ones I left blank are less direct.
Sections during CC meetings and on MCTV
Info on City bills

Which of the following drainage features would you like to see constructed in the City?

Select as many as you like.



#	Field	Choice Count	
1	1	10.98%	19
2	2	4.62%	8
3		12.14%	21
4		12.72%	22

#	Field	Choice Count
5		12.14% 21
6	6	16.18% 28
7		7.51% 13
8		8.09% 14
9		11.56% 20
10		4.05% 7

Appendix D: National Recommended Water Quality Criteria for Aquatic Life Criteria Table

Pollutant (P = Priority Pollutan	CAS Number	Freshwater CMC1 (acute) (µg/L)	Freshwater CCC2 (chronic) (µg/L)	Saltwater CMC1 (acute) (µg/L)	Saltwater CCC2 (chronic) (µg/L)	Publication Year	Notes
Acrolein (P)	107028	3ug/L	3ug/L	—	—	2009	
Aesthetic Qualities	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Aldrin (P)	309002	3	—	1.3	—	1980	These criteria are based on the 1980 criteria which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
Alkalinity	—	—	20000	—	—	1986	The CCC of 20mg/L is a minimum value except where alkalinity is naturally lower, in which case the criterion cannot be lower than 25% of the natural level.
alpha-Endosulfan (P)	959988	0.22	0.056	0.034	0.0087	1980	These criteria are based on the 1980 criteria which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines. This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.
Aluminum pH 5.0 - 10.5	7429905	--	--	—	—	2018	The criteria is based on the water chemistry data (for pH, hardness and DOC) entered into the criteria calculator for a given location.
Ammonia	7664417	—	—	—	—	2013 (Freshwater), 1989 (Saltwater)	Freshwater criteria are ph, temperature and life-stage dependent. Saltwater criteria are pH and temperature dependent.
Arsenic	7440382	340	150	69	36	1995	This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic. Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria.
Atrazine	1912249						
Bacteria	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
beta-Endosulfan (P)	33213659	0.22	0.056	0.034	0.0087	1980	These criteria are based on the 1980 criteria which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines. This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.
Boron	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Cadmium (P)	7440439	1.8	0.72	33	7.9	2016	Freshwater acute and chronic criteria are hardness-dependent and were normalized to a hardness of 100 mg/L as CaCO3 to allow the presentation of representative criteria values. . Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria.
Carbaryl	63252	2.1	2.1	1.6	—	2012	
Chlordane (P)	57749	2.4	0.0043	0.09	0.004	1980	These criteria are based on the 1980 criteria which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
Chloride	16887006	860000	230000	—	—	1988	
Chlorine	7782505	19	11	13	7.5	1986	
Chlorpyrifos	2921882	0.083	0.041	0.011	0.0056	1986	

Chromium (III) (P)	16065831	570	74	—	—	1995	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. The freshwater criterion for this metal is expressed as a function of hardness (mg/L). The value given here corresponds to a hardness of 100 mg/L.
Chromium (VI) (P)	18540299	16	11	1,100	50	1995	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria.
Color	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Copper (P)	7440508	—	—	4.8	3.1	2007	Freshwater criteria calculated using the Biotic Ligand Model. Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria.
Cyanide (P)	57125	22	5.2	1	1	1985	These recommended water quality criteria are expressed as µg free cyanide (CN/L).
Demeton	8065483	—	0.1	—	0.1	1985	
Diazinon	333415	0.17ug/L	0.17ug/L	0.82ug/L	0.82ug/L	2005	
Dieldrin (P)	60571	0.24	0.056	0.71	0.0019	1995	The freshwater CCC criterion and both Saltwater criteria are based are based on the 1980 criteria which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
Endrin (P)	72208	0.086	0.036	0.037	0.0023	1995	The derivation of the CCC for this pollutant did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels.
gamma-BHC (Lindane) (P)	58899	0.95	—	0.16	—	1995	The Saltwater CCC criterion is based on the 1980 criteria which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
Gases, Total Dissolved	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Guthion	86500	—	0.01	—	0.01	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Hardness	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Heptachlor (P)	76448	0.52	0.0038	0.053	0.0036	1980	These criteria are based on the 1980 criteria which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.
Heptachlor Epoxide (P)	1024573	0.52	0.0038	0.053	0.0036	1981	These criteria are based on the 1980 criteria which used different Minimum Data Requirements and derivation procedures from the 1985 Guidelines. If evaluation is to be done using an averaging period, the acute criteria values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines. This value was derived from data for heptachlor and there was insufficient data to determine relative toxicities of heptachlor and heptachlor epoxide.
Iron	7439896	—	1000	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Lead (P)	7439921	82	3.2	140	5.6	1984	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. The freshwater criterion for this metal is expressed as a function of hardness (mg/L). The value given here corresponds to a hardness of 100 mg/L.
Malathion	121755	—	0.1	—	0.1	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
	7439976	1.4	0.77	1.8	0.94	1995	terms of the dissolved metal in the water column. See Office of Water Policy and Technical Guidance on Interpretation and

Mercury (P)	22967926						Implementation of Aquatic Life Metals Criteria.
Methoxychlor	72435	—	0.03	—	0.03	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Methyl Tertiary-Butyl Ether (MTBE)							
Mirex	2385855	—	0.001	—	0.001	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Nickel (P)	7440020	470	52	74	8.2	1995	Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. See Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. The freshwater criterion for this metal is expressed as a function of hardness (mg/L). The value given here corresponds to a hardness of 100 mg/L.
Nonylphenol	84852153	28 ug/L	6.6 ug/L	7 ug/L	1.7 ug/L	2005	
Nutrients	—	—	—	—	—	—	See EPA's Ecoregional criteria for Total Phosphorus, Total Nitrogen, Chlorophyll a and Water Clarity (Secchi depth for lakes; turbidity for streams and rivers) (& Level III Ecoregional criteria)
Oil and Grease	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Oxygen, Dissolved Freshwater Oxygen, Dissolved Saltwater	7782447	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for freshwater. For saltwater, see Aquatic Life Criteria for Dissolved Oxygen (Saltwater) Cape Cod to Cape Hatteras.
Parathion	56382	0.065	0.013	—	—	1995	
Pentachlorophenol (P)	87865	19	15	13	7.9	1995	Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH and values displayed in table correspond to a pH of 7.8.
pH	—	—	6.5 – 9	—	6.5 – 8.5	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement. For open ocean waters where the depth is substantially greater than the euphotic zone, the pH should not be changed more than 0.2 units from the naturally occurring variation or any case outside the range of 6.5 to 8.5. For shallow, highly productive coastal and estuarine areas where naturally occurring pH variations approach the lethal limits of some species, changes in pH should be avoided but in any case should not exceed the limits established for fresh water, i.e., 6.5-9.0.
Phosphorus Elemental	7723140	—	—	—	—	1986	
Polychlorinated Biphenyls (PCBs) (P)	—	—	0.014	—	0.03	—	This criterion applies to total PCBs, (e.g., the sum of all congener or all isomer or homolog or Aroclor analyses.)
Selenium (P)	7782492	—	---	290	71	2016 Freshwater	See Aquatic Life Ambient Water Quality Criterion for Selenium - Freshwater 2016 for narrative statement.
Silver (P)	7440224	3.2	—	1.9	—	1980	
Solids Suspended and Turbidity	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Sulfide-Hydrogen Sulfide	7783064	—	2	—	2	1986	
Tainting Substances	—	—	—	—	—	1986	See Quality Criteria for Water, 1986 ("Gold Book") for narrative statement.
Temperature	—	—	—	—	—	1986	Criteria is species dependent. See Quality Criteria for Water, 1986 ("Gold Book").
Toxaphene (P)	8001352	0.73	0.0002	0.21	0.0002	1986	
Tributyltin (TBT)	—	0.46	0.072	0.42	0.0074	2004	
Zinc (P)	7440666	120	120	90	81	1995	
4,4'-DDT (P)	50293	1.1	0.001	0.13	0.001	1980	

Appendix E: Local Water Quality 2010-2013

Sample Source	Year Sampled	Constituent	Value	Unit
City Well	2010	Arsenic	0.00041	mg/l
City Well	2010	Alkalinity	52.6	mg/l CaCO3
City Well	2010	Barium	0.00369	mg/l
City Well	2010	Chromium	0.00026	mg/l
City Well	2010	Copper	0.0012	mg/l
City Well	2010	Flowrate	600	gal/min
City Well	2010	Hardness	32.7	mg/l CaCO3
City Well	2010	Lead	0.000217	mg/l
City Well	2010	Nitrate	0.686	mg/l NO3
City Well	2010	pH	6.5	std unit
City Well	2010	pH	7	std unit
City Well	2010	Specifc Conductance	99	uS/cm @25C°
City Well	2010	Specifc Conductance	102	uS/cm @25C°
City Well	2010	TDS	104	mg/l
City Well	2010	TDS	105	mg/l
City Well	2010	Temperature	9	C°
City Well	2010	Zinc	0.072	mg/l
Cold Creek Spring	2010	Arsenic	0.05	mg/l
Cold Creek Spring	2010	Barium	0.00081	mg/l
Cold Creek Spring	2013	Barium	0.00089	mg/l
Cold Creek Spring	2015	Barium	0.0008	mg/l
Cold Creek Spring	2010	Chromium	0.0001	mg/l
Cold Creek Spring	2013	Chromium	0.00014	mg/l
Cold Creek Spring	2010	Copper	0.0014	mg/l
Cold Creek Spring	2013	Copper	0.0014	mg/l
Cold Creek Spring	2015	Copper	0.0036	mg/l
Cold Creek Spring	2013	Flouride	0.04	mg/l
Cold Creek Spring	2015	Flouride	0.03	mg/l

Cold Creek Spring	2010	Hardness	17.9	mg/l CaCO3
Cold Creek Spring	2013	Hardness	17.5	mg/l CaCO3
Cold Creek Spring	2015	Hardness	16.1	mg/l CaCO3
Cold Creek Spring	2010	Lead	0.000234	mg/l
Cold Creek Spring	2013	Lead	0.000282	mg/l
Cold Creek Spring	2015	Lead	0.00125	mg/l
Cold Creek Spring	2010	Nitrate	0.301	mg/l NO3
Cold Creek Spring	2015	Nitrate	0.185	mg/l NO3
Cold Creek Spring	2010	pH	6.3	std unit
Cold Creek Spring	2010	pH	6.8	std unit
Cold Creek Spring	2013	pH	5.8	std unit
Cold Creek Spring	2013	pH	7.2	std unit
Cold Creek Spring	2015	pH	4.6	std unit
Cold Creek Spring	2015	pH	7.2	std unit
Cold Creek Spring	2010	Specifc Conductance	52	uS/cm @25C°
Cold Creek Spring	2010	Specifc Conductance	50	uS/cm @25C°
Cold Creek Spring	2013	Specifc Conductance	48	uS/cm @25C°
Cold Creek Spring	2013	Specifc Conductance	49	uS/cm @25C°
Cold Creek Spring	2015	Specifc Conductance	47	uS/cm @25C°
Cold Creek Spring	2015	Specifc Conductance	48	uS/cm @25C°
Cold Creek Spring	2010	TDS	62	mg/l
Cold Creek Spring	2013	TDS	37	mg/l
Cold Creek Spring	2015	TDS	48	mg/l
Cold Creek Spring	2010	Temperature	6.5	C°
Cold Creek Spring	2013	Temperature	5.5	C°
Cold Creek Spring	2015	Temperature	6	C°
Cold Creek Spring	2010	Zinc	37.9	mg/l
Cold Creek Spring	2013	Zinc	11.9	mg/l
Cold Creek Spring	2015	Zinc	5.4	mg/l

Appendix F: Quantifiable Metrics Plan

Background: The City of Mt Shasta is updating its Stormwater Master Plan, and part of the update involves collecting water quality data. The State Water Board provides detailed guidelines for these plans and emphasizes the importance of statistically meaningful data for a number of water quality criteria. The City is classified as a small Disadvantaged Community (DAC), which excuses the City from these requirements. The City has considerable leeway to determine the scope of its surface water quality monitoring. While not necessary to comply with regulatory requirements, monitoring will serve to improve the City's understanding of pollutants in its urban runoff, strengthen the City's eligibility for grant funding, and establish a baseline of data which can be used in future evaluation. Per State guidelines, "Watershed-wide and individual project data should be stored in centralized local, regional, or statewide water quality data collection systems."[9] Data collected by the city will be uploaded to the California Environmental Data Exchange Network (CEDEN).

Water Quality Criteria: Some water quality criteria are simple to test for in the field, some can be tested at the Waste Water Treatment Plant (WWTP) lab, while others require outside laboratory analysis. The criteria easily measured in-house are:

1. Dissolved Oxygen (testable in field)
2. Temperature (testable in field)
3. pH (testable in field)
4. Specific Conductance (testable in field)- not certified
5. Total Suspended Solids (TSS) (testable at WWTP lab)
6. Nitrogen Oxides (testable at WWTP lab)- not certified

Analysis by Basic Laboratories in Redding, CA will be used to measure the following criteria:

1. Total Coliform (testable at WWTP lab, if necessary)
2. Fecal Coliform/ E. coli (testable at WWTP lab, if necessary)
3. Metals (including Mercury)
4. PCBs
5. VOCs

Sampling Locations (map on page 4): The State Water Board has advised that it is most important to test Municipal Separate Storm Sewer System (MS4) effluent **a)** at its point of discharge to receiving waters; **b)** the downstream chemistry of those receiving waters after dilution has taken place; and **c)** creeks at their entry point to the city (also called the rural-urban interface). These locations allow the clearest possible view of how urban runoff influences the chemistry of water bodies. Given the abundance of wetlands in the City and their well-documented effects on water quality, the City should consider sampling these too. As shown on the attached map (Appendix A, page 4), the proposed sampling locations are:

1. Upper Cold Creek
2. Mid Cold Creek
3. Lower Cold Creek

9 State Water Resources Control Board. Storm Water Resource Plan Guidelines (2015).

4. Roseburg
5. Sisson Wetland
6. Alma/ Lake St Confluence
7. Big Springs
8. Lower Wagon Creek

Equipment & Documentation Needs:

- Sampling Bottles, available from Basic Labs via the bottle request form for no additional charge
- Handheld probes for field testing are already available from WWTP; no purchase will be necessary.
- Calibration chemicals for handheld probes, $77.07 one time
- Nitrogen test kits, $159 per box of 25 tests, $50.56 per day of sampling
- Custody Records/ "Chain of Custody" documents available from Brooke.
- MPN 15 tubes and BGB tubes, $8.03 per test. $64.24 per day of sampling. (Only needed if fecal/total coliform MPN 15 tests are performed at WWTP; see below.)

Sample Frequency and Funding Considerations:

City staff have determined that funding availability and the processing capacity of the WWTP lab are not sufficient to perform frequent random sampling of all chemical criteria at all sample locations. It is beyond the scope of the City's sampling efforts at this time to produce a comprehensive, statistically meaningful, randomized dataset. Because this monitoring is being pursued voluntarily, the City will instead strategically sample on representative days and locations in an effort to generate as much useful data as possible with limited resources. City staff will perform analysis of chemical criteria 1-6 (as listed above) in-house at least monthly. Through Basic Labs in Redding, the City will perform analysis of criteria 7-11 on a quarterly basis.

For the in-house testing of all 8 sample sites, analysis will cost the City $50.56 per sample day for the Nitrogen test kit and a one-time cost of $77.07 for the calibration chemicals required. (This cost per sample day increases to $114.80 if the WWTP also conducts the fecal/total coliform enumeration in-house, although this scenario is not the City's plan at this time.) Conducting this sampling once per month creates a cost of **$151.68 per quarter and $606.72 annually** for in-house testing of criteria 1-6, **plus the one-time cost of $77.07.**

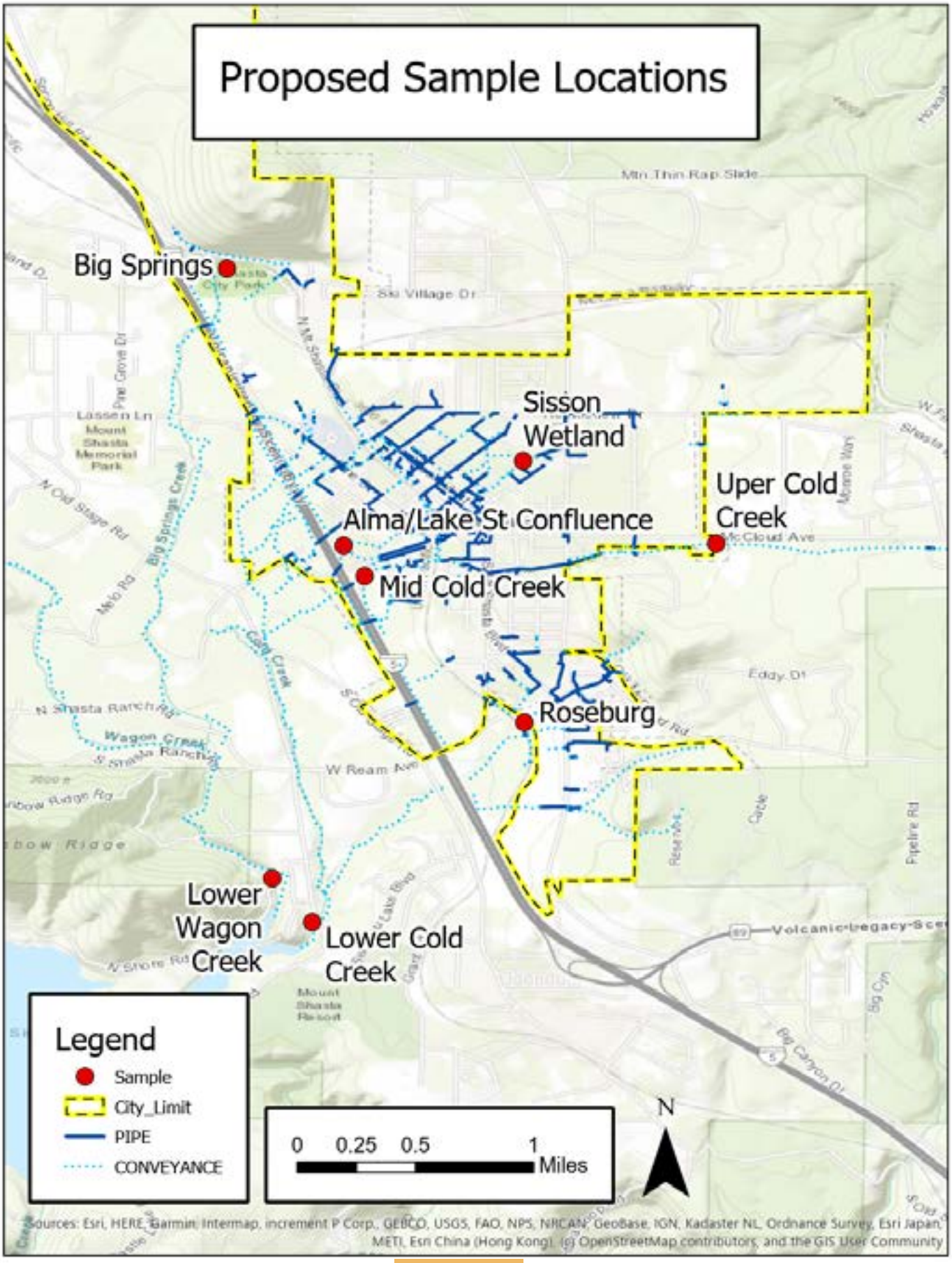
Sampling for analysis by Basic Labs should be conducted on a quarterly basis at a minimum. Table A illustrates the preferred testing and pricing.

If the City pursues this complete list of tests for each of the 8 sample locations, the total cost for all samples would be **$4,686.40 per quarter, $18,745.60** for quarterly sampling for one year.

Therefore, the full cost to the City for ALL testing (including monthly in-house tests, quarterly tests through Basic Labs, and one-time equipment costs) would be **$19,429.39 annually.**

Table A. Basic Lab Testing Information		
Test Name	**Criteria included**	**Price with discount per sample ($)**
Water Toxicity Panel	Bacteria (Total and Fecal Coliform) presence/absence, Turbidity, Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Copper, Fluoride, Lead, Mercury, Nitrate, Nitrite, Selenium, Thallium	167.2
EPA 524.2 - VOCs	VOCs	209.6
EPA 508 - Pesticides/ PCBs	PCBs	160
Total & Fecal Coliform MPN 15	Total and Fecal Coliform Enumeration	48
Sample fee	N/A	1
	Total Cost per sample ($)	**585.80**

There are many lower cost alternatives to this, the simplest and most minimal of which is to forego outside laboratory testing entirely until outside funding becomes available, and only conduct in-house tests quarterly rather than monthly. Under this lowest cost scenario, the chemical criteria analyzed would include Dissolved Oxygen, Temperature, pH, Specific Conductance, Total Suspended Solids (TSS), Nitrogen Oxides, and Total Coliform and Fecal Coliform/ E. coli MPN 15. Under this lower cost option, metals (including mercury), VOCs, and PCBs are not analyzed. This would cost **$114.80 quarterly, $459.20 annually**, for 8 sample sites.


Proposed Sample Locations
Big Springs
Sisson Wetland
Uper Cold Creek
Alma/Lake St Confluence
Mid Cold Creek
Roseburg
Lower Wagon Creek
Lower Cold Creek
Legend
Sample
City_Limit
PIPE
CONVEYANCE
0 0.25 0.5 1 Miles
N
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Appendix G: Caltrans De-Icing Application Table

(A) Application Guidelines

The following guidelines should be used when applying dry salt (Sodium Chloride- NaCl).

DRY SALT APPLICATION RATES

TEMPERATURE degrees Fahrenheit			RATE Pounds per lane mile		
With Falling temp F	In shade	In sun	To prevent ice films or to weaken bond between snow and road surface	To remove thin crusts of snow and ice after plowing	To remove thick crusts of snow and ice
	25-up	20-25	50 – 200	150	300
25-up	20-25	10-20	100 – 200	150 – 250	300 – 400
20-25	10-20	5	125 – 250	250	500

Appendix H: Stormwater Project List

1. Cold Creek Realignment and Restoration

Location: Cold Creek is a highly-altered urban creek that emerges from Cold Springs just east of City Limits and drains west through the City, ultimately to Lake Siskiyou and the Sacramento River. The City owns the right to divert up to 100% of Cold Spring's flow for its municipal water supply, but Cold Spring's production is usually in excess of City needs. Cold Spring's surplus flow is returned to the historic natural channel of Cold Creek, where it continues west into the City of Mt Shasta. Along its route, Cold Creek receives additional fow from urban runoff and tributary storm drains.

Cold Creek's historic channel flows west, parallel to and just south of McCloud Ave, until it is directed underground through a series of 24-36" pipes starting at Eiler Road. Cold Creek flows through this pipe system under City streets, private property, and critical infrastructure until it emerges as a daylighted channel just east of the Union Pacific Railroad (UPR). The creek continues through a large railroad culvert and two road culverts in a badly eroded channel before it reaches its culvert under I-5, where it exits City Limits.

Problems currently: The entire undergrounded section of Cold Creek requires major improvements. Mt Shasta's 1999 Stormwater Master Plan recommended realigning Cold Creek between Eiler and Water Streets and replacing all sections of 24" pipe with new 36" pipe, but that project was never completed. As a result, 20 years later this critical drainage

infrastructure remains undersized and badly eroded. Aging metal pipes are beginning to fail which threatens to cause road collapse, flooding, or other damage to public and private property. One event of road collapse has already occurred under Mt Shasta Blvd in 2019, which cost the City over $16,000 to repair. Key sections of Cold Creek are piped through private property without easements, which has prevented easy access by maintenance personnel.
The daylighted section of Cold Creek from the UPR tracks to I-5 is also in disrepair, with an unstable eroding stream channel, severely damaged culverts under public and private roads, densely overgrown invasive species, and homeless encampments. This section of Cold Creek is scheduled for inclusion in the upcoming development of Mt Shasta Centennial Park.

Site Photos:

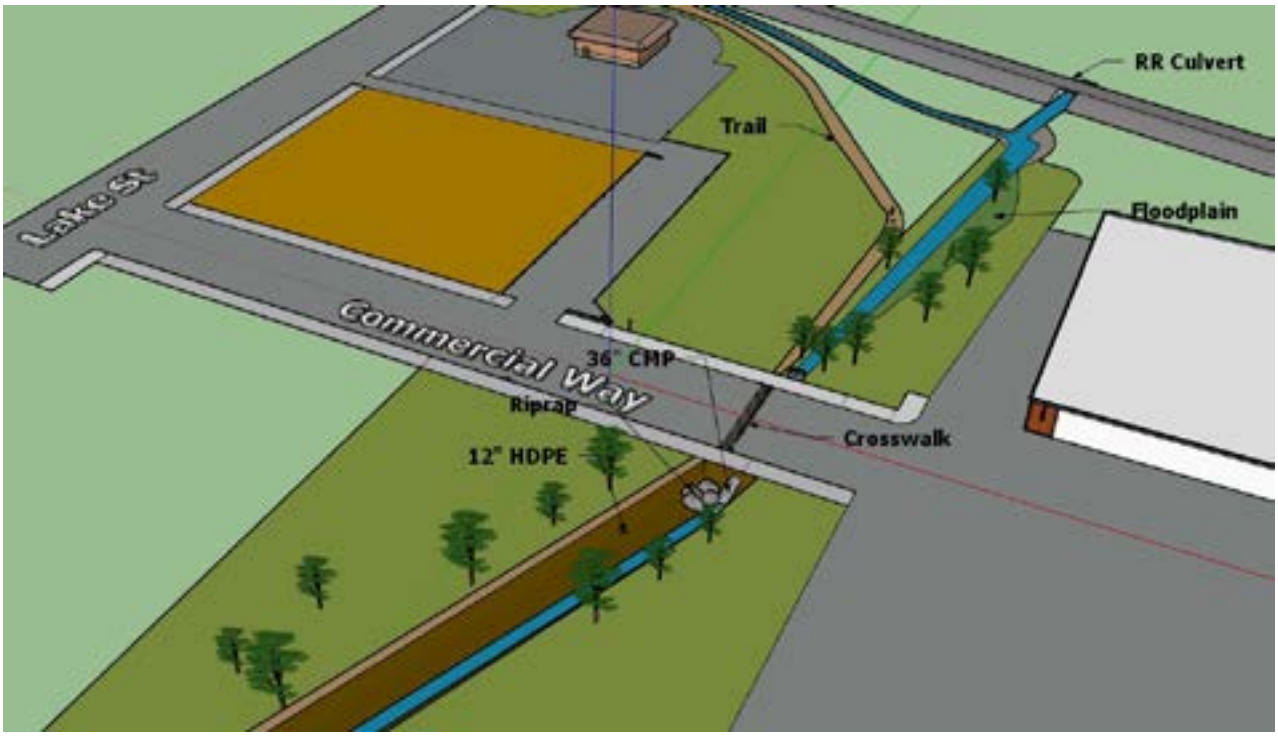
Proposed changes: All sections of Cold Creek in 24” or 30” pipes urgently need to be replaced with new 36” or larger PVC pipe, and the creek’s route needs to be realigned to flow under roads in the public right of way rather than through deeply buried pipes on private property, so Public Works staff can maintain access. The new route will follow Smith Street, Mt Shasta Blvd, and Water Street. This project will also replace or repair the severely damaged culverts where the creek passes under Commercial Ave and Morgan Way.

The daylighted section of the Creek between UPR and I-5 should be restored by professional contractors to reimpose natural hydrology, reduce erosion, reintroduce native plant communities, improve water quality, slow and cool water, and enhance neighborhood aesthetics. This may

also include the construction of a wet pond within the proposed Centennial Park, which would further improve water quality and habitat benefits. The long term maintenance responsibilities for the naturalized creek would be assumed by the Mt Shasta Beautification Committee or Recreation and Parks District.

Why: All of Cold Creek's pipes are well beyond their design lifetime and at risk of failure even during normal operations. The replacement and upsizing of old, damaged Cold Creek pipes is critical to prevent the catastrophic failure of this infrastructure during a major storm event. Restoration of the daylighted sections of Cold Creek will filter sediment and nutrients, enhance neighborhood beauty and habitat quality, and reduce flooding risks. Because much of the City drains to Cold Creek, revitalizing the creek's lower reaches would provide a centralized downstream location for green infrastructure to naturally treat water and enhance water quality.

Sketchup Rendition:



Cost: $800,000 for pipe replacements and restoration, cost excludes design, engineering, and park features

Metrics: needed

Notes: Long term maintenance and trash collection for the park will be issues. The Beautification Committee and Parks District will need to be partners. Greenway crossings at RR will be a concern; is it even possible to add a new RR crossing if it's not at an existing road? City does not own Commercial Way; it is owned by Dickerhoff and City staff are unsure if there is a drainage easement on its culvert. Collecting more detail on the winter 2019 pipe failure at Blvd could strengthen this project proposal.

2. Mill Creek Realignment and Restoration

Alternative 1

Alternative 2

Location: The City's two largest municipal water tanks, Tanks 2 and 3, are located at the top of Quail Hill on City-owned property east of City limits. When Cold Springs is producing in excess of the City's water demand, these tanks overflow into a steep, man-made, unlined channel which cascades down Quail Hill, known as "Mill Creek". This creek ponds to form a small wetland on private property at the base of Quail Hill called "Spini Pond", east of Old McCloud Rd. Mill Creek then enters City Limits through a system of pipes that convey the creek (and its tributary stormwater drains) through the Mountain View subdivision and across South Mt Shasta Blvd. From there, Mill Creek is daylighted in a creek channel as it crosses the basin of the historic Roseburg Lumbermill log pond, a brownfield site with known soil contamination. A culvert on the west side of the log pond conveys Mill Creek under the UPR and out of City Limits. Between UPR and I-5, Overflow Creek passes through a shrub-scrub wetland on City-owned property, known as the "Orchard Property" south of Ream Avenue.

Problems currently: The pipes connecting Mill Creek to the top of the Mountain View subdivision are severely undersized, damaged, and due for replacement. Despite carrying perennial flow, key sections of pipe are only 6 inches in diameter and at risk of failure. The pipes also pass through private property without drainage easements, which has made the long term maintenance of this key infrastructure difficult.

Where Mill Creek crosses through the basin of the old Roseburg log pond, it passes near areas with legacy pollutants from the Roseburg sites history as a lumber mill. The City has acquired funding to remediate brownfield contamination at the Roseburg Site, and will likely have site remediation complete by 2021. The key information related to brownfield conditions on the Roseburg property are detailed in the Draft Final Removal Action Workplan: The Landing – Old Mill Section (RAW). The RAW revealed that the log pond itself is suitable for recreational use currently and did not have pollutant levels high enough to trigger project action levels (PALs) for any Contaminants of Concern (COCs). However, the City remains concerned that pollutants could potentially be mobilized from the log pond by flowing water. The City has applied for grants to fund regular water quality testing of Mill Creek, but has not been awarded funds to date. At this time, little detailed water quality testing has occurred to determine if and what pollutants are being mobilized by surface water from the Roseburg mill site. The section of Mill Creek that runs through the log pond basin contains riparian and emergent wetland vegetation that offers some habitat value.

Proposed changes: The pipes which convey Mill Creek across Old McCloud Rd and through the Mountain View subdivision urgently need to be replaced, enlarged, and realigned so that they remain on public rights of way. The new route will follow Old McCloud Rd southeast for approximately 200 ft before turning southwest down Mountain View Drive. The stormdrain pipes along the full length of Mountain View Dr will also be replaced.

There are two alternatives to address problems along the daylighted section of Mill Creek through the Roseburg log pond. Alternative 1 would replace the existing culverts where Mill Creek enters and exits the log pond. The existing emergent wetland inside the log pond basin would be restored and enhanced. The ditch downstream of the log pond which connects Mill Creek to its culvert under UPR would also be restored and enhanced. The log pond would

remain as a riparian and wetland feature to be included in the future development of a City park at Roseburg. In Alternative 2, Mill Creek would be rerouted south into an existing parallel drainage ditch west of Loveta Lane to ensure that the creek would avoid brownfield areas altogether. This would require approximately 700 ft of new pipe along S Mt Shasta Blvd. The Loveta Lane ditch is free from soil contamination and, with the additional base flows from Mill Creek, would become a good candidate for creek restoration and the introduction of riparian vegetation.

The Roseburg property is scheduled for eventual development into a City park, and restoration of this section of Mill Creek will likely be connected to the overall redevelopment of the Roseburg property.

Why: Because Mill Creek is indirectly spring-fed, it conveys high volumes of water in all seasons which has accelerated the need to replace key sections of pipe and address concerns about surface water mobilizing pollution.

Site Photos: needed

Cost: $875,000 for pipe replacements and restoration, cost excludes design and engineering

Metrics: needed

Notes: "Spini pond" may need alterations as well. Checking water quality downstream would be nice so we know if and what is being mobilized pollutant-wise. Wetland on "Orchard" property could be part of the treatment solution. An optional alternative of this project includes building a greenway trail to connect Ream Ave at Old Stage Road to Lake Siskiyou via the lower section of Mill Creek through County land; it appears most of this corridor is on one undeveloped wetland parcel.

3. East Castle Street Improvements

Location: E Castle Street is located in Central Mt Shasta and serves to connect Sisson Meadow with downtown. Immediately north of E Castle Street is a heavily potholed decommissioned alley, known as Castle Alley, which is used as neighborhood greenway trail. A stagnant linear ditch parallels this alley and is hydrologically connected to the meadow's creeks to the east, wetlands on private property to the west, and the E Castle St drainage infrastructure. Castle St's drain pipes continue southwest along its entire length, under the Union Pacific Railroad, until they empty into a narrow man-made ditch behind RiteAid, about 370 ft north of Lake St. This ditch continues across an undeveloped field, following the property boundary of the Mt Shasta Elementary School campus until it reaches its culvert under I-5 and exits the City.

Problems currently: Several small unnamed creeks and ditches drain southwest through Sisson Meadow towards the east end of Castle Street, where they are intercepted by City-owned drainage infrastructure, including a clogged and buried French drain. However, the current drains are ineffective and allow a significant amount of water to bypass the drain inlets and instead flow down Castle Street to its intersection with Alder St, eroding the road surface and shoulder in the process. Road shoulder erosion is particularly pronounced on the southeast side of Castle St, which lacks curbs. The CMP pipes which run under Castle St are undersized, worn, and in need of replacement. Because the Castle St stormdrain system intercepts water just uphill of downtown, much of the City's most valuable commercial real

estate relies upon these aging pipes for flood protection.

E Castle St is very wide relative to its light traffic volumes and has a significant amount of on-street parking. Much of the street effectively serves as a public parking lot, with planter boxes and other landscaping features that enhance aesthetics but do not provide stormwater co-benefits. A stone fountain by the intersection with Mt Shasta Blvd is permanently turned off because it lacks the ability to recirculate its water. Castle Street's wide impervious surface generates stormwater runoff which is directed to drains without treatment. The City has opportunities to improve drainage while beautifying this highly visible part of downtown, and also improve the main pedestrian route between Mt Shasta Blvd and Sisson Meadow.

At the system's downstream end south of Pine St, the drainage ditch behind RiteAid is severely overgrown with blackberries and other invasive species, which has decreased ecosystem health and drainage capacity. Because the ditch is very linear, there are no meanders that could slow flood flows and reduce erosion. The RiteAid parking lot extends all the way to the rim of the ditch, which may be exacerbating drainage issues by increasing impervious area without offering needed parking. An informal bridge crosses this ditch by Cedar St andis used by members of the community to connect the Cedar St neighborhood to Lake St. However, the bridge is not ADA accessible or well marked.

Site Photos:

Proposed changes: The City should first address the frequent nuisance flooding at the northeast end of E Castle St, caused by poorly placed inlets and the clogged French drain. The French drain should either be:

- reconstructed to prevent clogging,
- converted to an open stream channel or bioswale that will convey water directly into a nearby City-owned drain inlet,
- abandoned,
- or a combination of these options.

Expert engineering opinions may be needed to evaluate competing options. Regardless, the ultimate goal of inlet improvements will be an aesthetically pleasing and easily maintained system by which water flowing through Sisson Meadow is intercepted and reliably conveyed into underground pipes along Castle St.

Castle Alley should be physically closed to vehicle traffic and designated as an official greenway and Class 1 bike path, with permeable pavement or other LID design features. An interpretive sign at the Castle St entrance to the meadow could raise public awareness of green infrastructure and mountain meadow ecology.

All drains and aging CMP pipes running under Castle Street should be replaced with new inlets and larger PVC pipes, from Sisson Meadow to the pipes' outlet into the ditch south of Pine St.

Missing sections of sidewalk between Chestnut St and Sisson Meadow should be constructed to improve pedestrian access. These new sidewalks will also reduce shoulder erosion and should incorporate LID design principles.

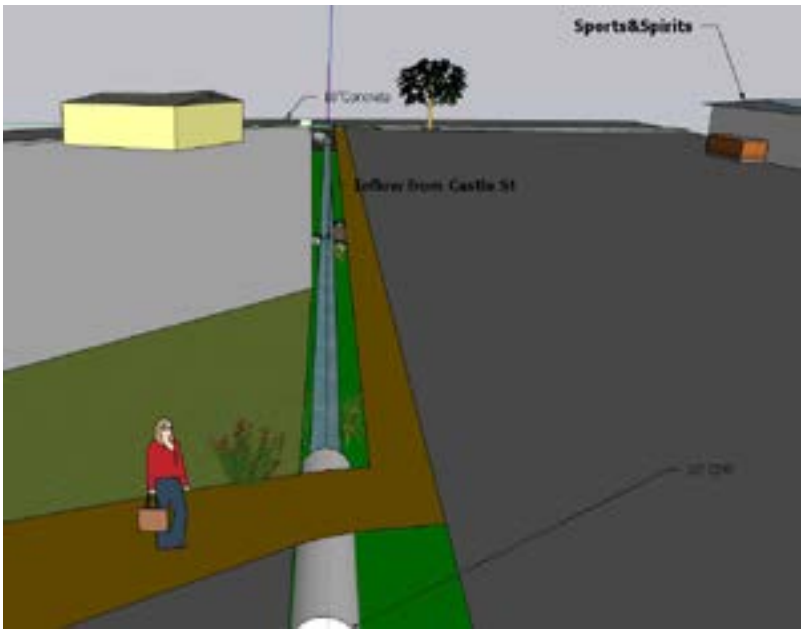
On the block of E Castle St between Mt Shasta Blvd and Chestnut St, trees in planter boxes should be replanted directly into the pavement (with curb cuts) so they can act as vegetated filters for stormwater. The City will also consider the installation of swales on sides of the street above existing inlets; these swales can be planted with native meadow grasses and wildflowers to filter stormwater, enhance aesthetics, and act as a way-finding mechanism that invites visitors to wander towards Sisson Meadow. Meadow grass swales will also reduce the risk of roots infiltrating buried infrastructure. The new swales can be as small as one parking space each, so the overall loss of parking will be minimal.

The existing fountain on the pedestrian island at Mt Shasta Blvd can be redesigned to enhance the street's aesthetics and add an attractive water feature, possibly using recycled stormwater. An alternative to designing the fountain would be to install a vault under the pedestrian island with a plexiglass or stainless steel grate cover, so pedestrians can hear and see water rush beneath their feet. Such a vault would add aesthetic and sonic improvements to the project at relatively low cost.

The ditch south of Pine St should have its excess vegetation controlled on a long term basis using grazing, mechanical removal, or other means. If adjacent property owners like RiteAid are willing, the ditch should be widened and naturalized to more closely replicate natural hydrology. A formal pedestrian path should be constructed alongside the ditch to increase safety and improve walkability. This project may involve removing 10-20 ft of pavement from the back end of the Rite Aid parking lot.The informal bridge should be improved or replaced to provide better accessibility. If stream restoration is successful, the ditch could serve as a play feature and/or education asset for the adjacent elementary school.

Why: Improving the existing drainage infrastructure will stop persistent nuisance flooding at the northeast end of Castle St as well as improve water quality and aesthetics. Because much of the street functions as a public parking lot, the City should take responsibility for treating the pollutants generated here. This area is also a prime location to advertise the City's efforts to implement green infrastructure and raise awareness of water quality issues among the public. Because Castle St is located in the center of downtown and connects local businesses with Sisson Meadow, enhancing the beauty and walkability of this street will offer huge community benefits. The City was built on top of a meadow, and Castle St LID retrofits could help revive and celebrate the history of the local landscape.

Sketchup Rendition:



Cost: $300,000 for pipe replacements and restoration, cost excludes design and engineering

Metrics: needed

Notes: Siskiyou Land Trust will be a key partner here; clear MOU about maintenance responsibilities do not exist yet but will be important. Castle St is crowned to drain to edges so a center swale is not possible without regrading. Root infiltration of aging pipes is a concern if trees are removed from their planter boxes; grasses and shrubs may be better options. Snow removal is a key consideration. Installing curbs flush with pavement may help reduce damage to City infrastructure by snow plows. Castle St is currently used as a parking lot and occasionally as an event space, and these uses should be preserved. There is some interest among members of the public in daylighting the creek, but it is unclear if this is feasible, cost effective, or desirable. Restoring aspects of meadow hydrology and aesthetics in bioswales will likely be far easier than tearing up the road to fully daylight a riparian creek. Future versions of the project map might benefit from a detail inset for the blocks between Meadow and Blvd.

The ditch behind RiteAid has an easement but is not City-owned. Ditch follows the property line of elementary school for approximately 1000 feet. The idea of an education component for this could be further developed. The back of RiteAid includes their loading dock for semi-trailer deliveries, so they may be reluctant to change their parking lot configuration.

4. Washington Dr connection to S Mt Shasta Blvd

Location: Washington Dr is a major north-south neighborhood connector street on the east side of the City, from its intersection with Everitt Memorial Highway to Old McCloud Rd. From a drainage perspective, the most problematic area is the southern section of Washington Dr, between Smith St and Old McCloud Rd. Runoff from this area is routed south through private property to S Mt Shasta Blvd and eventually to Mill Creek.

Problems currently: Washington Dr lacks stormwater infrastructure along almost its entire length, including the 1,900 ft section between Smith St and Old McCloud Rd. This southern section of Washington Dr slopes towards the south and experiences severe shoulder erosion along both sides of the road. Inconsistent design standards have produced a patchwork of street widths, curb styles, and shoulder paving materials, with only isolated unconnected sections of sidewalk. Together, this patchwork serves to guide runoff south to Washington Dr's intersection with Old McCloud Ave where it is intercepted by drain inlets. These drain inlets and their associated pipes are undersized and due to be replaced.

From the drain inlets at the Washington Dr intersection with Old McCloud Rd, pipes travel approximately 700 ft south through several parcels of private property, all of which lack drainage easements that would allow the City to access and maintain this infrastructure. The pipes then connect to a storm drain manhole at the northeast end of Roelofs Ct; runoff then

flows through aging pipes to S Mt Shasta Blvd and Mill Creek.

Nearby, the drainage infrastructure along S Mt Shasta Blvd between Old McCloud Rd and Mountain View Dr is also aging and due to be replaced.

Site Photos:

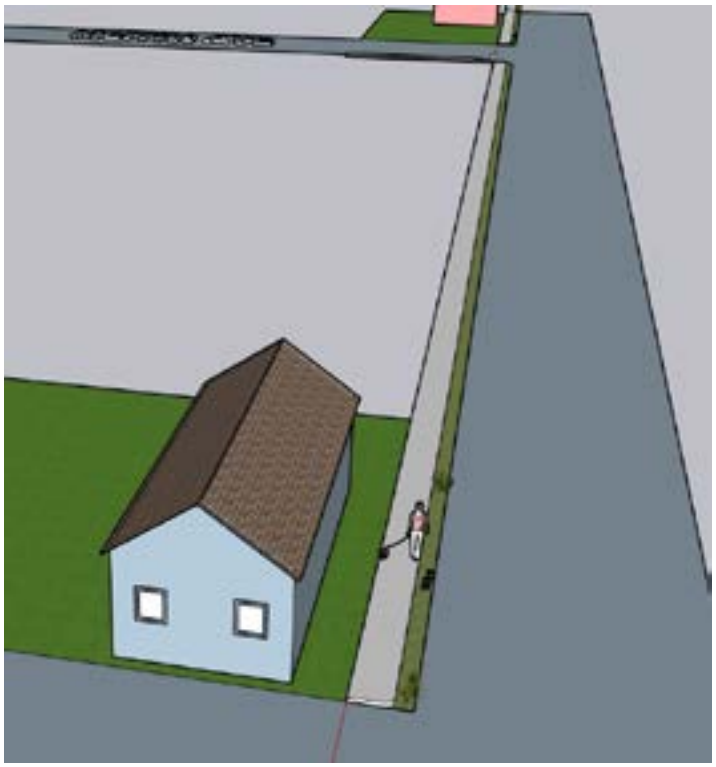
Proposed changes: Washington Dr should be repaved in its entirety, which is an opportunity to also install consistent curb gutter, LID design features, and connected sidewalks along at least one side of the street. The street is wide enough that in-street storm water features are likely feasible.

The drains at the south end of Washington Dr at its intersection with Old McCloud Rd need to be replaced and enlarged. The pipes that lead south from that intersection should be abandoned, and instead a new high diameter PVC pipe should be installed along Old McCloud Rd which will serve to direct runoff from Washington Dr to the existing drainage system along S Mt Shasta Blvd. The pipes along S Mt Shasta Blvd between Old McCloud Rd and Roelofs Ct

will also be replaced.

Why: The current lack of storm drain infrastructure along Washington Dr is creating an ongoing threat to public and private property. However, unless the pipes that connect the drain inlets at Washington Dr's intersection with Old McCloud Rd are replaced and enlarged, they will not have the capacity to accept more runoff from any improvements on Washington Dr. The current route drainage pipes take through private property without easements further complicates maintenance. The suggested changes will improve drainage, walkability, and PW access to key infrastructure while reducing flood hazards for public and private property.

Sketchup Rendition:



Cost: needed

Metrics: needed

Notes: This project needs to be developed more, and we should probably make an effort to observe the systems performance during a rain event. We should also dye test the current connection because there are lingering questions about how it even connects.

5. McCloud Ave Improvements

Location: McCloud Ave is an important neighborhood connector street which begins at Mt Shasta Blvd in downtown and runs east uphill 3,500 ft to City Limits. From there, it continues approximately 1 mile further east through a low density unincorporated residential area under the jurisdiction of Siskiyou County. The entire road is steeply sloped and its upper end serves neighborhoods with high potential for future development.

Problems currently: Although there are large drainage inlets at McCloud Ave's intersection with Mt Shasta Blvd, the street lacks storm drains and consistent curb-gutter along most of its length, and has severely damaged pavement as a result. There are drain inlets at McCloud Ave's intersection with Washington Dr, but these empty back onto the street immediately downhill of the Washington Dr intersection and are not connected to the City's larger system of drainage infrastructure. Along the whole street, inconsistent curb-and-gutter has led to shoulder erosion which mobilizes sediment and damages infrastructure. Sidewalks along both sides of the street are inconsistent, damaged and/or missing, which forces many pedestrians to put themselves at risk by walking in the traffic lanes.

There is inadequate drainage infrastructure along McCloud Ave, which allows stormwater runoff to gather along the road shoulders for approx 3,500 ft before it is intercepted by drains. The pipes which convey runoff from the drain inlets at the McCloud Ave intersection with Mt Shasta Blvd along Alpine, Mill, and Water Streets to Cold Creek are undersized and at the end of their design lifetime. Key sections of pipe are as small as 8 inches in diameter.

If development on unincorporated land east of the City continues, McCloud Ave's drainage problems are likely to further intensify. The entire street's runoff eventually drains to Cold Creek without treatment.

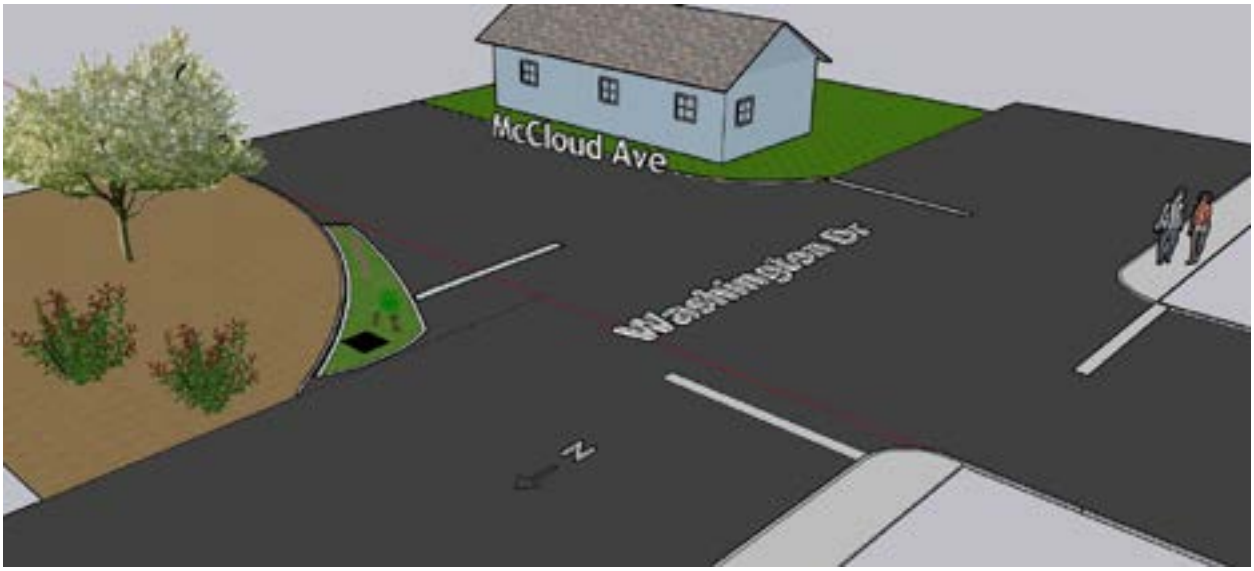
Changes: McCloud Ave should be repaved in its entirety. This is an opportunity to install consistent curb-and-gutter and sidewalks along both sides of McCloud Ave from Mt Shasta Blvd to Jefferson Dr. Existing damaged sidewalk segments should be repaired. The McCloud Ave intersection with Washington Dr is currently a two-way stop, but could possibly be made safer for motorists and pedestrians if it were converted to a four-way stop. Pedestrian improvements will greatly improve neighborhood walkability and offer drainage co-benefits by protecting road shoulders from erosion.

Just above the intersection of McCloud Ave and Washington Dr, McCloud Ave is wide enough to allow for the installation of bioswales which could significantly reduce the amount of runoff that continues to the lower section of McCloud Ave. Between Washington Dr and Mt Shasta Blvd, the City should install 1,800 ft of new storm drain pipes, consistent with LID design principles, with new inlets at B St. Starting at McCloud Ave's intersection with Mt Shasta Blvd, new larger PVC pipes should be installed along Alpine, Mill, and Water Streets to connect McCloud Ave's existing drain inlets to Cold Creek. All of McCloud Ave is underlain by soils with high infiltration rates so LID retrofits are likely feasible and cost-effective.

Why: McCloud Ave lacks adequate drainage infrastructure currently, which poses an ongoing risk to public and private property. Even in relatively minor storm events, the street's drains struggle to handle runoff. Because the road is long and steep, detaining stormwater closer to its source is preferable to allowing all runoff to travel thousands of feet to the bottom of McCloud Ave before it enters the City's drainage infrastructure.

Site Photos:

Sketchup Rendition:



Cost: needed

Metrics: needed

Notes: If the City wants to install storm drain pipes along some or all of McCloud Ave, the other buried infrastructure must be taken into account. Another alternative would be to reroute runoff south to Cold Creek at Washington Drive, although the lack of capacity in the existing Cold Creek systems makes this infeasible until improvements are made there first. The upward slope of Washington Dr between MCloud and Smith might also render this impossible.

LID retrofits are likely feasible and lower cost than installing 3,500 ft of new storm drain pipes. As an alternative to new drain pipes: curb cuts, stair-stepped vegetated strips, and small infiltration basins could be installed at regular intervals between the curb and sidewalk between Washington Dr and Mt Shasta Blvd. Because critical water and sewer infrastructure is buried only 8-10 inches below the road surface, there may be scarce room to install storm drain pipes without disturbing other utility infrastructure. Orem St is nearby and also underserved by storm drains. A spur drain pipe up N B St to Orem could intercept runoff from the upper end of Orem and then tie into the proposed improvements along McCloud.

6. Everitt Memorial Highway Retrofits

Location: Everitt Memorial Highway serves as the major recreation gateway connecting the City of Mt Shasta to major trailheads in Shasta-Trinity National Forest. The highway begins at its intersection with Rockfellow Dr and then continues for approximately 1,350 ft north until it exits City Limits, then continues for approximately 14 miles into Shasta-Trinity National Forest. The lower section of Everett Memorial is next to Mt Shasta High School, a California National Guard Armory, and residential single-family homes.

Currently: The 1,350 ft section of Everitt Memorial Highway uphill from its intersection with Rockfellow Dr to Shasta Ave is much wider than necessary, with drain inlets that are not large enough to intercept all runoff from this very large impervious area. The road is approximately 115 ft wide, with only 25 ft being marked as traffic lanes and actually serving as transportation infrastructure. The rest of the road (30 to 50 ft per side) is empty paved road shoulder, some of which is used for high school parking but most of which is unused at all times. Above Shasta Ave, Everitt Memorial narrows to 25 ft but lacks curb-gutter or other stormdrain infrastructure, and some sediment eroded from the shoulders of the highway travels downslope and is deposited nearer to Everitt Memorial's intersection with Rockfellow (particularly on the east side of the street). Everett Memorial's drainage pipes are aging CMP and due to be replaced.

Changes: Because of its very large width, Everitt Memorial's impervious area (and therefore runoff) can be reduced with no negative impacts on vehicle traffic or street parking for the High

School. The west shoulder of Everett Memorial is unnecessary and could have its pavement removed and instead replaced with a large grassy bioswale. A new inlet and pipe on the east side of the street north of the highschool will intercept runoff and sediment and direct it into the top of the new swale. A second grassy swale, on the east side of the street in front of the National Guard Armory will intercept runoff without interfering with on-street parking for the High School. Access to private driveways and parking lots will be maintained across the new swales. There is ample room to install new bike lanes on both sides of the street, which would serve to connect the existing bike lanes on Lake St to the McCloud rail-to-trail project and potentially to the Gateway Trailhead. Given the ample parkland nearby, aesthetically attractive streetscaping is probably more important than providing recreation opportunities in a linear park.

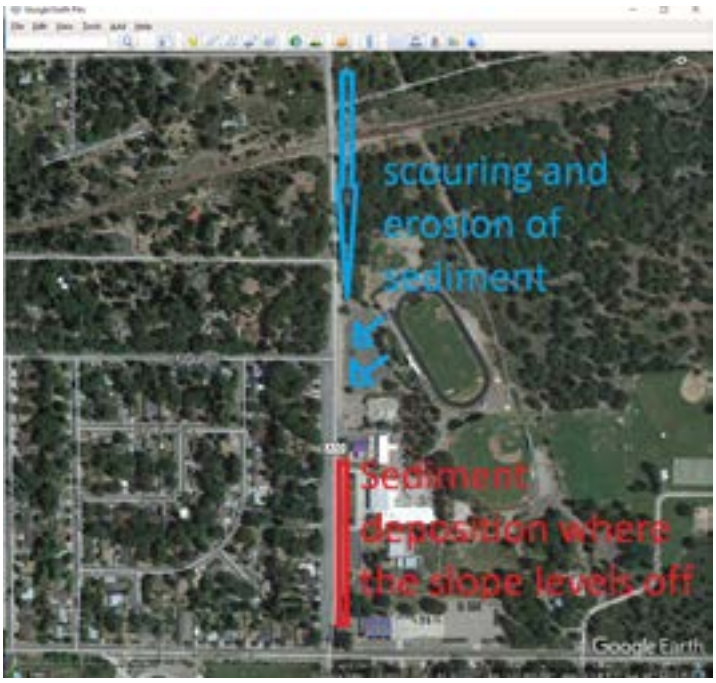
In addition, the City should replace and enlarge drain inlets and pipes near the Rockfellow intersection, Existing metal pipes should be replaced with HDPE pipe and existing drain inlets should be replaced and enlarged.
Why: Everitt Memorial highway is among the most commonly used roads in the City of Mt Shasta, and is particularly visible to visitors on their way to trailheads in Shasta-Trinity National Forest. The road is also a significant source of unnecessary runoff. LID retrofits along this road would serve to beautify this corridor while protecting water quality and enhancing neighborhood beauty.

Site Photos: needed

Cost: needed

Metrics: needed

Notes: See this image from Melanie Findley.



7. Ski Bowl Drive Retrofits

Location: Ski Bowl Drive is a neighborhood street in the northern part of the City, which connects Rockfellow Dr to Shasta Ave and provides access to other residential streets.

Currently: The drain inlets at the bottom of Ski Bowl Dr, by its intersection with Rockfellow, are the only ones in the entire residential neighborhood it serves, so significant amounts of runoff gather along its curb-gutters during major storm events. The drain inlets by Rockfellow Dr are too small and not properly placed to intercept all runoff from this neighborhood, which results in excess runoff continuing south across Rockfellow Dr causing nuisance street flooding. Ski Bowl Dr is not properly crowned at its centerline, which prevents runoff from flowing to the curbline and has further contributed to street flooding problems at this location.

There is road shoulder erosion on the south side of Rockfellow Dr where excess runoff from Ski Bowl Dr sheet flows across Rockfellow before spilling into an earthen ditch on the Siskiyou Land Trust property. This ditch is deeply incised and actively eroding. The section of Rockfellow by Ski Bowl Dr also lacks curb-gutters and sidewalks on the south side, but school children frequently use this unimproved road shoulder to walk to school despite the lack of pedestrian infrastructure. Existing sections of sidewalk are not ADA compliant.

Changes: The lower section of Ski Bowl Drive should be regraded so that it is crowned in the center and runoff is more effectively directed to existing gurb-gutters. The existing drain

inlets at Ski Bowl Dr's intersection with Rockfellow should be replaced and enlarged, to more effectively capture runoff.

On the south side of Rockfellow Dr, missing sections of curb-gutter and sidewalk should be installed so pedestrians (including school children) have improved walkability and safety. Existing sidewalks should be retrofitted to comply with ADA requirements. A new drain inlet at the current location of the eroding ditch would serve to capture any runoff from Rockfellow so it can still be conveyed to the earthen ditch downstream. The earth ditch could be planted with native riparian vegetation, in partnership with Siskiyou Land Trust, to stabilize the earthen banks.

Why: This area has experienced frequent street flooding for many years, and while minor ditch improvements have somewhat alleviated flooding, a more permanent solution is still needed. New sidewalks would improve pedestrian safety and prevent road damage in an area frequented by school children.

Site Photos:

Cost: needed

Metrics: needed

Notes:

8. Forest Street Improvements

Location: Forest St is a narrow, steeply sloping street in the southern part of the City. It connects Mt Shasta Blvd to Berry St through a historic residential neighborhood.

Currently: Forest St has 2 stormdrain inlets, but they are undersized and not connected to an underground pipe network. What runoff is captured by the drain inlet at the intersection with Mt Shasta Blvd empties back out onto Forest St about 100 ft west and then runs along the curbless shoulder of Forest St for the rest of its length. Another drain inlet at Forest St's intersection with Berry St also immediately empties back onto the unprotected road shoulder. A 0.25 acre unpaved parking lot at the corner of Mt Shasta Blvd and Forest St belonging to SJ Denham Chrysler Jeep Dodge RAM also contributes runoff to Forest St and adjacent properties. At the west end of Forest St, the road deadends by UPR without a stormwater culvert under the tracks. Runoff from storm events pools next to the UPR tracks until it evaporates or infiltrates the ground. The lack of a stormdrain infrastructure poses an ongoing risk to public and private property and key transportation infrastructure.

Changes: New drain inlets should be installed at the intersection of Forest St and Mt Shasta Blvd, and approximately 800 ft of new stormdrain pipes should be installed along the length of Forest St west all the way to the UPR tracks. Runoff from Forest St will then spill into a new bioswale running south parallel to the UPR tracks, before turning west through a new culvert under UPR and tie into existing private drain lines belonging to the Shopping Center. The

soils underlying this project area have rapid infiltration rates compatible with a bioswale or other related stormwater infiltration features. The unpaved SJ DEnham parking lot, which is on private property, could install drain inlets and tie them into the City pipes.

Why: This area has experienced frequent street flooding for many years, including on private residential properties. The entire neighborhood surrounding Forest St has very little developed stormwater infrastructure, and experiences nuisance flooding as a result. This project would prevent road damage, provide drainage, and prevent flooding. In addition, UPR would benefit from installing drainage infrastructure under their tracks at a key location with a history of flooding.

Site Photos:

Cost: needed

Metrics: needed

Notes:

Appendix I: Project Proposal Form

Project Proposal Form

Please complete the following form to have your stormwater project submitted for review and possible inclusion into the next iteration (2020, 2025, 2030, etc.) of the City's Stormwater Master Plan Update. Every project will first be reviewed for compliance with State Stormwater Resource Plan Guidelines to establish project eligibility. Eligible projects that pass initial screening will be reviewed by the Technical Advisory Committee. We appreciate your input on future projects!

Project Title:_____

Project Location: (Street address, parcel number(s), Latitude, Longitude)
_____

What Benefit Categories do you think will be achieved by completing this project? (Circle all that apply)

Environmental Water supply Water Quality Community Flood Mgmt.

Project Description:

_____

_____

_____

_____

Other comments & considerations: (Funding availability, project sponsors, reference documents, etc.)
_____

Your contact information: (Name / Phone / Email)
_____

Please attach any photos of the project or stormwater issue.

Please email this form to: jlucchesi@mtshastaca.gov
Or mail to 305 N Mt Shasta Blvd, Mt Shasta CA 96094